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Access Gaps Interact With Eachother: A Cognitive Investigation

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DIGITAL DIVIDE AND INTERRELATED ACCESS GAPS: A COGNITIVE INVESTIGATION

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Abstract

Inequalities in the access to and use of information and communication technologies (ICT) have become an important area of concern for over a decade. Yet, theoretical attempts to understand the dynamics behind shaping these inequalities are scarce. This study draws upon the extent literature on 'digital divide' and explains how four different access gaps (motivational, material, skills and usage) contribute to digital divide. Revealed causal mapping (RCM) is utilized to analyze the data collected from eight same-gender focus groups in four primary schools. The revealed causal map demonstrates the interaction and linkages between different access gaps. The findings provide a theoretical account of the dynamics behind shaping digital divide and generate insights into extending the concepts of 'access gaps'. The results place an emphasis on the centrality of motivational-related factors such as 'Lack of Interest in IT-Related Things' and 'Lack of Motivation to Learn Recent Technology' and skills-related factors such as 'Operating Skills', 'Anti-Filtering Skills' and 'Not Having IT Background'.

Keywords: Digital divide, Internet, Access, Developing countries, Access gaps

1 Introduction

It has been argued that the Internet is the source of several benefits as well as challenges (DiMaggio & Hargittai, 2001, Norris, 2003). One of the important challenges pertaining to the phenomenon of the Internet is the so-called concept of 'digital divide' (Chen & Wellman, 2004, Gunkel, 2003, van Dijk, 2012). The key concern in digital divide research and policies is the unequal allocation of ICT access and use that has resulted in the growing gap between individuals, groups, and nations (Vicente & Lopez, 2010, Wei et al., 2011).

Digital divide literature has attempted to understand 'digital divide outcomes' and 'digital divide antecedents' (factors that shape digital divide) (S. Mescha & Talmudb 2011, Wei et al., 2011). In terms of 'outcomes', digital divide may contribute to several inequalities such as immaterial, material, social and educational types of inequality (Katz & Rice, 2002, Katz et al., 2001, Rice & Katz, 2003, Van Dijk & Hacker, 2003). It has been argued that the underlying reasons behind digital divide ('digital divide antecedents') could be related to several factors such as international politics, inequality of positions and power in social networks, inequalities of skills and capabilities (Agarwal et al., 2009, Bonfadelli, 2002, Chen & Wellman, 2004, Cho et al., 2003, Rains, 2008). Van Dijk (2005) provides a theoretical framework that explains antecedents of digital divide (Van Dijk, 2006). This framework drives upon four types of 'access gaps' and proposes a cumulative model for predicting digital divide (Van Dijk & Hacker, 2003, Van Dijk, 2005). It should be taken into account that the model of 'access gaps' proposed by Van Dijk (2005) is rather static, as it does not explain the interrelations between different types of access gaps as well as how these access gaps interact with each other and shape digital divide as a whole.

In spite of calls for theoretical works that explore the underlying mechanisms that shape digital divide (Van Dijk, 2006), attempts to understand these mechanisms are very scarce. In particular, most of the research on digital divide has remained at a descriptive level, emphasizing the demographics of income, education, age, gender, and ethnicity. There is an insufficient attention paid to the dynamics and the interrelation of concepts behind shaping digital divide. In addition, extant literature asserts that technology-related issues (material access) are not neutral artefacts in society (Barzilai-Nahon, 2006, Eastin & LaRose, 2000), rather four types of access divides interact together in shaping digital divide. However, prior research has paid little attention in exploring how digital divide is shaped though interrelations between different types of access gap.

With this background, this study seeks to develop a theoretical understanding of the dynamics behind digital divide. Going beyond past research, we build on the hierarchical model of access gaps (Van Dijk, 2005) and expand the focus to understand the interrelations between different types of access gaps in shaping digital divide. In particular, we attempt to answer the following research question: **How different types of access (motivational access, material access, skills access, and usage access) interact together in shaping digital divide?.**

A qualitative methodology, Revealed Causal Mapping (RCM) (Narayanan & Fahey, 1990) is employed to identify respondents' cognitive structures regarding access barriers and their interrelations in shaping digital divide. RCM is a subcategory of cognitive mapping where respondents reveal their causal assertions about a domain specific phenomenon through interview or focus groups. This methodology lends itself into construction of revealed causal maps that represent the network of causal relations embedded in the individuals' explicit statements. Data was collected from thirty two participants over eight same-gender focus groups. The focus groups processes were guided by the model of access gaps proposed by Van Dijk (2005), but they were designed to evoke new concepts and linkages. Analysis on the collected data led to identifying new concepts as well as causal linkages between concepts and access gaps.

This study contributes to our theoretical understanding of the dynamics that shape digital divide. In addition, the undertaken approach contributes to a more subtle understanding of the

nature of different access gaps. Specifically, access gaps are not independent concepts but they are shaped through complex dynamic interactions with each other. A more dynamic perspective on digital divide helps individuals and policy makers have a better understanding of the underlying mechanisms through which access gaps are created and contribute to inequalities in the access to and use of the ICT.

2 Theoretical Background

2.1 Digital Divide & Access Gaps

Initially, Digital divide referred to the inequality of technological opportunities, in terms of the gap between 'those who do and those who do not have access to new forms of information technology' (Cammaerts et al., 2003). The technological orientation of this early definition led to several attempts to equalize technological opportunities in the form of equal physical access to the ICT(Hohlfeld et al., 2008, Van Dijk, 2006).

From 2001 onwards, the extant literature suggested the appearance of new expressions such as 'redefining the digital divide' and 'going beyond physical access' (Gurstein, 2003, Hargittai, 2002, Selwyn, 2004). These expressions aim to reframe the overly technical concept of the digital divide and to pay more attention to social, mental and cultural factors that contribute to the inequalities in the access to and the use of the ICT (Valadez & Durán, 2007, Warschauer, 2002). In other words, technology access should be seen as a process with many social, psychological and technological driving factors and not as a single event of obtaining a particular technology. As a result, digital divide gradually became understood as 'the gap between individuals, households, businesses and geographical areas at different socio-economic levels with regard to their opportunities to access ICT as well as to use Internet for a variety of activities" (OECD, 2001).

Van Dijk (2005) followed the multifaceted concept of access proposed by Van Dijk (1999) (Van Dijk, 1999) and offered a cumulative and recursive model of successive kinds of access to digital technologies. This model (as depicted in Figure 1) explains how digital divide is shaped by four divides of motivational, material, skills, and usage access. As shown, material access is proceed by motivational access and succeeded by skills access and usage access (Van Dijk, 2005). The successive aspect of the model suggests that 'effective access 'of technology is dependent on four types of access including 'motivational access', 'material access', 'skills access', and 'usage access', and therefore digital divide would be the result of gaps in these four access areas. The recursive aspect of the model implies that when the full process of technology appropriation is completed (usage access), a new innovation arrives and the process starts again. In the following, we explain each of the four components of the model in more detail.

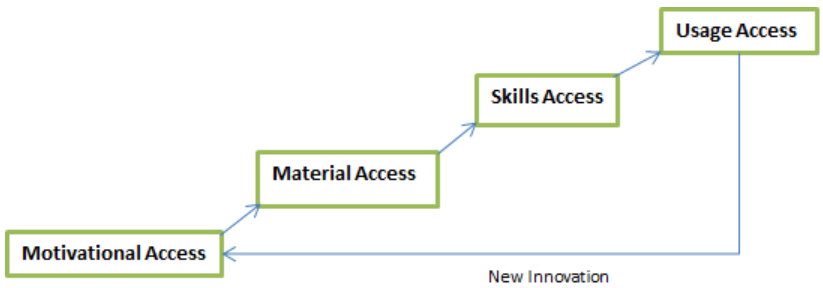

Figure 1. Access & Digital Divide & Outcomes (Van Dijk (2005))

The concept of 'motivational access' refers to the wish to have a computer and to be connected to the ICT. The factors explaining motivational access divide could be both of a social or cultural and a mental or psychological nature (e.g., low levels of income, low levels of education, computer anxiety, lack of time). The concept of 'material access' comprises

physical access and other types of access that are required to reach complete disposal and connections. The major contributing factors to material access include income, education and occupation. Material access is also succeeded by having motivation to have ICT. The concept of 'skills access' includes possessing three types of skills: (i) operational skills: the capacities to work with hardware and software, (ii) information skills: skills to search, select, and process information in computer and network sources, and (iii) strategic skills: capacities to use computer and network sources as the means for particular goals and for the general goal of improving one's position in society. The factors explaining skills access divide could be education. Skills access is succeed by motivation to use ICT and access to ICT (through try and error work with ICT). The concept of 'usage access' is about differential use of ICT applications in daily practices. This could include both the actual use of ICT as well as 'active versus passive use of ICT'. Active or creative use of ICT is about contributions to the Internet by users themselves (e.g., publishing a personal website, creating a weblog, posting a contribution on an online bulletin board, newsgroup or community). Usage is largely linked to demographic characteristics of users and connections (e.g., social class, education, age, gender and ethnicity, effectiveness of the connection). Usage access is also succeeded by motivation to use ICT, material access, and having appropriate skills.

The general impression is that while physical access gaps are more or less closing in the developed countries, the skills gap (in particular information skills) and usage gaps are growing (Mason & Hacker, 2003, van Dijk, 2012). It should be taken into account that some developing counties (such and Iran and China) still experience physical access gaps due to the politics of the Internet (e.g., filtering, low-speed Internet) (Ameripour et al., 2010, Cross, 2010, Giroux, 2009).

2.2 Interrelations between Access Gaps

Majority of the prior research on digital divide has focused on the first-level digital divide (material access divide) as the dependent variable with individual, socioeconomic, or geographical factors as determinants (e.g., (Kalichman et al., 2002)). There are studies that point to the existence of interactions between access gaps (Hoffman et al., 2000, Wei et al., 2011). For example, Wei et al. (2011) proposed and empirically validated a model that links three hierarchical levels of 'digital access divide' (associated with the concept of 'material access'), 'digital capability divide' (associated with the concept of 'skills access'), and 'digital outcome divide" (knowledge outcome & skills outcome). Another example is the literature on operationalizing and measuring digital divide (Barzilai-Nahon, 2006, Vehovar et al., 2006). Barzilai-Nahon (2006) proposes causal interrelations between various indicators of digital divide (e.g., socio-demographic, accessibility, use, infrastructure access, affordability, and social and governmental support) (Barzilai-Nahon, 2006). As an example, 'accessibility' may affect the Digital Divide Index directly, but it also affects it indirectly through the 'use indicator'. Causal interactions between digital divide indicators concur with the concept of dynamic interactions between access gaps. However, prior research is limited in offering a rigorous theoretical explanation for how digital divide is shaped though interrelations between different types of access gap. We attempt to address this gap by answering 'how different types of access (motivational access, material access, skills access, and usage access) interact together in shaping digital divide? Theoretical lens of access gaps (Van Dijk, 2005) provides us with a sound theoretical foundation to build our study on.

3 Research Methodology

We employed Revealed causal mapping (RCM) (Narayanan & Fahey, 1990) to investigate respondents' cognitive structures regarding the dynamics through which different types of access interact together and shape digital divide. RCM is a variant of cognitive mapping where respondents reveal their causal assertions about a phenomenon through interviews or focus groups. RCM is suitable for this study for two major reasons. First, it provides us with the possibility of studying the complexity of the causal interrelations between different types

of access. Second, this method has been widely used by IS researchers for understanding causal relations between various concepts (Nelson et al., 2000a, Nelson et al., 2000b). We use empirical descriptions from eight focus group sessions to provide inputs for analytical generalization (Yin, 2009) or in another words generalising from empirical material to theory (Lee & Baskerville, 2003). Following the guidelines proposed by Nelson et al. (2000), a three-step process was followed to evoke revealed causal map. These steps were: (i) data elicitation (site and sample selection), (ii) construction of revealed causal maps, and (iii) analysis and validation of revealed causal maps.

3.1 Data elicitation

An empirical investigation of four primary schools (School A, School B, School C, School D) in Tehran, Iran was conducted. Data was collected through focus-groups sessions where individuals discussed the dynamics through which different types of access gaps shape digital divide. In particular, thirty two individuals participated from four elementary schools. Together with the Principal Manager of each school eight students were identified and recruited (eight students per school). In the following, one of their parents was chosen for this study (random choice). Per school, four men and four women participated. All together, sixteen men (from four schools) and sixteen women (from fours schools) participated in this study. Participation was voluntary and participants' will be assured of confidentiality. After recruiting participants, one of the researchers conducted two same-gender focus groups in each school (in total: eight focus groups in four schools). Each focus group session lasted from sixty minutes to ninety minutes. The language of the focus groups was Farsi. The focus group sessions were recorded and transcribed into a document. One of the researchers, fluent in both Farsi and English, translated the documents to English. The length of the documents ranged from 25 to 42 pages. Both researchers were fluent in Farsi and this facilitated data collection and analysis. Table 1 presents the details of focus groups and the participants.

	School A	**School B**	**School C**	**School D**
Women (mothers) • **Average Age** (number of years): 36.3 • Average Education: o Postgraduate: 22% o Undergraduate: 45% o Diploma or less: 33%	1 Focus group with 4 participants	1 Focus group with 4 participants	1 Focus group with 4 participants	1 Focus group with 4 participants
Men (fathers) • **Average Age** (number of years): 42.4 • Average Education: o Postgraduate: 36% o Undergraduate: 54% o Diploma or less: 10%	1 Focus group with 4 participants	1 Focus group with 4 participants	1 Focus group with 4 participants	1 Focus group with 4 participants

Table 2. Focus Groups Demographics

The schools are based in Tehran, Iran. Iran was chosen as a context where the access to and the use of ICT encounter several challenges such as national and international issues (Ameripour et al., 2010).There were three reasons that guide the choice of elementary schools for data collection. First, the schools include a mixture of individuals (parents) with different demographics such as age, education and income for participants. Second, overcoming digital divide for parents of the elementary students is in particular important, because the next working generation is brought up by them, and it is important for these parents to be active participants of the Information Society. Therefore, the context of data collection (elementary schools) is an important target for research on digital divide. Third, we had access to these elementary schools and this choice could facilitate data collection processes.

Respondents were asked about their experience in working with the ICT and barriers they have faced regarding the access to and use of ICT. The focus group session processes were guided by the digital divide literature and the model of access gaps, yet they were designed to evoke new concepts and linkages. The questions asked in the focus group sessions were open-ended questions such as: *what are the problems that you have faced in access to the Internet? What are the problems that you have faced in using Internet? Have you experienced any barrier that inhibits the effective use of the Internet?* Based on the responses to these questions, probing questions were asked to elicit further information.

3.2 Construction of the revealed causal map

Four steps were followed to derive the revealed causal maps from the transcribed interviews. This procedure (Nelson et al., 2000a) is detailed in below:

3.2.1 Identifying causal statements and linkages in transcripts

The focus groups' transcriptions were systematically examined to identify causal statements. Causal statements are statements that imply an explicit cause-effect relationship. These statements can be identified by using specific keywords such "so", "if-then", "because" and so forth. Consistent with Nelson et al. (2000a), all the causal statements and linkages are recorded in the actual language of the interviewees. Using the generated coding scheme, the identified causal statements were broken into 'causes' and 'effects'.

3.2.2 Development of coding scheme

We then developed a coding scheme by grouping frequently mentioned words together and developing concept labels. Coding scheme summarizes the meaning of a phrase in a word or word group (concept label). One of the authors developed concept labels based on the concepts that were emerged from the phrases captured in the language of the participants. As an example in the phrase'*I think it is expensive for any average family. So it makes sense that I am not motivated to invest in the Internet'*, the cause statement was coded as '*High-Level Costs of Getting Access to the ICT*' and the effect statement was coded as '*Motivation to Get Access to the ICT'*. In another example, cause statement was coded as *'No Work-Related Requirements to Use ICT'* and effect is *'Operating Skills': "I am a teacher in guidance school with very little IT knowledge. My work doesn't require me to do anything with computers. So I don't have that much exposure to the ICT to learn how to work with computer and the Internet."*

The other author read the material to verify their face validity and assess the parsimony and coverage of the coding scheme. Scott's pi (Scott, 1955) was calculated in order to estimate the reliability of the coding process. A heuristic for content analysis is to require a reliability coefficient of approximately 0.75 or more when using pi or alpha (Holsti, 1969). For this study, Scott's pi was 0.93 indicating an acceptable level of reliability. Where disagreement occurred, the discrepancies were resolved through discussion and the authors' biases were neutralized.

3.2.3 Constructing raw revealed causal maps

We then replaced the causal statements with the appropriate concept labels as developed in the coding scheme. This resulted in developing eight revealed causal maps for each focus group session.

3.2.4 Aggregating revealed causal maps

The eight revealed causal maps were aggregated by adding together the concepts and linkages of each causal map. The union of all concepts and linkages from the individual maps were placed on the final aggregate map. As the concepts emerged from the participants, the point of

redundancy represented the point at which further data collection would not provide additional concepts (Armstrong et al., 2007). The point of redundancy was computed by aggregating the concepts mentioned by each participant. No new concepts were elicited from the sixth focus group, so redundancy was reached by the sixth focus group session. This suggested that the sample of eight focus groups was sufficient to capture the relevant concepts in the sample.

3.2.5 Analysis and validation of revealed causal map

According to Armstrong et al. (2007), the two aspects of 'content' and 'structure' should be considered in analysing revealed causal maps. The *content* analysis consists of identifying and defining the concepts contained in the domain under study. We used member checks to validate the concepts and linkages in the aggregate revealed causal maps. Similar to internal validity in confirmatory studies, the objective of comprehensive members' checks is to test for interpretive accuracy and to check credibility and trustworthiness of the results (Guba & Lincoln, 1985). This was done by going back to the original participants and asking their opinion about the concepts, constructs, and linkages that we represented on the maps. The *structural* analysis involves analysing the linkages between the concepts. Three measures were used for the structural analysis, borrowed from social network analysis: (i) *Reachability measures*, (ii) *Centrality measures*, and (iii) *Density measures*.

Reachability is an indicator of the total strength of the connection between concepts (Knoke & Kuklinski, 1982). *Reachability* is the sum of the direct and indirect effects of one variable on another. For this research we used a 0.2 reachability cut-off because it allowed for a maximum inclusiveness of concepts within the constraint of map readability. *Centrality* is for measuring how central or important a concept is to the map (Nadkarni & Narayanan, 2005). It is measured by dividing the number of direct linkages involving the concept to the total number of linkages in the map. *Density* was measured to examine the interconnectedness of the concepts in the map (Nadkarni & Narayanan, 2005). *Density* was measured by dividing the number of links among concepts to the number of concepts in the map.

4 Results

The research question asks: *How different types of access (motivational access, material access, skills access, and usage access) interact together in shaping digital divide*?. To address the research question, this section presents the aggregate causal map and provides a general overview of the dominant themes that were emerged from the focus group sessions. This is followed by a discussion of the findings with regard to the research question and the theoretical and practical contributions of this study.

4.1 Aggregate Model

Figure 2 demonstrates the aggregate map that reveals 22 concepts that focus groups participants stated as salient concepts that are cognitively associated with the barriers to the access to and use of the ICT. Figure 2 extends the prior model of access gaps in a number of ways including: introducing new concepts and revealing interactions between access gaps. The following two sub-sections describe the results.

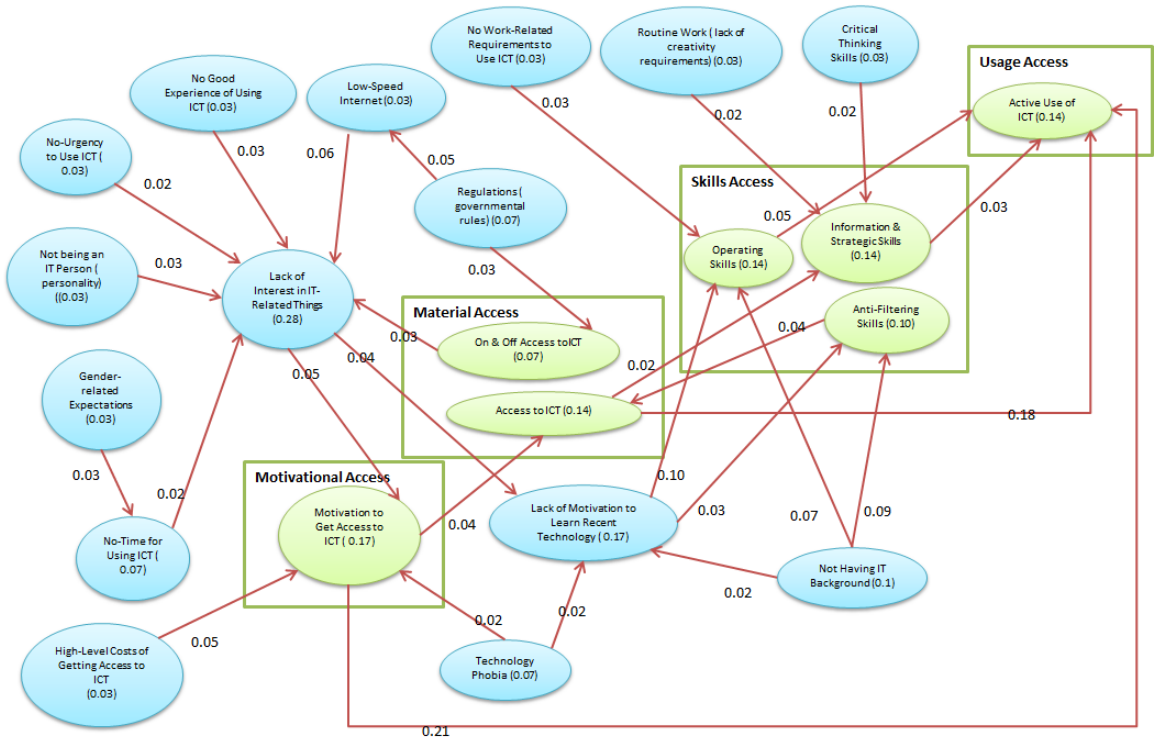

Figure 2. Aggregate Map

4.2 Access Types

One of the findings of this study is extending the concepts of access. The concepts of *'Motivation to Get Access to ICT'*, *'Operational Skill's*, *'Information & Strategic Skills'*, and *'Active Use of ICT'* concurs with the literature on access types and digital divide (as discussed in the previous sections). However, two new concepts were emerged: '*On & Off Access to ICT'* and '*Anti-Filtering Skills'*. Both of these concepts are emerged due to the politics of the Internet in the sample population, supporting the literature that refers to the filtering of the Internet as a socio-political tool in the context of Iran (Ameripour et al., 2010). According to the respondents, the challenges in getting material access are not only about getting an initial access to the ICT, but they also include 'on and off access' that occurs as the result of different filtering policies during the year. For example, '*close to elections there are more control on the use of the Internet ... I can't browse some of the websites that were working just the week before*'. Consequently, respondents referred to another type of Skills access (*Anti-Filtering Skills*) for dealing with the existing filtering policies. For example, *'I learnt from a colleague that by installing software I can bypass the filtering, but it doesn't work all the time and it needs updates*'.

4.3 Concepts and Linkages

The aggregate map has a *density* of 1.27, which indicates that the participants referred to strong connections between all of the concepts. The *centrality* of concepts is shown in their circle (in Figure 2). As shown, the following concepts had the highest centrality to the map: *'Lack of Interest in IT-Related Things'* (0.26), *'Lack of Motivation to Learn Recent Technology'* (0.16), *'Motivation to Get Access to ICT'*(0.13), *'Information & Strategic Skills'* (0.13), and *'Operating Skills'* (0.13). *Reachability* (a measure of the strength of relationships between two concepts) is represented by the number next to the arrow on the aggregate map of Figure 2. For example, the reachability for the relationship between *'Lack of Motivation to Learn Recent Technology'* and *'Operating Skills'* is 0.11, and this represents the sum of all the paths linking the two concepts. We can see that the strongest relationship (reachability at 0.19) is between *'Access to ICT' and 'Active Use of ICT'*. Overlaying the information on reachability and centrality, we can see (at least) twelve concepts play key roles in the

participants' mental model of the dynamics behind shaping digital divide. Based on their definition, we categorise them in five categories:

1. **Context-Related Concepts:**
   1. Regulations (governmental rules)
   2. Low-Speed Internet
   3. High-Level Costs of Getting Access to ICT
2. **Motivational-Related Concepts:**
   4. Lack of Interest in IT-Related Things
   5. Lack of Motivation to Learn Recent Technology
   6. Motivation to Get Access to ICT
3. **Access-Related Concepts:**
   7. Access to ICT
4. **Skills-Related Concepts:**
   8. Operating Skills
   9. Anti-Filtering Skills
   10. Information & Strategic Skills
   11. Not Having IT Background
5. **Usage-Related Concepts:**
   12. Active Use of ICT

5 Discussion

5.1 Theoretical and Practical Implications

This study is one of the early empirical attempts to advance a theoretical account of the underlying mechanism that contribute to digital divide. Using the model of access gaps as a foundation, we go beyond the past research on access divides and explore how four types of access gaps interact with each other. The aggregate revealed causal map is are rich in detail provide and future research possibilities. All together, the results shed light on the relationships among 22 concepts (out of which 7 concepts are in the clusters of access gaps and the rest are contextual concepts). Overall, this study makes two key theoretical contributions:

First, the model of access gaps from Van Dijk (2005) is extended into a dynamic model that shows the mechanisms through which motivational, material, skills, and usage access gaps interact with each other. In particular, building on the work of Van Dijk (2005), we identified 22 inter-related concepts, which is arguably a broader conceptualization of access gaps and digital divide than has been previously published. While some of the concepts have been discussed in other articles (e.g., (Rice & Katz, 2003, van Deursen & van Dijk, 2011)), some of the concepts (e.g., Anti-Filtering Skills) and the linkages among the concepts have not. The findings confirm that technology-related issues (material access) are not neutral artefacts in society (Barzilai-Nahon, 2006, Eastin & LaRose, 2000), rather four types of access divides interact together in shaping digital divide.

Second, this study yields additional insights explaining how several individual, social, national factors (e.g., *Technology Phobi*a, *High-Level Costs of Getting Access to ICT*, *Regulations (governmental rule)*) may intersect to impact each other, and in turn affect digital divide. The findings place a special emphasis on the centrality of motivational-related concepts such as *'Lack of Interest in IT-Related Things'* and *'Lack of Motivation to Learn Recent Technology'*, and to a lesser extend *Access to ICT* . As shown in Figure 2, the motivational access is shaped through several interactions among concepts thast are significantly more complex than the findings of the previous studies (S. Mescha & Talmudb 2011). While policies such as exposure to computers at the workplace or even home can be effective in increasing ICT-related skills and decreasing technology phobia, they are not sufficient in dealing with digital divide (Kvasny & Keil, 2005). '*Regulations (government rules)', 'Low-Speed Internet', and 'High Level Costs of Getting Access to ICT'* were shown to

be important. Surprisingly, the aggregate model shows that these three concepts contribute to digital divide through influencing motivational issues. For example, *'Regulations (government rules)'* indirectly contributes to *'Motivation to Get Access to ICT'* through *'On & Of Access to ICT'* (as well as *'Low-Speed Internet'*) and *'Lack of Interest in IT-Related Things'*. These findings emphasize the importance of promoting motivations of individuals in getting access to and the use of the ICT as well as learning recent technologies. On one hand, lack of motivation foments the development of negative attitudes to technology, which deter individuals from adopting the Internet and developing ICT-related skills. On the other hand, motivation increases the chance of getting access to ICT and the skills capabilities of individuals in dealing with challenges in the use of ICT (e.g., regulations).

The employed methodology provides a fertile theoretical grounding for future research on the dynamics of digital divide. This corresponds to the calls for theoretical-qualitative research studies in this area (Mason & Hacker, 2003, Van Dijk, 2006).

The aggregate model has insights for policy makes in understanding what shapes digital divide and how access gaps are created and can contribute to inequalities in the access to and the use of the ICT. In particular, the aggregate model provides a dynamic picture of how different concepts interact with each other and shape digital divide. Having awareness of these concepts is important in understanding digital divide at different levels and implementing the most appropriate methods for dealing with the existing divides.

5.2 Limitations and Future Directions

We acknowledge that genders have different concerns regarding digital divide and what contribute to it. Future research should evaluate these differences. Beyond the context of this study (parents of elementary schools' students in a single country), the aggregate model can be applied to individuals in other contexts and countries. We believe testing this model in a wide variety of contexts would help establish the boundaries of its applicability. Caution must be exercised when attempting to generalize our results to individuals in other countries with different institutional, cultural, and political environments. We welcome future research that examines and extends our findings and proposes appropriate interventions to alleviate digital divide in different contexts.

6 References

Agarwal, R.,Animesh, A. & Prasad, K., 2009. Research Note—Social Interactions and the "Digital Divide": Explaining Variations in Internet Use. Information Systems Research, 20 (2), 277-294.

Ameripour, A.,Nicholson, B. & Newman, M., 2010. Conviviality of Internet social networks: An exploratory study of Internet campaigns in Iran. Journal of Information Technology, 25 (2), 244-257.

Armstrong, D. J.,Riemenschneider, C. K.,Allen, M. W. & Reid, M. F., 2007. Advancement, voluntary turnover and women in IT: A cognitive study of work–family conflict. Information & Management, 44 (2), 142-153.

Barzilai-Nahon, K., 2006. Gaps and bits: Conceptualizing measurements for digital divide/s. The Information Society, 22 (5), 269-278.

Bonfadelli, H., 2002. The Internet and Knowledge Gaps A Theoretical and Empirical Investigation. European Journal of communication, 17 (1), 65-84.

Cammaerts, B.,van Audenhove, L.,Nulens, G. & Pauwels, C. (2003) Beyond the digital divide. VUB Brussels University Press.,Brussels

Chen, W. & Wellman, B., 2004. The global digital divide-within and between countries. IT & Society, 1 (7), 39-45.

Cho, J.,De Zuniga, H. G.,Rojas, H. & Shah, D. V., 2003. Beyond access: The digital divide and Internet uses and gratifications. IT & Society, 1 (4), 46-72.

Cross, K., 2010. Why Iran's green movement faltered: The limits of information technology in a rentier state. SAIS Review, 30 (2), 169-187.

DiMaggio, P. & Hargittai, E., 2001. From the 'digital divide'to 'digital inequality': Studying Internet use as penetration increases. Princeton: Center for Arts and Cultural Policy Studies, Woodrow Wilson School, Princeton University, (

Eastin, M. S. & LaRose, R., 2000. Internet self-efficacy and the psychology of the digital divide. Journal of Computer-Mediated Communication, 6 (1)**,** 0-0.

Guba, E. G. & Lincoln, Y. S. (1985) Naturalistic inquiry. Sage Publications, Incorporated

Gunkel, D. J., 2003. Second thoughts: toward a critique of the digital divide. New Media & Society, 5 (4)**,** 499-522.

Gurstein, M., 2003. Effective use: A community informatics strategy beyond the digital divide. First Monday, 8 (12)**,** 1-18.

Hargittai, E., 2002. Second-level digital divide. First monday, 7 (4-1).

Hoffman, D. L.,Novak, T. P. & Schlosser, A., 2000. The evolution of the digital divide: How gaps in Internet access may impact electronic commerce. Journal of Computer-Mediated Communication, 5 (3).

Hohlfeld, T. N.,Ritzhaupt, A. D.,Barron, A. E. & Kemker, K., 2008. Examining the digital divide in K-12 public schools: Four-year trends for supporting ICT literacy in Florida. Computers & Education, 51 (4)**,** 1648-1663.

Holsti, O. R., 1969. Content analysis for the social sciences and humanities. (

Kalichman, S.,Weinhardt, L.,Benotsch, E. & Cherry, C., 2002. Closing the digital divide in HIV/AIDS care: development of a theory-based intervention to increase Internet access. AIDS care, 14 (4)**,** 523-537.

Katz, J. E. & Rice, R. E. (2002) Social consequences of Internet use: Access, involvement, and interaction. The MIT Press,Cambridge

Katz, J. E.,Rice, R. E. & Aspden, P., 2001. The Internet, 1995-2000 access, civic involvement, and social interaction. American behavioral scientist, 45 (3)**,** 405-419.

Knoke, D. & Kuklinski, J. H. (1982) Network analysis. Sage Publications, Inc,Beverly Hills, CA.

Kvasny, L. & Keil, M., 2005. The challenges of redressing the digital divide: A tale of two US cities. Information Systems Journal, 16 (1)**,** 23-53.

Lee, A. S. & Baskerville, R. L., 2003. Generalizing generalizability in information systems research. Information systems research, 14 (3)**,** 221-243.

Mason, S. M. & Hacker, K. L., 2003. Applying communication theory to digital divide research. IT & Society, 1 (5)**,** 40-55.

Nadkarni, S. & Narayanan, V., 2005. Validity of the structural properties of text-based causal maps: An empirical assessment. Organizational Research Methods, 8 (1)**,** 9-40.

Narayanan, V. K. & Fahey, L. (1990) Evolution of revealed causal maps during decline: A case study of Admiral.John Wiley & Sons,Chichester, UK

Nelson, K. M.,Nadkarni, S.,Narayanan, V. & Ghods, M., 2000a. Understanding software operations support expertise: a revealed causal mapping approach. MIS Quarterly, (475-507.

Nelson, K. M.,Nelson, H. J. & Armstrong, D. (2000b) *Revealed causal mapping as an evocative method for information systems research*. In Hawaii International Conference on System Sciences, p:10 pp. vol. 2, IEEE, Hawaii.

Norris, P. (2003) Digital divide: Civic engagement, information poverty, and the Internet worldwide. Taylor & Francis

Rains, S. A., 2008. Health at High Speed Broadband Internet Access, Health Communication, and the Digital Divide. Communication Research, 35 (3)**,** 283-297.

Rice, R. E. & Katz, J. E., 2003. Comparing internet and mobile phone usage: digital divides of usage, adoption, and dropouts. Telecommunications Policy, 27 (8-9)**,** 597-623.

S. Mescha, G. & Talmudb , I., 2011. Ethnic Differences in Internet Acces. Information, Communication & Society, 14 (4)**,** 445-471.

Scott, W. A., 1955. Reliability of content analysis: The case of nominal scale coding. Public opinion quarterly, 19 (1)**,** 321-325.

Selwyn, N., 2004. Reconsidering political and popular understandings of the digital divide. New Media & Society, 6 (3)**,** 341-362.

Valadez, J. R. & Durán, R. P., 2007. Redefining the digital divide: Beyond access to computers and the Internet. The High School Journal, 90 (3), 31-44.

van Deursen, A. & van Dijk, J., 2011. Internet skills and the digital divide. new media & society, 13 (6), 893-911.

Van Dijk, J. (1999) The network society, Social aspects of new media. Sage Publications Limited,Thousand Oaks, CA

van Dijk, J. (2012) The Evolution of the Digital Divide.IOS Press

Van Dijk, J. & Hacker, K., 2003. The digital divide as a complex and dynamic phenomenon. The Information Society, 19 (4), 315-326.

Van Dijk, J. A. G. M. (2005) The deepening divide: Inequality in the information society. Sage Publications, Incorporated

Van Dijk, J. A. G. M., 2006. Digital divide research, achievements and shortcomings. Poetics, 34 (4), 221-235.

Vehovar, V.,Sicherl, P.,Hüsing, T. & Dolnicar, V., 2006. Methodological challenges of digital divide measurements. The information society, 22 (5), 279-290.

Vicente, M. R. & Lopez, A. J., 2010. A multidimensional analysis of the disability digital divide: some evidence for Internet use. The Information Society, 26 (1), 48-64.

Warschauer, M., 2002. Reconceptualizing the digital divide. First monday, 7 (7-1).

Wei, K. K.,Teo, H. H.,Chan, H. C. & Tan, B. C. Y., 2011. Conceptualizing and testing a social cognitive model of the digital divide. Information Systems Research, 22 (1), 170-187.

Yin, R. K. (2009) Case study research: Design and methods. Sage publications, INC