

The Digital Divide and Its Influence on Public Education Diffusion

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ABSTRACT

It is evident that information and communication technologies (ICTs) have improved performance and efficiency for different types of organizations. One of the important applications of ICT in public and private businesses is related to education, where electronic learning (e-learning) is a domain that became a paradigm more than a specific application. To utilize the full benefits of e-learning in public education and to exploit the diverse options of e-learning and specifically the synchronization of learning, digital divide is becoming an important obstacle that prevents teachers, students, and society members from benefiting from this phenomenon. Governments are striving to bridge the digital divide so that equal opportunities for education are guaranteed for their citizens in urban and rural areas. It is vital to explore the influence of digital divide on rural areas and how it affects the learning process. This study will explore the digital divide phenomenon, its relationship to e-learning concepts, how governments bridge this divide through e-government options, and finally, conduct an empirical test that explores the perceptions of students living in rural areas around the digital divide and its relationship to e-learning and education.

Keywords: Digital Divide, E-Government, E-Learning, Jordan, Perceptions, Public Education, Rural Areas, Technology Diffusion

1. INTRODUCTION

In the last two decades, the Internet contributed to the human wellbeing through the improvement in health, business and society. Information and communication Technologies (ICTs) and the Internet contributed also to spreading education to many rural areas specially through e-government and e-learning initiatives. Many universities are offering now online degrees and

even businesses are utilizing such capabilities to facilitate training and collaboration. It is vital to consider the Internet as a strategic weapon, where human and business can survive through the exploitation of such tool.

E-learning is an important phenomenon, where many universities and schools are using the Internet to offer their students the chance to learn when they are home or in remote areas. E-learning utilized the capabilities of the Internet

DOI: 10.4018/jtd.2012100104

to improve the performance and efficiency of the educational process. The major obstacle against such phenomenon is the digital divide.

The digital divide is not only related to those who have or have not, it has many layers and many types. It can relate to people with accessibility and those who don't, or it can relate to people who own the knowledge and skill to use computers and the Internet. In all types and levels of digital divide it is important to align the efforts related to bridging the digital divide to the desired levels agreed upon by the government of a country or users (Baker & Panagopoulos, 2004). The aim of such alignment is to look into people's need of the level of technology suitable to each area or segment.

E-learning efforts are divided between private and public sector, and also between universities and governments. E-government initiatives are important in bridging the digital divide. It is crucial to the success of e-government initiatives to bridge the digital divide, where citizens have equal access and opportunity to gain their education. E-learning can help governments bridge such gap and reach citizens in rural areas.

In this study, an empirical test will try to probe students' perceptions regarding the influence of digital divide and how can governments in developing countries overcome such challenge. Also, a comparison between the perceptions of students living in rural areas and the perceptions of students living in cities will be conducted to know the difference regarding issues explored in this study. Finally, conclusions and future work are stated at the end of this study.

2. LITERATURE REVIEW

To reach the desired level of efficiency in e-learning systems in a country, digital divide must be bridged to ensure the best communication and collaboration levels between users. Digital divide types must first be understood to better bridge the gap and improve the e-learning system. Also, the relationship between digital

divide and e-learning should be explored. Based on that, the following two sections will investigate the two areas by exploring the literature related.

2.1. The Digital Divide

In a very simple language, e-government is defined as providing public services using the Internet. One of the major services provided by governments all over the world is education. Abu-Shanab (2013) categorized e-government activities into four major dimensions: providing service, improving government performance, e-democracy and participation activities, and social development and bridging the digital divide. Based on that, research in the digital divide is explored from three major perspectives: social domain, e-government domain, and political domain. ICT is a major factor that cuts across the three areas and merges issues within each domain.

Many types of digital divide emerged in the literature, the following are the major typologies reported: people with disabilities digital divide (Seckin, 2010), gender digital divide (Minguez, 2006; Yao & Okoli, 2007; Subramanian, 2007; Tobola, 2010), race digital divide (Enoch & Soker, 2006), age digital divide (Redsell & Nycyk, 2010; Enoch & Soker, 2006; Geana & Greiner, 2011), education digital divide (Eynon, 2009), and income digital divide (Seckin, 2010). Each type of the previously mentioned digital divides requires a different scheme to overcome and each segment needs different and suitable system requirements.

Helbig, Gil-García and Ferro (2009) introduced three levels through which digital divide can be explored and using three approaches; in the first level, digital divide can be explored using a technology access approach, which differentiates between people who have access to technology and others who don't have. The second level, the multi-dimensional approach, in which several factors are considered when exploring the digital divide like: the existence of different economic opportunities, the differences between developed and developing

countries and people's technical skills. The last level explores digital divide using multiple-perspectives approach, in which people can be studied based on their values, beliefs, mental models and skills, also the impact of race, gender and ethnicity is considered.

Seckin (2010) related digital divide to countries, geographic areas, gender, age, and other demographic factors. The last level explores digital divide using multiple-perspectives' approach, in which people can be studied based on their values, beliefs, mental models and skills. Also, the impact of race, gender and ethnicity is considered. The literature shows that digital divide can be noticed internally (local digital divide) and externally (global digital divide). Similar to this categorization, Orbicom (2005) classified digital divide into two types: access divide and skill divide. Access divide relates to physical barrier to technology, and the skill divide is the competencies needed to utilize the technology and the Internet. Also, Baker and Panagopoulos (2004) viewed the issue from users' perspective, where it relates to the physical reach to technology, the availability of suitable content, and the perceived utility of technology and its content.

Savic and Radojicic (2011) indicated that digital divide is a complex and difficult problem to conceptualize especially that each technology will have a digital divide issue based on how it will be investigated and the factors that are considered; the differences in people's needs, their skills and educational level. Such complexity can widen or limit the scope and impact of bridging digital divide challenges, which differs from one individual to another and from one country to another. On the other hand, thinking of digital divide only in terms of "have" or "have not" and ignoring the technological, social and human factors is becoming a challenge and rethinking of digital divide using multi-dimensional framework is needed (Comunello, 2010).

The digital divide can result from a deficiency in the ICT infrastructure in the country and the political well and leadership support

(Hermana & Silfianti, 2011); the economic and income levels (UN Report, 2010); and education and literacy levels (Khan *et al.* 2010; UN Report, 2010). Finally, some research added technology type and cost as reasons that shape the digital divide (Dewan, Ganley & Kraemer, 2005). Based on that, researchers proposed different methods to measure the digital divide similar to the ratio of ICT services to population or ICT penetration to the GNP (Dewan, Ganley & Kraemer, 2005). Also, other methods for measuring the digital divide utilized mathematical equations or quantitative models (Billon, Lera-Lopez & Marco, 2010).

To bridge the digital divide, several methods can be used, the following are useful tips: formulating a well-balanced development strategy with continuous monitoring of information society, increasing the human resource power through strategic investment in education and ICT infrastructure, and the need for great focus on people's special needs and their perceptions (Savic & Radojicic, 2011).

In the Jordanian context, a study by Al-Rababah and Abu-Shanab (2010) utilized 50 interviews with women and explored the gender digital divide issues and concluded that the e-government project in Jordan did not reach the required level to help in bridging the digital divide and especially the gender one. On the other hand, the knowledge stations project supported by the Jordanian e-government project and the Ministry of Information and communication technology is a major step towards reaching people in rural areas. Another study by Abu-Shanab and Khasawneh (2013) conducted an empirical test to explore the digital divide issues related to e-government projects and concluded to the following: equal service were perceived necessary for three categories: rural areas vs. cities (78.5%), gender (76.2%), and income levels (68%). Also, 51.2% of their sample indicated that better public service should be provided for educated people and 52.9% indicated that citizens with special needs deserve better service.

2.2. E-Learning and the Digital Divide

Researchers emphasized the great role that the Internet plays in spreading education both globally and locally (Kelly & Nanjiani, 2005). The authors also looked into such phenomenon from a business perspective, where they proclaimed that investing in educating the “have-nots” has the potential of returning huge benefits. In the global context, and with the Internet help in bridging the educational gap between developed and developing countries, developing countries suffer from the inadequacy of infrastructure, gender gap, and the prevailing learning styles that prevents such countries from catching up with developed ones (Ali, Hussain & Ahmed, 2011).

Digital divide, when related to e-learning and education, can be categorized in relation to students financially unable to afford technology and broadband access, others lack the skills to engage with learning technology, culturally less able to benefit from technological enrichment, and even have gender and generational differences (Sims & Vidgen, 2008). In comparing the situation of Indian students to French ones, computers are seen as a tool for bridging the digital divide in India, where students are treating computers as a subject. On the other hand, the French Government is not treating computers in schools as a tool to bridging the digital divide as students have computers at their homes, thus computers are seen as means to learning (Cerisier & Popuri, 2011).

In a study conducted by Lin (2007), the author concluded that digital divide is among several factors that influence the effectiveness of aboriginal education in Taiwan. The crisis within the African societies constitutes a serious challenge to the implementation and the effectiveness of distance education, and contributes to widening the digital divide (Ojo, 2009). Also, in Africa, libraries have an important role in bridging the digital divide by providing access to information, videos, images, and knowledge by integrating new major paradigms

in a new networked world: information society, e-government digital divide, and e-learning/digital scholarship (Mutula, 2008).

In a study in India, Nayak and Kalyankar (2010) proclaimed that a policy should be developed to implement e-learning systems and maintain its quality. Also, they emphasized that the new web-based learning experience adds human support through on-line tutors, which makes e-learning an important factors. Finally, they cautioned that if not implemented in a massive and comprehensive way in rural areas, it will entrench a digital divide. Similarly, a study in the Pacific Island Countries concluded that digital divide is important to improve the readiness to e-learning and education (Raturi, Hogan & Thaman, 2011). Finally, in Pakistan, digital divide and specially the level of access to technology is an important factor in utilizing e-learning tools (Tatari & Tariq, 2011).

Promoting education through an e-channel might suffer from common communication problems like bandwidth adequacy. Some solutions to the communication problems faced were proposed through some ideas like the “learning computer”, where a low end bandwidth connection might be used, some minor updates are required, thus promoting a decentralized, modular, asynchronous integrated environment is proposed (Johnson, Kemp, Kemp & Blakey, 2007). This low bandwidth tool that provides a simplified, specialized e-learning environment which works with or without an internet connection might be a good solution for the digital divide in developing countries.

3. DATA ANALYSIS AND RESULTS

This study is an exploratory study that tried to know how Jordanian students perceive the relationship between e-learning and the digital divide. The study utilized 148 responses from students in a public university in the northern part of Jordan. The sample consisted of students in four courses in the MIS department.

The sample used is suitable for such research as students are the real population for research related to education and e-learning. Also, the northern part of Jordan is considered the richest with respect to the number of rural areas around the city of Irbid. Such environment (containing rural and city students studying in the same classrooms) is also suitable for conducting this study.

The survey used in this study consisted of four sections, where the first introduced the study to students. The second included some demographic questions. The third included 10 (Yes/No) answer type questions. Finally, the last

section included 17 questions that utilized a 5 point Likert scale, with 1 representing “totally disagree”, and 5 representing “totally agree”. The demographics of the sample are shown in Table 1. Figures 1-4 depict some visual representation of the sample.

Students were asked about certain issues with a Yes/No answer questions, where they emphasized certain answers and as shown in Table 2. Results indicated that the majority of students (more than 90%) have computers at their homes, use the Internet from home, browsed YU website from home, and own a mobile phone. On the other hand, only 57.4%

Table 1. Sample demographics (gender, age, degree, position)

	Count	%
Gender		
Male	42	28.4%
Female	104	70.3%
Missing	2	98.6%
Total	148	100%
Residence		
In City	68	45.9%
In Village (rural)	79	53.4%
Missing (Not reported)	1	0.7%
Total	148	100%
Age		
18 & 19 years	32	21.6%
20 & 21 years	58	39.2%
22 & 23 years	43	29.0%
>= 24 years	8	5.5%
Missing	7	4.7%
Total	148	100%
Year of Study		
First year	1	0.7%
Second year	41	27.7%
Third Year	14	9.5%
Fourth year	92	62.2%
Total	148	100%

Figure 1. Distribution of gender within sample



Figure 2. Distribution of residence within sample

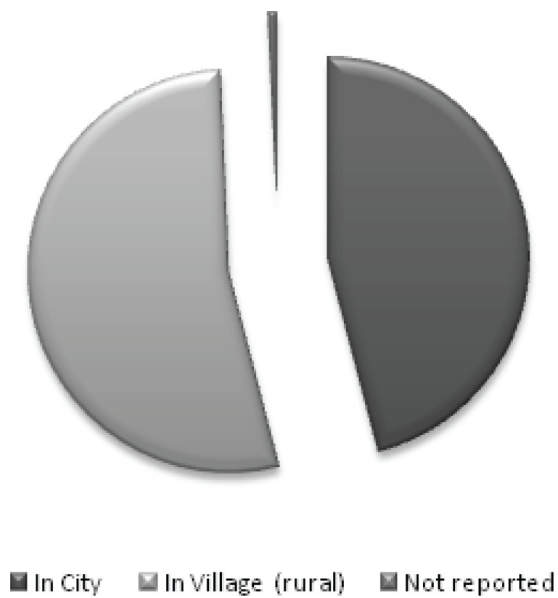


Figure 3. Distribution by level of study within sample

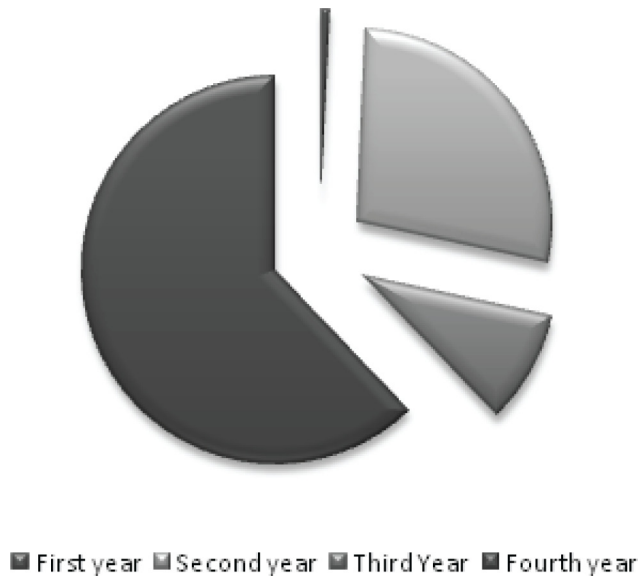


Figure 4. Distribution by age within sample

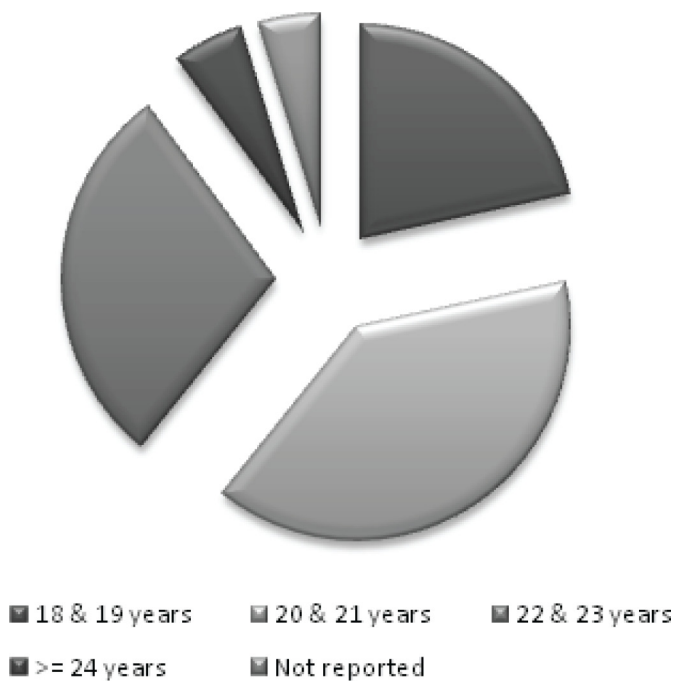


Table 2. Responses for section I questions (Yes/No type)

#	Question	Yes	%	No	%
A	Do you own a computer in your home?	143	96.6%	5	3.4%
B	Do you use the Internet from your home?	135	91.2%	13	8.8%
C	Have you browsed YU website from your home?	133	89.9%	14	9.5%
D	Do you own a mobile phone?	147	99.3%	1	0.7%
E	Does your phone have the capabilities of browsing the Internet?	124	83.3%	24	16.2%
F	Have you browsed YU website using your mobile phone?	84	56.8%	63	42.6%
G	Have you browsed YU student portal?	110	74.3%	37	25.0%
H	Is the Internet speed in your home important for you?	138	93.2%	10	6.8%
I	Do you trust electronic systems?	85	57.4%	61	41.2%
J	Do you prefer e-channels for conducting school transactions?	129	87.2%	18	12.2%

Note: Incomplete percentages are due to missing responses

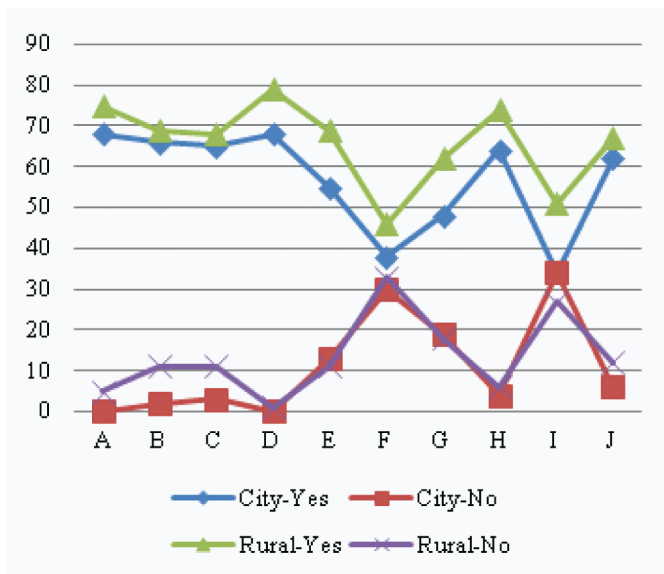
indicated that they trust electronic systems, and 87.2% prefer using it for school business. Finally, students indicated that Internet speed from home is important (93.2%).

When asked about their access levels, students indicated that their phones have the browsing capabilities (83.3%), but only 56.8% of them accessed and browsed YU website and

74.3% accessed the student portal from home. Finally, to explore the difference between city and rural residents regarding the 10 questions, Figure 5 did not indicate significant difference among the two categories.

Finally, direct questions using Likert scale were used to measure students' perspectives regarding the relationship between the digital

Figure 5. Differences in views between rural and city residents



divide and education. Tables 3 and 4 show the items, responses' means and standard deviation and the last two columns depicts two test that tried to explore the differences between the views of students living in a rural or city residences, or between male and female views. Bolded figures indicate significant results.

4. CONCLUSION AND FUTURE WORK

This work tried to explore students' views regarding the digital divide and its influence on education, especially e-learning. A first step was to review the literature and explore digital divide issues and try to assimilate its types, and

the related issues to education. Such empirical study is the first in Jordan and one of the few in the e-government and e-learning literature. To understand digital divide better, an empirical study was conducted where a sample of students was utilized to explore the issues related to digital divide in the domain of education.

Results indicated that no significant differences between the perceptions of rural area students and city students regarding many issues related to the topic. Also, the highest mean reported indicated that "Gov. should provide e-services suitable for both low and high income". The lowest mean reported was related to "using mobile phones might bridge the digital divide influence".

Table 3. Responses to scale questions related to digital divide

To Benefit from e-Learning Services and YU Website...						
#	Item	N	Mean	Std. Dev.	ANOVA 1*	ANOVA 2**
1	Gov. should furnish IT infrastructure in my area	146	4.336	0.949	0.979	0.002
2	Gov. should furnish Internet services in my area	146	4.521	0.881	0.831	0.100
3	Gov. should furnish mobile phone services in my area	146	4.466	0.856	0.287	0.052
4	Internet capacity should support my needs in my area	146	4.342	0.874	0.414	0.007
5	I must be skillful in using computers	143	4.238	0.872	0.326	0.006
6	I must be skillful in using the Internet	144	4.306	0.863	0.185	0.004
7	Gov. should provide training programs for using computers	141	4.156	0.980	0.655	0.328
8	Gov. should provide training programs for using the Internet	142	4.169	0.953	0.579	0.170
9	Gov. should provide e-services suitable for all ages	144	3.910	1.200	0.535	0.485
10	Gov. should provide e-services suitable for males and females	144	4.229	0.951	0.205	0.519
11	Gov. should provide e-services suitable for people with special needs	143	4.434	0.900	0.041	0.153
12	Gov. should provide e-services suitable for all educational levels	142	4.310	0.939	0.001	0.017
13	Gov. should provide e-services suitable for both city and rural areas	144	4.528	0.931	0.000	0.061
14	Gov. should provide e-services suitable for both low and high income	145	4.552	0.912	0.004	0.753

*One Way ANOVA based on Residence

**One Way ANOVA based on Gender

Table 4. Responses to scale questions related to digital divide

#	Item	N	Mean	Std. Dev.	ANOVA 1*	ANOVA 2**
Q15	Digital divide influences education efficiency in rural areas	144	4.076	0.954	0.382	0.849
Q16	There is a difference between cities and rural areas in the technology levels	144	3.938	1.178	0.038	0.189
Q17	Using mobile phones might bridge the digital divide influence	144	3.833	1.017	0.988	0.874

*One Way ANOVA based on Residence

**One Way ANOVA based on Gender

On the other hand, ANOVA tests were utilized to know if any differences exist between perceptions of rural and city students, and results indicated that 5 issues indicated a difference at the 0.05 level and they are related to the following: government should provide e-services equally likely to people with special needs, different educational levels, geographic areas, income differences, and that a difference exists between city and rural area in the technological level. Finally, the same tests were conducted using gender as a factor and also 5 areas were indifferent and they are related to the following: government should furnish IT infrastructure, Internet should support users' needs, users should be skillful in computing, users should be skillful in using the Internet, and the government should provide e-services suitable for all educational levels.

This study is important to the scientific community, businesses working in e-learning, public sector officials, e-government officials, and researchers on topics like e-learning, e-government and social issues. It is important to realize the issues related to the digital divide which can at the same time facilitate the diffusion of both e-government services, and e-learning channels. Finally, still in the literature the link between social development, e-government and digital divide is not explored fully and specially with empirical research.

It is important to understand the issues resulting from this research, where differences in perception in major issues were perceived, and

trust in e-government was not emphasized. This study suffered from its small sample size and from a new not well validated Arabic language instrument. Such research is new in this area and the relationship between digital divide and e-learning is not clear. Future research should focus more on measuring such relationship using other methods, instruments and techniques. Also, a larger sample might give different perspectives. Finally, a clear definition related to rural areas need to be established.

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