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The Impact of Information and Communication Technology on Pedagogy: Benefits, Issues, and Challenges

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Abstract

Information, Communication, and Technology (ICT) in education refers to the use of computer-based communication that incorporates into classroom instructional process (Ghavifekr and Rosdy, 2015). Technologies like computers, internet, broadcast technology are used to improve the effectiveness of the teaching and learning processes. Both teachers and students benefit from ICT. ICT in the classroom can result in higher learner motivation and can facilitate the transmission of basic skills. In addition, independent learning is supported by ICT. On the part of the teachers, it has been noted that many teachers view ICT as something that can assist them in the teaching process. Most teachers are of the opinion that the use of ICT helps them improve teaching through updated teaching and research materials accessed online. These materials allow them to design more interesting lessons and activities for the students. They also enable teachers carry out research beyond physical borders. Despite the benefits that the use of ICT in classroom brings, there are issues and challenges that need to be addressed. Among these are 1) lack of technological skills on the part of the teachers; 2) lack of technological tools/equipment; 3) high cost of facilities and infrastructure; 4) lack of technical support. It cannot be denied that ICT plays a significant role in changing the teaching and learning processes for the better. However, teachers must learn new skills that would enable them to adapt to a new and challenging teaching environment. There is also a serious need for a strong government support and institutional commitment to ensure successful and consistent teacher training and to improve ICT infrastructure in schools.

Keywords: *Information, Communication, Technology, Pedagogy/Education*

Introduction

Definition and Features of Information Communication Technology

Information, Communication, and Technology (ICT) in education refers to the use of computer-based communication that incorporates into classroom instructional process (Ghavifekr and Rosdy, 2015). ICT involves technological tools and resources such as electronic devices to create, communicate, store, and manage data and information. These technologies which involve the use of computers, the internet, broadcast technologies (e.g., radio, TV, Skype, podcast) are used for various teaching-learning procedures. It is believed that the use of ICT can increase learning opportunities as it enhances the quality of education through more advanced teaching methods and classroom techniques on the part of the teacher. In addition, according to UNESCO (in Nalugon and Nuqui, 2015), ICT can also improve learning outcomes and enable reforms and better management of the educational system.

ICT in education can be characterized by the following features (Ezike and Chicozie-Okwum, 2014):

1. ICT in education is any hardware and software technology that contributes in the educational information processing. This refers to computer technology with the hardware like PC, laptop, IPad, and softwares like power point, Word, Excel, and other various program packages.

2. ICT in education is any information technology that focuses on the acquisition, storage, management, transmission/reception of data for educational purposes. Examples are computerized registration system, data base for students' records, grades, admissions, etc.
3. ICT in education is any technology that deals with the exchange of information in the teaching-learning process. Teleconferencing, Power point presentations, Skype, online class sessions, and Hybrid classes are examples of this feature. In the University of the Philippines, we have the UVLE (The University Virtual Learning Environment) that enables instructors to: 1) organize their classes around themes and topics on weekly schedules; 2) upload digitized materials and share them with students; 3) link relevant materials from the sites; 4) create online fora for students to participate in (http://ilc.upd.edu.ph/).
4. ICT in education includes the hardware approach (laptop, SMART TV, cellphone, PC) and the software approach (PPT, Word, Excel) to assist methodologies, strategies in teaching and learning. In addition, ICT in education also includes the systems approach that uses management technology that deals with the systematic organization of the hardware and software. Examples are administrative softwares and library softwares.

Kinyanjui (2018) noted that the aims/goals of ICT in education may be categorized in four headings--utilitarian ; social; cultural; and personal. Under the utilitarian goal , ICT in education aims to help students become competent, reflective users who can use their knowledge and skills in their everyday lives. It also prepares the students for the future by helping them adjust to challenges in technology. For the social aims, ICT in education intends to equip students with social skills needed to communicate/cooperate with fellow students for a more productive learning. ICT in education allows learners to appreciate various cultures by facilitating access to different countries and their cultures (through internet, social media, etc.). Geographical limitations are transcended and it is hoped that the learners, through the exposure, would eventually become "cultured citizens of the world." ICT would like to assist the students to grow personally by presenting different methods of learning that can accommodate different types of learners. Open universities have made it possible for students who have physical constraints to pursue higher learning and obtain degrees.

There are two major trends emerging in educational technology. There is the technology for mass instruction which includes all forms of media aimed at being used to deliver instructions to a large population or groups of people at any given time. There is also technology for individual instruction which includes equipment and materials for individual operations that are designed to be used in delivering instructions to an individual at a particular point in time, such as teaching machines, programmed instructions, auto-tutorial systems, computer-assisted instruction/ learning modules/ etc (Ezike and Chicozie-Okwum, 2014). Savvidis (2016) noted that the use of technology improves students' engagement in what they are learning since it encourages a more active participation and collaboration among them. Technology also recognizes different learning styles and provides opportunities for making learning more effective because students can work on their own time and at their own pace.

With countless online resources, teachers can complement traditional teaching methods by adopting appropriate educational softwares for classroom activities and assessment softwares for grading and evaluation.

Perceptions of Teachers on ICT-Based Teaching

The developments in ICT resulted in its rapid spread in the education. Integrating ICT into teaching has become a source of concern, anxiety, fulfillment for many educators. ICT has practically changed many aspects of the teaching-learning process and studies have been undertaken to evaluate teachers views on ICT-based teaching; their readiness to use technology in their own classroom settings; their preference for professional development; and the support that they receive from their governments and other institutions.

In Scotland, an early study done by Simpson et al (1999) analyzed the attitudes of teachers, their range of skills, and the uses to which they applied ICT. Majority of the teachers (93% of 15 course directors) indicated that the use of ICT gave insights into new learning environments and enriched and enhanced courses. For some however, ICT had not reduced the burden of their teaching nor improved outputs. For half of the respondents, the use of ICT in teaching failed to improve the quality of the content of the students' work.

In the Indonesian setting, Suryana (2013) investigated teachers' perception on ICT-based English teaching for Teachers' Professionalism in Kuningan, West Java and he found out some interesting results. The study found that most of the teachers thought it was not time to apply ICT-based English teaching because the schools did not have yet the ICT equipment required. An interesting finding indicated that the senior teachers (those 53 and above) were ICT illiterate and were unable to follow the new technology. They tended to use the conventional way of teaching and were not motivated to learn ICT media for teaching and learning. The teachers were divided

into two major groups. The first group had no interest in ICT and were generally stuck in their habits. They were not motivated and did not want to study new things that they thought were time consuming. The second group had interest in ICT and these were the teachers with ICT literacy. They perceived that the application of ICT in the classroom was interesting and it was easier to do many things with the teaching process. Suryana concluded his study by stating that teachers in this era need to know much about ICT and apply it in their teaching but the lack of ICT facility caused most of the teachers not to apply ICT in their teaching.

In Malaysia, a study done by Ghavifekr and Athirah (2015) indicated that most teachers were aware of the usefulness of ICT in teaching. Most teachers realized that the use of ICT helps teachers improve teaching with more updated materials. Online teaching resources and materials are undeniably more updated and teachers can refer to them to design interesting and engaging lessons for the students. However, the study also showed that some teachers believed that ICT in teaching only cause the students to pay less attention to the lesson and to become too dependent on ICT. Whiles some teachers believed that they could still have an effective teaching even without the use of ICT, generally, the teachers were open to the use of ICT and they were comfortable in learning new things.

In Wales, Barnes and Kennewell (2017) interviewed teachers over a period of nine months to gain an understanding of the teachers' perception of skills definitive of ICT. Observations were done to establish if the classroom activity supported the development of the skill identified by the teachers. The findings revealed variation in the perception of ICT capability and pedagogical practices. The examination of perceptions and practices suggested that there might be a continuum of approaches to the development of ICT capability. On one end, the scheme of work was rigid, and the teaching tended to be mechanistic in nature and was concerned with the development of the tool within the software application under study. On the other end, there was a method of development which involved accessing the pupils' metacognitive skills using strategies such as facilitation and problem solving. This condition had pedagogical implications. Those who perceived ICT capability as being tool-based used a more mechanistic approach to their teaching. In the mechanistic approach, ICT was simply a tool and there was direct instruction and feeding of information. While those who perceived ICT capability as requiring metacognitive skills tended to use the problem-solving approach that allowed the development of higher order skills.

In the Philippines, Monserate (2018) noted that teachers were not ready yet to make use of technology but they were willing to learn. The teachers were not fully convinced that computers are indeed essential to student effective learning. The study found out that the teachers had satisfactory level of competencies but were still wanting more training to help them enhance their presentations. Based on the findings, however, there was no significant relationship between the teacher computer competence and teaching effectiveness. The study concluded that to have a positive effect on student academic performance, it is not mandatory to be skilled in technology.

Perceptions of Students on ICT-Based Teaching

The new generation is known to be computer savvy. Technology is something woven in their lives. This generation has been increasingly exposed to ICT –based learning contexts and this was the impetus that led educators, psychologists, and other stakeholders to conduct studies on students' attitudes toward ICT-based education.

Deaney, Ruthven, and Hennesy (2003) explored pupils' views of the ICT within subject teaching and learning. Grades 8, 10, 12, in six English secondary schools took part in this project for three years. The result indicated that the students view computer-based tools and resources as helping not just to effect tasks and improve presentations but also to refine work. The students welcomed the opportunities for independent working and collaborative work associated with the use of ICT in the classroom in which they could engage more directly with appropriately challenging tasks. However, they were also concerned that the reshaping of learning might displace valuable teaching.

Ang'ondi (2013) studied the perceptions of High school students in Kenya on the use of ICT in learning a second language. Group discussions and interviews were conducted and themes were identified. The themes included the learners' definition of ICT, enhanced motivation, redefined learning, and improved attainment. For the students, ICT was more than just computer and internet. It included radio, TV, newspaper. ICT was perceived to make the students' learning fun-based. The removal of constraints associated with manual learning contributed to the notion that the use ICT as fun and enjoyable. The students also agreed that the learner-centered approach led to motivated learning and improved attainment such as passing examinations. Students' capability in ICT was seen as a means of attaining knowledge rather than the end itself. Finally, the students also related the use of ICT

to good performance. According to them, ICT equipped them with skills to prioritize, plan, and manage assignments and projects with minimal assistance from teachers.

Wiyaka, Mujiyanto, Rukmini (2018) studied the perceptions of 263 students on the usefulness of ICT-based program DEC (pseudonym for a particular commercial English learning course). The results indicated positive reception on the ease of use of ICT-based learning. Fifty-four percent (54%) found the courseware easy to use while the rest did not find the software easy to operate. It was noted that simplicity was a big consideration in the positive attitude toward the use of the courseware. Fifty-five percent (55%) believed that the program could improve their performance. When a tool was perceived as important for the improvement of a task, then there was a positive attitude toward that tool. Sixty percent (60%) indicated their plan to use the program in the future.

What stands out in the perspectives reviewed is generally positive perception and attitudes toward ICT--enabling teachers and students to perform tasks easily and present more refined and attractive lessons and projects. The need to acquire updated, varied information particularly in doing research is something that ICT can provide. Many teachers see ICT as something that can assist them in their teaching and their professional growth through updated materials accessed online. The materials allow them to create and design more interesting, engaging lessons and carry out their own research for their professional needs beyond the physical limitations. However, the enthusiasm of both teachers and students is constrained by the concern related to the reshaping of learning. With ICT, everything seems automatic and the mental processing is deemed reduced. Teachers are feared to be displaced by computers and softwares. Both students and students agree that the teachers must remain central in providing organization, form, and support to the learning process. Technical skills and competence in ICT among teachers is another area of concern. Some teachers are still not adequately prepared emotionally, psychologically, and technically to try out teaching strategies that involve technology.

Benefits of ICT in education

The use of ICT in teaching and learning has become very popular; even research has been supported by advancements in computer technology. Efficiency and effectiveness in the acquisition of knowledge and skills in teaching and learning and in the methods of data gathering and analysis in research have increased in the recent years through technology.

ICT tools can enhance the quality of learning , teaching, and research in different ways:

Increase the learners' motivation. ICT like videos, TV, multimedia computer software that combine text, sounds, images provide challenging and authentic content that engages learners in the learning process (Altinay-Gazi and Altinay-Aksal, 2017). The distance between teachers and students is lessened and students have more opportunities for collaborative learning. Students can study together and even submit their work for evaluation through a less formal, less intimidating but highly interactive channels of communication such as email, group chat, or even blogs.

Facilitate the acquisition of basic skills. The use of ICT tools helps in the transmission of basic skills and concepts that are the foundation of higher order thinking skills and creativity through drills and practices (Altinay-Gazi and Altinay-Aksal, 2017). The various softwares and multimedia tools provide learners stimuli that can encourage them to engage in self-learning through repetition and reinforcement provided by the ICT tools.

Encourage shared teaching and expertise. ICT removed the limitations brought about by time and space. Now, teachers may carry out teaching activities beyond the physical classrooms. In terms of the teachers' professional growth, planning and lesson preparation are made more attractive, organized, and presentable and may be easily shared with others through the email, social networking sites, or through web links. Online discussions on specific academic topics can also be accessed through the internet.

Make classroom management easier. In the Philippines, there is a digital product called GENYO (https://www.genyo.com.ph/genyoportal/. The teacher uses the interactive features of GENYO using an Android tablet that stores ebooks, interconnected by a classroom management software. The teacher can review lessons, access students' assignments, scores, and process exam results immediately through this program.

Expanded resources for research data collection and analysis. In Pragmatics (the study of language use in context), emerging technologies have expanded the resources for collecting and analyzing materials and data. In studying pragmatic development and competence of second language learners, traditional classroom settings often lack resources in providing authentic input and varied social context (Taguchi, 2018). Technology offers potential

means to address this constraint (Taguchi and Sykes, 2013). Venues for collecting data have incorporated a variety of computer assisted programs and platforms for computer mediated communication (CMC). Face-to-face interactions in conventional classrooms are supplemented by technology-enhanced environments that provide opportunities for personalized learning and practice. Written or oral chats through CMC (messenger, Skype, group chats) have been used to connect second language learners with native speakers (Gonzales, 2013).

Options for data collection have been broadened by advancements in technology. For instance, Schauer (2007) developed a computer-based multimedia elicitation tasks (METs) which included 16 scenarios eliciting requests. In Pragmatics, variations in contexts and interlocutors are significant in analyzing language use. The MET enables researchers to adequately examine speakers' pragmatic behavior by presenting varied situations showing different interlocutors with different status and degrees of request imposition.

In Pragmatic research, corpus linguists and pragmaticists have discovered a common ground which paved the way for a new area, Corpus Pragmatics. Corpus pragmatics utilizes the best of two approaches: the vertical-reading methodology and the horizontal-reading methodology (interpreting individual occurrences within a specific context). The vertical-reading methodology instructs computer softwares to plough through myriads of text samples in search of a target lexico-grammatical item (Ruhlemann, 2018). By using technology, teachers and students both can develop knowledge and skills essential to the 21st century.

Issues and Challenges of ICT in Education

Despite the benefits brought about by the use of ICT in education, there are issues and challenges that need to be considered. In 2004, Jones identified and categorized the barriers to the ICT integration in education. These challenges include lack of teachers' competence; lack of resources; and technical problems. More than ten years after the study of Jones, the problems/issues remain fundamentally the same. While developed countries have been successful in the implementation of ICT in education, developing countries are still burdened with challenges such as:

Inadequate technological skills on the part of the teacher. Dotong et al (2016) noted that in the Philippine context, teacher preparation is still insufficient. Teachers' fear of technology and unsustained in-service training still hinder the use of ICT-related skills in their teaching. Successful ICT integration depends so much on the ability of teachers to add current knowledge through the use of technological media and a comprehensive and holistic teacher training must be in order prior to facing new educational challenges.

Lack of technological tool/s equipment. Lack of adequate ICT equipment like computers, software, laptops makes it difficult for schools specially in the rural areas to keep up with developments in technology in education. In the Philippines, the acquisition of tools/equipment is difficult due to funding constraints and bureaucratic procedures (Febro and Buan, 2013). In Banda Aceh, the lack of government support resulted in less than half of the schools being unprepared to implement ICT in education. Despite the high motivation of the teachers (Silviyanti and Yusef, 2015), there is still limited attention given by the government to provide facilities to support ICT use in the teaching and learning process (Muslem et al , 2018). The financial capacity and the lack of appropriations for ICT due to government policies and politics remain a major issue in the integration of technology in education.

High cost of facilities and infrastructure. The day-to-day implementation of ICT in learning can be constrained or limited by access. In Cambodia, just like in other developing countries, the high cost of electricity (or the lack of it) and internet access remains one of the major challenges to adopting technology in schools (Richardson, 2011). In Kenya, most schools still do not have internet access due to high cost of connectivity and many schools still do not have electricity (Mungai, 2011). Munyengabe et al (2017) reported that in Rwanda, 200,000 laptops were distributed to public primary schools under the "One laptop per Child program"; however, many schools cannot have access to this program due to lack of electricity brought about by geographical conditions.

Lack of technical support. Maintenance, updating, and management of technology (such as softwares, hardware, communication devices and tools) must be done on a regular basis to prevent equipment breakdowns. However, it is not uncommon to find a computer room full of obsolete or broken down computers because there is no provision for professional technical support. In addition, the lack professional technical support which can be a direct result of inadequate financial support from the government may actually spawn other challenges such as e-waste management problems.

Conclusion

The studies reviewed have highlighted how important government support is to the integration of ICT in education. Government policies, therefore, must be implemented appropriately and government support must be consistently sustained. For many developing countries, support (in terms of financial resources and technical support) from NGOs and private foundations and institutions must be encouraged and strengthened.

While technology facilitates creativity and productivity among learners, it can also be misused. The use of technology must be monitored so that the usage must be in consonance with the goals and objectives of pedagogy. Technology must be complementary with and supplementary to the learning experiences resulting from interactions among students and teachers.
The teaching-learning process using ICT requires fundamental skills in technology to be developed by the teachers and the students. The need of the young people (the millennials, generation Z) to construct their own learning and collaborate with others without time nor physical constraint must be complemented by the teachers' attitudes and efforts. The teachers must learn new technical skills and allot time for training. The teachers' role is crucial so they should learn to adopt/adapt methodologies, approaches to teaching and learning, strategies and classroom techniques that would make the most of technology.

On the other hand, technology should not drive human instruction to oblivion. It should not be a substitute for good education provided by good teachers. Teachers must see themselves as agents equipped with the capability—psychological, emotional, intellectual, and technological—to effect new learning and address educational challenges and changing pedagogical paradigms brought by the age of digitalization.

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