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Information and Communication Technologies (ICT): Components, Dimensions, and its Correlates

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ABSTRACT

Information and Communication Technologies (ICT) has been identified as one of the crucial factors that affect teaching effectiveness and student learning worldwide. UNESCO, many international organizations, and many governments emphasized the importance of ICT and try to incorporate ICT into education systems. This study examined self-assessed computer competency in thirteen ICT areas from two samples, e.g., the United States and Mexico. Reliability tests were conducted, and rank analysis was done among them. By using factor analysis, these thirteen areas were grouped into three categories: "basic ICT skills"; "advanced ICT skills;" and "multimedia skills and attitudes towards ICT". Subjects showed the highest scores in basic ICT skills, which include knowledge of computer systems, use of the operating system, search internet and communication and networking. The multimedia skills and attitudes towards ICT demonstrated the second highest scores. Advanced ICT skills that include image processing, use of database, technological platforms, and web 2.0 tools was found to have the lowest competency scores among subjects. Multivariate analysis was also conducted and found that age and gender are two significant factors to predict ICT competency, and age was found to have a non-linear relationship on advanced ICT skills.

Keywords: Information and Communication Technology (ICT), Measuring ICT, Correlates of ICT, Teachers and ICT

INTRODUCTION

Technological sophistication and advancement have long been recognized as critical elements of economic and social development. Thus, in the 21st century, policy makers and academics have directed their attention toward the emphasis on and approach toward technology, including specifically information and communication technologies (ICT) within the educational systems

of developed and developing countries. Kreijnsa, van Acker, Vermeulend, & van Buuren (2014) define ICT as "a set of tools enabling, supporting, and reinforcing educational reform"(p. 217). Government measurements of education are usually include ICT component (Hernández-Ramos, Martínez-Abad, Peñalvo, García, & Rodríguez-Conde, 2014). While the importance of integrating ICT within educational systems is readily agreed to, initiatives in this realm are varied with regard to method and aims (Christensen & Knezek, 2009; Conrad & Munro, 2008; Hakverdi, Dana, & Swain, 2011; Phelps, Hase, & Ellis, 2005; Teo & Koh, 2010). Efforts toward integration of ICT within educational institutions, furthermore, may benefit from being better informed with regard to the current ICT skill set among teachers (Alghazo, 2006; Cretchley 2007; Friedrich & Hron, 2011). Incorporation of ICT in the classroom directly affects students' academic performance (Kreijnsa, van Acker, Vermeulend, & van Buuren, 2014). Following previous research, this paper aims to develop metrics for assessing teachers' backgrounds and skill sets for ICT usage, and also to identify individual antecedents for ICT usage and competence. It is expected that establishing appropriate metrics for these elements of ICT pedagogical usage, as well as highlighting antecedents for usage and for competence among educational practitioners, will help to orient and focus future efforts by academics, policy makers and practitioners.

In 2008, UNESCO emphasized the incorporation of ICT within national education efforts (Castillo, Chen, Gatlin-Watts, & Enriquez de Rivera, 2013; Harasim, Hiltz, Turoff, & Teles, 2000; Hepp, 2003 cited in Cancino & Donoso, 2004). In addition to being a valid goal for education, ICT is also a means to an end, in as much as it enhances pedagogical effectiveness. When ICT is available to teachers and students, it can enhance learning and teaching experiences (Collins, 1991; David, 1991; Sheingold, Hadley, & Center for Technology in Education, 1990).

The effective usage of ICT expands learning and knowledge on local, national and global levels. Many countries, including the USA, United Kingdom, the Netherlands, South Africa, Chile, India, Czech Republic, Korea and Australia have developed standards and policies to foster and implement ICT in their educational systems (Bose, 2010; Castillo et al, 2013; Dawson, 2008; Driscoll, 2007; Heck, Houwing, & de Beurs, 2009; Jamieson-Proctor, Burnett, Finger, & Watson, 2006; Park, Khan, & Petrina, 2009; UNESCO, 2006; Zounek, 2005). Table 1 presents some national and international ICT affiliated institutions and policies.

Table 1: Importance of ICT Globally and Nationally.

Region	Institution/Organization/Project
African Community (Cameroon, Congo, Burkina Faso, Senegal, Angola, Namibia, Mali, Madagascar, Ghana, Guinea)	ICT- enhanced Teacher Standards for Africa (ICTeTSA)
Australia	* Department of Education and Training * Teachers ICT skills
Chile	* Center of Education and Technologies * The Information and Communication Technology Standards for teacher training * Estándares TIC para la formación inicial docente

China	China Educational Technology Standards
European Community	European Pedagogical ICT
European Union	* Definition and Selection of Competencies (DeSeCo) developed by OECD * The project--Tuning Educational Structures in Europe * European e-Competence framework (e-CF)
Great Britain Community	British Educational Communications and Technology Agency (BECTA) -The E -Learning Nordic project
India and South Asia	The Little Data Book on Information and Communication Technology, Information and Communication Technology for Education
International Community	* United Nations Educational Scientific and Cultural Organization (UNESCO) * International Society for Teacher Education * Organization for Economic Co-operation and Development (OECD) * World Bank (WB) * Inter-American Development Bank (IDB) * Organization for Economic Co-operation and Development (OECD) members: Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary , Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg , Mexico, Netherlands, New Zealand , Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States - Technology Use and Educational Performance in PISA (Program for international student assessment)
Jordan	* Education Reform for the Knowledge economy (ERfKE) * Jordan Education Initiative (JEI)
Mexico	* National Development Plan and * The State Development Plan for Yucatan * The Mexico with Quality Education Strategy
South Africa	Foundation for Education, Science and Technology (which has developed the High Performance Leadership Competencies Systems)
World Community (Finland, Denmark, the United States, Norway and the UK)	The Horizon Report by the New Media Consortium(NMC)
United Arab Emirates	* National Council for Accreditation of Teacher Education * Vision For Education 2020 * The Ministry of Education and Youth (MOEY)
United Kingdom	ICT Competency Standards for Teachers developed by UNESCO
United Nations	Global Alliance Information and Communication Technologies and Development
United States	* Office of Information and Communication Technology (OICT) of United Nations * The International Society Technology Education
	* The Society for Information for Technology and Teacher Education (SITE)
	* The International Education Practice

The breadth of the above programs and initiatives is a natural outgrowth of the consensus on the role that technology plays in today's learning environments. The potential benefits deriving from, and the need for, a well-integrated ICT dimension to teaching rests on extensive and developed literature. According to Duhaney and Zemel (2000), and D'Ignazio (1989), inter alia, today's teachers must incorporate technology in their jobs in order to comply with contemporary learning demands. In the information age, it is impossible to obtain, digest and utilize, all available knowledge. In this environment, ICT plays a role in accessing and managing knowledge, while making learning both easier and engrossing. At the same time, technologies develop "critical thinking, inquiry, and problem solving" (Alghazo, 2006, p. 328) abilities. Teachers must be proficient in ICT in order to bring available knowledge into their classrooms (Aduwa-Ogiegbaen, 2009; Barbera, 2003; Castillo et al, 2013, González, 2008; Hepp, 2003, Jari, Kalle, Maija, & Veijo, 2006; Peralta & Albuquerque, 2007; UNESCO, 2008; McVay, 2002; Vales, 2009). Mac Calluma, Jeffrey, and Kinshuk (2014) emphasize that teachers' and students' opinion of each other's technological proficiency and competencies diverge.

The actual roles played by educators in the dissemination and incorporation of ICT were examined by Castillo, Chen, Gatlin-Watts, and Enriquez de Rivera (2013). First, teachers become lifelong learners. Technology is a dynamic area which sees constant flux. In order to stay proficient, teachers have to experiment with new tools and resources which expand their capacity to use different technologies as teaching tools. Second, teachers incorporate inner and outer resources to expand their technological knowledge. Third, teachers convert to "learning facilitators" (Castillo et al., 2013, p. 26). They design and develop class curriculum to enhance learning outcomes. These new roles are implemented through teachers' willingness to learn ICT and to share it both with students and with colleagues.

Teachers on all levels from an elementary school to high school (and the equivalents of those levels among countries with different nomenclature) need to be comfortable with ICT and to empower their students to use ICT themselves and to learn from it. ICT knowledge is necessary at all educational levels for teachers and students, regardless of subjects taught and degrees obtained. However, some researchers have indicated that some teachers do not feel that they are adequately prepared to incorporate technology into their teaching (Butter, Pérez, & Quintana, 2014; Grabe & Grabe, 1998; Wetzel, 1993). The potential pitfalls for those teachers, and their students, are obvious: a classroom in which the educator feels uncomfortable with the technology that the students need may prove to rob students of necessary skill development, and fail to impart the knowledge ostensibly delivered there adequately. It may also well be that ICT attitudes are infectious, and that students are less able to feel comfortable using ICT if their teachers aren't. In addition, teachers are fearful that they lack ICT competences compared to their students (Butter, et al., 2014). In general, not only competence in ICT, but attitude towards ICT among teachers is also important. Although at both the local and national levels there is a general understanding of the need for improved ICT engagement within classrooms, the attitudes of individual educators will have positive or negative repercussions for the educational attainments of students.

Information Communication Technology (ICT) is defined as "skills around computing and communications devices, software that operates them, applications that run on them, and systems that are built with them" (Mid-Pacific ICT Center, 2014). There is as yet no universal or agreed-upon definition of what an ICT competency is. However, McLagan (1997) outlined different foci

of the concept, while Castillo et al. (2013) surveyed a number of different approaches that analysts have used. In this paper, we will focus on competency related to both expertise in the abstract and to "bottom line" functional performance (see Diaz Barriga 2006 for a utilitarian application of the term "competence"). As a relevant part of our strategy, we will also incorporate affect, or *attitude*. Teachers' attitude is crucial towards ICT's incorporation in teaching practices. Hernández-Ramos, Martínez-Abad , Peñalvo , García , & Rodríguez-Conde (2014) analysis showed that "perceived usefulness and the perceived ease of use" (p. 513) directly influence teachers' attitude towards ICT. However, it is important to remember that self-efficacy is more predominant then solely attitude towards ICT (Alshawareb & Majed, 2012; Kreijnsa, et al., 2014). Teachers have to believe in their ability to objectively implement ICT in teaching (Alshawareb & Majed, 2012). Kreijnsa et al. (2014) found that attitude was predominant to self-efficacy towards the intent of applying Digital Learning Materials (DLMs), as a subcategory of ICT.

According to the World Youth Report (2003) there are divisions based on the ICT access and learning. The first split is global. It can be experienced between developing and developed nations. The gap between developed nations and the usage of ICT in their countries cannot be overstated, especially with the existence of Internet. Many developed nations are far behind in their e activities and e earning. The second split can be noticed within the country. Population varies by income, geographic disperson within the country, and the attained educational levels of citizens which impact access and usage of ICT. Undoubtedly, ICT affects people and countries, and unfortunately leaves many behind the technological progress. ICT establishment and maintenance require extensive fiscal commitment (Alshawareb & Majed, 2012).

ICT includes skills, software, applications, and systems. ICT education consists of four components: ICT/Digital Literacy; ICT Infrastructure and Support Applied Technologists; Specialized Business and Industry uses of ICT; and ICT Research and Development Scientists (Mid-Pacific ICT Center, 2014). ICT/Digital Literacy, ICT Infrastructure and Support Applied Technologists are important basic and advanced futures of ICT that should be integrated in teaching and learning to insure ICT sufficient spread through generations (Mid-Pacific ICT Center, 2014).

In this research, we used an instrument designed by Cano (2005). In this survey, thirteen different domains are covered (to be specific, knowledge of computer systems, operating system, search internet, communication and networking, word process, image process, database, entertainment, online process, attitudes, technological platforms and web 2.0) (please see the Appendix). There are several questions in each domain.

Competency can be defined as the ability of an individual to do a job properly (Gilbert, 1978; Mulder, 2001; Raven & Stephenson, 2001; White, 1959). A competency is a set of defined behaviors. It is a combination of knowledge, cognitive skills, values and behaviors used to improve performance. ITC competence refers to knowledge, skills, and values toward a person's behaviors or performance in ITC. We measure self-assessed competency in ITC.

ICT in education can be identified as a supplement to boost the worth of education in the modern knowledge area. Many researchers have attempted to understand correlates of teachers' ICT proficiency. There are some factors that are commonly found in most reports, ranging from micro to macro level, among which are individual, organizational and national attributes.

Some of the individual factors are personal beliefs towards ICT and their reliance on ICT for learning, as well as teacher's personal usage of ICT (Butter, et al., 2014). To understand individual roots of the problem with teacher's competence, Peralta and Albuquerque (2007) divided teachers into two categories: innovative and traditional. Innovative teachers believe in powerful benefits of ICT in students' cognition process, while traditional teachers consider ICT as a restriction to students learning capability. Knezek and Christensen (2002) found the traditional approach being widespread throughout the world.

BECTA's report (2003) and Western Australia's Department of Education and Training investigation (2006) highlight that the teacher's personal usage of ICT in correlated to their usage and promotion of ICT in the classroom. Butter, Pérez, & Quintana (2014) research found that ICT usage and implementation in the classroom among Chile's intercultural schools in the areas of basic knowledge, pedagogical standards, knowledge management, deepening of knowledge, and social, ethical, and legal aspects can be increased through training. A yearlong study of teachers and teachers in training of five intercultural schools provided support to the motion that "virtual teaching models supported by Talent Management and Knowledge Management" (Butter, et al., 2014, p. 450) increased ICT competences among teachers. Despite the focus of many local and international agencies on promotion of ICT in the classrooms, teachers' readiness to effectively use ICT in teaching is not evident (Jari et al.,2006). Western Australia's Department of Education and Training reports that teachers' attitudes and motivations play key roles in ICT proficiency (Teacher ICT skills, 2006).

Some of the demographic factors may include gender, age, years of teaching, etc. Jamieson-Proctor, et al.(2006) surveyed 929 teachers from 38 Queensland state schools in Australia to examine students' ICT learning using 4-point Likert scale. Teachers' demographic data included in the survey were gender, school type, years of teaching experience, confidence to use ICT with students for teaching and learning, year levels and curriculum areas currently taught. According to chi-square analyses, male teachers reported more confidence in teaching and learning then their female colleges. However, MANOVA did not show significant differences between teacher's genders. The chi square and MANOVA analyses reported no significant differences between years of teaching experience and teacher's confidence in using ICT.

Western Australia's Department of Education and Training also investigated demographic factors of teachers' competence but found contradicting results to Jamieson-Proctor et al, (2006). The demographic factors that presented significant relationship to teacher's ICT competence are gender, age, experience, and school type. According to findings the males demonstrate higher competency compared to female teachers and with the age increase ICT competence was decreasing.

Peralta and Albuquerque (2007) notes that competence and confidence in teachers are not sufficient enough in promoting ICT in the classrooms. ICT training and technological organizational environment they work in are significant to teacher's ICT competence (BECTA, 2003; Butter et al., 2014; Peralta & Albuquerque, 2007; Jari et al., 2006). Some of the main environmental barriers towards teachers ICT competence are not sufficient schools' ICT equipment and absence of ICT in regular class rooms (BECTA's , 2003; Jari et al., 2006; Teachers ICT skills, 2006). Other important obstacles are difficulty of ICT usage, personal adaptively,

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technological background, commitment to lifelong learning, and local and national support through policies (Butter et al., 2014). Alshawareb & Majed (2012) investigation confirm that teachers have sufficient knowledge of computers to incorporate ICT into their teaching.

Peralta and Albuquerque (2007) suggest that to improve ICT in the classrooms, further research is needed in two areas: 1. Teachers' personal type and individual abilities and 2. Organizational context. Peralta and Albuquerque (2007) propose certain questions to understand and learn more about factors that affect teacher's ICT aspects. Our research incorporates some of those areas of interest.

Thus, it would benefit researchers and policy makers to pursue two research goals. Firstly, tested, appropriate metrics for assessing these very facets or aspects of teachers are called for. Survey instruments with proven reliability and applicability should be developed. Secondly, teachers can and should be studied, with an eye toward identifying the antecedents of specific ICT skills, familiarity, use and attitudes.

The research will:

- valídate the survey instrument among 13 different computer programming and attitudes;
- conduct a factor analysis to consolidate 13 areas into three major components;
- compare 13 different computer areas and 3 factor scores regarding ICT competencies;
- examine bivariate realtionships between background information and 13 different computer areas and 3 factors and;
- conduct a multivariate analysis.

METHODOLOGY

A self-report was used in a traditional survey for this paper. The survey instrument included three parts, consisting of personal background, institutional background, and competencies. Participants were asked to assess their level of competency in 13 domains (see Appendix for the list of questions for Information and Communication Technology, ICT). Competencies in 13 domains consisted of Likert-scale questions with answers ranging from 1 as "not at all" to 5 as "advanced."

Study participants included 83 faculty members from 13 different higher education institutions. There were 40 participants from 7 different institutions in Mexico and 43 participants from six different universities and colleges in Arkansas, United States of America. The survey was conducted in the spring of 2012 via face-to-face or by mails.

Table 2: Demographic Background of the Sample (n=83).

Background	n	Percentage
Country		
Mexico	40	48.2
United States	43	51.8
Gender		
Male	47	56.6
Female	36	43.4
Marital Status		
Single	22	26.5
Married	60	72.3
Widowed	1	1.2
Degree Earned		
Bachelors	28	33.7
Masters	35	42.2
Ph. D.	20	24.1
	Means	**Standard Deviation**
Age	44.58	11.64
Seniority	11.77	8.24

Table 2 shows the demographic background of the sample. It was found that more than half or 56.6 percent of the sample were males and 43.4 percent of the sample were females. It was also found that the majority of them are married with a percentage of 72.3. It was found that most of participants had a master's degree with a percentage of 42.2. And 24.1 percent of participants had a Ph. D. degree or higher. The means of age and seniority in teaching were 44.58 and 11.77 respectively.

The reliability coefficient of Cronbach Alpha was used to exam reliability among questions in 13 different areas. There was one area that only had one question. Table 3 shows how many questions were deleted to maximize the Alpha coefficients. The Cronbach Alpha coefficients were also listed in Table 3.

Table 3: Reliability Tests (Cronbach's Alphas for ICT's.

	Title	Questions in Survey	Questions Used	Cronbach's Alpha (α)
D1	Knowledge of Computer Systems	4	3	0.845
D2	Use of Operating Systems	6	6	0.880
D3	Search internet	4	3	0.862
D4	Communication and Networking	3	3	0.417
D5	Word Processing	7	6	0.880

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D6	Image Processing	1	1	N.A.
D7	Use of Spreadsheets	2	2	0.869
D8	Use of Database	4	4	0.930
D9	Entertainment and Learning with ICT	2	2	0.683
D10	Online Procedures	2	2	0.957
D11	General Attitudes towards ICT	3	2	0.803
D12	Technological Platforms	8	8	0.941
D13	Web 2.0 Tools	8	8	0.925

RESULTS

First of all, we would like to compare the means of different domains as presented in Table 4. Word processing technology had the highest score of 4.63, following by search Internet, general attitudes toward ICT, and communication and networking. The use of operation systems, spreadsheets and entertainment and learning were in the middle. Such technologies as online procedures, image processing, use of data base, technological platforms, and web 2.0 tools were relatively ranked lower regarding to self-assessed level of ICT's.

Table 4: Rankings of Means on 13 Different ICT's.

		n	Mean	Std. Deviation
D5	Word Processing	82	4.63	0.60
D3	Search Internet	82	4.53	0.75
D11	General Attitudes towards CT	82	4.37	0.83
D4	Communication and Networking	82	4.28	0.69
D1	Knowledge of Computer Systems	79	4.28	0.92
D2	Use of Operation Systems	82	4.24	0.84
D7	Use of Spreadsheets	82	4.17	1.08
D9	Entertainment and Learning with ICT	82	3.71	1.11
D10	Online Procedures	82	3.61	1.30
D6	Image Processing	82	3.52	1.34
D8	Use of Database	82	3.34	1.42
D12	Technological Platforms	80	3.02	1.23
D13	Web 2.0 Tools	81	2.18	1.12

Since there were 13 domains, it was rather complicated to compare them. A factor analysis was used to extract different factors (Pallant, 2010; Brace, Kemp, & Snelgar, 2006). Both orthogonal and oblique rotations are widely used in factor analysis to ensure that underlying constructs are independent (Tabachnick & Fidell, 2007, p. 638.) A Varimax rotation, one of the major orthogonal rotation methods, was conducted by using SPSS (Pallant, 2010). All domains were grouped into three different factors, with percentage of variances explained at values of 46.45, 10.4, and 8.56,

individually. We labeled them as "Basic ICT skills", "Advanced ICT skills", and "Multi-media and attitudes toward ICT". Loadings and percentages of variance explained were presented in Table 5. From the Table, it is clear that basic ICT skills include such technologies as knowledge of computer systems, use of the operating system, search internet, word processing, and use of spreadsheets. Advanced ICT skills include image processing, use of database, technological platforms, and web 2.0 tools. Multi media and attitudes toward ICT include entertainment and learning with ICT, online procedure, and general attitudes toward ICT.

Table 5: Rotated Factor Component Matrix for ICT's.

F1	**Basic ICT Skills**	Loadings	Loadings	Loadings
D1	Knowledge of Computer Systems	0.774		
D2	Use of the Operating System	0.855		
D3	Search Internet	0.679		
D4	Communication and Networking	0.540		
D5	Word Processing	0.777		
D7	Use of Spreadsheets	0.671		
F2	**Advanced ICT Skills**			
D6	Image Processing		0.552	
D8	Use of Database		0.676	
D12	Technological Platforms		0.731	
D13	Web 2.0 tools		0.861	
F3	**Multi Media and Attitudes Toward ICT**			
D9	Entertainment and Learning with ICT			0.758
D10	Online Procedures			0.686
D11	General Attitudes towards ICT			0.768
	% of Variance	46.45	10.40	8.570

We constructed three ICT factor scores and computed their means. In Table 6, it was found that basic ICT skills had the highest average scores with a mean of 4.35, while 3.03 and 3.89 for advanced ICT skills and for multi-media and attitudes toward ICT. It was apparent for most faculty members in Mexico or U.S., they ranked relatively high competencies (with an average of 4.35 in a 5 level scale) in basic ICT skills that include general computer knowledge, word process, spreadsheet, email and network, and search internet. Faculty members also have second high competences in multimedia and attitudes towards ICT with an average score of 3.89 out of a 5 level scale. Faculty members have an above average competence regarding to advanced ICT skills that include imaging processing, database, web 2.0 and technological platforms.

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Table 6: Rankings of Means of Three ICT Factors.

	ICT Factors	Mean	Std. Deviation
F1	Basic ICT Skills	4.35	0.66
F2	Advanced ICT Skills	3.03	1.03
F3	Multi Media and Attitudes towards ICT	3.89	0.86

Before we conducted multivariate analysis, we conducted a bivariate analysis by using major background variables to correlate with thirteen domains as well as three factors. It was found (see Table 7) that American faculty had higher self-reported competencies in database, entertainment and learning ICT's, and general attitude toward ICT's than their Mexican counterparts. Further, gender was found to a factor affecting some ICT's level of competences. Males had higher competency scores in such domains as knowledge of computer systems, use of the operating system, search internet, image process, spreadsheets, and database than their female counterparts. Age also found to affect the competency level of ICT's. Specifically, it was found that in use of operating system, search internet, communication and networking, image processing, and spreadsheets, older faculties were found to have lower competency level than those of younger faculties. Seniority in teaching is closely related to age of faculty members. However, different impact had been found on competency. Specifically, teachers with more teaching years had lower competency level in such technologies as the operating system, search internet, communication and networking, image processing, and use of database. Both age and teaching years had negative relationship with some ICT's.

We also examined relationships of background variables with three factors that were extracted from 13 domains, which are presented in Tables 8. It was found that no statistical differences found among all three factors regarding to nationality. Gender and age were found to be related to both basic ICT and advanced ICT scores. Males and younger faculty members were more likely to have higher competency level in both basic and advanced ICT's. Years of teaching were found to relate to the basic ICT competence. None of the background variables relate to the third factor, i.e. multi-media and attitudes toward ICT.

Table 7: Bivariate Analysis between Background Variables and Thirteen ICT's Domains.

	Domains	**Country**		**Gender**		**Age**		**Teaching Years**	
		Pearson	Sig.	F	Sig.	Pearson	Sig.	Pearson	Sig.
D1	Knowledge of Computer Systems	-0.11	0.35	8.69	0.00*	-0.29	0.10	-0.20	0.09
D2	Use of the Operating System	-0.15	0.19	4.92	0.03*	-0.34	0.00**	-0.30	0.01*
D3	Search internet	0.12	0.29	6.61	0.01*	-0.16	0.15	-0.25	0.02*

D4	Communication and Networking	0.17	0.13	0.38	0.54	-0.12	0.29	-0.26	0.02*
D5	Word Processing	0.03	0.78	0.05	0.82	-0.20	0.08	-0.18	0.10
D6	Image Processing	-0.08	0.46	4.75	0.03*	-0.23	0.04*	-0.24	0.03*
D7	Use of Spreadsheets	-0.08	0.50	5.90	0.02*	-0.35	0.00**	-0.29	0.01*
D8	Use of Database	-0.24	0.03*	5.90	0.02*	-0.25	0.02*	-0.12	0.27
D9	Entertainment and Learning with ICT	-0.27	0.02*	1.00	0.32	-0.18	0.11	-0.10	0.38
D10	Online Procedures	0.02	0.83	2.13	0.15	-0.12	0.27	0.10	0.36
D11	General Attitudes towards ICT	-0.29	0.01**	0.13	0.72	-0.13	0.25	0.14	0.22
D12	Technological Platforms	-0.17	0.13	0.96	0.33	-0.34	0.00	-0.03	0.83
D13	Web 2.0 Tools	-0.06	0.59	2.19	0.14	-0.31	0.01	-0.22	0.05

Table 8: Bivariate Analysis between Background Variables and Three ICT's Factors.

	Factors	**Country**		**Gender**		**Age**		**Teaching Years**	
		Pearson	Sig.	F	Sig.	Pearson	Sig.	Pearson	Sig.
F1	Basic ICT Skills	-.01	.91	-.272	.01**	-.326	.00**	-.32	.00**
F2	Advanced ICT Skills	-.19	.09	-.253	.02*	-.358	.00**	-.20	.07
F3	Multi Media and Attitudes toward ICT	-.19	.08	-.12	.30	-.181	.10	.05	.64

Finally, we ran two multiple regression analyses on two factors, i.e. Competency in basic ICT skills and advanced ICT skills by using age and gender as independent variables. The regression result are presented in Table 9. It was found that both models were statistically significant at the level of 0.001. For the model of basic ICT skills, about 16 percent of the variance was explained by age and gender. For advanced ICT skills, the model explained about 24 percent of the variance associated with the dependent variables. Moreover, it was found that age was not a linear relationship with advanced ICT skills. The advanced ICT competency will decrease as the age increases, but at a certain level the competency will increase. We did a computation and found that around age of 45.25 is the turning point. It means that the competency level will decrease as age getting older but after age of 45, the competency level will start to increase. For advanced ICT, age around 45 had the lowest scores, younger and older faculty members are more likely to have higher competency level.

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Table 9: Multivariate Analysis on Two ICT Factors.

Predicting Model	Basic ICT Skills	Advanced ICT Skills
Constant	5.346**	8.042**
Age	-.019**	-.181**
Age Square		.002*
Gender	-.356**	-.434*
Adjusted R Square	.157	.241
Significance (P<)	.001	.001

CONCLUSION

We used a survey instrument that had been used in a variety of studies, although it was mainly used in Mexico (Castillo et. al., 2014). This study sought to validate it in the United States. This instrument has the benefit of specificity in identifying and measuring several distinct and relevant constructs. The development of these related but distinct constructs renders measurement of "ICT skills" and "ICT propensities," more robust, such that future research can flesh out specific, targeted facets of ICT to consider, or to focus on in emphatic educational policy making. It can also provide educational policy makers and national development experts with some validated constructs on the classroom level that can form a part of future developmental strategies and tactics.

It was found that country, gender, age and years of teaching all significantly impacted several of the thirteen ICT groups. Only two, "word processing," and "online procedures," were not significantly correlated to one or more of the antecedents. These two exceptions in the findings imply that, regardless of background, all subjects have similar level of self-assessed competency in these two skills. Males, younger subjects, and subjects with less teaching years are more likely to have higher ICT competency level in certain areas. This is true for both Americans and Mexicans.

The policy implications of the above findings are manifold. Mentoring programs, for example, that pair senior and junior teachers so that the former can guide and coach the latter, can be seen in a new light. The benefits of such programs can now flow both ways, such that teachers with the advantages of substantial years of experience can benefit from the competencies of younger colleagues. Hence, mentoring can become more of a "two-way street," providing multiplied benefits for students.

We have also elucidated three components of ICT. The basic ICT skills, the advanced ICT skills, multi-media and attitude toward ICT were extracted from thirteen different ICT domains. This greater specificity and sophistication in the measurement of ICT can allow researchers more precision in their empirical efforts. At the same time, policy makers are thereby granted a potentially more useful conceptual framework for interventions in this dimension of education. Most participants were found to have higher competency in basic ICT skills. It was also found that multi-media and attitude toward ICT had middle level of competency. The competency score of the advanced ICT skills was found to be lowest among the three different ICT competencies. This

means that most subjects feel comfortable about basic ICT skills with an average score of 4.35 out of 5.0, followed by multi-media and attitudes toward ICT with an average score of 3.89 out of 5.0. The competency level of advanced computer skills is relatively lower compared to other two factors with an average score of 3.03 out of 5.0. Evidently, both proficiency and the comfort level that goes hand in hand with such proficiency is most wanting in those areas identified within the advanced computer skills component.

Beyond this, the study also provided potentially predictive models. We found significance in predicting both basic and (with greater variance explained) advanced ICT skills.

Any serious attempt to increase or to improve the quality of ICT in education, or to study the parameters of it, can benefit from better awareness of the attributes of the specific ICT element in question. Furthermore, on the actual individual and classroom level, a clearer understanding of the antecedents of individual ICT skills and attitudes can yield a fuller understanding of the nature of ICT practice in education. Steps in these directions on an empirical footing have been made in this research.

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APPENDIX

Survey Instrument for Information and Communication Technologies

Competencies					
Knowledge of Computer Systems (hardware, networks and software)					
I know the basic computer elements and its functions	1	2	3	4	5
I connect the basic peripherals from the computer (printer, mouse, etc) and perform its maintenance	1	2	3	4	5
I know the correct process of turning on and off a computer	1	2	3	4	5
I install programs (following the instructions on the screen or the manual)	1	2	3	4	5
Use of the Operating System					
I know the basic terminology of the operating system (file, folder, program)	1	2	3	4	5
I store and retrieve the information into the computer and different media (floppy, hard disk, CD, USB)	1	2	3	4	5
I properly organize the information through the generation of files, management of the windows, and dialogue boxes	1	2	3	4	5
I conduct basic activities of maintenance of the system (antivirus, backup, delete unnecessary information, etc.)	1	2	3	4	5
I know various utility programs (understanding of files, document viewers)	1	2	3	4	5
I know how to use shared resources in a network (printer, disks)	1	2	3	4	5
Search and selection of information through the internet					
I have the criteria to evaluate to assess the reliability of the information found	1	2	3	4	5
Basic use of the browsers: surfing the internet (store, retrieve and print information)	1	2	3	4	5
I use search engines (google, wikipedia, yahoo) to locate specific information on the internet	1	2	3	4	5
I have clear understanding of the objective of the search and browse relevant itineraries to the work (not browse without direction)	1	2	3	4	5
Interpersonal communication and participation in networking					
I know the rules of politeness and correctness in communication network	1	2	3	4	5

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Competencies					
I send and receive emails, organize the address book, and attach files	1	2	3	4	5
I responsibly use the ITC as a means of interpersonal communication in groups (chat, forums…)	1	2	3	4	5
Word Processing					
I am familiar with the basic terminology on text editors (font, paragraph, and margins…)	1	2	3	4	5
I use the basic functions of a word processor (write documents, store them and print them)	1	2	3	4	5
I internally structure documents (copy, cut, and paste)	1	2	3	4	5
I format a text (types of fonts, margins, etc)	1	2	3	4	5
I insert images and other graphic elements	1	2	3	4	5
I use the correct spelling to ensure the correction spelling checker	1	2	3	4	5
I know the use of the keyboard	1	2	3	4	5
Image Processing					
I use the basic functions of a graphical editor (make drawings and simple graphics, store, and print work)	1	2	3	4	5
Use of Spreadsheets					
I am familiar with the basic terminology about spreadsheets (rows, columns, cells, data, and formulas)	1	2	3	4	5
I use the basic functions of a spreadsheet (make simple calculations, adjust the format, store or print, etc.)	1	2	3	4	5
Use of Database					
I know how to develop a database	1	2	3	4	5
I know what is and what it is for a database	1	2	3	4	5
I query a database	1	2	3	4	5
I enter new data in a database through a form	1	2	3	4	5
Entertainment and Learning with ITC					
I control the time dedicated to entertainment with ITC and its power of addition	1	2	3	4	5
I know the multiple sources that provide training and information by the internet (libraries, courses, press, etc.)	1	2	3	4	5
Online Procedures					
I know the precautions that have to be followed to make monetary transfers, give, or receive information, etc.	1	2	3	4	5

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Competencies					
I know of the existence of protective systems for transfers (electronic signature, privacy, safe places)	1	2	3	4	5
General Attitudes towards ITC					
I develop an open and critical attitude towards new technologies (content, entertainment, etc.)	1	2	3	4	5
I am predisposed to continuous learning and permanent updating	1	2	3	4	5
I avoid access to unethical and/or illegal information that can generate problems					
Technological Platforms					
I properly use the channels of communication and interaction in this modality (assigning roles, forums, chats, tasks)					
I make learning units taking into consideration an appropriate language, textual content, graphics, and multimedia					
I incorporate electronic links to facilitate the use of open access materials to students					
I personalize the learning environment according to the needs of the assignment (colors, calendar, tools)					
I develop training pathways (didactic sequences) based on the needs of the assignment					
I use standards (SCORM) for the reuse of content used in these learning management systems					
I create repositories of information that allow to share documents and materials elaborated by the professor					
I design, create, and incorporate tools for evaluation in virtual environments					
Web 2.0 Tools					
Use of wikis (online strategy for collaborative work)					
Use of bloggers (posts information)					
Use of Google Docs (creates documents online)					
Use of Delicious (organizes subjects)					
Use of Slideshare, slideboom (uploads presentations to blogs)					
Use of RSS feeds (feeds Information)					
Use of Podcast (distributes audio files through RSS)					
Use of Google Earth (manages maps and satellite images)					

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