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5-21-2019

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ABSTRACT

The Agenda for Sustainable Development is a universal agenda to eliminate poverty through sustainable development by 2030. When it was adopted in 2015, the international community recognized that education was essential for the success of all seventeen of its goals. Ambitions for education are captured in Sustainable Development Goal 4, which aims to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all." The United Nations has explicitly stated the importance of using ICTs in achieving educational opportunities. Since then, very few studies have tackled the issue. The findings so far, do not provide detailed guidance on the impact of ICTs in this domain. The purpose of this study is to contribute to this gap by integrating research in the fields of Information Systems, Development studies, and Psychology to understand the factors for facilitating educational objectives through ICTs within marginalized communities.

Keywords

ICTs, education, marginalized community, culture, social development

INTRODUCTION

There have been two clear statements of agenda emerging from the United Nations – the Millennium Development Goals (MDGs), which ran from 2000 to 2015, and the Sustainable Development Goals (SDGs), which ran from 2016 onwards. MDG 2 and SDG 4 specifically deal with providing inclusive and equitable quality educational opportunities for all. One of the targets within SDG 4 specifically discusses the need to identify Information and Communication technologies for education. The desire for education is strong among ordinary citizens in developing countries. Educational use of Information and Communication Technologies (ICTs) is often the top priority when citizens are surveyed (Gomez 2014), with some evidence this ranks higher with women than men (Wahid 2007), and with educational impacts ranked among the top benefits of ICTs (Sey et al. 2015). Most uses of ICT for educational purposes are fragmented, individualized and instrumental – a typical example would be looking up an entry on Wikipedia in order to understand a particular topic for an immediate learning need. More structured approaches are increasingly available online. These can run from instructional videos on YouTube through to much more systematized offerings such as Massive open online courses (MOOCs). While it may be more difficult for those in marginalized groups to access digital education opportunities, if they are able to do so, they may benefit more than others. 42% of non-OECD Coursera MOOC completers without a college degree reported a tangible career benefit such as finding a new job, compared to only 33% of OECD-based completers with a graduate degree; and the former were significantly more likely to report tangible education benefits than the latter (Zhenghao et al. 2015). There is evidence that those using ICTs as the channel for learning also gain ICT-related competencies. A program distributing home computers to low-income families in Romania found a measurable increase in computing skills and knowledge (Malamud and Pop-Eleches 2011). Although, it has been explicitly emphasized by the United Nations as to the importance of using ICTs in achieving educational opportunities, in reality there have been very few studies that have addressed it. Based on the handful of studies that have been conducted, the analysis of the findings do not provide detailed guidance on the true impact of ICTs in this domain. Subsequently, the purpose of this study is an attempt to contribute to this gap by integrating extant research in the fields of Information Systems, Development studies, and Psychology. Specifically, our research question is, *what are the factors that need to be considered in facilitating the achievement of educational objectives within marginalized communities*? We begin by first looking at ICTs for educational purposes, followed by a discussion on the challenges of marginalized communities. We tie these two issues in the subsequent section through a conceptual model and provide implications and guidelines for research and practice.

INFORMATION AND COMMUNICATION TECHNOLOGIES FOR EDUCATION

The purpose of educational ICTs is to improve learning of knowledge through the use of electronic systems (Kurt, 2016). There are many types of technologies that are used in classrooms today. Smartboards along with laptops, desktops, and streaming services are all utilized (Lye, 2018). While these technologies are very common, they are not found in every classroom. Most classrooms in developing countries lack these technologies. However, there has been a big effort to bring

these technologies to these underserved communities (Gilbert et al, 2008). Most of these technologies are mobile technologies such as cell phones, radios, tablets and laptops (Trucano, 2017). Others include smartboards and desktops but these are not so common as they require many resources that these underprivileged areas lack (Gilbert et al, 2008). Televisions are also used along with satellite dishes. Solar powered panels along with smartboards have also been utilized (Livingston, 2016). Specific apps and online courses have been developed to help these communities (Dryden-Peterson et al, 2017). One example of these technologies is the one laptop per child initiative that developed VS-Pi, which is a low cost computer that can be used without internet access along with the hardware and software-GUI that is designed for constant connectivity (Le, 2018). Distance learning is also used (Pinto, 2018). MOOCs offer multiple learning gains (Maitland and Obeysekare 2015). In addition to the obvious content of the MOOCs, the following gains are also demonstrated: linguistic capabilities (most developing country learners will participate in MOOCs not in their first language), knowledge of different educational methods and technologies, knowledge of different national or global perspectives, and formation of social capital via relationships built with other MOOC participants.

CHALLENGES IN MARGINALIZED COMMUNITIES

The right to education is universal and does not allow for any form of exclusion or discrimination. However, all countries face challenges guaranteeing equal opportunities for all in accessing education and within education systems. Marginalized groups are often left behind by national educational policies, denying many people their right to education. Marginalized groups tend to typically, comprise of the following sub-groups: (i) migrants, refugees, and internally displaced persons, (ii) minorities and indigenous people, (iii) persons in detention, (iv) persons with disabilities, and (v) women and girls. A feature of marginalization is that people who are marginalized, are very likely to be subject to multiple layers of discrimination. Non-discrimination and equality are key human rights that apply to the right to education. These vulnerable groups face numerous problems in accessing education. Children of undocumented migrants and unaccompanied children are particularly vulnerable because they are often under threat of expulsion or in some cases cannot register at school due to their status. Internal displaced persons are also vulnerable as they are still under the jurisdiction of their own state, which in some cases may be the perpetrator of their displacement. In instances where internally displaced persons are denied education by the state, they have no further recourse at the domestic level and it is then the duty of the international community to facilitate the fulfilment of the right to education. Refugees are also vulnerable (Bonasio et al, 2017). Sometimes, refugee children are denied education because host states do not provide or cannot provide primary education for their own children. In some situations, they have no or very limited access to post-primary education or other types of training. When they are in refugee camps, poor infrastructure, inadequate resources (Gilbert et al, 2008) and the lack of trained teachers are common limitations. Consequently, the quality of education may be poor, the hours limited and school materials may be lacking.

INFORMATION AND COMMUNICATION TECHNOLOGIES FOR EDUCATION IN MARGINALIZED COMMUNITIES

Studies have shown the positive impact of ICTs in learning when marginalized groups were able to overcome barriers to access to e-learning. The use of digital assistive technologies levels the performance playing field for disabled students in Sierra Leone (Jones and Pal 2015). The use of mobile phones promotes better numeracy skills development and retention when used in education programs for illiterate adults in Niger (Aker et al. 2010).The latest International Telecommunications Union (ITU) data shows a steady growth in the adoption of mobile devices in developing countries (ITU 2018). This has resulted in an increased focus on mobile learning as a means to facilitate greater education within disadvantaged groups to help improve their livelihoods. However, many issues related to its effectiveness and usage remain such as mobile learning infrastructure, institutional support and design problems related to the pedagogy and content suitable for mobile delivery (Pimmer et al. 2016).

Disparate extant studies provides some evidence that ICTs play more of a secondary role when trying to achieve educational outcomes within marginalized groups (Chulilla-Cano et al, 2010). Motivation is a recurrent theme, especially around e-learning. In part, this relates to the motivation of teachers to introduce and make effective use of ICTs in the classroom (Furuholt & Orvik 2006; Rashid et al. 2013). Even more central is the motivation of learners. There are some signs that well-designed active learning or the incorporation of group learning into digital systems can improve motivation. Teachers also seem to provide a quite deeply embedded motivational presence in the learning process through face-to-face interactions (Wagner 2017; Livingston 2016). In another study carried out on junior high school students, it was shown that, when there is an interactive environment along with structured learning, students learned more and tended to be more involved along with feeling a sense of community (Gillies, 2003). Hence, the finding from review studies indicate that teacher-only and technology-only learning are less effective than blended teacher-plus-technology learning (Smith 2013). Locals and volunteers who already have experience with these technologies can play the role of mediums between the students and the ICTs. However, individuals who are mediators must be familiar with the culture of the target community or even better – be

from the same cultural background. In an initiative started by Village Science in Laos, local resources and instruction were used to educate students (Rathert 2014). Instructors must get the context right, local culture and local language must be utilized so that the students can relate better - localization is key (Wagner, 2017). A few studies conducted in refugee camps have shown that volunteers and instructors that participated in the same program previously, are now, part of instructing the new batch of young refugees in the program. Seeing someone similar to themselves helps the refugee students feel a sense of attachment and assimilation (Bonasio et al 2017). When the instructor came from the same community or understood the community's cultural norms, individuals seemed to relate better (Warschauer, 2002). A lack of understanding of a community and its culture was seen as the main cause of failure of the one laptop per child initiative in India (Le, 2018). Cultural differences and not having a good understanding of the communities' customs can hinder growth and can give way to discrepancies, as seen in initiatives taken by the Spanish Ministry of Industry, Tourism and Commerce. As a part of that initiative, the digital cities program was set up to promote the use of technologies in different areas such as leisure, culture, medicine, etc. For every aspect, modifications had to be made due to cultural and social factors (Salvador et al, 2010). One solution or method cannot be utilized for all communities (Duetsche, 2016). Environmental factors, cultural norms, accessibility and much more should be taken into account while trying to find a solution (Warschauer, 2002). Factors such as age of the target community population should also be taken into account when devising ICT-based educational initiatives – especially taking care to not leave any age group out. Many individuals who face digital exclusion may also face social exclusion (Chulilla-Cano et al, 2010).

In trying to make sense of the results from the literature from multiple disciplines, we extracted a number of major themes. These themes are shown below in table 1. Each theme corresponds to the sets of literature addressing them.

Theme	Publications
Educational ICT	(Livingston, 2016), (Pinto, 2018), (Lee, 2011), (Ratan, 2013), (Trucano, 2017), (Le, 2018), (R.B., 2005), (Bonasio et al, 2017), (Dryden-Peterson et al, 2017), (Deutsche, 2016), (Tyson, 2016), (Ralhan, 2016), (D'Aiglepierre et al, 2018), (Ischebeck, 2017), (Nxumalo, 2017), (Katz, 2015), (Kunakornpaiboonsiri, 2018), (Rashid, 2016), (SOS Children's Villages, 2017), (Rathert, 2014), (Chulilla-Cano, 2010)
Motivation & Mode of Instruction (face-to-face, techno-centric, group-based)	(Pinto, 2018), (Lee, 2011), (Ratan, 2013), (Deutsche, 2016), (Tyson, 2016), (Ralhan, 2016), (Doshi, 2014), (Ischebeck, 2017), (Katz, 2015), (Kunakornpaiboonsiri, 2018), (Rashid, 2016), (SOS Children's Villages, 2017), (Rathert, 2014), (Hill et al, 2003), (Gillies, 2003), (Furuholt & Orvik 2006), (Rashid et al. 2013)
Culture (Gender, Age, Race/Ethnicity)	(Trucano, 2017), (Le, 2018), (Bonasio et al, 2017), (Deutsche, 2016), (Tyson, 2016), (Doshi, 2014), (Nxumalo, 2017), (Warschauer, 2002), (Gomez-Barroso et al, 2007), (Crnic, 2013), (Salvador et al, 2010), (Chulilla-Cano, 2010), (Hill et al, 2003), (Bonasio et al, 2017), (Masucci et al, 2008), (Gilbert et al, 2004), (Masucci et al, 2008), (Hill et al, 2003), (Warschauer, 2002), (Crnic, 2013)
Environmental factors	(Trucano, 2017), (Le, 2018), (R.B., 2005), (Bonasio et al, 2017), (Deutsche, 2016), (Tyson, 2016), (Ralhan, 2016), (D'Aiglepierre et al, 2018), (Ischebeck, 2017), (Nxumalo, 2017), (Katz, 2015), (Kunakornpaiboonsiri, 2018), (SOS Children's Villages, 2017), (Rathert, 2014)

Table 1. Themes of ICT for Education in Marginalized Communities

The extraction and categorization of the above themes enables us to focus on what factors we need to consider in obtaining educational objectives through ICTs in marginalized groups. They are brought together through the conceptual model below.
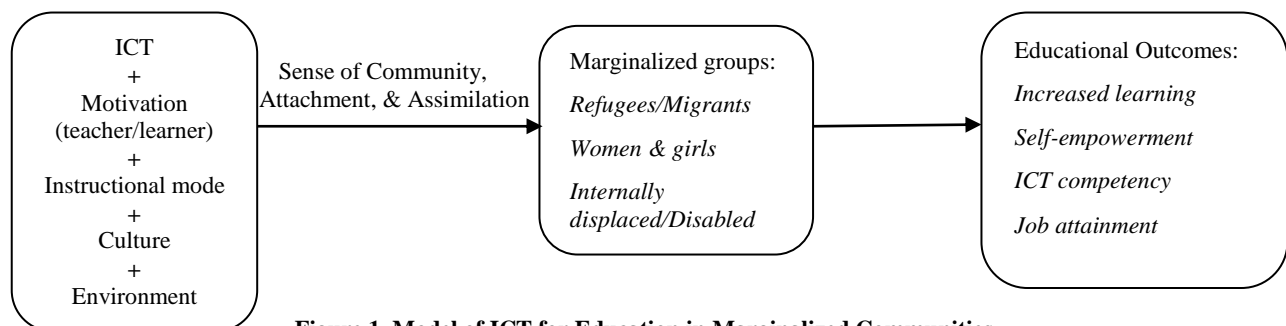

Figure 1. Model of ICT for Education in Marginalized Communities

The themes from table 1 need to be integrated together to serve as triggering factors. It is important to have motivated teachers that will take into consideration the cultural aspects of the community to devise an effective instructional mode (such as group-based active learning) via appropriate ICT (whether via MOOCs or mobile devices, etc.). In addition, the learning environment must possess the basic set of physical infrastructure components (e.g. electricity, network connectivity, etc.). The integration of all of these aspects will enable the marginalized communities to achieve a sense of attachment with the teachers and fellow students, as well as, greater assimilation of the knowledge taught via ICT. Sustaining this setup will improve the likelihood of achieving educational objectives.

Our analysis on this topic also enables us to offer the following guidelines & implications. To make significant gains, ICTs should be used to lever an improvement in the *process of learning* or even a *reorganization* of the pedagogic approach by:

- **Empowering teachers**: For learning initiatives to yield results, it is not sufficient to stop with explaining to teachers the technological functions of ICT devices and the types of content available in a digitally enhanced classroom. Only comprehensive training on the integration of technologies and appropriate pedagogical methodologies, as well as necessary subject matter knowledge, can equip teachers with adequate skills to design and facilitate ICT-based learning practices. A study conducted in Peru, showed that a participatory e-learning project was used to not only build the ICT competencies of teachers but also empower them to guide how ICT was used in their classrooms (Olivera et al. 2015).

- **Changing pedagogic processes**: Effective ICT-based learning projects should require ongoing support to guide teachers to use learner-centric techniques to respond to the myriad challenges in coaching students', especially refugee students' learning and self-empowerment activities. The transition from transmission-based instruction to facilitation needs to be managed with sensitivity, as it is likely to challenge the prior values and beliefs of both teachers and learners about what constitutes relevant learning in a changing context. An example of this was seen in a study in Senegal, where, rather than using ICTs to merely replicate the existing didactic approach, it was used to promote "a more learner-centered approach based on active learning" (Rashid et al. 2013), resulting in very significant improvements in national exam performance.

- **Changing pedagogic structures**: Using a traditional didactic model but enabling collective interaction between students can have positive effects. Use of video-conferencing within training for Ethiopian medical professionals enabled them to form a community of practice between themselves and the US trainers which developed knowledge to a deeper level (Negash 2010). In another study, use of mobile phones in a women's literacy project in Pakistan enabled formation of support groups who motivated one another to maintain their post-training literacy skills (Lee 2013).

CONCLUSION

The techno-centric approach is deeply rooted in the belief that technology can act as a silver bullet to socio-economic development problems, conceiving technology implementation as the most important part of the educational solution. Although these approaches have been widely criticized in education and development debates, they are still predominant in today's reality. Our analysis concludes that projects that focus on accomplishing educational goals and individual self-fulfillment needs should take an integrated need-centric approach by considering and addressing a plethora of elements in the wider educational environment. In marginalized groups, this would comprise initiatives that create and provide comprehensive measures including onsite learning and teacher support, transportation to facilities, support mechanisms for female learner participation, and/or educational pathways that lead them towards certification and degrees. In the integrated need-centric approach, technology is just one piece of the overall puzzle.

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