Article

Impact of ICT in Modernizing the Global Education Industry to Yield Better Academic Outreach

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Abstract: The advancements made by information technology have redefined the concept, scope, and significance of communication. The barriers in the communication process have been wiped out by the recent advances in information and communication technology (ICT) backed by high-speed data connectivity. People are free to communicate without bothering about physical borders distancing them from one another. Information and communication technology has diversified its dynamism by creating an e-environment, where people exploit the power of technology and communication to deliver many services. This research used the conceptual framework for ICT-enabled learning management systems and described their dimensions and scope in ICT-enabled education. The ubiquity of ICT has revamped the education industry worldwide by introducing new approaches, tools, and techniques to modernize education. The widespread popularity of ICT has forced educational establishments to endorse this to update the academia to leverage its bounders and enhance productivity to yield productive outcomes at different levels of education. This paper describes different ICT approaches and investigates the impact of ICT-enabled learning management systems and described their dimensions and scope in ICT-enabled education. The ubiquity of ICT has revamped the education industry worldwide by introducing new approaches, tools, and techniques to modernize education. The widespread popularity of ICT has forced educational establishments to endorse this to update the academia to leverage its bounders and enhance productivity to yield productive outcomes at different levels of education. This paper describes different ICT approaches and investigates the impact of ICT-enabled technologies on various educational practices to achieve productive educational outcomes. This research investigates the role of ICT in teaching and learning at different levels of education, explores various modulates and their influence on the overall development of educational activities, and identifies the research gaps that are bridged to achieve the primary aim of ICT and education. This research extended its ICT projections and scope to overcome the challenges emerging from pandemic circumstances and design and develop an online platform in proper consultation with market demand to make students more job-oriented or skill-oriented. This paper describes different ICT approaches adopted by various educational institutions across the globe to modernize student–teacher interaction. This paper further investigates the influence and impact of ICT-enabled technologies on various educational practices that are prerequisites for achieving productive educational outcomes.

Keywords: ICT; online education system; ICT architectural framework

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1. Introduction

Education is the most indispensable component of human society. It plays an essential role in shaping, guiding, and projecting human civilizations into the most decent life prospects as well as better ones. Education and its practices teach the principles of morality, ethics, submission, solicitation, and obligation. Education is not an innate skill or character that an individual obtains by birth; instead, it is achieved or gained through continuous practices and interactions with different entities living all around his or her living space. There have been many reforms in the educational sector in the past several decades. The traditional way of seeking education through the learning process that once was in the form of a simple speaker, speech, and the audience has changed horizontally and vertically. Every component in this teaching–learning paradigm has changed. From a much broader perspective, the whole concept of the teaching–learning process has changed to a greater extent and has redefined the contours of education.

Reforms, developments, and modernization witnessed that an educational setup across the globe, particularly in teaching and learning, was only possible when an adequate technology was waiting to be endorsed. Before the inception of ICT, a mix of traditional and computer-enabled practices was used to educate pupils in classroom education. These practices are still being used by educators worldwide to teach students at different levels of education. However, the most evident and apparent restriction associated with these computer-aided practices was that they were confined to creating a teaching–learning environment within a classroom. That means there was no scope for such an approach to leverage teaching beyond the physical boundaries [1].

Improvements and advancements in technology, especially in electronics and communication, have made technology more accessible and acquirable for almost everyone. The arrival of ICT has added more flavor to the teaching–learning process by encouraging a paradigm shift in nearly all educational setups across the globe. Teachers are free to communicate with their students, and students have obtained provisions to learn from their teachers/instructors from anywhere with ease and comfort [2]. As a result, the degree of comfort in teaching and learning mechanisms has increased by many unexpected folds. Moreover, we see many technological revelations in software and hardware from both ends of this teaching–learning process.

Adopting ICT-enabled modalities for education intending to enhance the outcome of educational institutions by consuming the least resources is not an easy job. There are many challenges that this technology has and is facing in becoming effectively and widely implemented across all levels of education. As ICT has removed geographical barriers, a teacher stationed at any location can efficiently deliver to students across different areas. The containment of teachers within the specified classroom has changed to open teaching. Teachers feel awakened and uncomfortable using this technological endeavor as their content is readily available for anyone to access, monitor, and rate. Teachers think that if their content is not fit enough to meet students’ expectations, they may face social targeting and ill publicity, resulting in lousy impressions and psychological trauma [3–7].

The inclusion of ICT in education requires proper facilitation and training. Teachers must be motivated to prepare the content that floats across nodes over the internet. In a general context, the ICT has helped society by facilitating the type of education called “education on wheels” or “mobility in education”. However, the overall capability to use this technology effectively is low [8]. Several studies and evidence from ongoing research on the technology acceptance model (T.A.M.) quantify ICT utilization among educators and students [9–12].

2. Background Literature

De Byl and Hooper, in their study, reveal the most influential factors that can motivate students to acquire their education through online sources [13]. Their research es-
established a five-dimension model to create a productive learning environment: playfulness, pedagogy, instrumentalism, status, and performance. However, the classification of the teaching–learning process has proved to be the more promising factor in engaging students to adopt the online teaching–learning paradigm to earn academic milestones at ease on affordable resources.

Reading C., in his study, discussed the effectiveness of ICT in creating a productive teaching–learning environment by categorizing and engaging the audience based on behavior, emotion, and cognitive engagement [14].

Yang Wang et al, in their study, revealed that the impulse of ICT in academia could be made more productive by creating an integrated environment where dynamic and realistic scenarios can be put together to engage students [15].

Wilson and Boldman, in their collaborative study, highlighted the importance of ICT and its inclusion in academics to surge the boundaries of traditional education for more productive outcomes with greater levels of accessibility and better student engagement. They stressed the creation of dynamic, realistic, and outcome-oriented scenarios to engage more students in adopting this technological modality. Their study further suggested using Web 2.0 technologies, mobile applications, and YouTube as powerful tools to increase student engagement [16].

Fredrikssa and Valiente, in their respective studies, have observed a relationship between teachers’ digital competence and ICT use. Therefore, the participation of teachers in professional training or development significantly improves the productive outcome of teaching–learning activities in online mode [17,18].

Bhati et al., in their study, observed that Wireless Learning Technologies (WLTs) of ICT are replacing the traditional approaches of classroom-type information dissemination with collaborative multiuser sharing. The various Wireless Learning Technologies (WLTs) used to educate distant people exploited the capability of smartphones, tablets, and laptops to engage students in this modern teaching–learning paradigm [19].

Tinto performed a study to investigate the growing engagement of more students with ICT-enabled educational prototypes. This study observed that students lack interest and motivation to stay at a particular educational institute for more extended periods. Lack of reason which may result in discontinuation of studies was caused by factors such as peers, professors, administrators, accessibility, location, environmental conditions, and sometimes social factors. This study concluded that ICT-enabled teaching–learning could be more outcome-oriented as students choose to switch the teachers and courses devoid of traditional education [20].

K. Guruz, in his study, mentioned that the Organization for Economic Co-operation and Development (OECD) indicated that the popularity of ICT-enabled education has successfully enrolled more than 4.5 million students alone at a tertiary level of education outside their country of citizenship in 2012. Moreover, 53% of enrolled international students were from Asia, particularly China, India, and Korea. At the tertiary level of education, international exchange activities increased more than threefold in the last couple of decades [21].

Mwalongo, in his study, highlighted that the use of ICT for teaching plays a significant and persuasive role for both teachers and learners. ICT has overcome the challenges faced in clarifying the doubts in traditional education. It helps them save time, make learners active, and simplify teachers’ work [22,23].

In their study, Bhattacharya and Sharma explored India’s status in the knowledge economy. They revealed that integrating ICT and education is very important to meet the educational desires of students at the tertiary level, which is overgrowing. However, traditional education may be insufficient to cover this rapidly growing tertiary level; therefore, ICT-enabled techniques and digital resources can be the only solution [24].

Neeru S. investigated the implementation of ICT in Indian universities and colleges and observed that with the recommendations of the 11th plan to achieve 15% GER by 2012, demand for higher education is expected to increase many folds. This study sug-
gests that ICT can be an ideal mechanism to bridge educational institutions’ exponential surge in intake [25].

Ozdemir and Abrevaya, in their study, revealed that the implementation of ICT in education could be economical in comparison to traditional educational approaches by reducing the cost per student. Moreover, ICT can prove more promising in achieving more student enrolment and facilitating a more friendly teaching–learning environment [26].

In their study of digital learning in modern education, Allen and Seaman reported that online education is gaining widespread popularity and usability. Furthermore, they observed that most of the students are taking at least one online class, and 48% are taking online courses, which means they obtain their degrees/certificates through an online mode of education facilitated through various online platforms [27].

Uttam Kr Pegu studied the role of information and communication technology in higher education in India and revealed that the inclusion of ICT-enabled practices in education would ultimately lead to the democratization of education. It has the great potential to transform Indian education to greater heights [28].

Mynarikova, L.; Novotny, L. collected the secondary school teachers’ data in January 2020 to analyze the role, barriers, and usage of ICT in their teaching practices. They conducted an online survey of 1846 Czech teachers and found that they have insufficient knowledge and skills in ICT. In addition, researchers looked at the perceived ICT competencies and use of various ICT tools in teaching [29].

Gonzalez-Zamar, M.D. et al. studied the management of ICTs for sustainable higher education at the global level from the years 2000 to 2019. Researchers applied bibliometrics to the 1814 research articles selected from different databases and found a growing publication trend on ICT management in higher education. The main contribution of this analysis was the determination of the scientific production and collaboration between the actors that stimulated research on the management of ICTs for sustainable education in the context of higher education [30].

Cha, H.; Park, T.; and Seo, J. conducted expert interviews to find various factors for developing an ICT-integrated classroom model. Based on experts’ recommendations, a conceptual framework is suggested that provides practical guidance on selecting more suitable classroom models customized to each country’s environments and contexts. In addition, this study draws implications from the interviews for classroom design guidelines related to hardware and infrastructure to improve the sustainability of ICT-integrated classroom projects [31].

Batez, M. framed a questionnaire to determine the ICT skills of the students. Three hundred sixty students from the Faculty of Sports and Physical Education (FSPE), University of Novi Sad, participated. The results show differences between the estimated level of ICT skills and the ICT skills used in online education. Therefore, it is concluded that FSPE students have adequate knowledge of ICT skills, and their sustainability and adaptation to the new online teaching requirements are not worrying [32].

Medina-Garcia, M. et al. present an essential novelty in using ICT for the educational inclusion of people with disabilities. In addition, a conceptual model is proposed and validated through partial least squares using a sample of 142 teachers from all educational stages. The results show that teachers’ ICT knowledge to ensure inclusion consists of five dimensions (knowledge about motor, hearing, cognitive, visual, and accessibility needs) on specific needs. Furthermore, ICT knowledge positively impacts teacher motivation and ICT use. The results found allow progress to be made in measuring the educational inclusion of schools and the ICT knowledge needed to ensure care and support for all people [33].

Hans G.K. Hummel et al. show assessment implementation in serious gaming to assure content validity. The evaluation shows that game-based assessments are more transparent, well documented, and more efficiently organized when compared to tradi-
tional assessments. The game-based assessment also seems to decrease the risks of subjective and arbitrary scoring by assessors [34].

S. A. Alserri, N. A. M. Zin, and T. S. M. T. Wook proposed a model that presents the components that work together to motivate and engage female students to learn and study computer science via games. They discuss females’ preferences in digital games and the social and cultural factors that influence females’ engagement in ICT. Each element in the model ensures that motivation and engagement will be present while playing the game [35].

3. Architectural Framework of ICT-Enabled Education (Teaching/Learning) Environment

It requires an array of systematically collaborated entities to create an environment where ICT-enabled teaching/learning can be possible. These entities are essential and inter-dependent on one successful delivery of teaching essentials. The arrangements of these entities to create a working environment that empowers the teacher to develop and deliver lectures to establish successful teaching/learning facilitation between teacher and students is known as the architectural framework for ICT-enabled education (teaching/learning). Figure 1 describes the basic architectural framework of ICT-enabled education (teaching/learning).

Figure 1. Conceptual framework for an ICT-enabled learning management system.

4. Research Hypothesis

ICT has removed geographical barriers, and teachers’ containment within specified classrooms has changed to open teaching. In addition, ICT has helped society by facilitating the type of education called “education on wheels” or “mobility in education”.

Figure 1. Conceptual framework for an ICT-enabled learning management system.
This research will explore the importance of ICT and its inclusion in academics to surge the boundaries of traditional education for more productive outcomes with greater levels of accessibility and better student engagement. This research will also check the growing popularity of ICT and its influence on online enrolments.

5. Research Methodology

The introduction of online education in academia substitutes traditional teaching–learning with much ease, freedom, and accessibility. The freedom imbibed in online education has motivated more students to enroll in various courses (degrees/certifications). The mobility in access has broadened the educational spectrum beyond physical boundaries separating nations worldwide. Students often face multiple challenges during classroom-bound education, including political bias, racial discrimination, etc., leading to discontinuing their courses. However, the online mode has significantly reduced the percentage of dropouts from institutions.

This research examines and understands the methodology used by researchers to study the impact of ICT on learning. In this research, we collected samples from the most popular online platforms, such as Coursera, Udemy, Ruzuku, Academy of Mine, Skillshare, LinkedIn Learning, NPTEL, EDX: THE SCIENCE OF EVERYDAY THINKING, SAKSHAT, and SWAYAM, and recorded student course enrolments year-wise. After year-wise collection of data records, we statistically analyzed them to find trends and check if the enrolments increased, decreased, or did not change. In this research work, we adopted the quantitative method to find the impact of ICT on learning. Findings from these research studies indicate that online learning has increased many folds over the past decade, and as a result, the e-learning and online course markets are soaring to new heights.

The overwhelming benefits of ICT-enabled education have aggressively increased the number of students enrolling in online courses. However, we observed that slower learners and under-achievers seemed to gain more from computer-based methods than able students and were generally effective at lower grade levels. We describe the statistical overview of these influences in the results section.

6. Models

Integrating information and communication technology to modernize education in general and academia promotes “learning beyond boundaries”. Students from different levels and disciplines of education become empowered to continue learning, who otherwise could not acquire it. Since the inception of ICT in education, various researchers have proposed a systematic prototype to develop a sophisticated ICT-enabled environment for better, quality, and easily accessible education for all interested. The models cited from the literature can be differentiated based on (i) focus area and (ii) elements/objectives/dimensions. Table 1 mention a few popular models used across different studies describing ICT and education.

<table>
<thead>
<tr>
<th>Model</th>
<th>Focus Area Sentence</th>
<th>Elements/Objectives/Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bloom’s taxonomy [37]</td>
<td>Classifies educational objectives’ structure and curricular activities</td>
<td>A progression from recalling facts to producing new and original work</td>
</tr>
<tr>
<td>TPACK framework [38,39]</td>
<td>Emphasizes key knowledge elements required for teaching and learning with technology</td>
<td>Technological, pedagogical, content knowledge: the TPACK describes what teachers need to know</td>
</tr>
<tr>
<td>NIMB framework [40]</td>
<td>Describes how ICTs can be used in teaching and learning based on the integration of several models</td>
<td>The effect of notions of learning, ICT in education, and models of learning design on the progression of learning as described by Bloom’s taxonomy</td>
</tr>
<tr>
<td>UNESCO framework [41,42]</td>
<td>Uses ICT and online technologies to provide ongoing support for teachers</td>
<td>Design programs based on what we know about how ICT can support learning</td>
</tr>
<tr>
<td>SAMR model [43,44]</td>
<td>Redefines how teaching and learning should be</td>
<td>Presents a guide for moving from substitution to redefinition</td>
</tr>
</tbody>
</table>
carried out using ICTs to perform tasks that cannot be accomplished without technology of learning tasks and switching from enhancement to transformation while exploring the massive opportunities ICTs have for teaching and learning

NIMB—notions of learning, ICT in education, the model for learning design, and Bloom’s modified taxonomy framework; SAMR—substitute, augmentation, modification, and redefinition.

7. Dimensions of ICT in Education

Building a pragmatic model to cater to the optimum requirements for productive outcomes in an online learning management system (LMS) can be understood by identifying the environment’s core components. These core components are also known as dimensions of ICT in procuring the main objectives of academics without compromising the quality and morals of education and its ethics. Identifying and analyzing the factors facilitates a better decision regarding selecting important fundamental components for establishing better teaching–learning interaction. Figure 2 below mentions these dimensions and their scope in ICT-enabled education.

Figure 2. Dimensions of ICT in education [36].

8. ICT-Enabled Teaching/Learning Platforms

Since the dawn of ICT in the education sector, many platforms have been designed and developed to perform desired activities. These platforms have witnessed many changes in their developments and modernization in both software and hardware technology. The gradual drop in more accessible and affordable data connectivity technologies has leveraged ICT boundaries in educational enterprises to deliver various educational materials. The diversification has been explored to the level that many academic and industrial institutions have started offering online degree and certificate courses in diverse disciplines, including arts, humanities, and engineering sciences.
The definition of ICT in educational enterprises is no longer limited to an activity wherein a teacher prepares lectures and delivers them to students via online media that bridges the geographical barrier of distancing to create a virtual presence.

ICT-enabled education, popularly known as online learning, has increased many folds over the past decade. As a result, ICT is emerging into a multimillion-dollar educational enterprise. Furthermore, the trending revenue of these ventures has resulted in more educational vendors’ public, private, academic, or corporate establishments offering many appealing and motivating online courses. As a result, the e-learning and online course markets are soaring to new heights and are estimated to be worth $325 billion by 2025 [45–47]. The most popular online platforms or learning management systems (LMS) facilitating online education across the globe through various online means are Coursera, Udemy, THINKIFIC, TEACHABLE, LEARNWORLDS, Kajabi, LEARNDASH, Ruzuku, Academy of Mine, WizIQ, Skillshare, LinkedIn Learning, TREEHOUSE, NPTEL, EDX: THE SCIENCE OF EVERYDAY THINKING, SAKSHAT, SWAYAM [48–50].

The multipurpose applications popularly used for building or creating an interactive virtual teaching–learning environment/classroom are Skype, Zoom, CISCO Webex, Google Suite, and Microsoft Meetings [51,52].

9. Delivery Modes

9.1. Instant and Interactive (Active Participation)

9.1.1. In-House

In this mode, universities or institutions use the concept of ICT to design a vocational, technical, or skill-oriented course for all interested students across the campus. Students from various departments can enroll and participate in their respective departments. The host department can access all other enrolled students from different departments and participate in the active teaching–learning process within separate classrooms. The host department has all other rights to conduct an assessment to award the course.

9.1.2. Outsourced or Invited

In this mode of ICT-enabled approach, prominent persons/professionals/professors specialized in certain areas of academics/research are invited to deliver talks/lectures from remote locations/institutions. In addition, the students of the hosting institute participate actively in classes. These lectures can be invited or core lectures of any designed course that leads to an award.

9.1.3. Fully Online and Mobile

In this particular mode of ICT-enabled education, students enrolled in some specific courses are provided with an opportunity to actively access and participate in lectures. These lectures are actively attended by enrolled students from their place of choice. Students must be connected to the internet and have devices such as desktop computers, laptops, or even mobile devices to participate in such a course. Students can interact with fellow students and instructors simultaneously. This teaching–learning platform’s environmental lows students a similar experience to traditional classroom-style learning with much-added benefits.

9.2. Online with Least Interaction (Passive Participation)

In this mode of ICT-enabled education, various institutions or independent organizations design multiple courses, most likely with high market or industrial demand. Content related to such courses is created before the commencement of the course. All the content is made available through means of online repositories or platforms. Students interested in taking such courses register on a course portal/institution website or an online platform such as Coursera. The course content is designed in a pattern such that
students are given a week to access the content. After completing the week’s contents, they are exposed to assignments or quizzes to open the next course level and continue until course completion. The quizzes and assignments submitted weekly are evaluated and given due credit scores. More often, examinations are machine evaluated, and assignments are evaluated manually. Students are provided an opportunity to raise queries and contact the course instructor to resolve them. After completing the course credentials, students are awarded the course/degree certificate.

9.3. Online Learning Repositories

In this mode of ICT-enabled education, various online platforms or institutions worldwide make the course content related to several certification or degree courses available. Interested students can benefit by accessing the course content either after simple signup or directly accessing or downloading the course content without paying any charges. In this mode, students may not be awarded respective certifications or degrees. This is merely an attempt to provide students with course content for better understanding.

9.4. Institutional Learning Repositories

In this mode, various institutions exploit the power, capability, and mobility imbied in ICT to create repositories of all the courses they provide. In addition to routine classroom teaching–learning, students can have a replicate opportunity to access the recorded content anytime. Students who miss their regular classes for different reasons find a chance to compensate by accessing the missed lectures from online institutional repositories. The access right to students may be restricted to enrolled students only. The delivered lectures are recorded either separately or using live streaming software applications. In this approach, students who access missed lectures can also be granted attendance.

9.5. Demand-Based Learning

In this mode of ICT-enabled education, the course or, most likely, the content related to some specialized discipline is created on-demand. The demand can result from various circumstances, e.g., management of outbreaks such as epidemics or pandemics, dealing with natural climates, disaster management, skill/training related to new inclusions, etc. Either public or non-profit organizations usually sponsor these courses. The participants in these courses or programs are generally people from professional trades and sometimes open for students to accolade themselves with such special certification. These are conducted and demonstrated online and undertaken simultaneously across multiple sites.

In addition to the above modes of ICT-enabled learning, there can still be multiple variants of such a teaching–learning approach. However, they can be directly or indirectly related to any of the modes above of ICT-enabled education.

10. Influence of ICT in Education

With the widespread use of the internet among people across the globe belonging to different age groups, the inclusion of network-enabled services surged at a much greater pace. These network-enabled services accessed remotely through World Wide Web (WWW) have motivated almost all the public and private enterprises to endorse these practices to increase global visibility. The introduction of online education in academia substitutes traditional teaching–learning with much ease, freedom, and accessibility. The freedom imbibed in online education has motivated more students to enroll in various courses (degrees/certifications). The mobility in access has broadened the educational spectrum beyond physical boundaries separating nations worldwide. Students often face multiple challenges during classroom-bound education, including political bias, racial
discrimination, etc., leading to discontinuing their courses. However, the online mode has significantly reduced the percentage of dropouts from institutions [53–55].

The Statistical Yearbook of the Department of Economic and Social Affairs, Statistics Division, United Nations, New York, 2019 showed the internet usage by different countries across the globe. The observations drawn from the report indicate that around 35–43% of the world population is using the internet globally [56]. Furthermore, there are countries worldwide where more than 90% of people use the internet for different services and operations (Figure 3). In the past decade (2000–2019), the percentage of the population of several countries around the globe has almost doubled. This internet explosion among societies has opened wide doors for educational institutes, development firms, corporate establishments, researchers, and the scientific community to explore new avenues to render their respective practices and services.

Figure 3. Graph showing countries worldwide with highest internet usage in percentage against the total population as per the report published by [56].

Patricia Wastiau et al., in their study, relate the use of ICT in education in European schools of all three levels of education: primary, secondary, and tertiary. ICT implementation in European schools varies depending on hardware and backbone connectivity strength and quality, as shown in Figure 4 [57].
Figure 4. Percentages of students at grade 4 (a) and grade 11 general (b) by school type in terms of equipment source: country and EU level, 2011–2012 [57].

The trend of acquiring ICT infrastructure by various educational institutions worldwide is growing at a much more overwhelming pace. Academic institutions of outstanding excellence are the front-line players in widening their boundaries to facilitate students from multiple locations to benefit from world-level education. With this initiative, most of the world’s reputed universities have already set up an online platform for students to enroll in various degrees/courses by paying nominal charges.
The influence caused by ICT-enabled aids and their use for different academic deliverability has produced both positive and negative effects, and the same is mentioned below:

- The growing capitalistic notion among the youths of all races across the globe has resulted in increasing demand for alternatives for acquiring academic degrees and simultaneously exploring various financial avenues for their better attainment of life. This living culture has heavily encouraged people to search for online means of education, resulting in less demand for traditional classroom education, leaving all established resources unutilized.

- In traditional classroom education, students were bound to stay in the classroom or within the premises to attend all the prescribed courses to complete their respective courses successfully. In this modern age, it seems like a hard and fast rule to help students within the educational initiations for a longer duration, resulting in decreasing motivation among the students to adopt this traditional approach. The availability of ICT-enabled alternative education has made them opt for online education rather than stay with traditional education.

- The complex and fast rules such as maintaining a prescribed minimum attendance percentage to be eligible to appear in assignments or tests have also prompted students to ask: why be disadvantaged by this when there is a friendlier platform? As a result, many students have dropped semesters because they failed to maintain the desired attendance percentage or submit assignments. This fear has left students with an open choice to switch to ICT-enabled online education, where students have ample freedom to learn while being on wheels and submitting assignments at ease.

- In traditional education, students have to pay huge fees and bear boarding and lodging expenses if residing at distant places from their colleges or universities. Therefore, the student’s collective efforts, both financial and human spending on attaining a degree, are very high compared to online education, where students pay nominal charges for highly interactive education. Again, this has motivated students to adopt online education, impacting overall enrolment in the traditional educational setup.

- In traditional education, in most cases, students are bound to face the same faculty in most of their courses. Meeting the same people may diminish their interest in the teaching–learning process. To ease themselves, students feel more comfortable in online education as they have open choices for selecting courses, institutes, faculty, and sometimes the course duration.

- Students who are shy and hardly encourage themselves to stand and ask for their queries in classroom education feel more comfortable raising their questions in online mode, as they no longer feel the threat of becoming a shamed in front of students if they fail to utter correctly.

- Teachers usually use boards and markers to deliver their content in traditional classroom education. However, ICT and compute rassistance has redefined education by empowering teachers with multimedia and graphics to make their courses more interactive, appealing, and explorative.

- The inclusion of ICT in academia has removed the traditional student–teacher ratio barrier in classroom-bound education. Online, a single teacher can accommodate hundreds of students simultaneously. The infrastructural constraints required to adjust to a more demanding intake can easily be removed by facilitating ICT-enabled services, thereby saving all resources.

The above characteristics cited for ICT-enabled education have invited more academic institutions to switch their routine academic services online by facilitating recorded and instant course content delivery. The decreasing cost of information and communication technology has made many players establish online and standalone platforms to provide online education. Students have preferred to enroll in different
online courses as it relieves barriers and anxiety faced during the teaching–learning process. The influence of ICT on educational or academic deliverability has completely redefined the education industry across the globe. Educational institutions are spending heavy budgets on the establishment of ICT-enabled education frameworks. The overwhelming benefits of ICT-enabled education have aggressively increased the number of students enrolling in online courses. The statistical overview of these influences can be further seen in the results section.

11. Results and Discussion

ICT-enabled education covers all sorts of teaching that directly or indirectly use the implementation and application of various constructive attributes of information and communication technology. The widespread use and much-anticipated endorsement of ICT at multiple levels of education across the globe has encouraged more student enrolment in different online courses. According to the national center for educational statistics (2019), 25.8% of college students took at least one online class in the United Nations alone, 12.5% of all college students took online courses exclusively, and 13.3% of students took combined online and traditional courses. It is observed that the percentage of students enrolling in online classes is comparatively more when it comes to the graduate course than undergraduate courses (22% and 11%) [44]. Another report published by the National Student Clearinghouse mentions that in the United States, the number of students who took at least some online courses increased by 5.7%. The overall percentage of enrolment for exclusively online courses increased to 15.4% in 2017 compared to 14.7% in 2016.

Similarly, the percentage of the students that opted for at least one online course grew to 33.1% in 2017, which was 31.1% in 2016. The three categories of institutions (public, private, or private non-profit) providing online education in the United States and elsewhere witnessed a surge in online enrolments for different courses. These enrolments were for degree courses, certificate courses, or partial learning. In the same context, institutions such as Western Governors University and Southern New Hampshire University cited that all schools have online enrolments that exceed 90,000 students. Moreover, private non-profit institutions also indicated a great increase and noted growth of about 5.9% in online enrolments in 2017[57].

A statistical overview of the enrolments by students on various popular online platforms from the past few years has shown an exponential increase and is expressed in Figures 5–7, respectively.

11.1. Online Courses

The trends of online courses provided through different online platforms have shown impressive growth. The increasing number of course providers indicates that students are demanding more courses to be made available online. In 2016, Coursera had 1700 courses, and this number almost doubled in 2017 with a 58% increase. It continued growing with 14.8% (3100) in 2018 and 22% (3800) in 2019. Similarly, Edx had 1420 courses in 2016, which got increased by about 28% (1820) in 2017, 17% (2275) in 2018, and 16% (2640) in 2019. The statistics of courses in 2019 are expressed in Figure 5 below.
Figure 5. Graph showing the number of online courses provided by some popular online platforms during the year 2019 [52–55].

Graph showing the approximate number of online courses available and provided to interested students through some popular online platforms in 2019.

11.2. Enrolments

Like courses, the number of students enrolling on different platforms has shown exponential growth over the past few years. The enrolment during 2017, 2018, and 2019 on a few popular online platforms such as Coursera, Future Learn, Udacity, Edx, and Swayam is expressed in Figure 6.

In 2016, Coursera alone registered 23 million enrolments, which continued to increase by about 30% (30 million) in 2017, 23% (37 million) in 2018, and 21% (45 million) in 2019. In 2016, Edx enrolments reached 10 million, which increased by around 40% (14 million) in 2017, 29% (18 million) in 2018, and about 33% (24 million) in 2019. Similarly, Udacity in 2017 had 1.8 million enrolments and increased by 250% (6.5 million) in 2018 and about 53% (10 million) in 2019. The overall statistics of the enrolments are expressed in Figure 6. The behavior of these statistics indicates that there is a continuous and overwhelming increase in enrolments on different platforms. This means that the demand for online courses and the popularity of ICT-enabled education are increasing quickly.
Figure 6. Graph showing enrolment status of various online courses provided by some popular online platforms during the years 2017, 2018, and 2019 [52,54,56].

11.3. Course Enrolment

The most demanding courses on the above-mentioned online platforms vary with course numbers and enrolment statistics.

The enrolment status per course conducted by Coursera during 2019 is shown in Figure 7. The insights drawn from it are that the most popular and demanding courses are directly or indirectly applied or engineering courses such as computer sciences and management studies. For example, more than 2 million enrolments were recorded on Coursera for machine learning courses and about 0.6 million for essential studies and skills. Similar trends were also observed on other online platforms as well.

The growth in both courses being provided and enrolments is expected to continue in the coming years. The tradition of switching to online education has almost become the need for sustainability for different institutions worldwide. The ubiquitous nature of ICT has made it possible for institutions to facilitate their students with the ease of learning environment to benefit more and more students.

Most enterprises worldwide have to switch their operations from ground stations to online mode. Online facilitators such as Zoom, Skype, Microsoft Teams, and Google Hangouts have witnessed an unprecedented and explosive increase in frequencies of daily use. Zoom reported around a 200–300% increase in online meeting hours; Microsoft Teams and Google Hangouts also reported similar trends. Most educational institutions adopted these to conduct online classes.
12. Recommendations

As the world is shrinking more and more in terms of connectivity, the cost of technology has reduced to a level such that most educational institutions can adopt the ICT-enabled educational paradigm. Ndibalema, in his study, investigated the attitude of teachers toward using ICT as a pedagogical tool and reported that teachers are not aware of the potential of ICT in their teaching. As a result, a few recommendations are made to modernize education and benefit more students to further enhance literacy across the globe [50]:

- More awareness of ICT must be spread among institutions to help them understand the power and importance of ICT-enabled education and its scope.
- Courses with industrial importance and demand must be designed as online courses.
- Teachers or instructors who design these courses must be trained to understand the importance and market value of the courses. This means the courses must be designed as job-oriented courses.
- Institutions must perform preliminary analysis to identify the most reliable ICT infrastructure to consume the lowest budgets with the most benefits.
- The degree of freedom a student may be granted must be among the primary focal areas of course design. The easier and more accessible the course is, the more students are motivated to pursue it.
- The assessment of the course understood by the students must be designed appropriately. While responding to these assessments, students must feel relaxed and enthusiastic in answering them.
- Students must be provided with an opportunity to express their understanding.
- There must be a proper mechanism to access the quality and feedback to improve further and include the scope of recommendations.
13. Conclusions

This paper has highlighted the demand for acquiring more ICT-enabled education at different levels of education. The popularity of ICT and its application across other domains of mankind has shown a mass increase. In parallel to their standard/traditional mode of servicing and operations, most public and private enterprises have adopted ICT-enabled technology to operate their work remotely. The widespread popularity of ICT has made its entry into education as well. In addition to established institutions/universities, many independent corporate establishments have started to design online means to provide education. Many instances lead students to discontinue their education, such as displacement from their original location due to conflicts or wars, disengagement due to various challenging circumstances, disabilities, or other financial or political reasons. ICT-enabled education is the only mode that can help these dropout students to continue their studies and earn degrees or certifications in diverse specializations. ICT-enabled education facilitates studies through broadly two methods of education: (i) passive learning by accessing the content stored online, and (ii) live interactive participation either in a classroom (such as video conferencing) or independently at a place of the student’s choice. The liberties facilitated through the online mode of education have motivated more pupils, resulting in more courses and enrolments. The design of the course must be carried out in proper consultation with market demand to make students more job- or skill-oriented. This mode of education has removed almost all the barriers that students were facing in traditional classroom-based education. Different platforms that facilitate this online education have also started designing and developing various online and applied courses. The need of the hour is to understand the importance of ICT and the courses to be prepared. There must be proper planning and desired strategies for such activities. Better outcomes can be achieved if prior and appropriate training is given to instructors to design their lectures and content more as more student-oriented. The demand and inclusion of ICT are expected to increase further to substitute traditional education, i.e., teaching–learning processes carried out in classrooms. The situation caused by COVID-19 led to the closure of all types of organizations, including educational institutions. ICT and various platforms were exploited during this period to carry on educational actions remotely, such as online classes on Zoom Cloud, Microsoft Teams, Skype, Google Hangouts, Google Classroom, Cisco’s Webex, etc. This study will further extend its projections, particularly on ICT and its scope to overcome the challenges emerging from epidemic or pandemic circumstances, where social distancing is an essential barrier to conducting small-scale or mass gatherings to execute route operations.

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Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ICT</td>
<td>Information And Communication Technology</td>
</tr>
<tr>
<td>T.A.M</td>
<td>Technology Acceptance Model</td>
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<tr>
<td>W.L.T.s</td>
<td>Wireless Learning Technologies</td>
</tr>
<tr>
<td>O.E.C.D</td>
<td>Organization for Economic Cooperation and Development</td>
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<tr>
<td>TPACK</td>
<td>Technological Pedagogical Content Knowledge</td>
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<tr>
<td>UNESCO</td>
<td>United Nations Educational, Scientific, and Cultural Organization</td>
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<tr>
<td>SAMR</td>
<td>Substitution, Augmentation, Modification, and Redefinition</td>
</tr>
<tr>
<td>LMS</td>
<td>Learning Management System</td>
</tr>
<tr>
<td>WWW</td>
<td>World Wide Web</td>
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References


