Adult learning: The nexus of ESD, ICT, NFE, and finance in developed nations

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ABSTRACT

Adult education has never been more important as changes to our planet continue to outpace sustainability efforts. Climatic changes once seemingly in our control have devolved into chaos, due in no small part to those who pollute the most – adults in developed nations. Educating adults in developed nations about sustainable development may hold the key to an eventual slowing of climatic changes, or at least enhanced resilience and adaptation. These educational efforts must consider that many adults have completed formal education and that a different form of education is the best of reaching this population – non-formal education. This type of structured learning outside of a formal classroom environment, paired with information communication technologies and different forms financing can enhance this learning process. This paper explores the nexus between these four themes through a review of the available literature and determines that a gap existed at their confluence. Though this gap may exist for several reasons, it is one that must be filled due to the importance of adult education for sustainable development to current and future generations.

Key words: Non-Formal education, Education, Education for Sustainable Development, ICT, Behavioral Change, Adult learning, Educational finance, Developed nations

INTRODUCTION

Education is the keystone upon which modern societies are built. For many in developed nations this education spans the formative years of life, only to abruptly end soon after becoming an adult. The formal education of youth does not often reoccur, creating an educational void that results in adults failing to gain critical knowledge necessary for sustainable development in the face of growing climatic threats. Education for Sustainable Development (ESD) is the next step in educational evolution. Within its teachings reside the tools and skills necessary for humanity to increase its resiliency and successfully adapt to climate change. Information Communication Technologies (ICT) has the power to further ESD, especially amongst adult populations in developed nations tied to smart devices.

These adults are the driving force of changes in our climate, and their continual education is essential to survival. Non-Formal Education (NFE) can provide these populations with the learning tools to develop knowledge outside of the classroom and immediately apply newly attained knowledge. The financial support of these goals is also a crucial piece of this puzzle,

as all educational efforts require funding. At the nexus of these four themes lies the possibility of creating behavioral change to preserve our planet for future generations.

Unfortunately, ESD as a holistic concept is not taken seriously. It has neither permeated the consciousness of adults in developed nations, nor led to behavioral changes that further sustainability. While academic publications exist that explain why the promotion of ESD has been lackluster, such publications do not fully consider how this deficiency can be overcome. The nexus of ESD, ICT, NFE, and financing may provide that answer and support the development of ICT-enhanced adult focused NFE for sustainability and climate change in developed nations.

The confluence of themes in this nexus represents a sizeable gap in knowledge. No academic papers have been written on the convergence of these themes outside of limited literature in the context of developing nations. This nexus may hold the key to reducing the emissions of those who pollute the most, but as this literature review demonstrates, these four themes remained siloed as disparate topics in

developed nations. This gap needs to be filled to fill to facilitate sustainable education for adult populations in developed nations.

This paper is broken into five parts. Part two provides a background into the four themes, part three explains the methodology of the literature review, and part four provides findings based on the results. The fifth part discusses the nexus between the four themes, and possible reasons why it has not previously been addressed.

INFORMATION COMMUNICATION TECHNOLOGIES

Information Communication Technologies (ICT) have existed in different forms since the advent of electricity. Radio, then television, were once the forerunners of ICT as both of these mediums addressed different audiences (Soukup, 2011). The advent of digital platforms, including computer and mobile based offerings, have become the new normal for transmitting information (Soukup, 2011).

Modern ICT platforms are present in many aspects of daily society in developed nations, from the classroom to the boardroom. ICT can be used to promote lifelong learning and further the development of knowledge based economies (UNESCO, 2016). ICT takes different forms depending on the platform used. Most web based ICT use Web 2.0, which helps to enable connections and collaboration (Garcia-Morales, Martin-Rojas, and Garde-Sanchez, 2019). Web 2.0 functionality provides developers with the tools to create content and share it with others (Grecu and Denes, 2013). These tools have empowered two common forms of learning on the go, mobile learning (mLearning) and electronic learning (eLearning). ELearning has become synonymous with distance learning, with mLearning acting as a subset of eLearning that occurs when the learning occurs outside of a fixed location (Latchem, 2017; Kalogiannakis and Papadakis, 2017). These ICT-enhanced learning methods provide access to Open Educational Resources (OER), or learning materials that are made freely available to the public (UNESCO, 2016; Latchem, 2017). One popular type of OER are known as Massive Open Online Courses (MOOC), which can deliver distance based educational content on demand (Wong, Li and Lam, 2014; Costa, et al., 2015; Delgado-Algarra, et al., 2019). Web 2.0 offerings are likely to continue to evolve with the introduction of Web 3.0, AI, and machine learning assisting learners in academic and professional environments.

ELearning and mlearning are relevant to adults in developed nations. The use of ICT is relevant to learners, as there is a connection between learning, earning, and developing skill sets that can further development (UNESCO, 2016). One of these skills sets may involve Education for Sustainable Development (ESD) (Kędzierska, et al., 2014). The correlation between ICT and ESD may bear fruit with additional development, provided that the outcomes are attractive to adult learners.

EDUCATION FOR SUSTAINABLE DEVELOPMENT

Education for Sustainable Development's (ESD) seeks to empower learners to acquire the knowledge, skills, and values that are essential to creating a sustainable future (Gokool-Ramdoo and Rumjaun, 2017). Unfortunately, the move towards sustainability has been lacking despite its potential to inform reductions in harm to our planet (Pavlova, 2013; Silveste and Ţîrcă, 2019). This may be due to the ESD concept itself, which became popular in the 1990's, despite its origins several decades prior (O'Brien, et al., 2013). The Stockholm Declaration's Principle 19 noted the importance of environmental education to create social and behavioral change in the early 1970's (UN, 1972). This environmental education concept was likely based on thinking from the 1960's that humanity is separate from nature (O'Brien, et al., 2013).

The environmental education concept evolved with varying levels of success throughout the next 20 years (O'Brien, et al., 2013). It was not until Agenda 21 that greater attention was focused on this topic, with its Chapter 36 calling for a reorientation of education towards sustainable development (UN, 1992). The Millennium Development Goals followed Agenda 21, but were silent on the issue of environmental education or ESD (UN, 2015b). It was not until the Decade for Education for Sustainable Development (DESD), which occurred between 2005 and 2014, that the United Nations Education, Scientific and Cultural Organization (UNESCO) aimed to promote sustainability education in and out of the classroom (Richmond, 2010). The DESD was followed by UNESCO's Global Action Program, which sought to increase the pace of sustainability learning (UNESCO, n.d.). The Sustainable Development Goals (SDGs) then arrived in 2015 with an aim to promote sustainable development by 2030 (Islam, et al., 2019).

Two SDGs, and associated targets, inform the development of ESD. SDG 4 promotes quality education and lifelong learning for all people (UN, 2019; Winthrop, et al., 2016). Its target 4.4 aims to increase skill set development, while its target 4.7 highlights the importance of sustainable development knowledge through education (UN, 2019). SDG 13 promotes taking action against climate change and its different effects (UN, 2019). Its target 13.3 speaks to the value of education in mitigating the effects of climate change, while simultaneously adapting to such

changes (UN, 2019).

As of 2021, the trends of these SDGs inform a likely inability for humanity to meet education and sustainability goals. SDG 4 as an overall goal is not on track to meet its education targets by 2030, thanks in no small part to the COVID-19 pandemic (UN, 2020). The climate crisis not slowing down, and it is doubtful that the overall SDG 13 goal will be met and humanity will be unable to keep global temperatures under 1.5 degrees Celsius (UN, 2020). Despite the importance of education in the face of these goal based issues, ESD faces the challenge of becoming incorporated throughout learning curricula rather than as a stand-alone body of knowledge (Hume and Barry, 2015). Time will tell if changes in education delivery can reverse this trend.

NON-FORMAL EDUCATION

Education is a vital component of human development. The delivery of educational content takes one of three forms: formal education (FE), informal education (IE), and non-formal education (NFE). NFE is often used as supplemental education, job training, cultural and religious based learning, and for ESD (Yasunaga, 2014). NFE is different from FE and IE in that NFE is often a form of social education that takes place at home or at work (Ando and Noda, 2017). By way of contrast, FE often occurs in educational institutions that provide full time education on designated pathways (UNESCO, 2011). Whereas IE is self-directed learning that occurs within the course of daily life and is less structured than FE or NFE.

NFE programs are usually small scale and short term, have limited funding, and are not necessarily aligned with FE efforts (Yasunaga, 2014). NFE is often focused on teaching children and teenagers rather than adults (Yasunaga, 2014). When NFE for adult populations does occur, it is often focused on the specific needs of a given population rather than a general audience (Noah, Musonda, and Wanga, 2016). Along these lines, NFE used in professional settings often takes the form of technical and vocational training, which is learner centric and focused on increasing the skill base of employees (Mubaryik, 2018). NFE, empowered by ICT, is one way that ESD can reach adult populations due to its flexibility and limited focus (Noah, Musonda and Wanga, 2016).

FINANCING   FOR   EDUCATIONAL DEVELOPMENT

In 2015 the Addis Abba Action Agenda called for businesses to "apply their creativity and innovation in solving sustainable development challenges" (UN, 2015a). This came in response to different financial solutions raising more than $100 billion for development

purposes between 2000 and 2013 (International Commission on Financing Global Education Opportunity, 2016). Public sector funding for education usually comes from governments however, as they have a vested interest in furthering the educations of their populations (Desjardins, 2009). Unfortunately, public investment outside of FE is frequently overlooked due a lack of information or political will (Desjardins, 2009). Certain types of private sector financing for adult education are common in industrialized nations, with employers paying for employees to improve their skills (Desjardins, 2009). In the case of employers this funding may be direct, but for others a solution may be outcome based financing, educational bonds, and student loans (International Commission on Financing Global Education Opportunity, 2016).

Financing for educational development is not without its challenges. Educational funding was barely a part of $100 billion raised for development between 2000 and 2013. (International Commission on Financing Global Education Opportunity 2016). It is unsurprising that only 1.6% of funds raised by the World Bank are destined for educational purposes (International Commission on Financing Global Education Opportunity, 2016). These challenges are due in part to the nature of the financial system and the desire to obtain a return on investment. It is also difficult to calculate the value of high skilled, well educated people (Desjardins, 2009). Though there may be plentiful funds to develop ICT, obtaining solid funding for NFE and ESD speak to a need for alternative reliable financial instruments and mechanisms that encourage a more resilient future.

BEHAVIOURAL CHANGE

The nexus of these four themes may create behavioral change in the adults of developed nations. Such changes would ideally lead to a more sustainable future, provided that adults are willing to make changes in their personal and professional lives.

Sustainable behaviors are actions taken to conserve natural resources, provide for equitable access, and to encourage cooperation (Choi, 2016).While the short term costs of sustainable behaviors can be high due to a need to change habits and reduce consumption, the long term benefits of these activities are environmentally beneficial and can lead to a reduction in the speed of climate change and the preservation of diverse ecosystems (van Horen, van der Wal, Grinstein, 2018). These behaviors are motivated by either intrinsic or extrinsic factors (Cecere, et al., 2014). Intrinsic motivations come from within the individual and result in a "warm glow" at contributing to a good cause, whereas extrinsic motivations often consist of financial rewards or improved social status (Cecere, et al., 2014).

MATERIALS AND METHODS

A systematic review of the literature relevant to ICT, ESD, NFE, and financing was conducted using desktop research. Desktop research is helpful in the analysis of what has previously been written (Delgado-Algarra, et al., 2019). Systematic literature reviews are a form of desktop research that can be especially useful in obtaining quantitative data (Costa, et al., 2015). This systematic literature review began in December of 2019 and concluded in February of 2020. It focused on generating results and reviewing scholarly articles related to the one or more of the four themes: (1) ESD (2) ICT (3) educational financing/funding and (4) ICT for climate change ESD.

Four search engines were used to obtain results using Boolean search term strings: (1) Google Scholar; (2) ERIC; (3) SCOPUS and; (4) Science Direct. All searches used filters to reduce clutter in the provided results. Google Scholar searches were limited to a 2009-2019 year range. Science Direct results were limited to the same year range, research articles, and review articles in English. SCOPUS results were limited to the same year range from English language journals. ERIC results were limited to the 2009-2019 year range.

ESD featured in majority of the searches, "climate change" and "ICT" also occurred in several searches. The words "funding," "private sector," "investment," and "non-formal education," received at least one specific search inquiry. All searches explicitly sought to avoid results features the terms "Africa" and "higher education."

These two terms were excluded due to the high number of results generated involving Africa and higher education during a pilot search. These large numbers skewed and overwhelmed the results relating to developed nations and NFE. The term "higher education" inevitably referred to FE environments rather than NFE environments, as many of the results discussed university level education. The term "Africa" yielded impressive number results about NFE in Africa. This is likely due to the prevalence of NFE in many African nations due to the limited availability and scope of government sponsored FE programs.

However, the focus of this literature review is on developed nations due to their high level of GHG emissions. African nations, and the continent of Africa as a whole, produce far fewer GHGs and include less developed economies than developed nations. Africa as a continent had a per capita GHG emission rate of 1.1 tons in 2017, less than 10% of the United States for the same year (Ritchie and Roser, 2017). Despite the explicit exclusion of these terms in Boolean search term strings, they still appeared in the results despite the limitations imposed. The search results would have been in the hundreds of thousands had these two terms not been explicitly removed.

RESULTS

A pilot search using only one Boolean search term string yielded limited results using all four search engines (Figure1). As a result, 11 different Boolean search term strings were used to obtain 26,852 results across the four search engines. The below Boolean search term strings were entered into all four search engines:

- "ICT"AND "Education for Sustainable Development" NOT "Africa" NOT "Higher Education"

- "Education for Sustainable Development" AND "INVESTMENT" NOT "Africa" NOT "Higher Education"

- "Non-formal education" AND "private sector" NOT "Africa" NOT "Higher Education"

- "Education for Sustainable Development" AND "APPS"

- "Education for Sustainable Development" AND "ONLINE" NOT "Higher Education" NOT "Africa"

- "Education for Sustainable Development" AND "Artificial Intelligence" NOT "Africa" NOT "Higher Education"

- "Education for Sustainable Development" AND "ICT" AND "Climate Change" NOT "Africa" NOT "Higher Education"

- "Education for Sustainable Development" AND "Climate Change" NOT "Africa" NOT "Higher Education"

- "ICT" AND "Climate Change" NOT "Africa" NOT "Higher Education"

- "Non-formal education" AND "funding" AND "ICT" NOT "Africa" NOT "Higher Education"

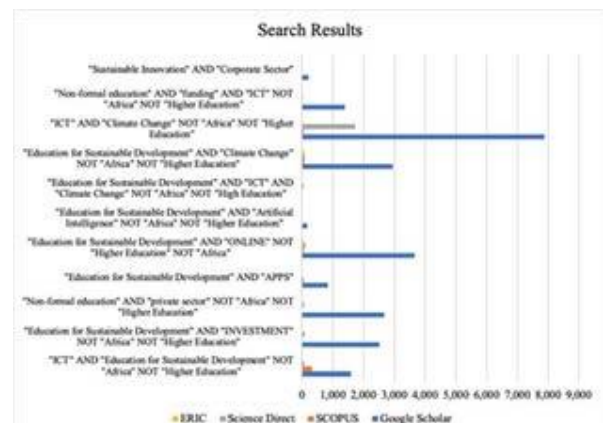- "Sustainable Innovation" AND "Corporate Sector"

Figure 1: Results by Search Engine.

Google Scholar returned the most results with 23,890, Science Direct returned 2,256 results, SCOPUS returned 610 results, and ERIC returned 96 results (Figure 2). All search results provided by Science Direct, SCOUPS, and ERIC were reviewed first by title, then by reading the abstract (if available) to determine the relevance to the four themes. The results from Google Scholar were reviewed differently; titles were reviewed on the results page and abstracts examined if a result related to one of the four themes. Due to the Google Scholar search engine producing only 1,000 reviewable results per search, the findings from this source were limited and generated the impetus to use additional Boolean search term strings.
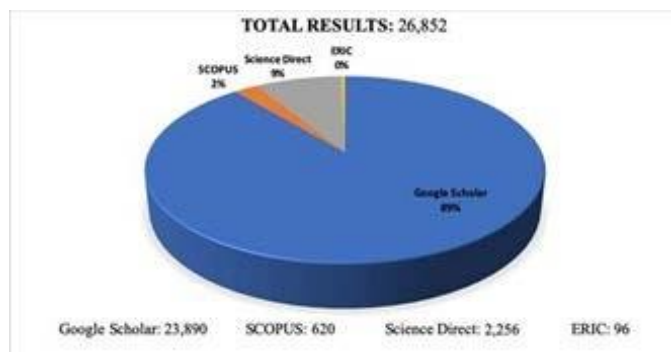

Figure 2: Total search results.

DISCUSSION

Surprising trends emerged from the 26,852 sources reviewed. A total of 82 sources met the criteria of being relevant to the correlation between at least two or more of the four themes. The searches that provided ESD results returned numerous papers and case studies from the DESD and the MDGs, including those from the United Nations (UN, 2015b). However, a majority of these results concerned applying ESD in developing countries, rather than developed countries. There was little about how ESD could impact adult learning, and even less about using NFE to enhance adult knowledge about climate change.

There were plentiful results about NFE as a stand-alone topic, including those that addressed how NFE could be used to change behaviors and address sustainable development issues (UN, 1992). Though many papers were premised on NFE in developing countries, there were several that focused on NFE activities in developed nations such as Sweden (Abdullai, et al., 2012), and Japan (Ando and Noda, 2017), where this method of learning has been adopted to fill gaps in knowledge for those unable to acquire FE. However, the papers on NFE in developing nations far outweighed those based on developed nations due to NFE being a more accepted form of education in locales where FE is not as robust.

There were numerous papers that tied NFE to ICT-specific learning platforms, such as MOOCs and OER. However, results that tied NFE to ESD often came in the form of FE offerings in primary, secondary, and higher educational settings; few articles tied adult specific NFE to ESD. When NFE as a concept was tied to adult learning, it often referred to blended learning or learning in the context of technical and vocational education and training in professional environments.

Searches that included ICT generated copious results about the different ICT applications and platforms. While the results explained that ICT can be utilized for both personal and private use, the use of the Web 2.0 development suite which supports numerous forms of ICT (Grecu and Denes, 2013) is geared more towards professional use (Garcia-Morales, Martin-Rojas and Garde-Sanchez, 2019). These numerous forms of Web 2.0 ICT included OER databases, and MOOCs, but also considered Wiki's, smartphone applications, and the use of more traditional digital ICT that included email and blogs (Soukup, 2011; Rogers-Estable, 2011; Miao, et al., 2016).

ICT results in relation to education were frequently tied to both youth and adult learners. This is likely due to UNESCO supporting the development of "knowledge societies" and a "knowledge based economy" from as early as the 1960's (UNESCO, 2016). Despite more than 50 years of time having passed, few results related ICT to ESD outside of environmental/social governance criteria used for investment purposes. However, several papers noted that combining ICT and ESD required a new appraisal of currently existing educational strategies (Kędzierska, et al., 2014). This is due in so small part to challenges in obtaining sufficient financial support, a lack of equipment, and determining the appropriate teaching methodologies (Suryawanshia and Narkhebed, 2015). This was especially true for MOOCs, which despite their appeal, may not offer degrees that are valued by employers (Garrido, et al., 2016) and which may require between 3 to 6 hours per week of study per course (Costa, et al., 2015).

The searches that related to funding and the corporate sector provided limited relevant results. While many of the results did tie financing to education, these results spoke to the funding of FE applications that included primary, secondary, and higher education offerings (Dev Regmi, 2016). The majority of these results were tied public sector funding, in the form of governmental support, to FE (Desjardins, 2009). Despite public sector funding, it was noted that the education sector overall had not "made its case" for being a worthwhile investment (Schäferhoff and Burnett, 2016). None of the results tied finance to ICT, as this is often handled by companies entirely in the private sector. Furthermore, none of the results tied private funding to ESD outside

of the Addis Abba Action Agenda of 2015 calling for businesses to "apply their creativity and innovation in solving sustainable development challenges" (UN, 2015a).

Four search engines were used to discover scholarly authorship on the confluence of these four topics, with 11 different Boolean search term strings used to obtain comprehensive results. Despite the wide net cast by this approach, zero papers were identified that overlapped ICT, NFE, ESD, and financing. Only 24 papers included climate change or ESD and another of the four themes. Even fewer results informed the correlation of how ICT could be applied to enhance ESD knowledge amongst adult populations in developed countries.

CONCLUSION

A nexus between ICT, ESD, NFE and financing should exist in a perfect world. ESD is vital to the continued forward development of humanity on earth. ICT provides a means to provide ESD to adult learners in developed countries through NFE. Finance and funding, from both the public sector and private sector, plays a major role in all three as ICT-enhanced adult NFE for ESD will not occur without money. This nexus may inform the development of behavioral change needed to make a dent in climate change due to the changing perceptions of adult learners.

However, the confluence of these topics does not exist in academic literature. While there is overlap between some topics, most of these themes remains siloed into distinct bodies of research rather than as a vitally important holistic concept. 82 total sources met the criteria for being considered by this literature review. Only 24 sources contained overlap within two thematic areas, with the most common overlap occurring between ESD and ICT. 8 sources overlapped with between three of the themes, with three of these sources coming from the U.N. The underlying cause for the limited amount of overlap was a result of many papers not considering the financial issues tied to ICT, ESD, or NFE. There are other possible reasons outside of financial considerations as to why there is limited overlap between the four themes. The first reason is that education is traditionally funded by public entities, and is traditionally the job of governments (Schaferhoff and Burnett, 2016). NFE may receive some funding from governments (Desjardins, 2009), but it does not come close to matching the level of support provided to FE. A second reason for limited overlap is that private sector financial interests are likely to require a return on investment. While public entities can fund education as a public good, for the private sector to become substantially involved it may require the valuation of educated populations to justify expenditure, or a return on investment through options such as student

loans (International Commission on Financing Global Education Opportunity 2016).

A third reason is that current ICT-enhanced NFE, such as MOOCs and OER, do not appeal to adults in developed nations. MOOCs take time to complete, which is something that may be in short supply for working adults (Garrido, et al., 2016). The time commitment on a weekly basis, paired with the length of time that MOOCs can take, may be a deciding factor against learning in this way (Costa, et al., 2015). A fourth, and perhaps the most concerning reason, is that ESD as a concept is still siloed (Filho, et al., 2018). Even if there is support from both the public and private sectors to support ICT-enhanced NFE, if ESD is not included throughout daily life then vital information about sustainability will not be effectively transmitted to those who need to know it the most. What remains uncertain is which of these reasons, if not all of them, is the cause for this lack of overlap.

This missing nexus highlights a significant gap in current academic research. The confluence of these four concepts represents a critical shortfall about the knowledge of adults in developed countries. While there are a few studies written about the confluence of these four topics in developing nations, more research is required regarding adults in developed nations. Specifically, this research should seek to determine why such a gap is present in the first place. Future research could determine that this gap exists due to an unwillingness to accept lifelong learning concepts, or a failure to modify personal or professional behaviors. Research into this nexus is essential, and filling this gap will help to clear a path to reduced environmental harm emanating from adults in developed nations.

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