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A Literature Review on the Current Technocology in Education: An Examination of Teachers Use of Technology and Its Association to Digital Inequality in School

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Abstract: The translation of technology to society has been an object of interest of most researches since 1980s. More and more studies had been produced that show various perspectives on how this phenomenon can be examined.

There were opposing views that explain how technology is cascaded to its end users. While others stated that people use technology at varying phases and at a certain time would reach the saturation point where all will be at the same phase of technology use, others argue that as technology is cascaded to its end users, varying reactions arise which include acceptance and rejection. Heterogeneous engineering should therefore be employed to limit the occurrence of technology rejection.

These opposing views call for further examination on how the different dimensions of society are affected by technology. It is in this light that this review of literature is conducted. It specifically aims to determine how technology is used in the classroom, how digital inequality is experienced by teachers and the association of technology use to the existence of digital inequality in schools.

Results of this review of literature reveal that technology is used in the classroom for instructional support, information referencing and, communication and collaboration platform. Teachers experienced digital inequality due to their digital competency gap, belief and institutional perception on the function of technology in the classroom. The digital inequality in schools based on the students' capacity to use technology for academic purposes has found to be associated to teachers' technological capacity and interventions.

Keywords: educational technology, digital inequality in schools, technology in schools, teachers and technology-based education, technology use and digital inequality

1. INTRODUCTION

Technology, as a term, had never given a standard definition due to varying meanings people attached to it. An ethological perspective of its definition connotes that it is something inherently intelligent enough to function, be used to function, or be interpreted as having a function that intelligent beings like humans can appreciate, something devised, designed or discovered serving particular purpose (La Shun, 2017). This definition suggests that technology is designed and created to

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serve specific functions to people. It has to be functional to receive appropriate appreciation from its users.

The translation of technology to society with people as its end users had never been in a smooth process. Its appreciation and use are in varying phases but upon reaching the saturation point, all users will be at a common phase (E.M. Rogers, 1985 as cited by Sahin, 2006). However, an important argument was raised stating that technology as cascaded to society will receive varying reactions from its end users. There are those who will instantly accept it while others simply reject its presence. Heterogeneous engineering involving the end users in the design of technology is therefore necessary to delimit the occurrence of technology rejection (Cressman, 2014).

The opposing views above prove that the integration of technology to society has multi-directional outcome. With the identified trend, it is therefore beneficial to conduct a review of studies focusing on how technology is integrated to different dimensions of society such as in the field of education. This literature review intends to describe the current technology integration status in education focusing on teachers' experiences. As such, it intends to answer the following questions 1) how do teachers use technology as a teaching and learning device, 2) what is the extent of the existence of digital inequality in school based on the experience of teachers and 3) how does the teachers use of technology associate with the existence of digital inequality in school.

Studies done from year 2013 to present are the ones reviewed in this article. Technology is referred to as Information and Communication Technology tools such as programs, systems and internet access use in the teaching and learning process. Reviewed articles are open access studies retrieved using Google Scholar.

2. TECHNOCOLOGY OF EDUCATION

Technocology is a combination of the term technology and ecology. La Shun (2017) defines technology as something inherently intelligent enough to either function, be used to function, or be interpreted as having a function that intelligent beings such as human can appreciate, something devised, designed or discovered serving particular purposes from a secular standpoint without humankind creating it, or significantly beneficiary of rationally derived knowledge that is used for purpose without itself necessarily being translated into something material does autonomously or dependently when used. Friedrich (1958) defines ecology from the 1866 definition of Haeckel as the entire science of the relations of the organism to the surrounding exterior world, to which relations can be counted in the broader sense all the conditions of existence. Thus, technocology is a term that describes the interaction of human beings to their exterior world that is infiltrated by technology in the form of innovative ideas and tools. In the field of education, it refers to the interaction of different groups of people in schools with technology-integration.

3. HOW DO TEACHERS USE TECHNOLOGY IN THE CLASSROOM?

Existing studies found in Google Scholar reveal that there were quite a number of researches done with regard to teachers' use of technology in the classroom. Using the theme "teachers' use of technology in the classroom", the said search engine reveal 19,500 related studies. However, majority of these focused on the following topics – factors influencing teachers' use of technology, technology acceptance and readiness of teachers, perceptions of teachers on using technology in the learning process and roles of teachers in a technology enhanced learning environment. There were 20 studies reviewed in this article that has found to be related with the topic.

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Results of the review of related literature conducted reveal that among the most commonly type of technology that teachers use to facilitate teaching are Power Point (Ruggiero, & Mong, 2015), internet or web-based applications [(Rolando, Salvador, & Luz, 2013), (Kale, & Goh, 2014)], tablet, iPads or mobile devices [(Riley, 2013), (Thomson, Bridgstock, & Willems, 2014) (Lindsay, 2016)], social media networking [(Aydin, 2014), (Cunha Jr, van Kruistum, & van Oers, 2016)], virtual classroom (Martin & Parkerm 2014), and game-based applications (Wang, 2015).

The presence of infrastructure has been regarded as an important ingredient to make technology-integration in schools successful. However, despite of the great efforts exerted by the schools in providing the necessary technological resources, gaps still exist on how teachers utilize technology as a teaching and learning tool. According to Aldunate & Nussbaum (2015), their capacity to apply innovations in their own respective classes depends on the complexity of technology and their willingness to learn technology. They added that teachers who are early technology adopters and commit a significant portion of their time incorporating educational technology into their teaching are more likely to adopt new technology, regardless of its complexities. Even for those who are using technology, most of them used it, such as the internet, for searching information and materials for distribution to their students (Rolando, Salvador, & Luz, 2013). In relation to this, teachers use technology for administrative purposes, technology education, non-educational purposes, instructional preparation, teacher-directed instructional delivery, student homework and instructional assessment (Kurt, 2013). The most commonly used for instructional purposes is Power Point (Ruggiero & Mong, 2015) which appears to be an extension of traditional teaching strategy. When examined based on the perspective of the students, teachers allow them to use technology in their class in the form of smartphones in making notes, revising and information gathering (Sormunen, Lavonen & Juuti, 2014).

On the lighter side, teachers had use technology for enhancement of lessons such as for music related activities such as in creating songs, rehearsals/performances, teaching instrument use, using virtual instruments, audio/video recording and listening resources (Riley, 2013). The introduction of mobile device and tablets in schools shifted how the students learn. According to Thomson, Bridgstock & Willems (2014), it has led to the polarization of teachers who use technology. There are those classified as innovative teachers who shifted from teacher-centered approach to learner-centered approach. Thomson and his colleagues stated that these teachers transformed their lessons in accordance to the advantages that tablet computers can offer. But there are also those regarded as instrumental teachers who seem to use the device as a book behind the glass. Social media networking had been utilized as well for instructional purposes in the classroom. It has been used by teachers to promote teacher-students and students-students interaction (Aydin, 2014). However, results of the study done by Aydin reveal that students prefer passive behaviors in terms of their interaction with their teachers. Aydin therefore recommended for additional related studies that intend to explore the possible factors affecting the level of interaction between teachers-students and students-students in social media networking. Beyond understanding the role of technology in deepening the interaction between the teachers and the students, collaboration in social media platform thru knowledge sharing has been examined in existing literature. According to Tseng & Kuo (2014), the development of social relationships among online teacher-members help obtain potential resources and reliable support through their social network. As an example, having a virtual classroom would allow students and teachers to communicate synchronously using features such as audio, video, text chat, interactive whiteboard and application rating (Martin &

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Parker, 2014). A more sophisticated type of technology is now being used in the classroom by both teachers and students. This is known as cloud-based technology where Google Docs serves as a good example. According to Zheng, Lawrence & Warschauer (2015), the use of Google Docs aided the students in activities such as collaborative writing and editing, and improved interactions between writers and readers. Game-based applications have found to improve the motivation and engagement of students in classroom lessons. According to Wang (2015), game-based applications like Kahoot! brought dynamic experiences to students. It boost their engagement, motivation and learning.

4. WHAT IS THE EXTENT OF DIGITAL INEQUALITY IN SCHOOL BASED ON THE EXPERIENCES OF TEACHERS?

With the theme digital inequality among teachers, Google Scholar presented 17,100 studies. Majority of these focused on factors associated to the existence of digital inequality, the different dimensions of digital inequality and effects of digital inequality in particular with students with school as the context of study. There are eleven studies found to have significant contribution in generating answers on the issue of digital inequality in school based on the experiences of teachers.

The rapid growth of Information and Communication Technology (ICT) has become one of the most important topics discussed by the scholars for over two decades (Ghavifekr, Razak, Ghani, Ran, Meixi, & Tengyue, 2014). A number of studies still use the term “digital divide” instead of “digital inequality” to refer to the differences observe among people with regard to their utilization of technology. The three levels of digital divide is still prevalent in most schools with first level divide as differences on access to internet, second level divide as differences on skills and use and the third level divide as differences on tangible outcome (Scheerder, 2017). Differences arise as a result of varying factors. However, most researches are largely limited to sociodemographic and socioeconomic determinants of digital divide (Scheerder, 2017). However, existing studies reviewed in this article contradict to what Scheerder had found out about the factors associated to the existence of digital divide. Findings of Makki, O’Neal, Cotton & Richard (2018) about the persistence of first level of digital divide which they refer to as the first order barrier or availability of computing resources support Scheerder. They consider this as the initial reason for the differences of teachers on utilizing technology. Beyond the availability of technological resources, teachers also differ in terms of technology usage due to their unique needs and conditions for the use of emerging technologies [(Goh & Kale, 2016), (Wang Pei-Yu, 2013)]. In terms of setting, Wang Pei-Yu said that teachers in the urban areas are in the familiarity and confidence stage of using technology while those in the rural areas are in the understanding and application of the process stage. Sims (2014) called this as differentiated practice on using technology.

Existing studies reviewed in this article have found the association of teachers’ use of technology in the classrooms to their individual characteristics. The second level of digital divide is still very much evident. Teachers differ in terms of their ICT competencies (Sipila, 2013) otherwise referred to as knowledge and skill gap (Kaarakainen, Kivinen & Vainio, 2018). Kaarakainen et al referred to the skill gap as differences based on digital skills or the capacity to use technology, advanced technical skills or having the necessary skills to trouble shoot technical problems, and professional ICT skills. They found out that in terms of sex, male outperformed the female population and in terms of educational level, teachers with higher educational achievement outperformed their counterpart. Sims (2014)

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referred to this phenomenon as differentiated practice. Teachers' belief and institutional perception on the role of technology in education is also considered as factors for their differences on using technology in the classroom (Rafalow, 2014). Makki et al (2018) regarded this as second order barrier or computer anxiety, attitude and computer feature comfort. In addition, they have identified the third level order barrier which they called as participation in training session as another factor for the differences of teachers on using technology. The limited ICT skills of teachers classified as still on infant stage may be attributed to the lack of training on its proper use (Omariba, 2015).

5. HOW DOES THE TEACHERS USE OF TECHNOLOGY ASSOCIATE WITH THE EXISTENCE OF DIGITAL INEQUALITY IN SCHOOL?

Starkey, Sylvester, & Johnstone (2017), in the review of literature they conducted found out that there are three categories of digital divide in schools – access divide, capability divide and participation divide. They added that schools focused more on access divide by exerting effort on investing to technological resources, and in developing capability for teachers thru trainings. While the first level of digital divide known as infrastructure divide has been slowly addressed, still there was a large divide on quality of computer instruction (Yang, Hu, Qu, Lai, Shi, Boswell, & Rozelle, 2013) where teachers play a major role.

Researches on the association of teachers' use of technology to the existence of digital inequality were retrieved and examined using Google Scholar. The theme teachers' role in digital inquality in schools was used and the search engine instantly reveals 17,200 references. Only eight out these more studies have been found to be significantly related to this literature review.

Results of the review of literature conducted for this article reveal that teacher trainings on the use of technology or ICT contributes the most to the existence of digital inequality and digital inclusivity of students (Kaarakainan et al, 2018). The higher levels of culture for professional development among teachers at school would lead to increase levels of digital competence among students (Hatlevik, Ottestad, & Throndsen, 2015). Developing capability of teachers on using technology thru trainings would serve as a platform for them to maximize the appropriate use of technology in the classroom. Their intervention on using technology has a positive effect on students' attitude toward the use of technology for educational purpose (Gibson, Stringer, Cotten, Simoni, O'neal, & Howell-Moroney, 2014). Aside from teachers' technology practice in the classroom, their attitude towards using ICT for teaching and learning strongly contributes to inclusive education (Beacham & McIntosh, 2013).

Findings mapped out from the studies reviewed in this article reveal that teachers play a prominent, mediating role in the effects of computer proficiency on academic achievement of the students (Paino & Renzulli, 2013).

6. CONCLUSION

Results of the review of literature conducted in this article reveal that there were limited studies conducted focusing on teachers' utilization of technology in the classroom and its association to the existence of digital inequality in schools.

Existing studies reviewed reveal that teachers use technology for instructional support, information referencing and, communication and collaboration platform. Technology has been widely

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used for instructional support as presentation aid, enhancement of lesson delivery and assessment. Technology as a learning tool to promote communication and collaboration between teachers and students and, students to students are less examined.

In terms of digital inequality as experienced by teachers, existing studies focused more on their individual characteristics as triggering factors for their differences on using technology. A significant finding from few studies reveal that teachers do experience digital inequality due to digital competency gap and, belief and institutional perception on the function of technology in the classroom.

Digital inequality in schools based on the capacity of the students to use technology for academic purposes has found to be associated to teachers technological interventions. While it has been proven in various studies that teachers' technological capability remains to be a major concern in a technology enhanced classroom, this concern has found to be effectively addressed thru trainings initiated by schools.

This review of related literature presented the complexity of cascading technology to society, in particular, to the education sector. It showcases the extent of teachers' utilization of technology in the classroom and how it could be better examined. In addition, it shed light on how digital inequality is experienced by teachers and how it could be possibly improved. Results of this review of literature could serve as the foundation in determining how digital inclusivity could be achieved in a technology-based education.

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