ASSESSING DIGITAL FLUENCY AMONG TEACHER-EDUCATORS IN UNIVERSITY SCHOOLS OF EDUCATION: THE CASE OF TANZANIA

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Abstract - This study assesses digital fluency among university teacher educators given its relevance in education industry. Digital fluency refers to educators' knowledge about digital tools and ability to make critical, creative, and autonomous blending of their potentials to realize teaching and learning objectives. Largely, the teacher education curriculum the educators studied did not integrate digital fluency as a key competence making the subject of interest to explore. The study established dimensions of digital fluency as a concept through literature review. The study used SAMR (Substitution, Augmentation, Modification, and Redefinition) model with its four levels of technology integration as a framework for assessing teacher educators' digital fluency. Data were collected through survey and interviews from 90 teacher educators at the university level including the management in schools of education. Findings show that most of the teacher educators perceive to have digital fluency at the substitution level, which is the lowest level. Educators with Information and Communication Technology (ICT) and science backgrounds sound to be more digitally fluent compared to the ones from the fields of humanities and social sciences, partly due to discipline exposure. The study contributes knowledge towards digital fluency as a key competence for teacher educators. Higher Education Institutions need to explore mechanisms for developing digital fluency skills in line with the preparation of 21st century teachers taking into consideration variations among educators' disciplines. Further research can shed light on the competence profile of digitally fluent teacher educators.

Keywords - Digital Fluency, Teacher Educators, Tanzania

I. INTRODUCTION

Worldwide, countries see education as a critical factor in generating knowledge and that quality education needs qualified teachers. The role of competent teacher educators in the process of preparing pre-service teachers who can facilitate learning has also been recognized (Sickel, 2019). The curriculum of most of the current teacher educators however focused on the Pedagogy Content Knowledge (PCK) content (Shulman, 1987), the aspect that missed technology part which embrace digital fluency aspect. A digitally fluent educator can design learning using technology and facilitate learning using appropriate digital pedagogies in all modes of learning environments (Howell, 2012; Kivunja, 2013; McKnight, et al., 2016). While PCK is still relevant in the contemporary world, the acquisition of the technology part of TPACK through relevant Continuous Professional Development (CPD) might be important for teacher educators also called digital immigrants (Wang, Myers and Sundaram, 2012). This will enable them to effectively utilize technology as a tool for teaching and learning (Mishra, & Koehler, 2006; Sickel, 2019). They will also be in a better position to model their learners (pre-service teachers) through using appropriate technology (Lunenberg, Dengerink, & Korthagen, 2013). While most of the Higher Education Institutions offer some form of online courses and /or programmes as well as integrating digital fluency aspects in the teacher education curriculum (Partnership for 21st century skills, 2011; ISTE, 2008; the US Department of Educational Technology, USDET, 2016), it is questionable whether teacher educators possess adequate digital fluency skills relevant to deliver the related curriculum. Research shows that teacher educators and student teachers over time have been feeling that they are not sufficiently well equipped for teaching and learning with technology in their classrooms (Tondeur, Kershaw, Vanderlinde and Van Braak, 2012; Uerz, Volman, & Kral, 2018). Teacher education institutions are also concerned now that their role of inspiring student-teachers to use technology is not fully realized due to insufficient number of digitally fluent teacher educators (Tondeur et al., 2012). On the one hand, much emphasize has been placed on frameworks highlighting how pre-service should be prepared along the teacher preparation programmes (see Partnership for 21st century skills, 2011; DigCompEdu by European Commission (Redecker & Punie, 2017); USDET, 2016; Teacher Development Competencies by Lázaro & Gisbert (2015); and Teachers ICT competence standards by UNESCO (2008) to mention a few. Few frameworks have focused on the assessing digital fluency skills among teacher educators besides recognizing the roles and practices of educators in technology-supported learning (USDET, 2016). On the other hand, few research has been conducted to assess digital fluency skills among educators in Higher Education Institutions (Kivunja, 2013; Uerz, Volman, & Kral 2018). Existing research on education and technology largely focused on integration of technology in the curriculum (Porter et al., 2014),how educators embed digital pedagogies in pre-service teacher education (Kivunja, 2013), how educators use digital

technologies to improve learning (McKnight, et al., 2016) and the competences teacher educators need both to teach and learn with technology and to foster student teachers' technological literacy (Uerz, Volman, & Kral, 2018). The studies came into a conclusion that research assessing digital fluency skills among teacher educators and the related digital fluency gaps in line with the technological growth in education is lacking (Kivunja, 2013; Uerz, Volman and Kral, 2019). Given the context, it is imperative to assess the level of digital fluency among teacher educators given their role in preparing future teachers as a research gap. The study will address the following questions; how do teacher educators perceive digital fluency? How do teacher educators assess their level of digital fluency skills? How do teacher educators demonstrate the possession of digital fluency? This study concurs with Trust (2017) recommendations that, teacher educators need to possess digital fluency and the related skills to enable them become better facilitators of the future teachers. A digital fluent educator can interact with online and offline resources, tools and management systems and utilize them ethically in realizing curriculum goals and learning objectives (Kivunja, 2013; Chigona, 2018). The study contributes to the inclusion of digital fluency as a competence to be developed among teacher educators. The study recommend for the need of teacher educators as second-order teachers (educating student teachers) versus first-order teachers (teach students directly) to acquire digital fluency skills as a competence along their roles, also supported by Kivunja, 2013; Uerz, Volman and Kral (2019).

II. LITERATURE REVIEW

2.1 Conceptualizing digital fluency for teacher educators

According to Heine and O'Conner (2014), digital information fluency is the ability to find, evaluate and use digital information effectively, efficiently and ethically in a teaching environment. In assessing the trends, the conceptualization of the term digital fluency has been emerging from terms such as literacies, digital competence and capabilities (Belshaw, 2011; Ferrari, 2013). Belshaw (2011) view the terms "literacy", "fluency" and "competency" to describe one's ability to navigate through digital environments to find, evaluate, and accept or reject information and is a blend of old literacy skills with new skills and knowledge required to understand the specifics of a digital ecology." (p. 4.). Bartlett and Miller (2011) 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. Li and Ranieri (2010) consider the 'literacy' and 'competence', to be conceptually equivalent and place emphasize on 'digital competence' now that digital literacy comprises of several literacies. In addition, digital competence can be translated into curricula, courses, certification programmes and has also been conceptualized in academic papers (Ferrari ibid). (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. Literature further adds that digital fluency involves knowing when and why we use the digital media that we choose, and using it with ease to communicate and/or retrieve information (Makice n.d). In the education context, digital fluency reflects advanced level skills embracing literacy, capabilities and competences necessary for performing an online facilitation and learning task to the required standard (Ferrari et al., 2013). Possession of digital fluency competencies prepare individuals to practice digital citizenship, which according to Ribble & Bailey (2007) comprises of Student Learning & Academic Performance (digital access, digital communication and digital literacy), Student Environment & Student Behavior (digital security and safety, digital etiquette and digital rights and responsibilities) and Student Life Outside the School Environment (digital law, digital health and Wellness and Digital commerce). Therefore, a digitally fluent teacher educator besides mastering the content and pedagogical knowledge needs also to demonstrate the mastery of digital fluency skills which include the effective use of Learning Management System (LMS), awareness about Open Education Resource (OER) and digital resources. Moreover, they should be in a position to promote academic integrity including copyright and privacy as recommended in the digital learning environment (White, 2013; Gordon, 2014). The study thus adopts the five dimensions of digital fluency for teacher educators as developed by (Fulgence, 2019, p. 319). 1) Digital fundamentals – Teacher educators' awareness of basic computer operations, internet fundamentals and the related education; 2) Learning design and development – Teacher educators' ability to design and facilitate learning using appropriate pedagogies in all modes of provision, i.e. face to face, blended and fully online using LMS and other frameworks; 3) Open Education Resources (OERs) – Teacher educators' awareness of OERs, their usage and creation using creative commons licensing; 4) Continuous Professional Development (CPD) – Teacher educators' participation and engagement in a continuous professional development through available institutional programmes and open courseware including the roles and practices of educators; and 5) Academic integrity – Teacher educators' awareness of ethical behavior, intellectual

property rights and data privacy and how to practice these along with their teaching and facilitation roles. This study adds 6) Storage and access of digital resources as a standalone dimension of digital fluency. The dimension includes digital tools relevant for accessing, managing and storing digital resources, which according to Fulgence (2019), they were categorized under digital fundamentals.

2.2 Framework for Assessing Digital Fluency among Teacher Educators

The study uses SAMR (Substitution, Augmentation, Modification and Redefinitions) framework to assess digital fluency skills among teacher educators taking into consideration the study digital fluency dimensions. SAMR framework identifies the level of technology integration within a classroom. The model comprises of four different degrees of classroom technology integration divided into two parts; enhancement and transformation Puentedura (2014). While enhancement includes Substitution and Augmentation, transformation includes Modification and Redefinition. The four levels are in continuum where by on the substitution level (lowest level of technology integration), technology can replace the traditional tools and on the other end, technology enables for accomplishment of tasks that without it, they are impossible to accomplish. SAMR framework offer relevant provisions for an educator to decide the level of technology integration depending on the subject knowledge, nature of learners and the pedagogical skills to be developed (Puentedura, 2013). Research findings further show that learning activities that lie at the two levels of transformation; that is modification and redefinition enable for higher level of learning transformation compared to the activities structured under the enhancement level (Puentedura, 2013, also supported by Hockley (2013). Each framework component will be discussed relating it to the study context. Under Substitution, technology acts as a direct tool substitute, with no functional change. In this regard, a teacher educator can use LMS as a technology to present curriculum content which substitute a reference list for students. Under Augmentation, technology acts as a direct substitute tool, with functional improvement. In the study context, augmentation refers to teacher educators' ability to use Microsoft word for word count and for checking grammar to mention a few. Technology therefore adds a new learning experience to the educator. Under Modification, technology allows for significant task redesign while at the same time accomplishing the learning objectives. Under this aspect, teacher educators can use Emerging Learning Technologies such as google Docs, blogs and emails to share documents and collaborate online in peer editing with a community of learners. Educators can also use google forms to collect and analyze data from large and diverse populations. Under Redefinition (the advanced level), technology allows for creation of new tasks that were previously inconceivable. Under this dimensionteacher educators' can create a movie, create own content such as OERs or an online course to be shared by the community of learners beyond the physical classrooms. At the redefinition level, a teacher educator now becomes a creator of knowledge versus a consumer of knowledge and can better promote the four Cs, critical thinking, creativity, collaboration and communication to students as key skills in the 21st century (McKnight et al., 2016).

III. RESEARCH METHODS

3.1 Research Design and Study population

A mixed research approach is used in this study with qualitative approach dominating the analysis. A qualitative research approach was appropriate in this study given the newness and limited awareness among the stakeholders on the digital fluency concept in literature and in the Tanzanian context (Raphael and Mtebe, 2016). Given the diverse backgrounds of study participants, qualitative data enabled for the development of a richer and more meaningful portrait of teacher educators regarding their perception and their digital fluency level. It was also important to gather descriptive data through quantitative approach to enrich the qualitative data collected. The study population consisted of universities that offer education programmes in Tanzania as case studies. According to Stake (l995), a case study enables a researcher to collect detailed information over a period of time considering its context. 4 out of 26 schools of education (TCU, 2016) were selected purposively, 3 public universities and 1 private university. The selection was based on the institutions' age, coverage as well as presence and absent of online programmes. Study participants were teacher educators including the management in the schools of education, with each individual forming the unit of analysis. The management were selected given their role in teaching and reviewing education programmes. Purposive and snow ball sampling were used to select study participants.

3.2 Data collection and analysis

One to one interview was held with the management in schools of education. Table 1 presents the breakdown. The participants also responded to the survey tool. Given the lack of a robust tool for measuring digital fluency (Wang, Myers and Sundaram, 2012), the survey and the interview questions were developed from a combination of the State Educational Technology Directors Association Teacher Survey (SETDA, 2013) and the study digital fluency dimensions after contextualization to fit the study context. The SETDA (2013) is meant to assess

effective technology use in schools among teachers. It was also important to observe initiatives demonstrating the mastery of digital fluency among educators such as development of courses or online teaching materials and engagement in other digital fluency dimensions. To triangulate the findings, educational technologists from the selected universities who also offer training to educators on digital fluency were interviewed to get their views on how they perceive teacher educators' digital fluency. The qualitative data obtained was recorded and verbatim transcribed. Thematic coding was used to analyse the transcripts using the research questions as themes. The analysis was aided by MAXQDA (2018) software for analysing qualitative data. Voices of participants have been reflected and further discussed using relevant literature. The survey findings have been presented in descriptive form.

Category	Description	Count	Percentage
Faculty / Schools / Departments	Education	58	64
	Science	12	13
	Humanities and Social Sciences	14	15
	Educational Technologists and ICT experts	6	8
	Total	**90**	**100**
Gender	Male	59	65
	Female	31	35
	Total	**90**	**100**
Designation	Directors, Deans and Associates	10	11
	Heads of Departments	25	28
	Lecturers	41	45
	Assistant Lecturers	14	15
	Total	**90**	**100**
Education	PhD holders	77	85
	Masters graduates	13	15
	Total	**90**	**100**
Online facilitation	Online Facilitators	55	62
	Non-Online Facilitators	35	38
	Total	**90**	**100**

Source: Research data (2019)

Table 1: Faculty representation and designation of the study respondents

IV. FINDINGS AND DISCUSSION

4.1 Educators perception about digital fluency and the related dimensions

The study aimed to establish the perception of teacher-educators about the digital fluency concept including the related dimensions. Participants' perception about digital fluency as a concept are presented in quotes; "Digital fluency has to do with knowledge and the level or extent of utilizing digital resources and materials regularly and on a day to day in teaching, researching, consultancy, and in every part of life..." (University Management and ICT Lecturer). "I view digital fluency as an ability of an educator to interact with technology..., how to utilize OERs, search engines, LMS to realize the course objectives and how to guide learners (pre-service teachers) to use the digital materials to facilitate teaching and learning...." Educator and non-online facilitator).

Other participants commented that; "Digital fluency has to do with the transformation of the PCK package to digital content using technology..." (University management and an Online Facilitator_89) and that "Educators have the TPACK package, but the technology part needs to be supported by Educational Technologists especially on the use of interactive audios and videos..." (University Management). As regards the conceptualization of digital fluency in line with the study dimensions, participants' rates in a five point scale in agreement to the study digital fluency dimensions and their ranking are presented in Table 2 in percentage. The dimension CPD was highly ranked among other dimensions, with the Academic integrity dimension being ranked the least. This means that participants largely view digital fluency to comprise of CPD including individual engagement in practices that enhances ones competencies and skills on digital fluency. The findings hold for the study participants since most of them are digital immigrants, now that the digital tools emerged along their professional career. Further research can explore the rationale behind other rankings especially academic integrity now that it received the lowest ranking.

Digital fluency dimensions	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	% Agree	Rank
Continuous Professional Development	13.6	4.5	-	54.5	27.4	81.9	1st
Digital Fundamentals	9.1	13.6	4.5	45.5	27.3	72.8	2nd
Learning Design and Development	16.04	2.2	13.6	50.0	18.2	68.2	3rd
Open Educational Resources	13.6	13.6	9.1	36.4	27.3	63.7	4th
Storage and Access of Digital Resources	18.2	4.5	18.2	36.4	22.7	59.1	5th
Academic integrity	4.5	13.6	27.3	36.4	18.2	54.6	6th

Table 2: Educators' agreement ratings about the study digital fluency dimensions

Source: Study findings

NB: 1 strongly disagree, 2 – disagree, 3 – neutral, 4 – Agree, 5 – Strongly agree. The % agree is the sum of the Agree (4) and stronglyagree (5)

4.2 Assessing digital fluency among teacher educators in schools of education

4.2.1 Possession of digital fluency among educators: Management perspectives

The study assessed from the management of schools of education (who are also educators) their views regarding the possession of digital fluency among educators in their respective units and departments. The management offered varied observations as

further presented. First, there was an observation commenting for the existence of categories as regards the possession of digital fluency and the related skills among teacher educators; "Basically, there are three categories of lecturers, the first category most of which are seniors..., are not aware of the digital fluency and the related fundamentals, they are also not that willing to learn..., the second category of lecturers do possess the basic digital fundamental skills, but they are not conversant in designing learning and are less aware of other digital fluency dimensions. The third category, comprises of the faculty who can design learning, but not to the advanced level. This third category comprises of all age groups and are willing to learn new technology and harness it in their core university roles...." (University management and Online Facilitator)

Other management members commented about the level of digital fluency among teacher educators as follows;

"The lecturers' digital fluency level is not of the recommended level..., some are fluent in some areas and not in others...., others are good in all dimensions, but this last category are the minority....."(University Management and Online Facilitator). There was also an observation reflecting the role of study specialization in developing digital fluency as here narrated; "The lecturers in my department are relatively fluent...., but at different levels...I think this is because of their specialization...." (University management and Online ICT Lecturer...) Overall, most of the management in schools of education had a perception that variations exist among educators on their level of digital fluency with this attributed to the field of study and individual interest in developing the related skills. This quote further supports these details; "...people have fragmented skills... others are good, say 50%, 70% and 100%, but in this last category are minority...the ones with the ICT background are better advantaged than the ones with for example History methodology background...." (University Management and Online Facilitator...).

4.2.2 Possession of digital fluency: Teacher educators' perspectives

The study also assessed from the educators' point of view as regards the possession digital fluency skills. From the findings, some perceive to possess what it takes to navigate through technology to enrich their teaching and learning practices given the existing environment. One educator shared personal experience as regards application of technology in the teaching; "In my courses I use blog, I have been using a blog for my undergraduate students for the past four years..., they are about 120. I also use it for my Masters' students, they are about 10... I prefer blog....some student posts are not authentic..., they should be corrected immediately... so I send it back for correction if the content does not fit the purpose..., so with blog, I can control this, but not under Moodle as a LMS.... Students participation contributes to grades... this has made students attach seriousness to the blog tasks..." (ICT Lecturer and Online Facilitator) Others perceive that they could have possessed higher levels of digital fluency, but the institution is not demanding them to apply digital fluency knowledge and skills besides offering trainings on the LMS and on the development of OERs. With an illustrative quote; "I happen to participate in a project, where we developed OERs for science subjects, which are freely available for use by secondary school teachers..., At times I use the materials especially during Chemistry practical..., and the institution does not demand me to do so....." (University Management and Non-online Educator).

Another facilitator commented that, "I benefited from the project where we developed science materials, I learned how to search for relevant video that enrich my teaching.... I have been applying this experience in my courses for about four years now..." (University Management and Non-Online Facilitator)

Other teacher educators however admitted that the level of digital fluency is low among them especially on their ability to develop OERs. As commented by one participant; "When I search for science resources for example..., I get very few from the Tanzanian context..., most of the You Tube videos are from other countries..., I don't understand why we cannot find the same from Tanzania..., I think we need to prepare more OERs relevant to our context..., we normally find the ones for the politicians, musicians, but not from the academicians..., I associate this with a gap in digital fluency among educators...." (Science Lecturer and non-online facilitator). Likewise, another facilitator with specialization in open and distance learning also commented that; "I am not confident in preparing OERs..., I lack the skills in preparing OERs...., and can the materials really go out for others? I need skills to make sense of what I would want to communicate..., there is also lack of peer support to make the OERs more appealing..., of high interactivity..." (Distance Education Expert and Online Facilitator). There also exist variations among study participants on their digital fluency levels. In particular, all study participants with specialization in technology did not indicate digital fundamentals and learning design as digital fluency gaps. This pattern was followed by teacher educators from the science disciplines especially Mathematics, Physics, Chemistry and Biology who demonstrate some advanced level of digital fluency compared to the ones from the fields of Humanities especially the ones from institutions that do not offer any form of online learning programmes and courses. The teacher educators from these enlightened fields however had other challenges and/or gaps as one ICT facilitator commented; "I do not see a tangible technical gap among us..., most of us know how to produce an

online course..., there are some gaps at the personal level..., for me the time for preparing the materials is the major gap, we also have other competing deadlines, and no time is provided for the task..." (University Management and Online ICT expert).

4.2.3 Aspects demonstrating the possession of digital fluency among educators

Besides the diverse perceptions among educators as regards their level of digital fluency, Table 3 summarizes the aspects that demonstrate possession of digital fluency skills among teacher educators as obtained from the study survey and the related percentages. From the Table, it shows that almost all educators access digital resources to enhance their teaching and learning including resources for publications. They also use referencing tools especially Mendeley (45.5%) and Endnote (31.8%) to manage their references. On the CPD including the roles and practices of educators, 64% happen to follow and complete online courses. It is interesting to note that digital fundamentals and OERs are comparatively less demonstrated and/or possessed among educators. Impliedly it indicates that teacher educators are not much aware of these dimensions and or the digital tools that support their applications, thus indicating digital fluency gaps.

V. DISCUSSION

5.1 Educators perception about digital fluency and the related dimensions

The study aimed to assess digital fluency among teacher-educators at the University level in schools of education. The study first established the dimensions of digital fluency, and used SAMR framework to assess educators' digital fluency based on the dimensions. Participants were also asked to conceptualize digital fluency. As regards the conceptualization of the concept, digital fluency to teacher-educators imply the possession of knowledge and ability to continuously and fluently use digital resources, transform PCK using technology in line with the core functions of the university, particularly teaching, researching and consultancy. While the definitions align to the digital fluency conceptualizations as reflected in research especially on its function in the attainment of specific learning objectives (Kivunja, 2013; Chigona, 2018), few studies have conceptualized digital fluency in line with other core functions of universities especially the aspects of research and consultancy, an area demanding further research. Likewise, while the digital fluency dimension for educators and the related attributes are not well researched in literature (Gordon, 2014; UNESCO, 2011; Wang, Myers and Sundaram, 2012), the existing definitions of digital fluency shows the concept to be a combination of knowledge and skills (Pinho and Lima, 2013), competencies (Ferrari et al., 2013), proficiencies (Addah, 2012), literacies (Li and Ranieri, 2010), capabilities (Beetham, 2015) and fluency (Bartlett & Miller, 2011). Further research can enhance the conceptualization of digital fluency as a learning concept detailing the related dimensions for teacher educators. The study however through the reviewed literature established six dimensions of digital fluency, which can form the basis for further analysis and categorization.

Dimension	Attributes	%	SAMR Framework
Storage and access of digital resources	Use of search engines and open access to search for academic journals, educational resources, funding sources; data storage using referencing tools, data analysis software	22	Substitution
CPD including the roles and practices of Educators	Personal development through conducting research, participation in online courses, engagement in consultancy and projects related to the design, monitoring and evaluation in the areas of digital fluency	17	Augmentation
Learning design and facilitation	Online facilitation, online communication, participation in projects demanding learning design, programme design	16	Redefinition
Academic integrity	Awareness of institutional rules regarding plagiarism, ability to identify falsification, misbehaviour, identity misrepresentation and fabrication with and without digital tools	16	Modification
OERs	The use and creation of OERs and MOOCs, awareness about creative commons, using open sources to accessing journals and articles	15	Redefinition
Digital fundamentals	Using ICT tools such as drop box, blogging, presentation tools, google groups, adoble flash, software for drawing, processing results and learning, website creation, use of mobile devices, Facebook, sharing of e-books, videos, learning logs, actively engaging in social media and academic networks such as research gate, academia as communication strategies, use of social media in classrooms,	13	Modification

Table 3: Aspects demonstrating possession of digital fluency skills among teacher educators
Source: Study findings

5.2 As assessment of digital fluency among teacher educators in schools of education

From the findings, it shows that educators in schools of education demonstrate digital fluency competencies at various level, with substitution level reflecting relatively higher percentage (22%) compared to other levels according to SAMR framework. Combining the two levels of enhancement and transformation, the findings show that large percent of teacher educators fall under the transformation level. These are however educators

with ICT background, followed by educators from the natural sciences, which comprise about 20 percent of the teacher educators population (TCU, 2016). According to Tondeur (2012), low digital fluency of faculty forms a challenge impeding significantly adoption of educational technology in Higher Education. While psychological factors particularly technology anxiety and aging form among the barriers from using technology (Jung et al., 2010), in this study, these factors were not evident. Rather, personal motivation and interest formed among the motivation factors along the demonstration of higher levels of digital fluency among teacher educators. Accordingly, factors such as socioeconomic status, organisational factors and opportunity to technology also provide for variations among individuals on their level of digital fluency (Wang, Myers and Sundaram, 2012).

The trend towards using education digital tools such as Web 2.0 tools, mobile devices, educational apps and virtual reality has also emerged from 2009 as commented by Brown & Green (2009). Thus there is a great possibility that the low level of digital fluency among educators is associated with the fast pace of development in educational technologies, the pace that did not align with the institutional and individual mechanisms to adapt and harness the same in teaching and learning. This makes it important for both individual and institutional mechanisms to come into play by offering continuous professional development progammes to develop the digital fluency of the teacher educators. Indeed, effective teaching requires knowledge of technology, pedagogy, and content taking into consideration the relationships among them views shared by Lundeberg, Bergland, Klyczek, & Hoffman, (2003).

VI. CONCLUSION AND RECOMMENDATIONS

The study aimed to assess digital fluency among teacher educators in the Tanzanian context and their conceptualization about the term. The study first conceptualized digital fluency based on the existing frameworks of digital competencies, capabilities and literacies. The SAMR framework has been used to assess the level of technology integration among teacher educators in enhancing teaching and learning in the classroom environment. On the perceptions, the findings show that digital fluency has to do with designing online learning and online facilitation as well as using technology ethically to enrich teaching and learning to realize curriculum goals. On the level of digital fluency, findings show that most educators fall within the enhancement level of the SAMR framework, particularly the substitution level. The study did not establish institutional mechanisms such as provision of CPD on digital fluency and individual initiatives in developing digital fluency that might have attributed to the study findings. Study participants however rated highly CPD as a major component of digital fluency. Further research can also explore factors such as reluctance among educators to embrace new technologies, difficulties in shifting attitude and commitment in dedicating quality time to harness the available opportunities such as the available trainings and OERs, also recommended by Heinonen, Jaaskela & Isomaki, (2019). Likewise, given the lack of a tool for measuring digital fluency among teacher educators, the study recommends for the development of one, views also shared by Wang, Myers and Sundaram (2012). The study findings however provide relevant details regarding the assessment of digital fluency among educators in the Tanzanian context and in other areas with similar context.

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