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Digital Transformation of Teacher Education by Bridging Digital Divide between Teacher Educators and Prospective Teachers

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Abstract

Digitalization has profoundly transformed the organizational processes, activities, experiences and teaching-learning models to fully persuade the shifts and prospects of a blend of digital technologies and their elevating effects across whole education sector in an ordered, strategic and highlighted way. Teacher education is highly influenced by the digital transformation globally. In Pakistan, it is imperative to digitally transform teacher education so that by overcoming the current prevailing challenges. Digital divide is one of the biggest challenges predominated in teacher education which necessitates to be bridged for meeting learning needs of prospective teachers. This research study was conducted to analyze the need and ways to bring digital transformation in teacher education by bridging the digital divide between teacher educators and prospective teaches. The study was descriptive in nature which followed quantitative method whereas sample of this study comprised of prospective teachers and teacher educators from education departments of three universities of Lahore. The study revealed that there is a dire need to bring digital transformation in teacher education, while there exists a prominent digital divide where prospective teachers are comparatively more superior in digital competencies and digital literacy. It was also found that digital transformation and digital divide are closely related and occurrence of digital transformation is dependent upon applying strategies to bridge digital divide. The study suggests that if teacher education institutions employ some digital divide-bridging strategies like e-Training, digitization of curriculum, enhancing digital

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infrastructure and devising digital strategies, it is possible to beget digital transformation in teacher education.

Keywords: Digital Transformation, Digital divide, Teacher Educators, Prospective teachers, Teacher Education, Digital tools and Technologies, Digital Competencies

Introduction

Nowadays we live in digital age beholding multidimensional revolutions in the structures and processes of societies and all arenas of human life due to the advent of emerging digital technologies. "We are witnessing a world in transition with a massive dynamism that is strongly influenced by technological trends" (Trend Report, 2016). Innovations of this updated digital world are combined and embraced globally at exceptional speed (Ratchford, 2019). As narrated by Narang & Shankar (2019), these digital innovations have certainly transmuted the marketplace which surmises that society all together is going through a pervasive transformation (Ebert & Duarte, 2016). Digital transformation is the overwhelming change of organizations and organizational processes, systems, activities, models and competencies effusively influence the transitions and prospect of blend of digital technologies and increasing effect throughout the society in an ordered and strategic manner.

Different authors have defined the term digital transformation (DT) in varying contexts. According to OECD (2019), *d*igital transformation is a process of change comprising numerous digital technologies, from 5G to AI (artificial intelligence), Blockchain and big data. These technologies form an ecosystem through which future economic and social changes will arise. Osmundsen, Iden & Bygstad, (2018) define DT as the disruptive variations due to the integration of digital technologies by altering the approaches businesses are run nowadays. According to Parviainen, Tihinen, Kääriäinen & Teppola, (2017), digital transformation is professed as an essential social evolution for digital generations who experience digital technologies rooted deeply in day-to-day tasks and systems. Fitzgerald, Kruschwitz, Bonnet & Welch, (2014) in their research delineated that DT implies the transformations accompanying the application of digital technologies like cloud, IoT (Internet of Things), social networks, big data and ubiquity. In their research study, Sayabek, Ziyadin & Suieubayeva, Saltanat & Utegenova (2020) infer that DT is a diversified technology-enabled systematic

conversion of processes and operations of organizations which requires to address imperative functions and tasks of innovative digital development and capacities for effectual digital advancement in digital world.

Dholakia (2019) claims that these digital disruptions are not only offering the enthusiasm, eagerness and new opportunities; but also devastating the educators and institutional structures to sustain the extent and swiftness of change. To coop with this digitization, teacher education institutions are reshaping their systems and processes (Gonzales, 2016) while designing new digital curricula and initiating e-Certification courses to deliver training to managers and digital leaders to keep pace with swift rate of digital transformation (Lane & Levy, 2019). The teacher education is termed for adaptation and evolution for taking benefits of innovative digital tools and technologies and for planning and developing tasks and strategies to perform vigorous functions in digital transformation process. Fullen (2002) claims that any transformation in education deals in three dimensions which are utilization of new technologies, transformed pedagogical practices and development of new models and theories in accordance with transformation.

Many research studies ponder upon the significant elements which are required to bring digital transformation. The most evident elements of digital transformation are *Digital Competencies* (Morze & Glazunova (2019); Svoboda, Lorenzova, Jirkovska, Mynarikova, Valisova & Andres (2019); Wolff, Omar & Shildibekov (2019); Kuzminska, Mazorchuk, Pavlenko & Prochorov (2018)); *Digital Literacy* (Livari, Sharma & Venta-olkkonen (2020); Shmatko & Volkova (2019); Kane 2019); Bilyalova, Salimova & Zelenina (2019); Blankenship (2019)); *Digital Infrastructure* (Avazov & Abduraxmonov (2020); Kraus & Kraus (2019); Balyer & Oz (2018); Khalid, Ram, Soliman, Ali Khaleel & Islam (2018); Shenglin, Simonelli, Ruidong, Bosc & Wenwei (2017)); *Digital Learning Environments* (Abad-Sagura, Gonzalez-Zamar, Infante-Moro & Ruiperez-Garcia (2020); Pinchuk, Sokolyuk, Burov & Shyshkina (2019); Bilyalova, Salimova & Zelenina (2019); Bond, Marin, Dolch, Bedenlier & Zawacki-Richter (2018)); *Digital Tools and Technologies* (Mhlanga & Moloi (2020); Bond, Marin, Dolch, Bedenlier & Zawacki-Richter (2018); Kiryakova, Angelova & Yordanova (2018)); *Digital Policy & Strategy* (Ekanayake, Shukri, Khatibi & Azam (2020); McCarthy (2020); Bojte (2019); Jackson (2019); Glahn (2019)); *Digital Communication and Collaboration* (Balyer & Oz (2018); Langset, Jacobson & Haugsbakken (2018); Barak (2017); Suarez-Guerreco, Lloret-Castala & Mengual-Andres (2016)); *Attitude Towards*

Digitization (Tamulee (2020); Kozlov, Kankovskaya, Teslya & Khasheva (2019); Moyo & Hadebe (2019); Avidov-ungar & Forkosh_Baruch (2018)); *Utilization of Digital Tools & Technologies* (Brevik, Gudmundsdottir, Lund & Stomme-Aanesland (2019); Bond, Marin, Dolch, Bedenlier & Zawacki-Richter (2018); Huda, Maselano, Shahrill, Jasmi, Mustari & Basiron (2017); Blundell, Lee & Nykvist (2016)); and *Digital Training* (Starkey (2020); Halken (2020); Voronin, Salenko & Tolchieva (2020); McClanahan (2017); Jan (2017)).

Teacher education signifies the policies, processes, strategies and opportunities intended to endow prospective teachers with attitude, knowledge, skills and behaviors which they need to accomplish their professional tasks efficiently in the institution and classroom. The professional teachers who engross to train future teachers are entitled as teacher educators. European Commission (2013) provides a comprehensive definition of teacher educators as the professionals who coach or teach prospective teachers by means of an objectivity to support their professional development. Any educational change which may be anticipated for the future is infused in prospective teachers by teacher educators (Lunenberg, Dengerink, & Korthagen, 2014). In case of digital transformation, it is needed to train future teachers to align their teaching and profession according to the necessities of digital era and anticipated digital pattern in coming future. There must be an established mechanism to teach them with emerging digital and online technologies to meet their diverse learning needs. Cam & Kiyici (2017) claim that current generation of prospective teachers needs to professionally evolve digital competencies and abilities for managing creatively and proficiently in this rapidly transforming digital world so that they may be able to teach future generations in accordance with the digital models of coming era.

Prospective teachers as digital natives are nonlinear, fast-paced, visually-oriented, always-on and self-paced learners whereas teacher educators are deemed as digital immigrants. As Prensky (2001) termed the preceding group for utilization of technology "The Digital Immigrants", the professionals who adopted and learnt novel digital technologies whereas they were not born with digital technologies in contemporary world. They may not effusively know the approaches, in which digital natives learn, communicate and interpret. Researchers suggest that age is not only a factor upon which digital divide is based (Lai & Hong, 2015; Thinyane, 2010), rather it is the matter of technology experiences partaken by the individuals. As defined by Srinuan & Bohlin (2019), the term Digital Divide is disparity between two groups

of people, one group having access and efficient utilization of digital technology and other group who do not.

The utilization of emerging digital technologies in teacher education entails new roles and responsibilities of teacher educators, new teaching methods and ultimately new approaches to teacher education. Stoerger (2009) says that technology can successfully be integrated in teaching if teacher educators possess the skills and knowledge to use them, and abilities to organize the learning environment in the novel ways by employing emerging digital technologies in teaching. Literature submits that students of this era are found connected all times through digital tools and technologies like social networking sites, laptops and smartphones (Levine, 2012; Koehler, 2012; Vodanovich et al., 2010; Jones et. al, 2010). Bacow et al. (2012) found today's students view their academic activities like assessments or assignments in alignment with daily experiences of their lives with primacy, relevance, attention and return on investment. As discussed in the findings of several research studies (Tapscott, 2009; Berk, 2009; Cashmore, 2009; Greenberg & Weber, 2008; Junco & Mastrodicasa, 2007), digital native learners possess certain characteristics which are typically found in almost all the learners of this group. Ultimately literacy and competencies gaps persist between natives and immigrants which propagate a disconnection regarding participation in online activities. In a broader perspective, it signifies that digital natives enact their position as main thespians of digital innovation (OECD, 2019a).

The digital divide presents intimidating challenges for teacher educators to seek the ways for fulfilling the digital needs of a prospective teacher in a better way by means of digital learning. Some ways to address these challenges are indicated more effective to bridge this digital divide and for bringing digital transformation in teacher education. According to Nakhoda (2020), one of the biggest challenges in teacher education of Pakistan is to bridge the widening digital divide across teacher educators and the student-teacher that mainly occurs due to inequality in utilization and competencies for using digital technologies.

As teacher education institutions strive to move for bridging the digital divide, they need digital environment that supports digital transformation from every point on the TEIs. In a report of Scottish government, Assessment-Result (2016), it is narrated that key to the success of such initiatives is building a digital environment which provides learning and teaching support to teacher educators and students in new and innovative ways. In order to facilitate the new digital learning

environment, the TEIs should strategically equip all classrooms including provision of devices to teacher educators and students supported by a vigorous wireless infrastructure whereas access to digital resources is vital, even involving teachers in new digital learning environment is essential (Gann, 2015). One important approach to narrow down the digital divide is the development and utilization of digital educational resources in teaching-learning. Khvilon & Patru (2018) relate in their book that teacher educators require to be acquainted with the requisites of the digital resources, their content and typology. It is essential for teacher educators to adopt digital pedagogy and e-Teaching models (Anderson, 2010; Timperley, Wilson, Barrar & Fung, 2008) which explain and exhibit the utilization of digital resources and technologies in classroom teaching.

Furthermore, teacher education requires a strong pledge of professional development to build and enhance the digital competencies of teacher educators by familiarizing them best utilization of digital tools and technologies in their professional tasks (Collier, Bukholder & Branum, 2016). In a study conducted by Balyer & Oz (2018), it is emphasized that for narrowing digital divide, the most significant function of teacher education should be the provision of necessary well-designed training to teacher educators, administrators and students for digital transformation. As suggested by Lopukhova & Makeeva, (2018), an ingenious and well-executed professional development program must be considered as an indispensable element of teacher education which may support educators to develop the digital literacy, digital competencies and e-Teaching skills that are prerequisite to elevate and progress in the 21st century.

One more important strategy to bridge digital divide is provision of digital infrastructure in teacher education institutions. According to OECD report, TEIs' leaders should develop digital infrastructure which may be capable to handle all the dimensions of digital transformation in teacher education. TEIs must leverage wifi, connectivity, networks, cyber security and all types of digital devices and technologies (Cochran-Smith, Alexanderson, Elis, Grudnsoff, Hammerness, Oancea & Toom, 2020). Educational leaders and policymakers who are concerned with teacher education should understand the need to offering digital policy (TNO, 2015; Schoechle, 2009) and devising plans and strategies to bridge digital divide and foster digitization in teacher education. Teachers emphasize the need of educational policies to be developed for bringing digital transformation to safeguard a positive change in students, teachers and administrators (Balyer & Oz, 2018).

The existing literature shows a relationship between digital transformation and digital divide but less evidence are found to express that digital divide influences the digital transformation in teacher education. This research study intended to address the gap found in literature which is the effect of strategies for bridging digital divide on digital transformation of teacher education.

Objectives & Hypotheses Framework

The research study aimed at:

1. To measure digital divide between teacher educators and prospective teachers
2. To compare factors of digital divide between teacher educators and prospective teachers
3. To analyze influence of digital divide on digital transformation in teacher education.

The hypotheses were as:

$H_0$1: There is no difference between teacher educators and prospective teachers regarding digital competencies.

$H_0$2: There is no difference of acceptability of digital tools and technologies between teacher educators and prospective teachers.

$H_0$3: There is no difference between teacher educators and prospective teachers regarding provision of digital infrastructure.

$H_0$4: There is no difference between teacher educators and prospective teachers regarding utilization of digital tools and technologies.

$H_0$5: There is no difference between teacher educators and prospective teachers regarding access of digital tools and technologies.

$H_0$6: There is no association between digital transformation and strategies for bridging digital divide.

Research Methodology

This research study was descriptive in nature which was followed by positivist paradigm and quantitative method for research. Sample of the study comprised of 85 teacher educators (regular and visiting) and 150 prospective teachers from the departments/institutes of teacher education of three universities of Lahore i.e. i) University of the Punjab, ii) University of Education, and iii) Lahore College Women University. Teacher educators were selected followed by purposive sampling technique on the basis of having familiarity with e-Learning and digital

innovations in education. Furthermore, followed by purposive sampling, prospective teachers were selected from senior semesters who had already studied the subjects of ICT/instructional technology/computer in Education. Two questionnaires were utilized and administered while data were collected by the principal researcher herself. To solve the research problem, followed by objectives and hypotheses framework, different data analysis techniques were applied which are reported as results in next section of this research paper.

Data Analysis and Findings

For this research study, data were analyzed to get the findings which are narrated as under.

Table 1
Opinions of Teacher Educators regarding Digital Divide in Teacher Education

Sr.#	Nature of Digital Divide	Mean
1	Digital Divide exists between teacher educators and students.	4.32
2	Digital divide is crucial issue.	4.81
3	Students are digitally more aware than teacher educators.	4.03
4	Students possess more digital skills than teacher educators.	4.64
5	Digital Divide needs to be bridged.	4.70

Table 1 illustrates the opinions of teacher educators regarding digital divide between teacher educators and prospective teachers. Mean values show that teacher educators agreed (M=4.32) that digital divide exists between teacher educators and prospective teachers. Besides most of teacher educators approved (M=4.81) that digital divide is a crucial issue. Whereas M=4.64 reveals that prospective teachers possess more digital skills than teacher educators and M=4.03 prospective teachers possess more digital awareness than teacher educators. Additionally, teacher educators need this gap of digital divide be bridged (M=4.70).

Table 2
Comparison of Factors of Digital Divide between Teacher Educators and Prospective Teachers

	Factors of Digital Divide	Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	M.D.	S.E.D	95% CI of the Difference	
									Lower	Upper
$H_0$1	Digital Competencies	.001	.022	-2.533	8	.015	-1.046	.412	-1.998	-.093
$H_0$2	Acceptability	.985	.043	-5.554	8	.024	-.886	.346	-1.685	-.086
$H_0$3	Digital Infrastructure	.023	.014	4.527	8	.002	.342	.648	-1.154	1.838
$H_0$4	Utilization	.544	.003	-2.468	8	.001	-1.544	.625	-2.986	-.101
$H_0$5	Access	1.521	.027	-1.845	8	.012	-1.124	.609	-2.528	.280

In table 2, findings regarding "digital competencies" illustrate that ρ=.015 (which is less than 0.05) and t=-2.533. It is clear that there lies statistically significant difference between the digital competencies of teacher educators and prospective teachers. So the null hypothesis $H_0$1 was rejected. For second factor 'Acceptability', ρ=.024 (which is less than 0.05) and t=-5.554 divulge that acceptability of digital tools and technologies of prospective teachers was significantly different from prospective teachers. So the null hypothesis $H_0$2 was rejected. For factor "digital infrastructure", ρ=.002 (which is less than 0.05) and t=4.527 shows that there exists statistically significant difference between digital infrastructure available to both. So the null hypothesis $H_0$3 was rejected. Furthermore, ρ=.001 (which is less than 0.05) and t=-2.468 highlights that there exists statistically significant difference between teacher educators and prospective teachers regarding utilization of digital tools and technologies. So the null hypothesis $H_0$4 was rejected. For fifth factor, ρ=.012 (which is less than 0.05) and t=-1.124 shows that access to digital tools and technologies is significantly different between teacher educators and prospective teachers. So the null hypothesis $H_0$5 was rejected.

Table 3.1
Regression Analysis on digital transformation and digital divide in teacher education

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	.818[a]	.669	.624	.143

a. Predictors: (Constant), SBDD (Strategies to bridge digital divide)

Table 3.1 illustrates the model summary of regression analysis for null hypothesis $H_0$6. Table provides R and R^2 values where R=.818 represents simple correlation which indicates high degree of correlation. The value of R^2=.669 represents that digital transformation is almost 67% explained by the strategies for bridging digital divide in teacher education.

Table 3.2
ANOVA

Model		Sum of Squares	df	Mean Square	F	p
1	Regression	3.822	1	3.822	122.080	.001
	Residual	.198	3	.001		
	Total	4.021	4			

a. Predictors: (Constant), SBDD (Strategies to bridge digital divide)
b. Dependent Variable: DT (Digital Transformation)

Above mentioned results of table 3.2 show as ρ=.001 which is less than 0.05 indicates that regression model predicts digital transformation significantly good. It means model is good fit for data.

Table 3.3
Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	p
		B	Std. Error	B		
1	(Constant)	9.120	1.359		2.295	.015
	SBDD	.776	.052	.818	11.049	.003

a. Dependent Variable: DT (Digital Transformation)

In table 3.3, the slope is .776 and intercept is 9.120 whereas T=11.049. The coefficient .776 interprets that for one increase in SBDD (independent variable), .776 increase is expected in DT (dependent

variable) at ρ=.003. Moreover, from standardized coefficient β, a one standard deviation increase in SBDD leads to .818 increase in DT (digital transformation).

Conclusions & Discussion

The results of this study substantiate that digital transformation may be brought in teacher education of Pakistan by bridging the digital divide between teacher educators and prospective teachers. Digital transformation is very much allied with digital divide (Livari, Sharma & Venta, 2020) and teacher education cannot be transformed digitally until the challenge of digital divide is not addressed, as the results of this study refer that there prevails the digital divide between teacher educators and prospective teachers. Results reveal that in most cases prospective teachers are more superior to the teacher educators regarding utilization and acceptability of digital tools and technologies in learning activities along with owning more enhanced digital competencies than teacher educators being digital natives. Findings of study have identified the factors of digital divide (digital competencies, acceptability, digital infrastructure, utilization and access of digital tools and technologies) while in literature review, elements of digital transformation are permeated which are digital competencies, digital literacy, digital infrastructure, digital learning environments, digital tools and technologies, digital policy and strategy, digital communication and collaboration, attitude towards digitization, utilization of digital tools and technologies and digital training. Findings of the study reveal a relationship and intermingling of elements of DT and factors of DD. Results further ascertain a robust association between DT and strategies to bridge the digital divide as 'correlation value' clearly depict a strong relationship between digital divide and digital transformation. Whereas outcomes of 'regression analysis' illustrate the dependency of digital transformation on execution of strategies to bridge the digital divide. This research study thus determines that digital transformation can be brought in teacher education if the digital divide between teacher educators and prospective teachers is bridged. Results of study also suggest that teacher education should be digitally transformed as it is essential need of this high-tech digital era. This gap is crucial to be filled to coop with the digital learning needs of prospective teachers and to meet the international standards of teacher educators in digital world. Study suggests that applying strategies to bridge digital divide are imperative to establish a fundamental shift towards digital

transformation. The results of this research highly recommend to teacher education institutions (TEIs) to promote digital transformation through bridging the digital divide by i) initiating e-Training programs for teacher educators to enhance their digital competencies and digital literacy, ii) digitizing curriculum of teacher education, iii) enhancing digital infrastructure of TEIs, iv) providing opportunities to teacher educators to utilize emerging tools and technologies in their teaching activities and develop digital pedagogical models, and vi) devising digital strategies to promote digitization in teacher education.

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