

A GENDER-BASED SURVEY OF LEARNING STYLES OF SOUTH AFRICAN EMPLOYEES IN ICT CAREERS

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Abstract

This research is one of a series that attempt to unveil the various reasons why the numbers of women participating in Information and Communications Technology (ICT) education and careers in South Africa is significantly low compared to that of their male counterparts. The study is meant to establish if there exists a relationship between learning styles of ICT professionals and the choice of an ICT career and if there are visible differences in learning styles between men and women in ICT careers. One learning style each from the different categories of learning styles, that is, perceptual, cognitive information processing, personality type and social interactions is identified as an assessment instrument. Howard Gardner's Multiple Intelligences instrument, Kolb's Learning Style as represented by the Honey and Mumford questionnaire, Myers Briggs Personality Test and Gracha-Reichmann's instrument fall into the different learning styles categories, respectively. It is hoped that this approach will contribute towards the determination of the numbers of females that are likely to take up careers in ICT, considering the vast numbers of factors that contribute towards choices of any career. The investigation was conducted in the form of a case study at South Africa's Advanced African Institute for ICTs - the Meraka Institute. This research was both qualitative and quantitative in nature.

The research shows there is no significance of learning styles as pertaining to gender in the ICT industry. The differences in learning styles among females and males are minimal and have no significant impact on ICT career choices. Therefore there are some other issues demanding of the government in enticing women into ICT careers than the issue of learning styles. The research concluded that there exists an identified pattern of both males and females in ICT careers being logical-mathematical. The interpersonal trait in this field is associated with females more though. Researchers and programmers are more likely to be logical mathematical than program managers, for instance. Both males and females are equally likely to be any of reflectors and pragmatists but this trait is more visible among programmers and researchers. Both males and females in the ICT environment show traits of being collaborative, independent, competitive and participant. Women are more collaborative than men, although in other traits the differences are minimal.

Keywords

Learning styles, women, ICT education, careers, gender

1. INTRODUCTION

According to Booth and Brooks (1995), a learning style is ‘a compilation of patterns of behaviour that appear consistently in the learning process of an individual from the initial stimulation to the final recognisable product of learning. Simple stated, it is how we process our information and work with the outcome’. Dunn and Griggs (2000) give the following definition: “A learning style addresses the biological uniqueness and developmental changes that make one person learn differently from another. Individuals do change in the way they learn. Similarly, developmental aspects relate to how we learn but, more predictable, follow a recognised pattern”.

The question that arises therefore is, “Do individuals with certain learning preferences choose careers that are aligned to their learning preferences”. The careers supported in the field of ICT includes computer scientists, electronic engineers, information systems specialists, systems analysts, network engineers, programmers, to name but a few. The study is meant to establish if there exists a relationship between learning styles of ICT professionals and the choice of an ICT career and if there are any visible differences in learning styles between men and women in ICT careers. One learning style each from the different categories of learning styles, that is, perceptual, cognitive information processing, personality type and social interactions is identified as an assessment instrument. Howard Gardner’s Multiple Intelligences, Kolb’s Learning Styles Inventory as represented by the Honey and Mumford questionnaire, Myers Briggs Personality Test and Gracha-Reichmann’s instrument fall into the different learning styles categories, respectively. It is hoped that this approach will contribute towards the determination of the numbers of females that are likely to take up careers in ICT, considering the vast numbers of factors that contribute towards the choice of careers.

The research was conducted as a case study at the Council for Scientific Research (CSIR)’s Meraka Institute. The CSIR undertakes directed and multidisciplinary research, technological innovation as well as industrial and scientific development to improve the quality of life of the South African people. The Meraka institute specifically facilitates national economic development through research and development leading to products and services based on ICTs. The Meraka runs a number of research groups, namely, Wireless Africa, Knowledge Systems, ICT for Earth Observation, Living labs, Digital Doorway, Human Computer interaction, Remote Sensing, Integrative, Centre for High Performance Computing, Domain and Ability-based Technology Interventions (ABTI)

2. LEARNING STYLE INSTRUMENTS

Learning styles may be classified as perceptual, cognitive information processing, personality type and social interactions.

2.1 Perceptual learning styles

Perceptual learning styles are the means by which learners extract information from their surrounding environment through the use of their five senses (Learning styles and preferences, 2009). Commonly researchers identify auditory, visual, kinaesthetic and tactile styles, although there are generally speaking seven perceptual styles: print, aural, visual, interactive, haptic, kinaesthetic and olfactory. Print follows learning through printed or written words. Aural refers to listening, while visual refers to seeing visual depictions. Interactive refers to verbalisation, while haptic refers to the sense of touch. Kinaesthetic refers to the whole body movement, while olfactory on the other hand refers to the sense of smell. Joy Reid's Perceptual Learning Style Preference Questionnaire (PLSPQ) (Reid, 1987: 87-111), VAK Learning Styles (What is your learning preference?, 2009), O'Brien's Learning Channel Preference Checklist (O'Brien, 1990) and Howard Gardner's Multiple Intelligences (Gardner, 2000) are some of the instruments for the assessment of perceptual learning styles.

Howard Gardner's Multiple Intelligences assert that there are seven modalities and intelligences that link our individual learning style. As such human beings can be sensitive to: (1) meaning or words (verbal linguistic), (2) pitch, melody, rhythm and tone (musical), (3) handling chains of reasoning and recognise patterns and order (logical-mathematical), (4) perceive the world accurately and try to recreate that world (spatial), (5) able to use the body skillfully and handle objects (bodily-kinaesthetic), (6) understand people and relationships (interpersonal) or (7) possess access to one's emotional life as a means to understand oneself and others (intrapersonal).

2.2 Cognitive information processing

Cognitive information processing distinguishes between the way we sense, think, solve problems and remember information. It is an individual approach to assimilating information. Each one of us has a preferred consistent way of perceiving, organising and retaining information. Cognitive styles are relatively stable strategies, preferences and attitudes that determine an individual's typical modes of perceiving, remembering and solving problems as well as consistent ways in which an individual memorises and retrieves information. Dimensions of cognitive style preference include introversion, extroversion, sensing, intuition, sensing, thinking, feeling, judging and perceiving. Examples of cognitive information processing include the Kolb's Learning Styles Inventory (Personal Thinking Styles, 2009; Reading Styles Inventory, 2009; Kolb's Learning Styles Inventory, 2009), Gregorc Learning Style Delineator (Clagherty and Smith, 2009), Oxford's Style Analysis Survey (Oxford, 1993), Felder and Soloman's Index of Learning Styles (Felder and Soloman, 2009) and Canfield's Learning style (Canfield, 2009).

Kolb's Learning Styles Inventory emphasises the need for learning to be grounded in experience. It divides learners into activists, reflectors, pragmatists and theorists. Activists prefer to feel and experience rather than think. The reflectors focus on the ability to understand the meaning of ideas. The theorists have the ability to build general theories in order to come up with ideas. The pragmatists emphasize practical applications rather than reflective understanding of a problem. Kolb includes this 'cycle of learning' as a central principle in his Experiential Learning Theory, typically

expressed as a four stage cycle of learning in which immediate or **concrete experiences** provide a basis for **observations and reflections**. These observations and reflections are assimilated and distilled into **abstract concepts**, producing new implications for action which can be **actively tested** in turn creating new experiences. Kolb says that ideally this process represents a learning cycle where the learner ‘touches all bases’, i.e. a cycle of experiencing, reflecting, thinking and acting. It is important to remember when using Kolb’s learning cycle that the learner can enter the cycle at any stage.

Kolb’s model gives a four type definition of learning styles, each representing the combination of two preferred styles of the four stage cycle. These are the **diverging, assimilating, converging and accommodating** styles. The diverging style represents concrete experience and observation and reflection. The assimilating style represents abstract concepts and observation and reflection. The converging style represents abstract concepts and actively testing concepts. The accommodating style represents active experimentation and concrete experience. Divergers, assimilators, convergers and accommodators are referred to as reflectors, theorists, pragmatists, and activists, respectively, as shown in Table 1.

Learning style	Learning mode components	Predominant preference
Diverger (Reflector)	CE- concrete experience RO – reflective observation	Imaginative problem-solving
Assimilator (Theorist)	RO – reflective observation AC – abstract conceptualisation	Rational theory building
Converger (Pragmatist)	AC-abstract conceptualisation AE – active experimentation	Practical solutions
Accommodator (Activist)	AE – active experimentation CE – concrete experience	Hands-on experience

Table 1: Kolb's Learning Styles

2.3 Personality types

Personality patterns focus on attention, emotion and values. Studying these differences allows us to predict the way learners will react and feel about different situations. The Myers-Briggs Type Indicator (An introduction to personality styles, 2009; MBTI Basics, 2009), the Keirsey Temperament Sorter (Keirsey Temperament Sorter, 2009; About 4 temperaments, 2009), the Thomson-Maidenbaum Personality Inventory (Thomas Maidenbaum, 2009), are well known instruments for personal assessments. These three instruments are based on Carl G. Jung’s Theory of psychological differs (Jung, 1976). This theory identifies 16 personality traits. It identifies two sets of mental preferences – ‘perceive’ and ‘judgement’. ‘Perceive’ can either be through ‘sensing’ or ‘intuition’ and ‘judgement’ can be through ‘thinking’ or ‘feeling’. The same theory identifies two kinds of mental-orientation – ‘energy orientation’ and ‘extraverted orientation’. Energy orientation comes as either ‘introversion’ or ‘extraversion’. The extraverted-orientation comes as either ‘judging’ or ‘perceiving’. Judgement is identified with a J, and perceiving with P. People perceive through sensing or by intuition. Sensing is identified by S, and intuition by N. People form judgement through thinking or feeling. Thinking judgement is identified with T and feeling judgement with F. There are two kinds of mental orientations, the energy-orientation and extraverted-orientation. In energy-orientation we occupy two worlds - introversion and extroversion. Introverts draw their primary energy from the inner world, while extroverts draw their energy from the outer world. Extraversion is identified with E, while introversion is identified with I. The second

set of mental- orientations, the extraverted-orientation relates to the mental preference one relies upon relating to the outside world. This orientation is called judging. Those who prefer judging rely upon their T and F, while those who prefer perceiving rely upon their S or N. This means that the 16 traits identified are: ISTJ, ISFJ, INFJ, INTJ, ISTP, ISFP, INFP, INTP, ESTP, ESFP, ENFP, ENTP, ESTJ, ESFJ, ENFJ and ENTJ, depending on the combinations.

2.4 Social interactions

Social Interaction looks at likely attitudes, habits and strategies learners will take towards their work and how they engage with their peers when they learn. Examples of learning styles that emphasise social interactions are the Grasha-Riechmann Student Learning Styles Scales (Grasha, 1996; Reichmann and Grasha, 1974: 213-223) and Dunn's Learning Style Inventory (Dunn, Dunn and Price, 1975; Dunn, Dunn and Price, 1989). Dunn's model creates teacher awareness of individual differences in learning. The model involves the identification of individual learning styles and planning to accommodate these learning styles in instruction. Underlying these activities is a series of 21 learning style elements under environmental, emotional, sociological, physiological and psychological stimuli. The Learning Style Inventory (Free Learning Styles Inventory, 2009) and the Reading Style Inventory (Reading Style Inventory, 2009) are the assessment instruments recommended by the model developers. The Grasha-Riechmann Student Learning Styles Scales classify learners into independent, dependent, participant, avoidant, collaborative and competitive. Independent learners think for themselves and are confident in their learning abilities. Avoidant students are not enthusiastic about learning. Collaborative students learn by sharing ideas. Dependent students are not inquisitive, and will only learn what is required. Competitive students learn material in order to perform better than others. Participant students are active in class.

3. METHODOLOGY

3.1 Purpose of research

Aim:

The purpose of this research was to establish the relationship between learning styles and individual's choice of ICT careers and if there are any visible differences in learning styles between men and women in ICT careers.

The question therefore is:

“Do individuals with certain learning preferences choose careers that are aligned to their learning preferences, and does gender play a role in this”?

Objectives:

The questions that this research asks are:

- Is there a correlation between individuals' learning styles and their choice of ICT careers?
- Are there any differences in learning styles between males and females in ICT careers?

3.2 Data collection

The research was a case study. A case study is a research strategy that investigates a phenomenon within its real-life context (Cohen, Manion and Morrison, 2000). This study was carried out at the Meraka Institute because of its concentration of ICT professionals. The study was both qualitative and quantitative. A questionnaire was put in place to collect information on learning styles of individual participants and also collect demographic data about the participants. The participants were requested to independently assess themselves online using the learning style instruments identified and capture the results on the questionnaire provided.

For the purposes of this project, the research identified Howard Gardner's multiple intelligences to represent the perceptual learning styles, Kolb's Learning Style in the form of Honey and Mumford's questionnaire (Rough and ready reckoner, 2009) to represent the cognitive information processing, Grasha-Reichmann learning style to represent the social interactions and the Myers Briggs Test to represent the personality types. Howard Gardner's Test was taken online using the Howard Gardner's free multiple intelligence tests available on the businessballs.com web site (Multiple intelligence tests, 2009). A free informal Myers Briggs online test was taken on personalitypathways.com (What is your Myers-Briggs personality type?, 2009). A free Honey and Mumford Learning styles questionnaire which is based on Kolbe's Learning theory is also available free on (Rough and ready reckoner, 2009). Grasha Riechman assessment instrument is available free on (Grasha Reichmann Student Learning Style Scales, 2009).

3.3 Profile of respondents

The questionnaires were rolled out randomly to ICT staff at Meraka. Responses were received from 30 participants. The participants consisted of 40% women and 60% men. This was done in order to understand and compare how learning style issues affect both men and women. The representation as a percentage of the total participants according to groups was: Integrative – 31.25%, Wireless – 21.88%, ICT4EO – 9.38%, CHPC – 15.63%, Domain – 6.25%, ABTI – 3.13%, Digital Doorway – 3.13%, HCI – 3.13% and Living Labs – 6.25%. The ICT professionals referred to in this study are people who possess a diploma or higher from a recognised university or are on attachment from higher education institutions and currently actively employed by the Meraka institute on an in-service basis. The researchers are Meraka staff members involved in gender and ICT research. The distribution of participants according to gender and qualifications is shown in Table 2.

Gender	Qualifications					
	Degree	Honours	Masters	Matric	National Diploma	Grand Total %
Female	6.67%	16.67%	10%	3.3%	3.33%	40%
Male	6.67%	20%	13.33%	3.33%	16.7%	60%
Total %	13.33%	36.7%	23.33%	6.67%	20%	100%

Table 2: Respondents by age and gender

National Diploma Holders are interns doing in-service training and Matric holders are attached to the institution as part of their industrial attachment and working towards their degrees and diplomas. Out of the total participants, 13.3% are first degree holders. The majority of these first degree holders, that is, 10% of the total participants, fall within the ages of 15 and 25. Honours degree holders constitute 36.67%. The majority of them, that is, 23.3% of the total participants fall within the 26-35 years age group. Masters degree holders constitute 23.3%. Of these 20% are in the 26 to 35 years age group. National Diploma holders total 20% of the participants and of these 13.33% of the total participants are within the 26 to 25 years age group.

A total of 40% of the participants are Computer Scientists of which 16.67% of them are female and 23.33% are male. The Computer Science holders work in ICT groups such as ABTI, management, CHPC, Domain, ICT4EO, Integrative and Wireless. Those with an electrical/ electronic background constitute 23.33%, with males making 20% and females 3.3%. They are found in management, CHPC, Integrative and Wireless groups. Information systems majors have a total of 16.67%, of which 13.3% are female. This covers groups such as the Digital Doorway, CHPC, Integrative, Knowledge Systems, Living Labs and HCI.

In the career ladder system, the majority is in the research career ladder at 33.3%, interns – 23.33%, research and development practitioners – 10%, those on studentships – 10%, technical support staff – 16.67% and 6.67% are in project management. Of the interns 10% are women. Of the researchers 20% are women, and of the technical support 10% are females.

According to career roles, programmers constitute 33.33% of the total participants, with 26.67% males and 6.67% female. Programmers constitute only those with first degrees, Honours degrees, National Diplomas, Matrics and interns. Those conducting research constitute 50% of the sample of which 26.67% are female and 23.33% are male. Researchers are likely to be first degree holder, Honours, Masters and PhD holders. Systems analysts constitute 6.67% and all are male. Technical support constitutes 6.67% and all are female. 3.3% are project managers. 26.7% of the programmers have less than 5 years experience, with 23.33% of these being male and 3.33% female. Also 33.3% of the sample is researchers with less than 5 years experience, of which 13.33% are female and 20% are male. 10% of the total participants are women who have 16-20 years experience in research. Project managers are more likely to be Masters Degree holders.

3.4 Ethical considerations

According to Cooper and Schindler (2006), ethics are norms or standards of behaviour that guide moral choices about behaviour and our relationships with others. For this study the researchers ensured that ethics were complied with. The main ethical consideration was respondents' privacy. The researchers had to comply with the principles aimed at protecting the dignity and privacy of every individual who provided personal information. No names of individuals can be revealed as regarding their opinions. The participants were notified of the aims, methods and benefits of the research, and assured of their right to abstain from participation and the right to terminate their participation.

3.5 Study protocol

The development of a protocol enabled the study to improve and achieve reliability. Table 4 shows this study protocol.

Purpose	Study issues	Effects
To conduct background research on learning styles and instruments used to measure these	Identify learning styles issues and then translate these into questionnaires	The questions to be included in the questionnaire should be able to extract information on individuals' learning styles
Identify respondents	The respondents should be ICT professional who are active in the field. Meraka Institute was chosen as the source because of a concentration of ICT professionals	The study targets people who are in the ICT workplace because the survey is all about them
Identify role of researcher	The role of the researcher is to identify issues of learning styles by conducting a literature survey and subsequently compile a questionnaire and distribute it	The researcher is a person within the Meraka Institute and has an established relationship with the targeted staff. It makes the job of distributing the questionnaires and making follow-ups much easy.
Ensuring optimum response is obtained	Information from respondents are gathered and analysed at this stage. Effort should be made to get optimum response in terms of the numbers of respondents	The responses are recorded and analysed.
Facilitate good timing	The researcher should make a follow-up on the questionnaires within a reasonable time limit.	It should be expected that not all people that the questionnaire is distributed to will respond, and that not all will respond in time. Effort should be made to distribute as many questionnaires and a follow-up made within reasonable time on the questionnaires for maximum response.
Ensure the questionnaire is the perfect resource	The questionnaire should be unambiguous, in English, and adequate	The questions should be easy to answer. The questionnaire should not be too long but should be

		able to solicit enough content. No expertise in the language should be required for anyone to answer the questions contained
Check out the ethical concerns	All responses will be anonymous to protect the privacy concerns of the respondents	Privacy is guaranteed. No revelations of respondents' private information will be made. Authenticity of results is also guaranteed

Table 3: The study protocol

4. FINDINGS ON LEARNING STYLES

The following are findings according to each of the identified instruments from the various categories of learning styles:

4.1 Howard Gardner's Multiple Intelligences

Table 4 captures the data on Howard Gardner's Multiple Intelligences.

As % of the total participants in each particular choice of learning style							
	Logical mathematical	Musical	Bodily Kinaesthetic	Spatial	Interpersonal	Intrapersonal	Linguistic
1 st choice	59.38%	12.50%	0%	3.13%	15.63%	0%	9.38%
2 nd choice	18.75%	6.25%	9.38%	9.38%	25.00%	18.75%	15.63%
3 rd choice	9.38%	21.88%	9.38%	15.63%	15.63%	21.88%	6.25%
4 th choice	3.13%	12.50%	12.50%	21.88%	21.88%	18.75%	9.38%
5 th choice	3.13%	21.88%	18.75%	12.50%	3.13%	12.50%	28.13%
6 th choice	3.13%	6.25%	18.75%	25.00%	12.50%	18.75%	15.63%
7 th choice	3.13%	18.75%	31.25%	12.50%	6.25%	9.38%	15.63%
Total	100%	100%	100%	100%	100%	100%	100%

Table 4: Howard Gardner's Multiple Intelligence data

Table 4 shows that the participants are predominantly logical mathematical followed by interpersonal traits as first and second choices respectively. According to Howard Gardner's Multiple Intelligence Model, 59.38% of the respondents are logical mathematical as a first choice of which 28.13% are female and 31.25% are male. This constitutes 60% of the female participants and 58.82% of the male participants in this learning style. 15.63% are interpersonal as a first choice, of which 9.38% are female and 6.25% are male. This constitutes 20% of the female participants and 11.70% of the male participants in this learning style. 12.50% are musical as a first choice, of

which 3.13% are female and 9.38% are male. This constitutes 6.67% of the female participants and 17.65% of the male participants in this learning style.

25% of the respondents are interpersonal as a second choice of which 15.63% are female and 9.38% are male. This constitutes 33.33% of the female participants and 17.65% of the males in this learning style. 18.75% are logical mathematical as a second choice of which 6.25% are female and 12.50% are male. This constitutes 13.33% of the female participants and 23.53% of the male participants in this learning style. 18.75% of the respondents are intrapersonal as a second choice of which 9.38% are female and 9.38% are male. This constitutes 20.00% of the female participants and 17.65% of the male participants in this learning style.

Bodily-kinaesthetic and musical feature as the least preferred options.

4.2 Kolbe’s Learning Style

Assessment in Kolbe’s Learning Style shows that 46.88% of the respondents are reflectors of which 25% are female and 21.88% are male. This constitutes 53% of the female participants and 41.18% of the male participants in this learning style. 31.25% of the respondents are pragmatists of which 15.63% are male and 15.63% are female. This constitutes 33.33% of the female participants and 29.14% of the male participants in this learning style. 12.50% of the respondents are theorists of which 6.25% are male and 6.25% are female. This constitutes 13.33% of the female participants and 11.76% of the male participants in this learning style. 9.388% of the respondents are activists of which 0% are female and 9.38% males. This constitutes none of the respondents being female participants and 17.65% of the male participants in this learning style.

4.3 Gracha Reichmann Learning Style

Assessment according to the Gracha-Reichmann instrument revealed the following statistics (Table 5):

Learning style	High %			Moderate %			Low %		
	As a % of female participants in this learning style	As a % of the male participants in this learning style	As a % of the grand total	As a % of female participants in this learning style	As a % of the male participants in this learning style	As a % of the grand total	As a % of female participants in this learning style	As a % of the male participants in this learning style	As a % of the grand total
Independent	53.33%	47.06%	50%	40%	52.94%	46.88%	6.67%	0%	3.13%
Avoidant	20.00%	17.65%	18.75%	46.67%	64.71%	25%	33.33%	17.65%	25.00%
Collaborative	80.00%	47.06%	62.50%	13.33%	41.18%	28.13%	6.67%	11.76%	9.38%
Dependant	13.33%	11.76%	12.50%	66.67%	58.82%	62.50%	20%	29.41%	25.00%
Competitive	60.00%	47.06%	53.13%	33.33%	47.06%	40.63%	6.67%	5.88%	6.25%
Participant	53.33%	35.29%	43.75%	40%	47.06%	43.75%	6.67%	17.65%	12.50%

Table 5: Gracha Reichmann data

Table 5 Shows that 62.5% of the participants are highly collaborative, 53.13% of them highly competitive, 50% of them highly independent and 43.75% of them highly participative in their work. In these identified categories females outperform the males percentage wise, in terms of percentages against female totals in the learning style and percentages against male totals in the learning style respectively.

4.4 Myers Briggs Personality Test

Assessment according to the informal online Myers Briggs Personality Test revealed the following (Table 6):

Learning style	As a % of the female participants in this learning style	As a % of the male participants in this learning style	As a % of the grand total of all participants
ESTJ	40%	47.06%	43.75%
ISTJ	33.33%	11.76%	21.88%
INTJ	6.67%	23.53%	15.63%
ESFJ	0.00%	11.76%	6.25%

Table 6: Kiersey Temperament Sorter data

Table 6 that a majority of the participants fall into the personality styles ESTJ at 43.75%, ISTJ at 21.88% and INTJ at 15.63%. There are more female ISTJ personalities than males per percentage sample of each gender. The opposite is true of ESTJ, INTJ and ESFJ.

4.5 Overall assessment

The top performing learning styles were consolidated and gauged against the roles of the participants in the ICT environment as shown in Table 7.

Learning style	Current role as % of participants in learning style								Total %
	Programmer		Project manager		Researcher		Technical support		
	Female	Male	Female	Male	Female	Male	Female	Male	
Howard Gardner's Multiple Intelligences									
Logical mathematical	3.13%	9.38%	3.13%	6.25%	15.63%	12.50%	6.25%	3.13%	59.38%
Interpersonal	0.00%	3.13%	0.00%	0.00%	9.38%	0.00%	0.00%	3.13%	15.63%
Gracha Reichmann									
Collaborative	6.25%	9.00%	3.13%	0.00%	25.04%	12.52%	3.13%	3.13%	62.20%
Competitive	0.00%	9.39%	3.13%	3.13%	21.91%	15.42%	3.13%	0.00%	53.21%
Independent	0.00%	9.39%	3.13%	6.25%	15.65%	9.39%	6.25%	0.00%	50.06%
Participant	3.13%	9.39%	3.13%	0.00%	15.65%	9.39%	3.13%	0.00%	43.82%

		%		%	%			%	%
Kolbe's Learning Style									
Reflectors	3.13%	6.25%	0.00%	0.00%	15.63%	12.50%	6.25%	3.13%	46.88%
Pragmatists	3.13%	9.38%	3.13%	3.13%	9.38%	3.13%	0.00%	0.00%	31.25%
Myers Briggs Style									
ESTJ	3.13%	9.38%	0.00%	3.13%	9.38%	6.25%	6.25%	6.25%	43.75%
ISTJ	0.00%	0.00%	3.13%	0.00%	12.50%	6.25%	0.00%	0.00%	21.88%
INTJ	0.00%	9.38%	0.00%	3.13%	3.13%	0.00%	0.00%	0.00%	15.63%

Table 7: Role versus learning style

Female researchers are more likely to be logical mathematical at 15.63% of the total participants, followed by the male researchers at 12.50% and male programmers at 9.38%. Of the interpersonal trends female researchers dominate that group at 9.38% of all participants. Both female and male researchers are highly collaborative at 25.04% and 12.52% respectively. This is followed by both female and male programmers at 6.25% and 9.00% respectively.

Both female and male researchers are highly competitive at 21.91% and 15.42% respectively, followed by male programmers at 9.39%. A similar trend is followed for independent and participant characteristics. Female and male researchers top the list of reflectors at 15.60% and 12.50% respectively. However, female researchers and male programmers top the lists of pragmatists at 9.38% each respectively.

Female researchers and male programmers are more likely to have an ESTJ personality at 9.38% compared to other groups. On the other hand female researchers are also highly more likely to be ISTJ than males, at 12.50%. Male programmers lead the group of INTJ personalities at 9.38%.

5. DISCUSSION

According to the Howard Gardner's Multiple Intelligence Model data given in Table 2, the most preferred learning styles among participants in the ICT field is logical mathematical, with interpersonal as a second choice. The typical ICT professional in the sample of participants is therefore logical interpersonal. The logical individual works well with numbers and logic. Interpersonal individuals have the ability to relate to others. The logical interpersonal people discuss things with others in a logical way, and analyse problems. This is an essential component in the ICT workplace in that the specialists not only work with each other in the design and development of products and services, but they also have to work with those they are developing the products and services for. One point of note is that there is a balance in gender among the logical mathematical people (60% of female participants and 58.82% of male participants), and yet in the interpersonal traits, females are in the majority (33.33% of female participants and 17.65% of male participants). The average ICT person is least

likely to be bodily kinaesthetic according to this sample, because we are dealing with people who work mostly with their heads.

According to the results from Kolbe's assessment instrument, people in the ICT field are predominantly reflectors and pragmatists. This comes to about 80% of the total participants. Pragmatists are active experimenters and they prefer practical solutions to problems. Reflectors prefer imaginative problem solving. Both male and female reflectors are mostly in the research domain. For the pragmatists the females are in the research domain predominantly and the males in the programming domain. The women are more likely to be in the field researching, while the males are developing programs.

According to the Gracha-Reichmann instrument (Table 5) people in the ICT field are more likely to be independent, collaborative, competitive and participant. This means that although they collaborate in huge projects by sharing ideas, they are equally capable of working independently. They confront each other with ideas and facts to solve problems collaboratively. They are competitive in the sense that they strive to perform better as individuals and against others, that is, in an effort to get an end result. Of the competitive people, females are predominantly researchers, while the males are both researchers and programmers. The average ICT person is less likely to be a theorist in this sample most probably because the ICT professionals who participated are involved in a lot of hands-on work. But research is about theories and proving these theories. Therefore the nature of the sample could be the reason for this fall out.

The three most common traits among the people in ICT fields, from the Kiersey Temperament Sorter are ESTJ, ISTJ and INTJ, with ESTJ being the highest. The females who fall into the ISTJ group are in research and project management, while the males are predominantly in research. In INTJ it is predominantly male programmers. According to Myers-Briggs people who fall into the ESTJ and ISTJ groups are logical, practical, cooperative and orderly. The INTJ are introspective, pragmatic and directive. The myth about programmers being nerds holds. From the above two paragraphs, the logical mathematical ESTJ that are collaborative dominate this ICT workplace.

6. CONCLUSIONS

Links between learning styles, gender and ICT career choices were discussed. The research shows that there is no significance of learning styles as pertaining to gender in the ICT industry. The differences in learning styles among females and males are minimal and have no significant impact on their ICT career choices. Therefore there are some other issues demanding of the government in enticing women into ICT careers than the issue of learning styles.

Although the sample is very small to reach significant decisions, the data analysis is suggestive of trends that merit further investigation. The study suggests that ICT has a greater presentation among reflectors and pragmatists than among people with other traits. There is an identified pattern of both males and females being logical-mathematical and interpersonal. The interpersonal trait is associated with females more though. Researchers and programmers are more likely to be logical

mathematical than program managers. The question therefore is on whether or not there are less logical thinkers among women than men, which has resulted in reduced numbers of women in this predominantly logical mathematical environment. Further research would mean conducting research on the same among the general populace who have no ICT orientation. A bigger and more diversified sample would suffice.

From the results of Kolbe's assessment both males and females can be any of reflectors and pragmatists but this trait is more visible among programmers and researchers. Both males and females in the ICT environment show traits of being collaborative, independent, competitive and participant. Gracha Reichmann though shows that women are more collaborative than men, although in other traits the differences are minimal. The average ICT person is less likely to be a theorist in this sample most probably because the ICT professionals who participated are involved in a lot of hands-on work. But research is about theories and proving these theories. Therefore the nature of the sample could be the reason for this fall out. In the Myers Briggs instrument, females are more likely to be ISTJ than INTJ. The reverse is true of men. Both men and women appear in the ESTJ trait though.

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