

GENDER AND MOBILE APP DEVELOPMENT AS A CAREER OF CHOICE: AN EXPLORATORY STUDY IN SOUTH AFRICA

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Abstract

The underrepresentation of women in the Information Communication Technology (ICT) sector is a challenge despite the existing conducive opportunity for a career in ICT. In this digital era where smartphones are almost synonymous with urban living, this paper sought to explore the social sustainability of gender diversity as a degree of involvement of women in technically developing mobile apps (apps). App development is an emergent lucrative career choice today and is predicted to remain as such for the foreseeable future. The research drew on the individual differences theory of gender in ICT by Eileen Trauth (2006; 2004) to explore the extent to which the underrepresentation has similarly permeated app development. The findings from the exploratory study of 44 app developers in South Africa suggest that gender underrepresentation and bias has spread to app development. The results nonetheless reveal a similar degree of interest among women as men to attempt a career in app development, but more especially, that women have a preference for collaborative app development environments. For practice, the results call for more deliberate efforts and interventions to change female perceptions about app development and to stem the ever widening technological gender gap in a region where the mobile phone market has exploded. The study also lends support to the social constructionist view that women underrepresentation is ICT not primarily a result of essentialist differences between men and women but more a result of social and cultural habits.

Keywords: Mobile apps, app development, gender, career in ICT, Information and Communication Technology, ICT, South Africa, mobile apps, individual differences theory, gender and ICT

Introduction

ICT today has changed to such an extent that creating a webpage or mobile app is as simple as dragging and dropping the interface elements. The simplicity in use of ICT means that men and women have an equal career opportunity in ICT. There is nonetheless an existing stereotypical mind-set about women's ability to succeed in an ICT career (Hayes, 2014). For example, a career in ICT is still perceived as "men's work" (Trauth, 2006). The general perception that ICT specialists are unsociable males with a great interest in ICT clashes with the stereotypical roles assigned to women (Jepson & Perl, 2002). It is however surprising to discover that women underrepresentation in ICT has not always been that way. Abbate (2012) in her book illustrates using the history of women in technology, how women dominated programming in the early days of computing. It is surprising because the current perception is that women are at times regarded as only half-skilled in technology oriented careers (Wilson, 2004).

The perception has an impact on the mind-set such that women feel that they are technically incompetent. Women also feel that they do not want to sit in front of a boring terminals all day excluding socialisation in their lives, and feel incompetent to get a job due to ICT being a male-dominated sector (Durdell, 1991). Males however appear to enjoy computer-related challenges and subconsciously accept the field of computers as a male-dominated field (Whitley, 1997). For example, Si (2010) identified that males categorise the task of "*web design*" and "*write a simple program*" as masculine, and that the task of "*write a simple program*" became more complex and harder for females to complete. Canada and Brusca (1991) labelled women's negative attitude towards ICT as the "*technological gender gap*".

In this paper, we drew on the individual differences theory of gender and ICT (Trauth, 2006; Trauth et al., 2004) to explore the relationship between the choice of mobile app development platform and gender, with a particular focus on the choices that women are taking. The theory places emphasis on differences within gender rather than on the differences between gender using three constructs; the individual's personal identity, the personal influences on the individual in making a decision to work in ICT, and the environmental influences on the individual such as culture and economic factors. The theory was developed and has been applied in the United States of America to understand how to make sense of the underrepresentation of women in the ICT sector.

Mobile apps are a piece of software that runs on a mobile device. There are different apps for different types of mobile devices. From a functional perspective, mobile apps are designed to help improve an individual's well-being, the lifestyle and to assist in making important decisions. App users make a choice of app based on factors such as attractiveness, value, usability and safety (Chang, Kaasinen, & Kaipainen, 2012). App developers create apps with executable source code which has multiple lines of code (Wasserman, 2010). App developers have the choice of developing native apps which run on the mobile device (native apps), apps that run from a web browser on the mobile device, or a hybrid of native apps that draw their content from the internet (web apps). The choice of development tools and frameworks is dependent on the app platform and the app developer.

The research postulated that women choose a particular app development platform to reduce the difficulty they might experience at a later stage during the app development process (Clayton, von Hellens, & Nielsen, 2009). We therefore sought to find answers to the research question: What is the relationship between gender and choice of mobile app developer platform?

The remainder of the paper is structured as follows: The next section explores the literature on the individual differences theory and mobile apps, from which sub research questions were extracted. It is followed by the research approach which explains the choice of research approach. The analysis and findings section discusses the main findings of the research. The final section presents the conclusions, and the paper contributions and limitations.

1 Literature review

1.1 App development

App development is a growing phenomenon across all sectors of society. The five most common mobile development platforms are Android, Blackberry, Windows phone, iPhone and Symbian (Oliver, 2009). App developers have to decide which platform they feel most comfortable with. It is not only the demand for apps that stirs developers into developing for a specific mobile platform, but also the characteristics and requirements of each platform (Gavalas & Economou, 2011)

There are three technical aspects that influence developers when choosing a platform; the software development kit (SDK), the app store and the degree of integration. The SDK includes an emulator for the mobile device, a library for the development language as well as debuggers to remove coding errors. Some SDK's such as the iPhone SDK have a number of restrictions. An app store is the publication portal. Some portals allow developers to publish their apps on their stores without review such as Google's Play while others such as Apple's App Store review every app before it is published (Butler, 2011). The degree of integration refers to the extent to which an app is bundled with the device at manufacturing or is placed on the portal for later download by the device. The research therefore sought to investigate two sub-research questions to explore the relationship between gender and app development as follows:

SR₁: There is a relationship between gender and app developer platform chosen

SR₂: There is a relationship between gender and the number of app developer platforms chosen

1.2 Women and ICT

Although a great deal has changed in recent times to encourage female participation in technical ICT careers, there are still a number of influences from a young age that affect women's confidence with regards technical ICT fields. Some of these include negative utterances by people in authority such as teachers and parents about women and ICT. Such socio-familial influences and the accompanying responsibilities of women affect their confidence (Wajcman, 2010). It also creates a glass ceiling about their capabilities in ICT (Clayton et al., 2009; Trauth et al., 2004). At the work place, the underrepresentation, lower income and fewer promotions of women in the ICT sector compared to men also reinforce the negative perceptions about women in ICT (Sumner & Niederman, 2002)

There are a number of successful initiatives and bursaries by international bodies, governments, civil society, education and industry to encourage women to join the ICT sector (James, Smith, Roodt, Primo, & Evans, 2006). For example, Innovaspire in South Africa encourages women to become technologically inclined entrepreneurs by creating apps. The girls involved in the programme were surprised by the apps they were able to build in a short time as shown in this parent's quote: "*my daughter never thought she could do anything technical; now she knows she can*" (Butler, 2011, p. 7). In the next section, we present a theory that brings together ideas on women and ICT.

1.3 The Individual Differences Theory of Gender and ICT

The individual differences theory draws from the essentialist and social construction perspectives of gender to explain the causes of female underrepresentation in the ICT sector (Trauth, 2006; Trauth et al., 2004). The underlying ontology of essentialism is that every natural specie is different based on a unique set of attributes, which attributes enable that specie to function in that capacity (Ellis, 2001). The proponents of the essentialism view gender underrepresentation as a result of the inherently

unique and different biological and psychological attributes between men and women. Essentialists argue that women respond differently from men to ICT. The essentialist strategies to deal with the underrepresentation of women therefore focus on creating “*separate but equal*” environments which suit women in the ICT sector (Trauth, 2004). The thesis of social constructionism is that human beings make sense of the world in which they live through interaction and communication with others (Pinch & Bijker, 1987; Wajcman, 2010). The proponents of social constructionism therefore attribute the underrepresentation of women in the ICT sector to the sector being socially constructed to suit men and not women. The social constructivist strategies therefore focus on assisting women to adapt in a male-dominated sector and to re-shape the ICT sector to be more accommodative of women. The argument of a social constructivist is that ICT is gender-neutral but male dominated, and that the results of ICT are influenced by such male domination (Wajcman, 2010). The main criticism of the essentialist perspective is that the view masks the reality that women once dominated the ICT field at the beginning of the computing field, a position which has changed over time (Abbate, 2012).

The individual differences theory takes a middle ground between the essentialist and the social constructivist views. The theory considers the ICT sector as socially constructed to suit men, and identifies how women individually respond to the 'socially-constructed-for-men' ICT environment. The theory has three constructs: individual identity, individual influences and environmental influences.

Individual identity draws from the essentialist domain to describe the inherent features of an individual. The demographic category shows an individual's memberships in particular groups within the population such as age, race or ethnicity. The professional items relate to the type of work and industry in which the individual is. Individual influence refers to the influence on the decision to enter and remain in the ICT field. It is a mixture of an individual's personal characteristics and life experiences. Personal characteristics include educational background, personality traits, interests and abilities, inclination to ICT work and gender identity. Personal influence represents other people and the ICT experiences which have influenced the individual into working in the ICT profession. The factors include early experiences with ICT, role models, mentors and significant life experiences. Environmental influence provides the context within which the individual's response to an environment is situated. These are cultural attitudes and values about ICT, the contextual information about the particular geographic region in which the individual lives, and the economic conditions of the individual. The research therefore sought to investigate the following three secondary research questions:

RQ₁: There is a relationship between individual identity and the involvement of women in app development.

RQ₂: There is a relationship between individual influence and the involvement of women in app development.

RQ₃: There is a relationship between environmental influence and the involvement of women in app development.

In the next section we describe how the research investigated the hypotheses.

2 Research approach and data collection

The research adopted an exploratory design in the qualitative research approach as the context of research sought to be understood (Bhattacharjee, 2012). The data used in the research was made available from the iKamva e-Skills institute (iKeSI) of the Department of Communications in South Africa. The data was collected using the survey methodology using online questionnaires posted on a website over a 3 month period between July – September 2012. The survey was distributed by email, social media, phone, and advertised on national media to app development companies, other e-Skills

hubs and to as many app developer communities as were known in South Africa. The incentive devices of three BlackBerry® Playbooks® were sponsored by Research in Motion® South Africa, the holding company of BlackBerry®.

The questionnaire had 37 main questions which sought to collect data about the local relevance of apps, demographics of app developers, demographics of app users, demographics of app development training institutes, app demand, fostering innovation in apps, understanding the eco-system in terms of the environment, inhibitors to app development and stimulants to app development.

44 mobile app developers responded with 35 being men and 9 women. Although the population size was sufficient to understand whether a relationship exists between gender and app development platform, the number of women who responded was not sufficient. The app developers were informed that their responses remain confidential and anonymous. The data was analysed using exploratory data analysis.

2.1 Research context and background

iKeSI signed a memorandum of understanding (MOU) with one of the large Universities in South to coordinate efforts in the Gauteng province towards e-skilling. E-skilling is defined as the ability for an individual to make use of any digital platform to do whatever is needed to be done (NeSPA, 2010). In the context of South Africa, seven e-Skills were identified (Twinomurinzi, 2012): e-Literacy Skills: the simple or intermediate use of ICT such as word processing. e-Participation and e-Democracy Skills: for participation of citizens in governance. e-Government/Governance Skills: to improve the use of ICT within government. e-Business Skills: for business productivity. e-User Skills: the application of ICT knowledge by the individual. e-Practitioner Skills: for technical ICT competences. e-Community Skills: for social interaction at community level. The iKeSI agenda measures the impact of e-skilling on employment readiness, effective e-governance and service delivery, business development, socio-economic development, and research and development. From an eKeSI perspective, this research aimed to understand the employment readiness of e-practitioners, women in app development.

3 Analysis and discussion of findings

Because of the exploratory nature of the research, exploratory data analysis was used to understand the relationship between gender and choice of app developer platform. The limitations imposed by retrospectively collected data and low number of women respondents meant that only the following factors from the individual difference theory could be assessed: Individual identity (gender and age), individual influence (educational background, collaboration, experience with app development), and environmental influence (attitudes about app development, demography and income).

3.1 Individual identity

The individual identity construct draws mainly from the essentialist domain.

3.1.1 Participation

35 men (79.5%) and 9 women (20.5%) responded in the three months of the survey. Two of those nine women answered that they did not voluntarily complete the survey. The results correspond with Canada and Brusca's (1991) suggestion of the "*technological gender gap*" and confirm the underrepresentation of women in app development.

3.1.2 Age

In terms of age (Table 1), the most active female app developers (66.6% of females) were in the age range of 23-27 and 33-40 (Tables 2 and 3). The active male respondents were spread between the age ranges of 23-27, 28-32, 33-40, 41-50. Overall however, the most active age range of app developers reflects the women’s most active age group, 23-27 and 33-40.

Gender		Frequency	Percent	Valid Percent	Cumulative Percent
Male	Valid	19-22	2	5.7	5.7
		23-27	9	25.7	31.4
		28-32	7	20.0	51.4
		33-40	8	22.9	74.3
		41-50	8	22.9	97.1
		51-60	1	2.9	100.0
		Total	35	100.0	100.0
Female	Valid	19-22	1	11.1	11.1
		23-27	3	33.3	44.4
		28-32	1	11.1	55.6
		33-40	3	33.3	88.9
		51-60	1	11.1	100.0
		Total	9	100.0	100.0

Table 1. App developers by age

3.2 Individual influence

Individual influence refers to the influence on the decision to enter and remain in the ICT field. The analysis drew from the following questions: What is your highest education level? On which mobile platforms do you develop applications? How long have you been developing mobile applications? How did you learn to develop mobile applications? Are you working (in collaboration) with other mobile developers? Would you be interested in (collaborating) participating in a "jam session" where you are partnered with developers, users, designers, managers as a team to develop, test and put to market a mobile app within a short period of time? Is mobile applications development a career path for your future?

3.2.1 Educational background

The majority of women, 88.9%, had University degrees and post-University degrees compared with the men 54.2% (Table 2).

Gender			Frequency	Percent	Valid Percent	Cumulative Percent
Male	Valid	NCS(matric)	3	8.6	8.8	8.8
		Grade 10	1	2.9	2.9	11.8
		National diploma	4	11.4	11.8	23.5
		B degree	10	28.6	29.4	52.9
		Honours degree	7	20.0	20.6	73.5
		Masters degree	2	5.7	5.9	79.4
		Postgraduate diploma	6	17.1	17.6	97.1
		Certificate	1	2.9	2.9	100.0
		Total	34	97.1	100.0	
	Missing	System	1	2.9		
Total			35	100.0		
Female	Valid	NCS(matric)	1	11.1	12.5	12.5
		B degree	3	33.3	37.5	50.0
		Honours degree	3	33.3	37.5	87.5
		PhD	1	11.1	12.5	100.0
		Total	8	88.9	100.0	
	Missing	System	1	11.1		
Total			9	100.0		

Table 2. Educational background as an individual influence of women app developers

3.2.2 Number of app development platforms

Android is the preferred development platform for those who answered, 40% for the women and 35.21% for the men (Table 3). For the men, the iOS platform came second with 25.35% of them. The other platforms were spread for the men while none of the women develop for Symbian (Nokia).

Gender			Frequency	Percent	Valid Percent	Cumulative Percent
Male	Valid	iOS	18	25.35%	25.35%	0.3
		Android	25	35.21%	35.21%	60.56%
		Blackberry	10	14.08%	14.08%	74.65%
		Symbian	10	14.08%	14.08%	88.73%
		Windows Mobile	8	11.27%	11.27%	100.00%
		Female	Valid	iOS	1	20.00%
Android	2	40.00%		40.00%	60.00%	
Blackberry	0	0.00%		0.00%	60.00%	
Symbian	1	20.00%		20.00%	80.00%	
Windows Mobile	1	20.00%		20.00%	100.00%	

Table 3. Individual influence in terms of app development platform

Table 4 show that 47.2% of all app developers only develop on one platform, this means that 52.8% of all app developers have skills to develop on more than one platform. 43.8% for the men and 75% for the women develop on one platform. It also reveals that more men are willing to develop in more than one app platform in comparison to women.

Gender		Frequency	Percent	Valid Percent	Cumulative Percent
Male	Valid	1	14	40.0	43.8
		2	5	14.3	59.4
		3	6	17.1	78.1
		4	2	5.7	84.4
		5	4	11.4	96.9
		6	1	2.9	100.0
	Total	32	91.4	100.0	
Missing	System	3	8.6		
Total		35	100.0		
Female	Valid	1	3	33.3	75.0
		2	1	11.1	100.0
		Total	4	44.4	100.0
	Missing	System	5	55.6	
Total		9	100.0		

Table 4. Number of app platforms by gender

3.2.3 Experience with app development

Of the 4 of 9 women who answered the question, 3 have less than 6 months experience and the other 6 more than a year (Table 5). The men on the other hand were quite spread in their experience.

Gender			Frequency	Percent	Valid Percent	Cumulative Percent
Male	Valid	Less than 6 months	12	34.3	37.5	37.5
		More than 6 months but less than a year	4	11.4	12.5	50.0
		More than a year but less than 2 years	6	17.1	18.8	68.8
		More than 2 years	10	28.6	31.3	100.0
		Total	32	91.4	100.0	
	Missing	System	3	8.6		
Total			35	100.0		
Female	Valid	Less than 6 months	3	33.3	75.0	75.0
		More than a year but less than 2 years	1	11.1	25.0	100.0
		Total	4	44.4	100.0	
	Missing	System	5	55.6		
Total			9	100.0		

Table 5. Experience with app development as an individual influence

3.2.4 Collaboration

Tables 6 and 7 show that the 4 women who answered the question do not collaborate with other app developers. On the other hand 46.4% men collaborate with other app developers. Nonetheless, all the women who responded have an interest in collaborating in a jam session where they work with other developers and non-developers. It indicates to a degree how women app developers prefer working in collaboration as compared to men, 60%.

Gender			Frequency	Percent	Valid Percent	Cumulative Percent
Male	Valid	Yes	13	37.1	46.4	46.4
		No	15	42.9	53.6	100.0
		Total	28	80.0	100.0	
	Missing	System	7	20.0		
Total			35	100.0		
Female	Valid	No	4	44.4	100.0	100.0
		Missing	System	5	55.6	
	Total			9	100.0	

Table 6. Collaboration with other app developers as an individual influence

Gender			Frequency	Percent	Valid Percent	Cumulative Percent
Male	Valid	Yes	21	60.0	75.0	75.0
		No	7	20.0	25.0	100.0
		Total	28	80.0	100.0	
	Missing	System	7	20.0		
Total			35	100.0		
Female	Valid	Yes	4	44.4	100.0	100.0
		Missing	System	5	55.6	
	Total			9	100.0	

Table 7. Interest in a jam session as an individual influence

3.2.5 Learning to develop apps

The majority of men (90.6 %) and women (75%) teach themselves how to develop mobile apps. It indicates how personal interest in app development is as strong in women as it is in men (Table 8).

Gender			Frequency	Percent	Valid Percent	Cumulative Percent
Male	Valid	Self-taught	29	82.9	90.6	90.6
		Certificate course	1	2.9	3.1	93.8
		Part of curriculum	2	5.7	6.3	100.0
		Total	32	91.4	100.0	
	Missing	System	3	8.6		
Total			35	100.0		
Female	Valid	Self-taught	3	33.3	75.0	75.0
		Part of curriculum	1	11.1	25.0	100.0
		Total	4	44.4	100.0	
	Missing	System	5	55.6		
Total			9	100.0		

Table 8. Individual influence as learning to develop apps

3.2.6 Future career prospects

68.8% of men and 50% of the women believe app development is a future career path (Table 9).

Gender			Frequency	Percent	Valid Percent	Cumulative Percent
Male	Valid	Yes	22	62.9	68.8	68.8
		No	10	28.6	31.3	100.0
		Total	32	91.4	100.0	
	Missing	System	3	8.6		
Total			35	100.0		
Female	Valid	Yes	2	22.2	50.0	50.0
		No	2	22.2	50.0	100.0
		Total	4	44.4	100.0	
	Missing	System	5	55.6		
Total			9	100.0		

Table 9. Individual influence from a career path perspective

3.3 Environmental influence

Environmental influence considers the context in which an individual is placed and how the individual responds to that environment. Data was analysed from the following questions. Do you think you can make a decent living out of the development of mobile applications? Do you live in a rural, urban or peri-urban area? Are there any obstacles making it difficult to publish your mobile apps? Is there a market demand for local mobile apps? Do you think that a mobile apps development hub/factory can be established in a rural area? Are you generating any income from your mobile applications?

3.3.1 Attitudes about app development

This question targeted the attitudes about whether a career path in app development is worthwhile. The data from this question was differentiated from an individual influence because it forms an attitude based on external rather than personal interest. Table 10 shows that both men (84.4%) and women (75%) believe that app development can provide a decent living.

Gender			Frequency	Percent	Valid Percent	Cumulative Percent
Male	Valid	Yes	27	77.1	84.4	84.4
		No	5	14.3	15.6	100.0
		Total	32	91.4	100.0	
	Missing	System	3	8.6		
Total			35	100.0		
Female	Valid	Yes	3	33.3	75.0	75.0
		No	1	11.1	25.0	100.0
		Total	4	44.4	100.0	
	Missing	System	5	55.6		
Total			9	100.0		

Table 10. Environmental influence as an attitude about a decent living

3.3.2 Demography

This question assessed where the app developers live. A peri-urban area in South Africa is more commonly known as a township. In a South African context, a township carries with it a connotation of the segregated history. All the participants answered this question. Table 11 shows that the majority of app developers live in townships; 85.7% of men and 66.7% of the women.

Gender			Frequency	Percent	Valid Percent	Cumulative Percent
Male	Valid	Rural	2	5.7	5.7	5.7
		Peri-urban	30	85.7	85.7	91.4
		Peri-urban	3	8.6	8.6	100.0
		Total	35	100.0	100.0	
Female	Valid	Rural	3	33.3	33.3	33.3
		Peri-urban	6	66.7	66.7	100.0
		Total	9	100.0	100.0	

Table 21. Environmental influence as area where app developer lives

3.3.3 Obstacles to publishing apps

The question sought to understand any impediments. Table 12 shows that the women who answered do not find any obstacles to app development. 35.7% of the men identified some obstacle.

Gender			Frequency	Percent	Valid Percent	Cumulative Percent
Male	Valid	Yes	10	28.6	35.7	35.7
		No	18	51.4	64.3	100.0
		Total	28	80.0	100.0	
	Missing	System	7	20.0		
Total			35	100.0		
Female	Valid	No	4	44.4	100.0	100.0
		Missing	System	5	55.6	
	Total			9	100.0	

Table 32. Environmental influence of obstacles

3.3.4 Perceptions of market demand

Table 13 shows that 75% of the women and 74.1% of men app developers believe there is a demand.

Gender			Frequency	Percent	Valid Percent	Cumulative Percent
Male	Valid	Yes	20	57.1	74.1	74.1
		No	5	14.3	18.5	92.6
		Do not care	2	5.7	7.4	100.0
		Total	27	77.1	100.0	
	Missing	System	8	22.9		
Total			35	100.0		
Female	Valid	Yes	3	33.3	75.0	75.0
		No	1	11.1	25.0	100.0
		Total	4	44.4	100.0	
	Missing	System	5	55.6		
	Total			9	100.0	

Table 13. App demand as an environmental influence

3.3.5 Perceptions of app factory in a rural area

75% of women believe that such app factories would succeed in rural areas. The men are divided – 51.9% perceive it is possible, the remainder not perceiving that it is possible (Table 14).

Gender			Frequency	Percent	Valid Percent	Cumulative Percent
Male	Valid	Yes	14	40.0	51.9	51.9
		No	13	37.1	48.1	100.0
		Total	27	77.1	100.0	
	Missing	System	8	22.9		
Total			35	100.0		
Female	Valid	Yes	3	33.3	75.0	75.0
		No	1	11.1	25.0	100.0
		Total	4	44.4	100.0	
	Missing	System	5	55.6		
Total			9	100.0		

Table 4 Perceptions of app factories being established in rural areas

3.3.6 Income from apps

40% of the men make an income from app development compared with 22.2% of the women. Overall, 36.4% of app developers are making an income from app development (Table 15).

Gender			Frequency	Percent	Valid Percent	Cumulative Percent
Male	Valid	Yes	14	40.0	40.0	40.0
		No	21	60.0	60.0	100.0
		Total	35	100.0	100.0	
Female	Valid	Yes	2	22.2	22.2	22.2
		No	7	77.8	77.8	100.0
		Total	9	100.0	100.0	

Table 15. Income from apps by gender

4 Conclusions

The paper set out to understand the relationship between gender and choice in app development in South Africa. Mobile phones are a growing phenomenon in South Africa (and Africa), and are slated to pass the 100% mark over the next few years. It is therefore important to understand and increase the participation of women in app development. The paper in drawing from the individual differences theory of gender and ICT confirmed how the underrepresentation of women in app development continues, as it does in ICT (Alexander et al., 2011). The findings nonetheless suggest that there is as good an interest among women as men regarding app development, and that app development is not essentialist – it is neither inherently male nor female oriented. The suggestion points to question how the app development environment in South Africa may unknowingly be fostering patriarchy.

4.1 Focus on collaboration and education for women

The findings also conjecture that women who develop apps have a graduate and postgraduate education and prefer to work in collaboration with other app developers rather than alone. The proposition points to how women are responding to app development environments in South Africa by preferring a collaborative work environment. The finding may also indicate how women may inadvertently be making a choice between femininity and professionalism (Wajcman, 2010).

4.2 Android gaining ground

Android in its open platform policy appears to be the app platform of choice even for the women. The preference for Android signals a shift in the South African app market towards Android from the dominant Blackberry 7 user market base.

4.3 Women are equally interested

Both men and women believe that there is a market demand for app developers and that app development can be financially rewarding as a career path. In fact, women are similarly generating income from app development. Nonetheless, women are generally developing on less platforms. The research suggests that women may tend to get deeper in one app platform rather than have knowledge of multiple platforms. We make this assumption because different from women, men identified some obstacles to app development while the women did not. We also note that the interest in men and women leads both groups to self-train in app development. This shows that the intrinsic motivation of app developers is as high in women as in men. The ability to self-train rather than wait for a course is well related to the perception that app development as a possible career.

4.4 App development and city life

The majority of the app developers in South Africa live in peri-urban areas but are not convinced that app development centres are worth creating in rural areas. South Africa is a developmental state which means government has an interest on increasing capacity in rural areas by setting up app centres for training and collaboration. It is clear app developers associate app development with the cities.

4.5 Contribution to theory and practice

The three constructs of the individual differences theory provided an appropriate framework to understand women underrepresentation in South Africa. However, the essentialist dimension of the theory did not stand up successfully to scrutiny because of the lower number of women who participated in the study. The individual difference theory was derived from an American context. This research therefore did not find a sufficient fit of the individual differences theory in Africa as well, particularly in South Africa. The conclusions show that efforts to support more women to become app developers are worthwhile but need to be more collaborative in the way the training and mentorship is done. The research shows that women are more likely to remain interested if there are more collaborative opportunities.

References

- Abbate, J. (2012). *Recoding gender: Women's changing participation in computing*: MIT Press.
- Alexander, P., Holmner, M., Lotriet, H., Matthee, M., Pieterse, H., Naidoo, S., . . . Jordaan, D. (2011). Factors affecting career choice: Comparison between students from computer and other disciplines. *Journal of Science Education and Technology*, 20(3), 300-315. doi: 10.1007/s10956-010-9254-3
- Bhattacharjee, A. (2012). Social science research: Principles, methods, and practices.
- Butler, M. (2011). Android: Changing the mobile landscape. *Pervasive Computing, IEEE*, 10(1), 4-7.

- Canada, K., & Brusca, F. (1991). The technological gender gap: Evidence and recommendations for educators and computer-based instruction designers. *Educational Technology Research and Development*, 39(2), 43-51. doi: 10.1007/BF02298153
- Chang, T.-R., Kaasinen, E., & Kaipainen, K. (2012). *What influences users' decisions to take apps into use?: A framework for evaluating persuasive and engaging design in mobile apps for well-being*. Paper presented at the Proceedings of the 11th International Conference on Mobile and Ubiquitous Multimedia.
- Clayton, K.L., von Hellens, L.A., & Nielsen, S.H. (2009). *Gender stereotypes prevail in ict: A research review*. Paper presented at the Proceedings of the special interest group on management information system's 47th annual conference on Computer personnel research.
- Durndell, A. (1991). The persistence of the gender gap in computing. *Computers & Education*, 16(4), 283-287.
- Ellis, B. (2001). *Scientific essentialism*: Cambridge University Press.
- Gavalas, D., & Economou, D. (2011). Development platforms for mobile applications: Status and trends. *Software, IEEE*, 28(1), 77-86.
- Hayes, C.C. (2014). Recoding gender: Women's changing participation in computing by janet abbate (review). *Technology and Culture*, 55(1), 280-281.
- James, T., Smith, R., Roodt, J., Primo, N., & Evans, N. (2006). *Women in the information and communication technology sector in south africa* (Vol. 3): Meraka Institute.
- Jepson, A., & Perl, T. (2002). Priming the pipeline. *SIGCSE Bull.*, 34(2), 36-39. doi: 10.1145/543812.543826
- NeSPA. (2010). *National e-skills plan of action: E-skilling the nation for equitable prosperity and global competitiveness*. The e-Skills Institute Retrieved from www.doc.gov.za.
- Oliver, E. (2009). A survey of platforms for mobile networks research. *ACM SIGMOBILE Mobile Computing and Communications Review*, 12(4), 56-63.
- Pinch, T., & Bijker, W. (1987). The social construction of facts and artifacts *The social construction of technological systems* (pp. 17-50). Cambridge: MIT Press.
- Si, C.W. (2010). *Gender difference in the use of computer software: Computer self-efficacy and stereotype of computer software*. Hong Kong Baptist University Hong Kong.
- Sumner, M., & Niederman, F. (2002). *The impact of gender differences on job satisfaction, job turnover, and career experiences of information systems professionals*. Paper presented at the Proceedings of the 2002 ACM SIGCPR conference on Computer personnel research.
- Trauth, E.M. (2006). Theorizing gender and information technology research. *Encyclopedia of gender and information technology*, 2, 1154-1159.
- Trauth, E.M., Quesenberry, J.L., & Morgan, A.J. (2004). *Understanding the under representation of women in it: Toward a theory of individual differences*. Paper presented at the Proceedings of the 2004 SIGMIS conference on Computer personnel research: Careers, culture, and ethics in a networked environment.
- Twinomurinzi, H. (2012). *The role of ict in sustainable and responsible development: E-skilling*. Paper presented at the HCC10 - 10th IFIP Human Choice and Computers International Conference, Amsterdam, The Netherlands.
- Wajcman, J. (2010). Feminist theories of technology. *Cambridge Journal of Economics*, 34(1), 143-152. doi: 10.1093/cje/ben057
- Wasserman, T. (2010). Software engineering issues for mobile application development. *FoSER 2010*.
- Whitley, B.E. (1997). Gender differences in computer-related attitudes and behavior: A meta-analysis. *Computers in Human Behavior*, 13(1), 1-22.
- Wilson, M. (2004). A conceptual framework for studying gender in information systems research. *Journal of Information Technology*, 19(1), 81-92.