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Conceptualizing Digital Fluency For Teacher Educators

Katherine FULGENCE[1]

Abstract

Digital Fluency as an emerging concept needs to be conceptualized in education setting. This is important, now that technology has revolutionized teaching and learning processes as evidenced in the delivery of curriculum through online courses and increased use of open education resources among others. Against this background, digital fluency as a concept and its defining characteristics are systematically analyzed in the education context for teacher educators mostly PhD holders at the University level. The findings provide guidance as regards the conceptualization of digital fluency and the related dimensions and attributes for teacher educators. Policy implications and areas for further research are provided.

Keywords: *Lifelong Learning, Digital Fluency, Teacher Educators, Prospective teachers*

INTRODUCTION

Digital fluency as a concept has been emerging over time in different sectors. In the education sector, digital technologies and educational technologies have transformed the way curriculum knowledge is embodied, organized, disseminated and preserved (Van Ouytsel et al. (2014). The role of digitally fluent educators has also been recognized in the process of delivering the curriculum in line with the technological advancements (Mishra and Koehler, 2006; Slater, Davies, and Burgess, 2012; Van Ouytsel et al. 2014). Given the context, digital fluency form among the key competence to be demonstrated by teacher educators as it enables them to effectively deliver curriculum in both virtual and traditional learning environments using educational technologies and appropriate digital pedagogies (Chigona, 2018; Van Ouytsel et al. 2014; Kivunja, 2013). Although the application of education technologies potentially provides access to education resources across sectors, one's ability to harness knowledge through technology is more dependent on knowledge and skills than on access and use (Erstad, 2010). This makes it important for educators to develop digital fluency as a key competence in the digital era, however the conceptualization of the concept in education is not that comprehensive (Van Ouytsel et al. 2014; Kivunja, 2013).

This study contextualize digital fluency in the education sector with emphasize placed on educators taking into consideration their roles in implementing the pre-service teacher education curriculum. According to Wood et al., (1976) educators play a scaffolding role by controlling and directing learners to focus on and complete the learning elements (such as learning a new skill) that are within their range of competence. Likewise, collaborative learning among learners as advocated by

1 First author's affiliation: Dar es Salaam University College of Education, Dar es Salaam, Tanzania, e-mail: Katherine.fulgence@outlook.com

Vygotsky (1896-1934) social learning theory of the zone of proximal development become important learning theory for building digital fluency among learners on the acquisition of the new language, digital functions and digital content.

RELATED WORKS

Searching for a consensus about digital fluency has been encouraged by earlier authors (Miller and Bartlett, 2012; Niessen, 2013). From the literature, digital fluency has been used interchangeably with terms such as ICT fluency; ICT proficiency; digital literacies; digital competence and digital capabilities (Addah, 2012; Sharon and Liam, 2019; SugHee et al., 2013; Kim and Choi, 2018; Ferrari et al., 2013; Li and Ranieri, 2010). According to White (2013), digital fluency, also viewed as a set of competencies and curriculum, is yet to be defined consistently. Miller and Bartlett (2012) see the terms literacy and fluency to be not interchangeable, but rather interrelated, with preference given to digital fluency as a complex mixture of skills required to navigate effectively through the online environment. In analyzing the trends, digital fluency has evolved in diversity from; ICT proficiency (Addah, 2012); Information and Communication Technology (ICT) fluency (National Research Council, 2006) and digital literacy (Robin, 2015; Li and Ranieri, 2010; Ng, 2012). In assessing its application, Lowenthal et al., (2016) argues that demonstration of digital fluency is applicable in any professional and in communities of practice that values technology use and innovation. Niessen (2013, p. 14) concludes digital fluency to be a complex concept that is emerging which goes beyond the basic digital fundamentals (computer skills and information literacy) and that the acquisition of digital fluency is a lifelong process involving, inquiry, exploratory, collaboration and embraces ethical aspects. Besides the recognition of digital capabilities, ICT competencies and digital fluency as key 21st century skills for learners (Ferrari et al., 2013; OECD, 2014; Beetham, 2015; National Research Council (NRC), 2006), for pre-service teachers (Griffin, McGaw, & Care, 2012; Miller and Bartlett 2012) and the development of guidance of the competences to be demonstrated by educators in developing digital skills, ICT fluency and integration of ICT into academic content (OECD, 2014; NRC, 2006; UNESCO, 2011), the harmonization of the digital fluency as a competence for educators is as yet conclusive (NRC, 2006; Niessen, 2013). Conceptualizing digital fluency for educators will exert an influence on, how teaching and learning is conducted in the digital environment, on what a teacher education curriculum should comprise of, and on ways in which educators evaluate digital tools given their role in enhancing teaching and learning at the university level.

METHOD

Concept analysis as a research methodology has been used in this study. According to McMillan and Schumacher (1997), conceptual analysis clarifies different meanings of an educational concept and its appropriate usage. The study uses a combination of conceptual analysis elements as modified from Näsi (1980), Braun & Clarke (2006), Walker and Avant (2005) and Nuopponen (2011). Näsi (1980) proposes four elements of conceptual analysis which include; creation of knowledge foundation about the concept across disciplines; external analysis which involves differentiating

the concept from other related concepts; internal analysis where different views and/or parts on the concept are broken down for analysis and finally forming conclusions about the concept by either accepting, modifying or forming new concepts, hypotheses, definition, guidelines and recommendations. Thematic analysis was used to identify the dimensions of digital fluency (Maguire and Delahunt, 2017; Braun & Clarke (2006). According to Braun & Clarke (2006), thematic analysis is a systematic comprehensive process of identifying themes (patterns) within qualitative data to address a research topic. Review articles were obtained through freely available databases such as Google Scholar, Social Sciences Research Network (SSRN), Education Resources Information Centre (ERIC), free databases for accessing materials and through subscription such as Scopus and Web of Science. The keywords include digital fluency, digital literacy, digital competence, digital capabilities, ICT proficiency and ICT fluency. The selection criteria for the resources focused on the articles that addressed the meaning, attributes and measures of the digital fluency as a concept and the related skills as outsourced from diverse scholarly publications. In total, 78 journal articles were obtained with 39 providing relevant information to thematically analyze and come up with 5 dimensions of digital fluency as a concept for teacher educators. To identify digital fluency characteristics for educators, the study used a combination of attributes as obtained from digital literacies (JICSI), digital capabilities (Beetham (2015) and digital competencies (Ala-Mutka, 2011; Ferrari et al., 2013). Other frameworks used in characterizing digital fluency for educators included the UNESCO ICT Competency Framework for Teachers (UNESCO, 2011) and the partnership for 21st century skills. The review was repeatedly done to attain saturation point, where no further perspectives or schools of thought were added by further acquisition of articles. The findings are thus organized based on the familiarization with the concept, digital fluency dimensions and the related characteristics for teacher educators and a conclusion about the concept digital fluency.

FINDINGS AND DISCUSSION

Familiarization With the Concept and External Analysis

Digital fluency is thus viewed as a combination of; (a) Digital, technical and proficiency knowledge - one's understanding to select and use technologies and technological systems); (b) Digital literacy (cognitive and/or intellectual competencies) - ability to read, create, evaluate and make judgments and apply technical skills in using technologies and the related systems; and (c) Social competence and/or dispositional knowledge - one's ability to relate to others and communicate with them effectively in the digital environment. In the education context, digital fluency is the ability to strategically integrate technology into teaching and learning with the aim of improving students learning outcomes and enriching the environment of a classroom (Spencer, 2015). Digital fluency enables educators to equip learners with the tools and expertise for becoming digitally fluent. Mahiri (2011) explains digital tools as any type of software or hardware that can be used for education ranging from a course including open courseware, computers, tablets and interactive games. The digital tools

can be employed in the classroom by an educator in a variety of forms from simple tools such as power point presentation to complex programming software, views also supported by Perini (2015) and Haelermans (2017). Digital tools are thus connected to technology, making technology and digital literacy to be the key for educators if they are to use digital tools to enhance teaching and learning in any environment (UNESCO, 2011). Digital fluency in the education context as a process therefore starts from possession of skills, to the development of competencies, proficiencies, literacies, capabilities and fluency which portrays an advanced level of digital capabilities as hereunder summarized.

- Skills - Ability to use digital technology to perform a task. Example information search and collection
- Competence - Ability to use digital technology to perform a task to the required standard. Example using a digital tool to produce, prepare or present an educational content
- Proficiency - Knowledge and skills about digital technologies such as presentation tools, search engines, analysis software
- Literacy - Effective application of the knowledge and skills to perform a task. Example identifying relevant education resources using relevant search engines
- Capability - The potential (skills and attitude) to learn and utilize digital technologies to perform a task. Example a responsible use of interactive media to realize a curriculum goal
- Fluency - Strategic and ethical application of digital technologies to realize curriculum goals. For example, designing of an interactive online course.

Internal Analysis of the Digital Fluency Concept: Dimensions and Characteristics

Besides conceptualizing digital fluency as a process, it was also important to establish the components and/or dimensions of digital fluency to facilitate further the internal and external analysis of the concept. Based on the reviewed literature, the study proposes five dimensions of digital fluency as summarized in Table 1. Building on the internal analysis, Table 2 externally analyses the digital fluency concept in education.

Category	Attributes	Source
Digital fundamentals including education tools and the ones relevant to the access, management and storage of digital resources	Basic computer operations, Internet fundamentals Digital tools, edu tools, tools for access and storage of digital resources, Content management systems	Addah, 2012; UNESCO, 2011; Mahiri, 2011; White, 2013; Warschauer, 2011; Samzugi & Mwinyimbegu, 2013
Learning design and facilitation	Models, Frameworks and Processes of designing learning; Digital Learning Development; Modes of provision – face to face, blended and fully online, learning management systems, Capabilities of an online educator, Instructional approaches, digital pedagogies and techniques, Effective learning strategies, Effective classroom management, Collaborative learning, Managing Diversity, Communication modes	White, 2013; Warschauer, 2011; Bates, 2014; Mallinson, (2013); Vidya, 2014; Sewell, Frith & Colvin, 2010; Kivunja, 2013
Open Education Resources and their potential	Open Courseware (OCWs), Massive open online courses (MOOCs); OER repositories, Creation of OERs, Creative Commons Licensing	Atkins, Brown,& Hammond, (2007); US Department of Education Technology, (2016)
Continuous professional development through institutional programmes and individual initiatives	Active use of technology, practicing digital fluency roles, awareness about institutional continuous professional development programmes and freely available MOOCs, willingness to learn, doing personal reflection	US Department of Education, 2016; UNESCO, 2011
Academic integrity	Awareness about intellectual property, data privacy, data safety and security the related practice along their teaching and facilitation roles	White, 2013; Ahmed, &Ullah, 2015; Cruz et al., 2015; Füzér, 2016; Langa, 2013

Table 1: Digital Fluency attributes for Educators

Source: Reviewed literature

Category	Digital fundamentals	Learning design & Facilitation	OER	CPD	Academic Integrity
Purpose / Relevance of the digital fluency dimensions in education (Resnick, 2002; White, 2013; Spencer, 2015; Howell, 2012; Kivunja, 2013	Prerequisite for active participation in the digitized society	Advocate for integration of technology into teaching and learning	Improve students learning outcomes	Develop digitally fluency knowledge and skills among educators	Ethical, authentic and copyrighted materials
	Enhances graduates employability	Enriches the classroom environment	Improved equity and access to digitally-enabled education system		
Characteristics / Properties of the digital fluency dimensions in education (JICS1; Beetham, 2015; UNESCO, 2011; Ala-Mutka, 2011; Ferrari et al., 2013)	Technology skills, digital information, organizational digital reputation, digital participation, digital tools (blogs, wikis, web pages), ICT productivity, ICT proficiency, ICT integration, Information literacy, digital identity, technology literacy, ICT literacy, Media literary	Online pedagogy, Crosscultural awareness, digital teaching, digital collaboration, Awareness about different education settings, digital communication, digital innovation, digital research, collaboration, technology enabled learning, social justice, civic responsibility	Creative expression, Content creation, Digital creation, Media literacy, licensing, knowledge creation, improved pedagogy, enlightened educator, knowledge generation and sharing, cocreation, remix, knowledge construction, new creations	Harnessing digital opportunities, personal learning, digital learning, digital research, digital scholarship, learning skills, teacher professional learning, lifelong learning	Digital identity protection, data protection, data literacy, digital safety, plagiarism, personal protection, Licensing, Intellectual property rights, digital well-being, copyright rules
Activity concept (Activities demanding digital fluency) (Lowenthal et al., 2016; Lysenko, et al. in press)	Application formalities, Registration processes, creation of educational blogs, institutional and personal websites	Implementation of the curriculum, learning facilitation, tests, provision of feedback to learners assessment, grading	Curriculum content design, implementation, learning design	Digital fundamentals, learning design and facilitation	Learning design, creation of OERs, Authoring of education resources
Agents (educational professions performing digital fluency tasks) (Lowenthal et al., 2016, Tucker, 2014): Educators, Teachers, Educational technologists, Instructional designers, Researchers, Academic and Research Institutions, field experts, Career planners					
Symbols (educational aspects signifying digital fluency) (Witte, 2007; CNNIC, 2009; Lowenthal and Wilson 2010; Lowenthal, et. al., 2016	Designed digital materials such as apps, Educational websites, games, digital education technologies, creation and sharing of OERs,	Designed online courses, Online facilitation, digital learning, online learning, mobile learning, social networking, educational digital media, online conferences	Application of OERs such as games, animations, videos and the related to enrich teaching and learning	Educators participation in CPDs via institutional programmes including MOOCs at personal level	OERs licensed under creative commons, research data, ethical publications
Tools for performing digital fluency activities (Lysenko, et al. in press): Digital tools, edu tools, educational technologies, Learning Management Systems					
Location where digital fluency activities are performed (Lowenthal et al., 2016): Education settings, physical classrooms, virtual learning environments					
Results (Outcomes of digital fluency at different levels) (Li and Renieri, 2010): Digital society comprising of digitally fluent educators, learners, researchers who can demonstrate digital fluency skills such as digital innovation, problem solving, communication, collaboration, critical thinking and research skills, research outputs and publications					
Alternatives to digital fluency: Conventional education, Distance learning education, print media					

Table 2: Conceptual area (categories and subcategories) used in analyzing the digital fluency concept

1 **https://digitalcapability.jiscinvolve.org/wp/2017/03/08/digital-capability-profiles-for-different-roles/**

Forming Conclusion About Digital Fluency in Education

Digital fluency as a concept in education presents an advanced level digital capabilities, competencies and skills that enable one to navigate and/or practice at different levels of competence the study digital fluency dimensions and the related characteristics to ethically realize objectives in any learning environment. The study proposes five dimensions of digital fluency which include;

a) Digital fundamentals - An awareness about basic computer operations to internet fundamentals and the related education tools (Eady & Lockyer, 2013). The tools should also include the ones relevant to the access, management and storage of digital resources (Samzugi & Mwinyimbegu, 2013);
b) Learning design and development - An ability to design and facilitate learning using appropriate pedagogies in all modes of provisions i.e. face to face, blended and fully online (Bates, 2014; Vidya, 2014; Sewell, Frith & Colvin, 2010);
c) Open Education Resources (OER) - An awareness about OER, their usage and creation using creative commons licensing (Atkins et al., 2007)
d) Continuous Professional Development (CPD) - Continuous engagement in professional development through available institutional programmes and open course ware (US Department of Education, 2016) and
e) Academic integrity - Awareness about ethical behavior, intellectual property and data privacy and how to practice the same along their teaching and facilitation roles (Ahmed & Ullah, 2015; Cruz et al., 2015; Füzér, 2016; Langa, 2013).

The definition and the dimension fit into the existing literature as reflected by Bartlett and Muller (2011), Niessen (2013), Bashlew (2011) and the UNESCO teacher ICT framework. Each of these dimensions has been further operationalized using the study conceptual analysis model. The model offers a comprehensive conceptualization of digital fluency concept in education with relevant and diverse attributes supported with literature under each criterion.

CONCLUSION

The objective of the study was to conceptualize digital fluency in education context as a gap in literature. The study first, reviewed literature to establish the terms related to digital fluency as used in different contexts and disciplines. Through thematic analysis, the researcher came up with five dimensions of digital fluency as a concept which included digital fundamentals, learning design and facilitation, open educational resources, continuous professional development and academic integrity. To conceptualize digital fluency, the study used Nasi (1980) and Nuopponen (2011) approaches to conceptual analysis and establish nine criteria for conceptualizing digital fluency in education which included purpose and/or relevance characteristics, activities, agents, symbols, tools, location, results and alternative to digital fluency. The criteria were described against each dimension of digital fluency as established in this study. Findings show that digital fluency dimensions as established in the study fits across all the nine criteria of conceptual analysis. The study adds to the conceptual

understanding of digital fluency in the education sector and the competencies to be demonstrated by educators in the digital era. To the policy, the study calls for the reflection of the digital fluency dimensions in pre-service teachers' curriculum and as a component to continuous professional development for the in-service educators. Empirical study will further enrich the study dimensions and expand further the digital fluency research for educators.

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