Are Confidence levels a Valid Indicator of Digital Literacy?

Table of Contents

Table of Tables

Table of Charts

Table of Figures

Abstract

This paper questions the validity and reliability of methodologies and tools previously employed to determine digital literacy levels, in particular surveys and skills tests are investigated and analysed. The aim being to determine if surveys of respondents (based on self assessment and/or reporting) provide an accurate and reliable method for determining literacy levels. Findings for this report are based on the data collected from a survey and assessment tool completed either online or offline by respondents. The survey required respondents to complete a respondent profile, then indicate their level of confidence in given skill areas and then undertake the tasks in order to determine their actual skill level. From this data, the correlation or relationship between their confidence levels and actual achievement will then determined, this will either corroborate or refute the findings and conclusions of previous methodologies employed to determine digital literacy levels based on surveying and self assessment.

Introduction

Digital Literacy exists in a continuum, relative to currency and cultural and socio-economic contexts. The term encompasses many domains and meanings, “the question of what counts as technological literacies is complex” (Lankshear & Knobel, 1997) and many terms have been used synonymously to Digital Literacy (European Commission, 2003) including: ICT Literacy (Educational Testing Service, 2002), ICT fluency (NRC, 1999), computer literacy (Williams, 2003), ICT skills (QCA, 2005), Technological literacy (ISTE, 1998), Media literacy (2005), information literacy (ACRL, 2004), (Bundy, 2004), eliteracy (Martin, 2000), Multiliteracies (Cope & Kalantzis, 2000) and 21st century literacies (Partnership for 21st Century Skills, 2002).

In conjunction with the differing terms encompassing the related literacies, many frameworks, standards, policies and benchmarking have been applied for determining digital literacy skills. Research undertaken has attempted to apply these, using various methodologies. Predominantly, this has incorporated four main approaches for determining digital literacy levels – Surveys/questionnaires (majority of research to date), skills tests (considered expensive and time consuming), numbers achieving certification, or e-skill shortages. There has been minimal research employing combinations of these approaches to determine the validity and reliability of findings.

Many initiatives have been promoted to increase awareness of digital literacy skills, ICT profiles and formal and informal training. The e-skills Industry Leadership Board founded in 2007 is just one example of such an initiative through it’s “European e-Skills and Career Portal”.

This report will investigate previous methodologies employed to date and utilise the data collected within this research to determine the validity of surveys, self reporting and confidence levels as a valid method of assessing existing skill levels and as a tool for future research.

Literature review

Definitions of Digital Literacy

In addition to the numerous terms encompassing digital literacies, varied definitions have been presented Cuttance & Stokes, (2000); Kearns and Grant, (2002); Markausite & Dagiene, (2004); Markausite (2005). These definitions have evolved relative to technological innovation. In the early 1990's definitions focussed on the ability to comprehend "hypertext" structure and understand "multimedia" texts. In 1997 digital literacy was defined as the ability to understand and use information in multiple formats from a wide variety of sources when presented via computers (Gilster, 1997). In 2001 the term was used interchangeably with ICT Literacy (OECD, 2001). The definition evolved to incorporate "the interest, attitude and ability of individuals to appropriately use digital technology and communication tools to access, manage, integrate and evaluate information, construct new knowledge and communicate with others in order to participate effectively in society" (OECD, 2003), (ETS, 2003, 2005) (PISA and OECD, 2005), (ACRL, 2000), this definition was applied in the feasibility study for the PISA ICT Literacy Assessment. The European Commission (2004) treated the term synonymously with media literacy. The evolution of terms to incorporate more than skills was reflected in the definition presented by Project DigEuLit – Development of a European Framework for Digital Literacy, (2005),

> "the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyse, synthesize digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life situations, in order to enable constructive social action; and to reflect upon this process."

The definition applied provides the foundation of the framework and standards applied for determining digital literacy levels. After investigation of numerous definitions from skill perspectives, "the skills required to achieve digital competence, the confident and critical use of ICT for work, leisure, learning and communication" (Digital Literacy European Commission, 2008) and social perspectives, "a basic human right in the digital world" (Alexandria, 2005), a lack of consensus is notable. The term digital technology as defined by ETS, (2002, 2003) covers only Information Technology (IT) and excludes communication tools, other definitions incorporate Information and Communication technology (ACTG,

2004), both exclude any technologies that are not directly related to computer based information processing and/or transmission. The European Union Action Plan, eEurope 2005 includes various high order and communication capacities such as team work, problem solving and project management. (European Commission, 2002)

Similarly to ETS (2003, 2005), PISA and OECD (2005) and ACRL (2000), UNESCO (2008) define the elements of Information Literacy as Recognising Information Needs, Locating and evaluating the quality of information, Storing and retrieving information, making effective and ethical use of information and Communicating knowledge. The framework applied to PISA school assessments and DHS Household Surveys incorporates digital technology use, use of communication tools, use of networks, sift media messages, analyzing media messages and other ICT/ Media Skills (UNESCO, 2008).

Digital Literacy Frameworks

In conjunction with recognising information needs, locating and evaluating the quality of information, storing and retrieving information, making effective and ethical use of information and applying information to create and communicate knowledge (Alexandria, 2005), Martin (2005) also incorporates the use of digital tools in order to enable constructive social action: and to reflect upon this process as necessary elements of the definition.

Alongside the definitions available, a broad range of frameworks, proficiencies and skill level indicators have been established, ranging in detail and the level of proficiencies specified. The World Summit on the Information Society 2003/5 Partnership for the Measurement of ICT's for Development (OECD, UNCTAD, ITU, UIS and UN Regional Commissions) Partnership developed 48 'core indicators'. The European Commission (2003) in E-Skills for Europe: Towards 2010 and Beyond defined e-skills under three main categories: ICT Practitioner Skills, ICT user skills and e-Business skills, these categories were also applied in 2007 for Benchmarking in a policy perspective: Report No. 6 Digital Literacy and ICT Skills (Empirica, 2007). In comparison, the 2005 PISA study determines digital literacy through proficiencies detailed as Cognitive, Technical and ICT proficiencies, similar to the American ICT fluency framework covering fundamental ICT knowledge, ICT skills and cognitive capabilities (NRC, 1999), the British Qualifications and Curriculum's Authority (2005) and (ETS, 2002) also covering some elements of inter-literacy and situated literacy perspectives.

ICT skills standard frameworks combine ICT skills, cognitive capabilities and some elements of the situated learning perspective.

In line with the European Qualifications Framework, a number of frameworks have been established including AITTS, SFIA, CEN/ISSS, CIGREF and APO IT. In December 2007 the eSkills Policy, Benchmarking Policies on Multi-stakeholder Partnerships for e-Skills in Europe recommended development and promotion of a “European e-competence framework” at European Union level in co-operation with relevant key stakeholders and in line with the European Qualifications Framework.

The DigEuLit framework proposed the concept of ‘digital literacy’ should include elements: carrying out digital actions in everyday life, evolution of digital literacy processes, related literacies (info literacy, media literacy and visual literacy) and acquiring and using knowledge, techniques, attitudes and personal qualities, including planning, executing and evaluating digital actions to solve life’s tasks,

As well as frameworks and proficiencies, a number of taxonomies have been developed including Anderson & Weert (2002), Martin (2000), Williams (2003) and Markausite (2005), a number of skill level or progress indicators have also been established including Anderson & Weert (2002), Langhorne, et al (1989), Ridgeway & Passey (1995) and Weert (1995).

Like the digital literacy definition, the core and theme of these models has been an evolutionary process, incorporating varied approaches and aspects. Davis (1986) presented the Technology Acceptance Model, combining individual’s perceived usefulness and ease of use with intentions and attitudes towards technology. Alberta education in (1997) presented a framework for assessing wide range of IT learning outcomes deemed progressive and sequential, reflecting knowledge, skills and attitudes that are integrated and applied within a wide range of learning and work settings.

The ICT Literacy framework (Education Testing Service, 2002) applied in the ALLS assessment measured self reported incidence, frequency, complexity and criticality of computer use, in particular general ICT use, computer and internet use, use and skills in work context, use in non-work context, development of computer skills, personal benefit of computer use and receptivity to computer use among current non-users. Sciadas (2003) provided a cohesive conceptual framework which went beyond connectivity measures and incorporated skills, (covering skills in 192 countries). The results were presented on a component by component basis.

Many frameworks such as that established by Tannenbaum and Katz (2008), have been established specifically for application in skill assessment tools, in this case for determining recommended minimum scores required for the assessment of ICT literacy skills at Core and Advanced iSkills at Foundation Level.

The Eshet-Alkalai (2004, 2005) model is considered one of the most complete and coherent models for digital learning (Akers, 2005). This model classified digital literacy into 5 main groups, using a 5-skill holistic conceptual model for digital literacy: Photo-visual literacy, Reproduction literacy, Branching literacy, Information literacy and Socio-emotional literacy.

The basic elements of all of the existing frameworks and assessment instruments are incorporated in the framework established by Educational Testing Service (2007) and Prensky (2001) integrating the ability to assess, manage, integrate, evaluate, create information and ethics and human elements.

Digital Literacy Assessment

Numerous ways for determining digital literacy skill levels and gaps (the digital divide) have emerged in literature. These approaches are then conducted through two main approaches: Internally within a country (since the mid 1990s, initially focussing on connectivity and penetration rates of various ICTs, and Cross country comparisons - such as Eurostat and OECD studies). Assessment is formulated on many different approaches, namely, indirect measures such as determining e-skills shortages, or direct measures: acquisition of existing certification levels, surveying/assessment of actual skill levels and predominantly self reporting survey based assessment of skills.

E-skill shortage research

Determination of skills by INSEAD (2009) into three tiers designated Literacy and Basic Skills as the prerequisite for the Skills Pyramid. The European Business summit determined Europe to be placed higher than non-European countries on average, although there is a distinctive ‘skills divide’ in Europe. (INSEAD, 2009).

Numerous investigations have attempted to determine the current and future supply and demand of e-skills including studies commissioned by DG Enterprises (September 2005), E-Skills for Europe: Towards 2010 and Beyond, The European E-Skills Forum (September 2004) and the study on the supply and demand of e-skills in Europe undertaken by the RAND corporation (2005) for the European

e-skills forum. All of these studies concluded that there is limited evidence and data to accurately clarify the current situation and predict future skill shortages, gaps and mismatches due to the lack of statistical information available. For this reason, it is not a viable method of determining current digital literacy levels.

Certification Levels research

Of the methodologies applied to determine digital literacy skill levels, research based on levels of certification are least common. Lee (1986) designed a Computer Experience Questionnaire (CEQ) incorporating five questions related to computer course completion. Cedefop (2004) conducted a study on “ICT-skills certification in Europe”. This research determined ICT certification levels at International and European level. The range of approaches to and sources of certification (public, private, commercial and voluntary) standards for e-skills certification were also investigated. Research has also examined the global assessment of ICT skills for students in secondary schools (Venezky,2001)

Skills Test based research

Alternatively, digital literacy levels have been determined through research utilising skills based tests or assessments. This has been applied numerous ways in both country specific and international research. The most extensive example of this research methodology is the PISA (Programme for International Student Assessment) assessments which were developed and conducted under the auspices of the OECD (Organisation for Economic Cooperation and Development). These assessments incorporated ACER (Australian council for Educational research, NIER (National Institute for Educational Policy Research) in Japan, and ETS (Educational Testing Service) in the United States, using 35 respondents from each country, at 15 years of age.

Initially the assessments covered the domains of reading, mathematical and scientific literacy with the inclusion of a digital literacy assessment tool since 2003. The digital literacy assessment tool incorporated tasks from the following skill areas to determine digital literacy levels: email, databases, world wide web (abstract and search tasks) and a simulations.

The PISA ICT Literacy Assessment tools were based on simulation applications which were developed specifically for this purpose to ensure validity of the assessment, with the initial aim of

determining the feasibility of administering a computer based assessment and the viability of this approach this approach. The panel concluded that computer based assessment is more advantageous that surveys and would improve validity, data capture and operational efficiency. The next phase of this project is the 2009 PISA Assessment tool, which is currently at tendering stage.

In addition to the PISA assessments, research on assessment specific to digital literacy includes a study by Dai et al (2006) focussing on the Digital literacy of students. The study used IC3 semi-test and the results were compared with IC3 world standards.

The University of Quebec funded the development of an online tool infoCompetences+. The tool aimed to encourage students to recognise the value of Information Literacy skills and hence improve these skills by assessing skills and providing the students with a list of strengths and weaknesses. The tool was tested for usability and the results reported by Basque, Ruelland, Lavoie, (2007).

A study by Smith & Kirsch (2004) focussed on a national initiative which was a partnership between Higher Education institutions and ETS, in order to assess and hence improve ICT proficiencies. The aim of this study focussed on assessing ICT proficiencies including cognitive skills, technical skills, ethical and legal use of information. Of important note, was the inability of respondents to effectively and efficiently find, use and evaluate content to solve problems and make decisions. This tool was the first problem-based, scenario-based, web-based assessment tool that crossed disciplines and class levels.

Collis and Anderson (1994) developed an assessment consisting of 30 multiple choice questions to measuring computer related knowledge, skills and insights. This test was developed for use in 13 countries and incorporated three themes: computers as part of IT, applications, and user strategies. The research findings were applied to an internationally comparative framework based on computer use by school children (Pelgrum, et al, 1993)

Survey/Self assessment based research

Numerous initiatives assessing digital literacy levels through survey methodologies have been undertaken. These have been based on two approaches. Statistical research based on connectivity (usually computer and internet access) including The Conference board of Canada (2000, 2001, 2002), ICT Task Force (UN, 2001), InfoDev Program (World Bank, 2002) and OECD indicators

(2001a, 2001b, 2002). The second approach encompasses more than connectivity, also incorporating ICT literacy and skills and links to knowledge and social inclusion, examples of this research include "The Internet Galaxy" (Castells, 2001), "Digital Transformation: A framework for ICT Literacy" (ETS, 2002a) and Sciadas (2002).

The largest surveys undertaken to date (considered to be the world's largest monitoring of e-skills or digital literacy) have been connectivity based. Digital Literacy was the final target set up quantitatively in the 2006 Riga Ministerial Declaration. Measurement of progress on this target had been and continues to be measured on the basis of available indicators and further work in the context of i2010. Under this pretence, the ICT surveys carried out by Eurostat (2005) and the European National statistical institutes have contained measurements of e-skills since 2005 in a special module included in the Community Household survey. The 2005 and 2006 modules measured e-skills via lists of 6 computer and internet related activities and respondents stated whether they had carried them out. The initial questions asked if the respondent had previously used a computer before, if computer training had been undertaken and where computer skills were obtained. The spectrum covers low level entry skills as a starting point. Full details of this study are detailed in "Benchmarking in a Policy Perspective" (Empirica, 2007)

The computer related activities surveyed included: copying or moving a file or folder, using copy and paste tools, using basic arithmetic formulae in spreadsheets, compressing files, connecting and installing new devices and writing a computer program using specialised programming languages.

The internet related activities included: using a search engine, sending emails with attachments, posting messages to chat rooms, newsgroups or an online discussion forum, using the internet to make a phone call, using peer to peer file sharing and creating a webpage.

Respondents were then rated on the number of tasks (from the six) they stated as previously carried out. Respondents were rated with:

Skill Level Rating	***Number of tasks completed***
High Skills	5-6
Medium Skills	3-4
Low Skills	1-2
No Skills	0

Table i Skill Determination (Empirica, 2007)

The results were published in the Digital Literacy European Commission Working Paper and Recommendations from Digital Literacy High Expert level Group Report (2008).

The latest undertaking was the Eurostat 2007 survey, with data sourced from the community surveys of Households and Individuals and Enterprises conducted by the national statistical offices and Eurostat. (European Commission, 2008).

The results of the Eurostat 2007 survey were reported by Demunter (2006) and conclusions were drawn for implementation in future surveys. The issue of the non-existence of a commonly agreed definition of e-skills arose as a major problem. Other issues included the lack of a reference point for question design, the non-existence of a commonly adopted conceptual framework, the level of e-skills which were focussed on, the target respondents (general public or IT professionals), lack of self assessment items, and e-learning and overall the skills being surveyed.

Empirica (2007) in Benchmarking in a policy perspective: Report No. 6 Digital Literacy and ICT Skills also reported on the Eurostat surveys, in particular the community surveys, focussing on ICT usage and e-commerce in Enterprises 2007. Demunter, (2006) reported on specific aspects including shortages in e-skilled staff, employment of ICT specialists and the difficulty filling vacancies, training to develop or upgrade ICT skills and outsourcing and off shore outsourcing of ICT functions.

The OECD has also undertaken numerous surveys in relation to digital literacy levels, In 2004, they stated that the digital divide is progressively shifting from an “access” divide to a more complex “use” divide”. This is reflected through their change of approach for research from this point, most significantly, the Broadband and Internet Access and Use by Households and Individuals Survey (OECD, 2007).

The OECD is currently developing a Programme for the International Assessment of Adult Competencies (PIACC). This assessment will be administered for the first time in 2011 in OECD countries and will assess the level and distribution of adult skills in information technology, literacy and numeracy practices, the results will be published in 2013. The focus will be assessment of literacy in the information age, defined as the “interest, attitude and ability of individuals to appropriately use socio-cultural tools, including digital technology and communication tools, to access, manage, integrate and evaluate information, construct new knowledge and communicate with others”.

Research was also undertaken as part of the Adult Literacy and Life Skills Survey (ALLS) - an International comparative study focussing on literacy and numeracy skills (1994, 1996 and 1998). Information Literacy has been incorporated in the study since 2005, with the OECD (2005) reporting on use and familiarity with ICTs. The survey required self assessment of ICT use, perceptions of experience and degree of comfort with ICTs. Patterns of use, connectivity and computer access were used to confirm the digital divide.

The UIS Beacon project – LAMP (Literacy assessment and Monitoring Programme) added to IALS and ALLs assessments but also included data collection on use of computers including internet, newspapers, radios and TVs in homes and schools.

The US Department of Commerce have conducted numerous studies into Digital literacy and the Digital Divide, including Computer and modem penetration in relation to the 'rural poor' (U.S. Department of Commerce, 1995), Computer and internet access by rural, urban and central cities (U.S. Department of Commerce, 1998), Access to electronic services, the digital divide (Household computers and Internet access), and the Internet (Where accessed, how households access, how people use the internet) (U.S. Department of Commerce, 1999), Household access to computers and the Internet (access, speed), Use of the internet by Individuals (location and activities), Internet access and computer use among people with disabilities (U.S. Department of Commerce, 2000), Computer and Internet Use, online activities, how and where internet is accessed, young people and the internet, digital workplaces, people with disabilities and the perceived reduction in inequality from survey results (U.S. Department of Commerce, 2002).

Other smaller scale studies have been undertaken including the World Bank Development Report 2000/2001 Access to computers and the Internet. (OECD, 2000)

Survey and Skill Test based research

Hargittai (2005) conducted an in-depth study into online skills (which he proposed as a compound measure of digital literacy skills). The research aimed to test the validity of survey proxy measures and incorporated respondents self reporting of skills and actual performance (actual performance incorporated the time taken to complete the allocated tasks). This research consisted of four yes or no self-report questions about digital literacy, 38 (five levels) self reported ratings of specific digital literacy related areas, 37 multiple, choice test question based on digital literacy and an overall self

report of their internet skills in 1 question, concluded self reported measure is a good indicator (in relation to knowledge of the terms).

The seven following items were used: Use of MP3 devices, applying preference settings to browsers, refreshing or reloading webpages, use of newsgroups, portable document file formats, advanced searches using search engines and downloading files.

Hargittai concluded a high correlation between the self reporting and actual achievement levels. Notably though, the sample size for this study was 100, this due to the fact that measuring digital literacy through survey and actual skill measures is expensive and data collection methods difficult , this difficulty was increased here as observation was used to determine actual skill levels.

This research forms the core of minimal research undertaken to date to determine digital literacy levels employing both self reporting and actual achievement, whilst forming a basis by which the validity and reliability of research using only self reporting can be determined. Hargittai concluded that the results suggested that composite variables of survey knowledge items are better predictors of actual digital literacy levels than people's perceived levels.

The PISA assessments have also obtained data on confidence levels as well as their actual achievement, but the correlation between their proficiency and confidence levels have not been tested. Conclusions drawn from the PISA assessments have included the requirement for multiple sources of evidence and the enormous potential of computer based assessments for determining what students know and can do across a variety of ICT environments.

The Study

Structure of Survey

The method of data collection employed will be survey based, collating information entered by users which will be of a qualitative nature and results from tasks completed, of a quantitative nature. Definition of the term 'survey' is no straightforward, but the definition offered by Hutton (1990) will be employed for this study as a method of collecting information by asking a set of pre-formulated questions in a predetermined sequence in a structured questionnaire, the sample size in this case though will not be predetermined.

More specifically the purpose of surveys as a data collection tool as described by Cohen, et al (2000), will be employed,

> "Typically, surveys gather data at a particular point in time with the intention of describing the nature of existing conditions, or identifying standards against which existing conditions can be compared, or determining the relationships that exist between specific events."

This is specific to the purpose of this research in order to determine the relationship between the confidence level as entered by the respondent and their actual achievement indicators, determined by their success completing the allocated tasks.

The methodology employed will follow the recommendation of Yin (1994), employing four stages: Design of the case study, conducting the case study, analyzing the case study evidence, and developing the conclusions, recommendations and implications. Through the methodology employed in this research, the research results will ensure applicability to real life, as this along with the issue of generalisation has appeared in literature with regularity.

Initially the most appropriate instrumentation to be employed for this study and the structure of the survey were determined. It was determined that in order to ensure reliability and validity of the data collected the survey will be cross dimensional obtaining data at a single point in time, with one method of data collection, although this will incorporate self reporting and completion of tasks, both qualitative and quantitative data.

Sample size or population was not pre-determined or restricted, although data collection was discontinued after 6417 respondents had completed the survey; access to the survey was available through various computer societies throughout the world in a wide range of countries, fourteen (14) specifically. Details of the fourteen countries involved, and the number of respondents from each is detailed in Appendix A. Completion of the surveys was promoted by the ECDL licensees in the countries and also through the centres in each of these countries, currently delivering ECDL modules and certification. Clients visiting or within these centres, but not undertaking technology or computer related courses were also requested to complete the survey to ensure a valid sample of the population.

Upon completion of data collection, thirty eight (38) pieces of data were collected from each respondent and data was collected from 6417 respondents, for this reason, this report and its conclusions will be based solely on respondents who declared the country as Ireland, totalling 292.

This data collection tool is predominantly online (access also available with assistance for respondents not having access or skills to complete online). The survey is divided into three sections: Respondent profile details, identification of confidence levels and tasks to determine respondent's actual achievement.

Respondents select from drop down lists and check boxes to ensure data could be manipulated after collection. All data was stored in an excel workbook, with a row for each record, to ensure valid manipulation on the collected data.

Respondent Profile

To ensure anonymity of all respondents, no personal data was requested. Ages were determined in intervals, and no details were specific to any respondent, other than the test ID which was allocated by default, incrementing for each respondent. These ID numbers will not identify any specific respondent; rather the numbers are used to determine the number of respondents who had completed the survey at any given time. Table ii details the information collected in relation to the respondent profile.

Question Number	*Data collected:*
	Language
	Country where they are living
1.	Age (in intervals)
2.	Gender
3.	Nationality
4.	Locality: Urban or Rural
5.	Have you ever used a computer?
6.	How long experience with computers?
7.	How often the respondent uses a computer?
8.	Where computer use is based? Work, Home, Both
9.	Have they received computer training? If so, where training was received?
10.	Have they ever heard of ECDL?
11.	Their overall estimation of their ability or “digital literacy”

Table ii Respondent Profile

Confidence level Indicators

After completing the respondent profile, they then progressed to the confidence level indicators, which required self reporting of their own abilities in key skill areas. The respondent completed thirteen questions indicating their confidence in completing tasks– the skill areas covered are as described in Table iii. The confidence levels were offered to the respondent in a drop down list, the respondent selected the appropriate level for that skill: Not confident, Not very confident, Fairly confident or Very confident.

The skill areas were identified with the purpose of encompassing a broad range of skills, levels of understanding and application of technology in every day lives. For this reason, the skills covered are not solely software application based tasks, but rather incorporate a broad range of computer and current technologies as well as security and e-inclusion aspects.

Question Number	*Skill Area*
13.	Identifying main parts of the computer
14.	Identifying types of portable storage devices
15.	Ability to create/send an email.
16.	Ability to explain purpose of a search engine.
17.	Knowledge of virus prevention.
18.	Knowledge of shopping safely online.
19.	Ability to save a document.
20.	Performing simple calculations in a spreadsheet.
21.	Ability to perform basic editing within a document.
22.	Ability to identify different file types.
23.	Describing purpose/advantages of a digital camera.
24.	Explaining the purpose of an MP3 player.
25.	Knowledge required to send / receive a message on a mobile phone.

Table iii Skill areas included

Actual Achievement

After completion of the confidence level indicators, the respondent progressed to the last section consisting of hotspot based questions, respondents completed tasks to determine their actual knowledge and skills in order to determine their actual “digital literacy” in that skill area. The skill areas covered (see Table iv) were specific to those identified for the confidence level section (see Table iii), this was to ensure the correlation between their confidence and actual achievement could be determined for each of the corresponding skill areas.

Question Number	*Skill Area*
26.	Identifying an output device
27.	Identifying a portable storage device
28.	Attaching a file to an email
29.	Use of a search engine
30.	Email security
31.	Identifying a secure connection on the web
32.	Saving a word processed document
33.	Using autosum in a spreadsheet
34.	Changing font colour in a word processed document
35.	Identifying image file types
36.	Advantage of a digital camera
37.	Uses of an MP3 player
38.	Identifying a new text message on a mobile phone

Table iv Skill Areas for Actual Achievement

Triangulation was employed throughout this research at all levels through the application and combination of several research methodologies to study the same theory. There are four basic types of triangulation, data triangulation, investigator triangulation, theory triangulation, and multiple triangulations, this research focussing on methodological and data source triangulation. This research involves the use of more than one method of data collection, consisting of within-method or between-method strategies. Data source triangulation was also deemed important as recommended by Denzin (1984) anticipating the data collected would remain the same in different contexts, although the coverage of this report focuses on Ireland, calculation of the correlation between confidence levels and actual achievements within each country for comparison would also be recommended. Through the methodology applied by employing self assessment and completion of actual tasks to determine skill levels, triangulation will be ensured.

Limited research is available encompassing both self reporting and skill assessment to determine levels of digital literacy. Easterby-Smith et al (1994) stresses the importance of research being able to stand up to outside scrutiny and more importantly, be believed, this is often referred to as the reliability and validity of the research. This study will determine the reliability and validity of the majority of research undertaken to date, drawing conclusions from survey and self assessment based

methodologies, applied together and tested against each other to determine the strength of the relationship between actual and perceived skill levels.

Results and Findings

The conclusions drawn from this research focus on the respondents who nominated their country as Ireland, this gives a sample of 292 respondents, whilst encompassing various genders, locations, ages and computer related experience. A summary of the sample respondent profile is available in Appendix B. This summary details personal information including language, gender, age interval and location (rural of urban), as well as research specific information including experience with computers (including where used and for how long) and computer specific training which may have been undertaken.

The data detailed in this section focuses on section two and three of the survey: the confidence intervals indicated by the respondents and their actual achievement. This data is not used to determine digital literacy level among the sample, but rather to determine if the confidence intervals and self reporting statistics are a valid indicator of digital literacy if compared to their actual achievement in tasks from the designated skill areas.

Table v shows the number of the 292 respondents who selected each of the confidence intervals over the 13 skill areas.

Number of times selected	*Not confident*	*Not very confident*	*Fairly confident*	*Very confident*
Not selected	237	101	11	186
1	29	31	10	45
2	4	24	7	20
3	6	31	16	17
4	2	28	11	9
5	5	33	18	4
6	4	16	16	5
7	3	10	16	4
8	0	9	10	1
9	0	2	18	0
10	0	4	23	0
11	0	2	20	0
12	0	1	27	0
13	2	0	89	1

Table v Confidence Intervals selected Overall

As detailed in table v, only 55 from the 292 of the respondents designated themselves as “not confident” in any of the skill areas, these predictions are in line with the results in vii, as no respondents achieved less than 3 correct answers when completing the tasks. In contrast, 2 of the respondents selected “not confident” for every question, therefore, underestimating their knowledge and skills. 186 of the respondents did not select “very confident” at any time, with only 1 person electing “very confident” for every question; this is in contrast with the 162 respondents who successfully completed every question. In line with the results, 89 people picked fairly confident for every question.

Table vi details the number of times confidence intervals were selected by respondents for each question. Notable here, is skill areas.

	Question Number and Skill Area	*Not confident*	*Not very confident*	*Fairly confident*	*Very confident*
13	Identifying an output device	9	94	24	165
	Proportion	*3.1%*	*32.2%*	*8.2%*	*56.5%*
14	Identifying a portable storage device	20	88	31	153
	Proportion	*6.8%*	*0.3%*	*10.6%*	*52.4%*
15	Attaching a file to an email	4	25	14	249
	Proportion	*1.4%*	*8.6%*	*4.8%*	*85.3%*
16	Use of a search engine	8	51	16	217
	Proportion	*2.7%*	*17.5%*	*5.5%*	*74.3%*
17	Email security	16	84	28	164
	Proportion	*5.5%*	*28.8%*	*9.6%*	*56.2%*
18	Identifying a secure connection on the web	19	91	23	159
	Proportion	*6.5%*	*31.2%*	*7.9%*	*54.5%*
19	Saving a word processed document	5	23	4	260
	Proportion	*1.7%*	*7.9%*	*1.4%*	*89%*
20	Using auto sum in a spreadsheet	21	53	31	187
	Proportion	*7.2%*	*18.2%*	*10.6%*	*64%*
21	Changing font colour in a word processed document	9	45	11	227
	Proportion	*3.1%*	*15.4%*	*3.8%*	*77.7%*
22	Identifying image file types	12	57	31	192
	Proportion	*4.1%*	*19.5%*	*10.6%*	*65.8%*
23	Advantage of a digital camera	12	88	26	166
	Proportion	*4.1%*	*30.1%*	*28.9%*	*56.8%*
24	Uses of an MP3 player	15	60	20	197
	Proportion	*5.1%*	*20.5%*	*6.8%*	*67.5%*
25	Identifying a new text message on a mobile phone	9	20	12	251
	Proportion	*3.1%*	*6.8%*	*4.1%*	*86.0%*

Table vi Confidence Intervals selected by Question

Actual achievement compared to actual achievement is fully detailed in Appendix D. The most notable accurate prediction of ability level was among the respondents declaring themselves as “very confident” with actual achievement of correct – a minimum of 50% of respondents who declared themselves as “very confident” then correctly completed the related task. The most notable inaccuracies were among the respondents who declared themselves as “not very confident” and then

completed the related task successfully, these inaccurate predictions indicate that respondents who feel they are not completely confident about their skills have limited ability to determine their skill levels, in contrast to this, respondents with high success rates are more accurately able to gauge their skill level.

Table vii details the number of respondents achieving each of the scores from the total of 13. Most notable is the minimum score achieved being 2 marks, and this was achieved by only 2 people.

Total Actual Mark	*Number of responders achieving that score.*	*Proportion of all respondents achieving that score.*
0	0	0.0%
1	0	0.0%
2	2	0.7%
3	2	0.7%
4	3	1.0%
5	2	0.7%
6	4	1.4%
7	5	1.7%
8	10	3.4%
9	13	4.5%
10	13	4.5%
11	32	3.8%
12	44	15.1%
13	162	55.5%

Table vii Number of respondents obtaining questions correct or incorrect

To allow for comparisons between the confidence interval selected and actual achievement, the data collected from the survey questions was scored using the following weightings: Not confident (0), Not very confident (0.25), Fairly confident (0.75) and Very confident (1).

Actual Achievement

A confidence score and actual achievement score was then calculated for each respondent, using the weightings for Correct (1) and wrong (0). The average scores were calculated for both the respondent confidence score and actual achievement score. The variance between these scores was then determined by question. The results are detailed in Table viii. The variance in overall score by candidate is detailed in Appendix D.

Question Number	*Average Confidence Score*	*Average Actual Score*	*Variance (minus means underestimation of skills)*
Question 13 and 26 *Identifying main parts of the computer*	0.71	0.79	-0.08
Question 14 and 27 *Identifying types of portable storage devices*	0.68	0.95	-0.27
Question 15 and 28 Ability to create/send an email.	0.91	0.9	0.01
Question 16 and 29 *Ability to explain purpose of a search engine.*	0.83	0.93	-0.1
Question 17 and 30 *Knowledge of virus prevention.*	0.71	0.94	-0.23
Question 18 and 31 *Knowledge of shopping safely online.*	0.68	0.81	-0.13
Question 19 and 32 *Ability to save a document.*	0.92	0.9	0.02
Question 20 and 33 *Performing simple calculations in a spreadsheet.*	0.77	0.74	0.03
Question 21 and 34 *Ability to perform basic editing within a document.*	0.84	0.87	-0.03
Question 22 and 35 *Ability to identify different file types.*	0.79	0.94	-0.15
Question 23 and 36 *Describing purpose/advantages of a digital camera.*	0.71	0.95	-0.24
Question 24 and 37 *Explaining the purpose of an MP3 player.*	0.78	0.98	-0.2
Question 25 and 38 *Knowledge required to send / receive a message on a mobile*	0.91	0.95	-0.04
Overall	0.79	0.9	-0.11

Table viii Variance by Average Confidence Level and Average Score

As detailed in Table viii, respondents underestimated their skills and knowledge in eleven of the thirteen skill areas. The ability of a respondent to determine and self report their skill level in the nominated skill areas ranges from underestimation of skills by 0.27 or 27% to overestimation by 0.03 or 3%, respondents finding most difficulty in assessing their skills in knowledge of portable storage devices and use of a digital camera, but most correctly assessing their skills in creating and sending emails. This also shows that the levels of underestimation were much greater than the levels of over estimation of skill levels, therefore respondents are most likely to underestimate their skill levels and by a greater degree.

On average, respondent's underestimated their skill level in relation to their actual achievement by 0.11 or by 11%.

The above calculations reflect the ability overall by question. The ability to determine skill level was also determined by candidate by question. Pearson's correlation coefficient was used to determined to determine the strength and direction of the relationship of the linear relationship between the respondents self assessment or confidence level and their actual achievement. Pearson's correlation coefficient was selected as it is the most common, and is suited to two variables of data for comparison. Using the formula below, the correlation co-efficient by question and overall was calculated, the results are detailed in table ix.

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{(\sum X^2 - \frac{(\sum X)^2}{N})(\sum Y^2 - \frac{(\sum Y)^2}{N})}}$$

Figure i Pearson's Correlation Co-efficient formula

Table ix shows the statistics calculated for the group overall by question.

Question Number(s)	*Pearson's Correlation co-efficient*	*Positive or Negative Relationship*
Question 12 and 25	0.31	Positive
Question 13 and 26	0.21	Positive
Question 14 and 27	0.20	Positive
Question 15 and 28	0.24	Positive
Question 16 and 29	0.13	Positive
Question 17 and 30	0.31	Positive
Question 18 and 31	0.32	Positive
Question 19 and 32	0.47	Positive
Question 20 and 33	0.36	Positive
Question 21 and 34	0.22	Positive
Question 22 and 35	0.20	Positive
Question 23 and 36	0.10	Positive
Question 24 and 37	0.22	Positive
Over 12 questions:	0.66	Positive

Table ix Correlation by Question, by Respondent

The above calculations reflect the lack of reliability and validity in data collected based solely on self assessment or self reporting of respondents. The majority of questions display a weak relationship between respondent's prediction of their achievement and their actual achievement.

As displayed in the correlation of all twelve questions together, the ability to assess skills overall is more correct. This is because in some questions, respondent's over assessment of their skills and in other questions under assessment of their skills, giving a more correct self assessment overall. The most important conclusion (for each question and skill area) being the very poor relationship between respondents self assessment and actual ability.

As detailed in the chart below, the confidence levels and respondent actual achievements have a positive relationship (shown by the positive direction of the linear line), the relationship between the data is fairly weak, and this is reflected both by the large scattering of data and the line of best fit appearing fairly horizontal. This is also detailed in the correlation calculation of +0.66 above using the Pearson correlation.

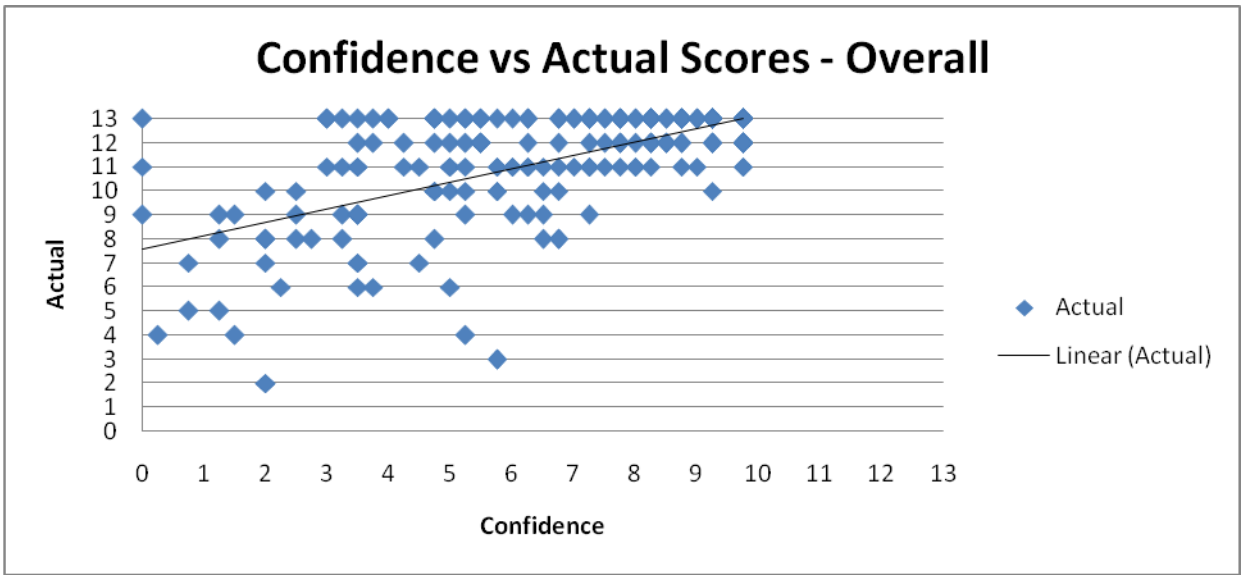

Chart i Scatter plot for questions overall

Conclusion

Digital Literacy

The importance of digital skills is evident in the European Skills Pyramid (INSEAD eLab, 2009) consisting of three levels, with tier 1 consisting of Literacy and basic Skills (Math, Science, IT Literacy). These skills are defined as less quantifiable, yet critical for both innovation and addressing new challenges and issues, these skills are also defined as the prerequisite for the capacity to generate the skills detailed in the higher tiers.

The problem of the growing ICT skills gap and inadequate levels of digital literacy levels within the workforce is highlighted in the European eLearning Summit Declaration, 2001. Enhancement of digital literacy levels forms one of the challenges to European education and training systems as set by the European commissions eLearning action Plan including comprehensive integration of ICT into education and training, creation of flexible infrastructures to make eLearning available to all, creating a culture of lifelong learning and development of high quality educational content (as detailed in the European eLearning Summit Declaration, 2001)

A significant variance both by definition, skills and skill levels is apparent, evolving to determination of skill level. Martin (2009) noted the lack of definition and skill levels and proposed levels of Digital Literacy with the precursor of Digital competence, hence the definition of skills measured by the levels of digital competence. This is supports the lack of definition, agreed skill levels and framework noted earlier, leading to the proposition that definition and skill levels vary by age, occupation, socio economic, country and other factors, consideration should also be given to the continual evolution of technologies, skill levels and skills encompassed.

The importance of skill level determination relative to age, gender and previous experience with technology is reflected in the achievement rates detailed in Appendix F reflecting the skill levels within various age groups, genders and previous experience with technology. This data concludes that achievement is related in particular to experience with technology, drawing the conclusion that levels of experience are directly related to digital literacy levels and frameworks should reflect these various levels of skills and their evolution.

Most existing research draws on info about people’s self perceived skill levels instead of a measure of actual abilities; this is evident from the PISA and Eurostat studies detailed above. This has evolved

from the belief that providing infrastructure leads to improved digital literacy levels. Finding and planning still proceed as if the purchase of digital literacy tools will lead to the holistic integration of new literacy practices Rivoltella (2008).

Result Comparison

The results concluded in relation to participants are in contrast to the conclusions from the latest OECD study detailed by Donnelly (2009) based on self reporting and confidence intervals. OECD surveys concluded 1 in 3 Irish 15 year olds have never used a computer in a school and 30% of Irish students have never used a computer in school – well below OECD average of 13% in comparison to less than 1% of 16-25 year old respondents having never used a computer although this does not just focus on school use. The OECD study also concluded that the average self confidence in higher level computer tasks among Irish students was lower than the OECD average, in comparison to 50% of the 16-25 year old respondents reporting their skills as good in this research. The data collected here concludes an average achievement of 11.66 from 13 marks (89.7%).

Relationship between Confidence Levels and actual Achievement

The most prevalent research today incorporating self reported confidence levels and actual achievement was conducted by Hargittai (2005), based solely on Internet usage skills. From his results, Hargittai determined 80% of respondents had good internet use skills: 42.9% fairly skilled, very skilled 36.3% and expert skill 13.7% and concluded a positive relationship in regards to finding data online, negative relationship in regards to knowledge and time spent using internet searches. Hargittai recommended creation of a composite variable for measuring web-oriented digital literacy using survey questions. A comparison of Hargittai's results are contrasted to the results from the PISA studies and the research here in Appendix G.

The inability of respondents to assess and report their skill levels may be explained by one or numerous reasons: the question structure, the content of the areas covered, the technology based skills assessed, the currency of areas included, lack of knowledge in the subject area, or the inability to benchmark their skills.

The correlation or relationship between respondents self reporting, self assessment or confidence levels for the designated skill areas and their actual achievement demonstrates the inability of

respondents to accurately determine their skill levels. This in turn refutes much of the existing research into digital literacy skill levels which has been based on self assessment and survey methodologies.

Of important note is the fact that respondents of weaker skill levels are less likely to accurately predict their skill level, although this excludes respondents of very weak level.

The inaccurate self reporting by candidates reflects not only the inability to self assess their skills, but also the continual changing of skills underpinning digital literacies, the technologies assessed, the variance in digital literacy skills by environment, age and other factors, lack of benchmarking of skills and standards for determining digital literacy skills, both as a population and as an individual.

The inadequacy of benchmarking and international monitoring, along with the lack of indicators and notable examples of their application in assessment of skills has been noted in extensive research (Drenoyianni, et al, 2008). Many of the definitions commonly associated with digital literacy are primarily concerned with the Digital divide and determination of levels through survey of computer ownership and self reported skill levels.

The European eLearning Summit Declaration: recommendation 6, (2001) recommended development flexible curricular and assessment frameworks to provide individuals with the skills needed for participation in the Information age. The declaration concluded that in order to make maximum use of eLearning digital literacy levels need to be improved and pedagogical and institutional change. An important aspect of their conclusions is reinforced through this research: Europe is only making first steps towards promoting digital literacy, stating an important aspect of the need for European citizens to recognise the need for reskilling and lifelong learning. The ability to self assess and report abilities is an important aspect in determining both reskilling and learning requirements and the most suitable path.

The Future

Actual levels of digital literacy must be accurately determined before measures instigated to improve skill levels. A number of measures are underway to assess digital literacy skills both nationally and internationally:

Further PISA studies are under construction for 2009, 2012 and 2015. The aim and approaches of these studies is detailed by PISA (2007). Most importantly, these studies aim to make better use of computer based assessment not only for determining ICT skills, to use dynamic and interactive tasks, to move from student's self assessment of attitude and appreciation but a new focus has not yet been defined, a move from questionnaires in order to link information. In order to achieve these aims, their focus for 2009 is on development and determining whether computerised assessment is compatible with pencil and paper tests and are considering a new component relying in self assessment or self assessment and self reporting rather than just the questionnaires used to date. Their long term goals include development and implementation of supplementary computer assessment of focus areas (intended for 2012 study).

PISA have determined the benefits of computer based assessment to include the possibility of assessing further thinking types (as tested in 2005 pilot) and their expectation that tests will align better with performance level indicators ensuring more fine grade analysis will be available.

Other bodies have also demonstrated the intention of developing computer based assessment for determining digital and technology literacy skills including the National Assessment Governing Board, which sets policy for (National Assessment of Educational Progress), intending to create a new framework for evaluation, to be added (on a pilot basis) to the federally sponsored assessment in 2012. Test will be totally computer based. (Tech Literacy Confusion, 2009)

The move towards computer based assessment of skills demonstrates the awareness of the increased possibility, accuracy and validity of this method of determining skill levels, either incorporated with survey based data collection or as a distinct data collection method.

The validity of research determining digital literacy levels is questionable based on many factors. The lack of an established definition, is a strong factor as the application of ay definition needs to account for continual evolution of skills, which in turn are relative to different skill areas, employment, age, environment, education, socio-economic and many other factors. These in turn need to be incorporated into a conceptual framework, agreed indicators, levels and standards.

In conclusion, determination of digital literacy levels is dependent on more than the inability of respondents to accurately assess their skill level in self reported data collection as inaccuracies are evident as concluded in this research.

Appendices

Appendix A

Country	Number of respondents
Austria	200
Colombia	6
Germany	645
Hong Kong	206
Hungary	1979
Ireland	292
Lithuania	521
Myanmar	1
New Zealand	300
Portugal	502
Romania	500
Serbia	120
South Africa	170
Spain	270
Switzerland	524
Thailand	168
Vietnam	13
TOTAL	6417

Table x Number of respondents by Country

Appendix B

Respondent Profile

Main Language						
English	German	Polish	Spanish	Portuguese	Hungarian	Italian
277	4	4	3	2	1	1

Age				
16-25	26-40	41-55	56-70	70+
58	113	90	30	1

Gender	
Female	Male
137	155

Location	
Rural	Urban
73	219

Previous use of a Computer?	
Yes	No
272	20

Previous Computer Experience			
Less than 1 year	1-4 years	5-7 years	8+ years
19	23	39	211

How often they use a computer			
Occasionally	A few times a Month	A few times a week	Everyday
12	7	32	241

Main Computer use		
Personal	Work	Both
52	43	197

Computer Based training	
Yes	No
231	61

If training completed, Where?					
Training Centre	College	Work	At home / self led	School	Other
65	58	45	34	23	6

Have they ever heard of ECDL?	
Yes	No
248	44

Overall rating of digital literacy Level			
Never used a computer	Basic	Good	Excellent
65	58	45	34

Table xi Respondent Profiles: Summary of Data

Appendix C

Confidence Level	Actual Achievement	Q12 /25	%	Q13 /26	%	Q14 /27	%	Q15 /28	%	Q16 /29	%	Q17 /30	%	Q18 /31	%	Q19 /32	%	Q20 /33	%	Q21 /34	%	Q22 /35	%	Q23 /36	%	Q24 /37	%
Not confident	Correct	1	0.3	15	5.1	3	1.0	6	2.1	11	3.8	10	3.4	3	1.0	8	2.7	4	1.4	8	2.7	9	3.1	14	4.8	5	1.7
	Wrong	8	2.7	5	1.7	1	0.3	2	0.7	5	1.7	9	3.1	2	0.7	13	4.5	5	1.7	4	1.4	3	1.0	1	0.3	4	1.4
Not very confident	Correct	67	22.9	83	28.4	19	6.5	44	15.1	81	27.7	64	21.9	14	4.8	26	8.9	31	10.6	53	18.2	82	28.1	58	19.9	19	6.5
	Wrong	27	9.2	5	1.7	6	2.1	7	2.4	3	1.0	27	9.2	9	3.1	27	9.2	14	4.8	4	1.4	6	2.1	2	0.7	1	0.3
Fairly confident	Correct	11	3.8	28	9.6	8	2.7	9	3.1	24	8.2	14	4.8	3	1.0	8	2.7	7	2.4	23	7.9	22	7.5	20	6.8	12	4.1
	Wrong	13	4.5	3	1.0	6	2.1	7	2.4	4	1.4	9	3.1	1	0.3	23	7.9	4	1.4	8	2.7	4	1.4	0	0.0	0	0.0
Very confident	Correct	151	51.7	152	52.1	232	79.5	213	72.9	159	54.5	148	50.7	243	83.2	174	59.6	213	72.9	190	65.1	165	56.5	195	66.8	242	82.9
	Wrong	14	4.8	1	0.3	17	5.8	4	1.4	5	1.7	11	3.8	17	5.8	13	4.5	14	4.8	2	0.7	1	0.3	2	0.7	9	3.1

Table xii Achievement by Confidence Interval chosen

Appendix D

Minus scores symbolise an underestimation of their own skills

	Confidence Score	Actual Score	Variance
R 1	6.25	13	-6.75
R 2	3.5	6	-2.5
R 3	3.25	13	-9.75
R 4	9.25	13	-3.75
R 5	2	10	-8
R 6	9.75	13	-3.25
R 7	8.25	13	-4.75
R 8	7	13	-6
R 9	9.25	12	-2.75
R 10	9.75	13	-3.25
R 11	9.25	13	-3.75
R 12	8.75	13	-4.25
R 13	9.75	13	-3.25
R 14	9.75	13	-3.25
R 15	7.25	13	-5.75
R 16	9.75	13	-3.25
R 17	9.75	13	-3.25
R 18	6.25	11	-4.75
R 19	5.75	3	2.75
R 20	2	2	0
R 21	8.5	12	-3.5
R 22	9	13	-4
R 23	8.25	13	-4.75
R 24	9.75	13	-3.25
R 25	9.75	13	-3.25
R 26	0.75	7	-6.25
R 27	0.75	5	-4.25
R 28	6.75	13	-6.25
R 29	7.75	13	-5.25
R 30	7.75	12	-4.25
R 31	5.5	12	-6.5
R 32	7.5	12	-4.5
R 33	3	13	-10
R 34	8	12	-4
R 35	8.5	13	-4.5
R 36	1.25	8	-6.75
R 37	9	13	-4
R 38	9.75	13	-3.25
R 39	9.75	13	-3.25
R 40	7.25	13	-5.75
R 41	9.75	13	-3.25
R 42	8	13	-5
R 43	9.75	13	-3.25
R 44	9.25	13	-3.75
R 45	9.75	13	-3.25
R 46	8.75	12	-3.25
R 47	8.75	13	-4.25
R 48	9.75	13	-3.25
R 49	7.75	13	-5.25
R 50	9.75	13	-3.25
R 51	8.25	13	-4.75
R 52	7.25	11	-3.75
R 53	9.75	13	-3.25
R 54	9.75	13	-3.25

	Confidence Score	Actual Score	Variance
R 55	9.25	13	-3.75
R 56	8.25	13	-4.75
R 57	3.75	12	-8.25
R 58	7.25	11	-3.75
R 59	9	11	-2
R 60	9.75	12	-2.25
R 61	9.75	11	-1.25
R 62	5.5	13	-7.5
R 63	9.75	13	-3.25
R 64	9.75	13	-3.25
R 65	3.75	13	-9.25
R 66	8	11	-3
R 67	9.75	13	-3.25
R 68	9.75	13	-3.25
R 69	9.25	12	-2.75
R 70	9.75	13	-3.25
R 71	4.75	13	-8.25
R 72	9.75	13	-3.25
R 73	9.75	13	-3.25
R 74	9.75	12	-2.25
R 75	9.25	13	-3.75
R 76	6.25	11	-4.75
R 77	9.75	12	-2.25
R 78	9.75	13	-3.25
R 79	2.75	8	-5.25
R 80	9.75	13	-3.25
R 81	9.75	13	-3.25
R 82	8.25	12	-3.75
R 83	7	11	-4
R 84	6.75	8	-1.25
R 85	9.75	13	-3.25
R 86	8.25	11	-2.75
R 87	8	11	-3
R 88	8.75	13	-4.25
R 89	9.75	12	-2.25
R 90	9.75	13	-3.25
R 91	9.25	13	-3.75
R 92	9.75	13	-3.25
R 93	7.25	12	-4.75
R 94	9.75	13	-3.25
R 95	9.75	13	-3.25
R 96	9.25	13	-3.75
R 97	9.75	12	-2.25
R 98	5.25	10	-4.75
R 99	9.25	12	-2.75
R 100	9.75	13	-3.25
R 101	9.75	12	-2.25
R 102	8.75	13	-4.25
R 103	9.75	13	-3.25
R 104	9.75	13	-3.25
R 105	9.75	13	-3.25
R 106	9.75	13	-3.25
R 107	9.75	13	-3.25
R 108	9.75	12	-2.25
R 109	9.25	12	-2.75
R 110	8.25	13	-4.75
R 111	9.75	13	-3.25
R 112	6.25	13	-6.75
R 113	7.5	13	-5.5
R 114	9.75	13	-3.25

	Confidence Score	Actual Score	Variance
R 115	3.5	12	-8.5
R 116	8.25	12	-3.75
R 117	9.75	13	-3.25
R 118	5.25	9	-3.75
R 119	9.75	13	-3.25
R 120	7.75	13	-5.25
R 121	9.75	13	-3.25
R 122	5	13	-8
R 123	5	11	-6
R 124	6.5	10	-3.5
R 125	0	9	-9
R 126	0	11	-11
R 127	9.25	13	-3.75
R 128	9.75	13	-3.25
R 129	9.75	13	-3.25
R 130	9.75	13	-3.25
R 131	3	13	-10
R 132	9.75	13	-3.25
R 133	9.75	13	-3.25
R 134	6	11	-5
R 135	9.75	13	-3.25
R 136	7.75	13	-5.25
R 137	9.75	13	-3.25
R 138	8.5	12	-3.5
R 139	3.5	13	-9.5
R 140	9.75	13	-3.25
R 141	7.75	12	-4.25
R 142	2	8	-6
R 143	1.25	5	-3.75
R 144	4.75	13	-8.25
R 145	7.75	13	-5.25
R 146	7.25	13	-5.75
R 147	7.75	12	-4.25
R 148	6.25	13	-6.75
R 149	9.25	13	-3.75
R 150	9.75	13	-3.25
R 151	9.75	13	-3.25
R 152	9.25	13	-3.75
R 153	8.25	13	-4.75
R 154	9.75	13	-3.25
R 155	8.25	13	-4.75
R 156	9.75	13	-3.25
R 157	9.25	13	-3.75
R 158	2	7	-5
R 159	9.75	13	-3.25
R 160	4.25	12	-7.75
R 161	8.75	13	-4.25
R 162	9.75	13	-3.25
R 163	9.75	12	-2.25
R 164	8.25	13	-4.75
R 165	9.75	13	-3.25
R 166	8.25	13	-4.75
R 167	9.75	12	-2.25
R 168	9.75	13	-3.25
R 169	9.25	13	-3.75
R 170	9.75	13	-3.25
R 171	7.75	11	-3.25
R 172	9.75	12	-2.25
R 173	8.25	13	-4.75
R 174	2.5	10	-7.5

	Confidence Score	Actual Score	Variance
R 175	9.25	10	-0.75
R 176	5.25	4	1.25
R 177	3.5	11	-7.5
R 178	9.75	11	-1.25
R 179	7.25	9	-1.75
R 180	3.5	9	-5.5
R 181	4.5	7	-2.5
R 182	7.5	11	-3.5
R 183	5.75	10	-4.25
R 184	5.75	10	-4.25
R 185	2.25	6	-3.75
R 186	5	12	-7
R 187	3.25	8	-4.75
R 188	4.75	12	-7.25
R 189	6.75	8	-1.25
R 190	3.75	6	-2.25
R 191	6	11	-5
R 192	6.5	11	-4.5
R 193	3.5	7	-3.5
R 194	8.25	12	-3.75
R 195	8.25	13	-4.75
R 196	2	8	-6
R 197	6.25	12	-5.75
R 198	9.25	13	-3.75
R 199	4.5	11	-6.5
R 200	4.25	11	-6.75
R 201	6.25	9	-2.75
R 202	5.5	12	-6.5
R 203	5.25	11	-5.75
R 204	2.5	8	-5.5
R 205	2.5	9	-6.5
R 206	5	6	-1
R 207	6	9	-3
R 208	7.25	11	-3.75
R 209	3.5	11	-7.5
R 210	3.5	9	-5.5
R 211	8.75	13	-4.25
R 212	3.5	9	-5.5
R 213	6.75	13	-6.25
R 214	6.5	8	-1.5
R 215	4.75	10	-5.25
R 216	9.75	12	-2.25
R 217	8.25	13	-4.75
R 218	4.75	10	-5.25
R 219	0.25	4	-3.75
R 220	6.75	11	-4.25
R 221	9.75	13	-3.25
R 222	7.75	13	-5.25
R 223	6.75	10	-3.25
R 224	4.75	13	-8.25
R 225	7	13	-6
R 226	4	13	-9
R 227	9.75	13	-3.25
R 228	9.75	13	-3.25
R 229	9.25	13	-3.75
R 230	5.75	10	-4.25
R 231	9.25	13	-3.75
R 232	0	13	-13
R 233	5.75	11	-5.25
R 234	5.25	13	-7.75

	Confidence Score	Actual Score	Variance
R 235	4	13	-9
R 236	8.25	13	-4.75
R 237	5.75	11	-5.25
R 238	5.25	12	-6.75
R 239	5	11	-6
R 240	8.25	12	-3.75
R 241	5.75	13	-7.25
R 242	3.5	7	-3.5
R 243	8.75	13	-4.25
R 244	3.25	11	-7.75
R 245	6.75	12	-5.25
R 246	8.75	13	-4.25
R 247	5.5	12	-6.5
R 248	9.25	13	-3.75
R 249	6.75	13	-6.25
R 250	8.5	13	-4.5
R 251	4.75	8	-3.25
R 252	3.25	9	-5.75
R 253	8.75	11	-2.25
R 254	9.75	12	-2.25
R 255	6.5	9	-2.5
R 256	3	11	-8
R 257	8.75	13	-4.25
R 258	1.25	9	-7.75
R 259	1.5	9	-7.5
R 260	8.75	12	-3.25
R 261	9.75	13	-3.25
R 262	5.5	13	-7.5
R 263	5	10	-5
R 264	5.5	12	-6.5
R 265	4.75	10	-5.25
R 266	9.25	13	-3.75
R 267	1.5	4	-2.5
R 268	9.75	12	-2.25
R 269	9.75	13	-3.25
R 270	8.75	13	-4.25
R 271	9.75	13	-3.25
R 272	9.75	13	-3.25
R 273	7.25	13	-5.75
R 274	9.75	13	-3.25
R 275	9.75	13	-3.25
R 276	6.25	11	-4.75
R 277	5.75	3	2.75
R 278	2	2	0
R 279	8.5	12	-3.5
R 280	9	13	-4
R 281	9.75	13	-3.25
R 282	9.75	13	-3.25
R 283	9.75	13	-3.25
R 284	8.25	13	-4.75
R 285	9.25	13	-3.75
R 286	9.75	13	-3.25
R 287	9.75	13	-3.25
R 288	6	13	-7
R 289	8	13	-5
R 290	7.25	13	-5.75
R 291	7.5	13	-5.5
R 292	5.25	13	-7.75

Table xiii Variance between confidence level and actual achievement by respondent

Appendix E

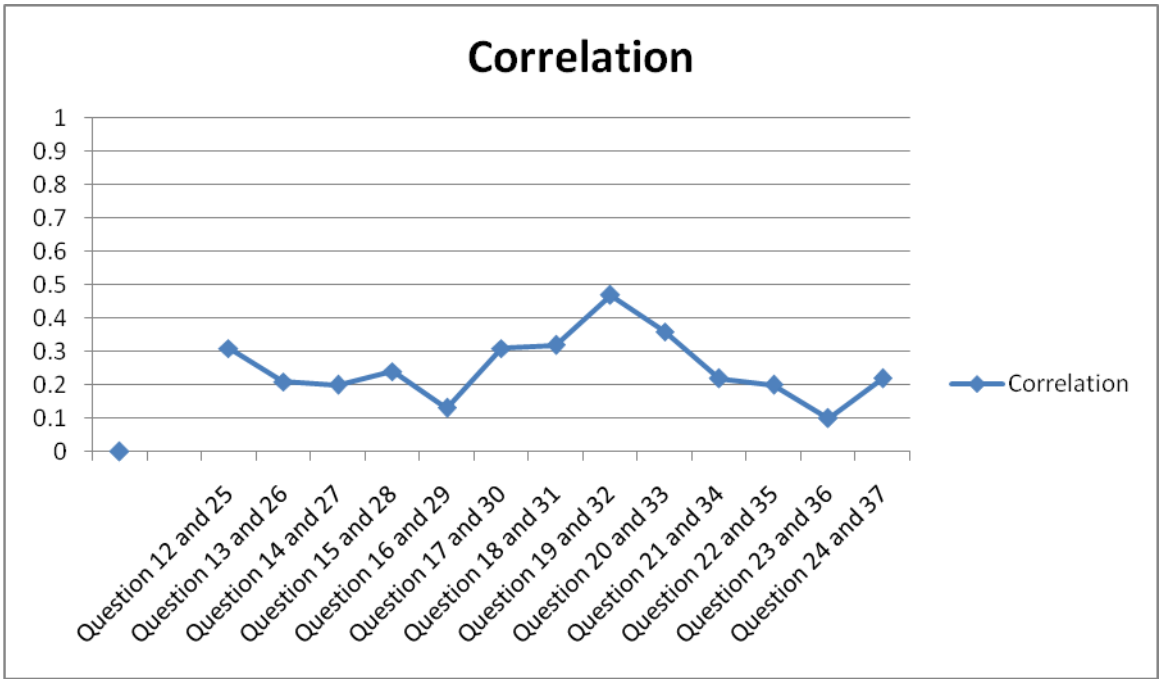

Chart ii Correlation between confidence level and actual achievement by question

Appendix F

Number Correct	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*
16-25	*0*	*0*	*0*	*2*	*0*	*0*	*1*	*2*	*3*	*7*	*13*	*12*	*10*
	0%	0%	0%	3.4%	0%	0%	1.7%	3.4%	5.2%	12.1%	22.4%	20.7%	17.2%
26-40	*0*	*0*	*2*	*0*	*1*	*1*	*1*	*3*	*3*	*1*	*9*	*18*	*74*
	0%	0%	1.8%	0%	0.9%	0.9%	0.9%	2.7%	2.7%	0.9%	8.0%	15.9%	65.5%
41-55	*0*	*0*	*2*	*0*	*1*	*2*	*3*	*2*	*4*	*4*	*7*	*11*	*54*
	0%	0%	2.2%	0%	1.1%	2.2%	3.3%	2.2%	4.4%	4.4%	7.7%	12.2%	60.0%
56-70	*0*	*0*	*0*	*1*	*0*	*1*	*0*	*3*	*3*	*1*	*3*	*5*	*13*
	0%	0%	0%	3.3%	0%	3.3%	0%	10.0%	10.0%	3.3%	10.0%	16.7%	43.3%
70+	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%

Table xiv Achievement by Age

Number Correct	1	2	3	4	5	6	7	8	9	10	11	12	13
Female	0	0	0	3	1	1	4	6	2	9	25	19	67
	0%	0%	0%	2.2%	0.7%	0.7%	2.9%	4.4%	1.5%	6.6%	18.2%	13.9%	48.9%
Male	0	2	2	0	1	3	1	4	11	4	7	25	95
	0%	1.3%	1.3%	0%	0.6%	1.9%	0.6%	2.6%	7.1%	2.6%	4.5%	16.1%	61.3%

Table xv Achievement by Gender

Number Correct	1	2	3	4	5	6	7	8	9	10	11	12	13
Less than 1 year	0	2	2	1	1	1	2	3	1	0	1	1	4
	0%	10.5%	10.5%	5.3%	5.3%	5.3%	10.5%	15.8%	5.3%	0%	5.3%	5.3%	21.1%
1 – 4 years	0	0	0	0	1	1	2	3	3	2	2	8	1
	0%	0%	0%	0%	4.3%	4.3%	8.7%	13.0%	13.0%	8.7%	8.7%	34.8%	4.3%
5 – 7 years	0	0	0	1	0	2	1	4	5	3	6	4	13
	0%	0%	0%	2.6%	0%	5.1%	2.6%	10.3%	12.8%	7.7%	15.4%	10.3%	33.3%
8+ years	0	0	0	1	0	0	0	0	4	8	23	31	144
	0%	0%	0%	0.5%	0%	0%	0%	0%	1.9%	3.8%	10.9%	14.7%	68.2%

Table xvi Achievement by Experience

Appendix G

Task				Internet Use Skills	
Hargittai				80%	
Task	Copy or move a file or folder	Duplicate or move text	Use basic formula in a spreadsheet	Use search engine	Send an email - attachment
Eurostat 2006 (EU)	54.7	52.8	38.4	53.9	45.1
Eurostat 2006 (Ireland)	48.7	46.2	35.2	52.5	44.2
Task and question number (if equivalent)	Perform basic editing within a document.	Perform basic editing within a document.	Performing simple calculations in a spreadsheet.	Explain purpose of a search engine.	Create /send an email.
Confidence	78.6	78.6	84.4	70.5	82.8
Actual	87.3	87.3	74	93.2	89.7

Table xvii Comparison of Results: Hargittai, PISA, Digital literacy Survey

Bibliography

ACRL, 2000 Association of College and research Libraries (2000) Information literacy competency standards for higher education. Chicago, IL. Association of College and Research Libraries. Available at www.ala.org/ala/acrl/acrlstandards/standards.pdf.

Akers, C. (2005). IRT's Top 20. Library Instruction Roundtable News, 27 (4), 8.

Alberta Education (1997). Learner Outcomes in Information and Communication technology: ECS to Grade 12: A Framework. Available at http://ednet.edc.gov.ab.ca/technology

Alexandria, Bibliotheca, (2005) Beacons of the Information Society, High Level Colloqium on Information literacy and Lifelong Learning, Egypt, 2005.

AMLA, (2005) Alliance for Media Literate America, (2005) What is media literacy? Denver, CO: Alliance for a Media Literate America. From www.amlainfo.org/home/media-literacy

Anderson, J. & Weert, T. (2002) Information and communication technology in education. A curriculum for school and programme of teacher development. Paris: UNESCO Available at unesdoc.unesco.org/images/0012/001295/129538e.pdf

Basque, J., Ruelland, D., Lavoie, M., (2007) A Digital Tool for Self-Assessing Information Literacy Skills. In G. Richards (Ed.) Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher education 2007, (pp 6997-7003) Chesapeake, VA: AACE

British Qualifications and Curriculum's Authority (2005)

Bundy, A. (Ed) 2004. Australian and New Zealand information literacy framework. Principles, standards and practice. (2nd ed.) Adelaide: Australian and New Zealand Institute for Information Literacy.

Castells, M. (2001) "The Internet Galaxy" Oxford University Press.

Cedefop, (2004) Study on "ICT-skills certification in Europe"

Cohen, et al, (2000: 169) From Research Methods in Educational Leadership and Management, By Ann R. J. Briggs, Marianne Coleman, Edition: 2, illustrated, Published by SAGE, 2007

Collis, B. and Anderson, R. (1994) Computer literacy for the 1990s: theoretical issues for an international Assessment. Unpublished Report, Adult Literacy and Life Skills Survey.

Conference board of Canada (2000) Canada wins silver in the race for Connectedness, January.

Conference board of Canada (2001) Connectedness and the Economy: Measuring our Performance, January.

Conference board of Canada (2002) Connecting Canadians: 3rd Annual report, May.

Cope, B. & Kalantzis, M. (2000) Multiliteracies: literacy learning and the design of social features. London Routledge.

Cuttance, P. & Stokes, S. 2000 Monitoring progress towards the national goals for schooling: information and communication technology (ICT) skills and knowledge. Report to the National Education Performance Monitoring taskforce of the Ministerial Council on Education, Employment, Training and Youth Affairs. Available at http://www.mceetya.edu.au/pdf/reportnepmt_ict.pdf

Dai, C., Ho, C. & Hsu, M.(2006). ICT and the Digital literacy of the Students from the Digital publishing Department in Taiwan. In E. Pearson & P. Bohman (Eds.) Proceedings of world Conference on Educational Media, hypermedia and Telecommunications, 2006 (pp 2687-2692) Chesapeake, VA. AACE.

Davis, F. (1986) A Technology Acceptance Model for Empirica;;t testing New End-User Information Systems: Theory and Results. Unpublished doctoral dissertation. Massachusetts Institute of Technology.

Demunter, Christophe (2006) E-skills measurement, Working party on Indicators for the Information Society. Presented at OECD 3-4th May 2006, Paris.

Denzin, N. (1984). *The research act*. Englewood Cliffs, NJ: Prentice Hall.

DG Enterprises (September 2005) Go Digital Initiative. From E-Business and ICT Skills in Europe. Presented at the Copenhagen ESkills Summit, October, 2002.

Digital Literacy European Commission (2008) Working Paper and Recommendations from Digital Literacy High Expert level Group. Report from e-Inclusion Ministerial Conference & Expo, 30th November to 2nd December 2008, Vienna, Austria.

Donnelly, K. 2009. Ireland trails the world for use of school computers, From the Irish Indepenent, Friday, March 27th, 2009.

Drenoyianni, H., Stergioulas,L., Dagiene, V. (2008) The pedagogical challenge of digital literacy: reconsidering the concept - envisioning the 'curriculum' - reconstructing the school. From the International Journal of Social and Humanistic Computing, Volume 1, Number 1, 27 September 2008 , pp. 53-66(14). Published by Inderscience Publishers.

Easterby-Smith et al (1994: 89) From Research Methods in Educational Leadership and Management, By Ann R. J. Briggs, Marianne Coleman, Edition: 2, illustrated, Published by SAGE, 2007

E-Skills for Europe: Towards 2010 and Beyond. The European E-Skills Forum (September 2004)

Educational Testing Service, (2002) Digital transformation: a framework for ICT literacy. A report of international information and communication literacy panel. Princeton, NJ: Educational Testing Service. Available at http://www.ets.org/media/tests/Information_and_communication_technology_literacy/ictreport.pdf

Educational Testing Service, (2003) Succeeding in the 21st Century. What higher education must do to address the gap in information and communication technology proficiencies. Assessing literacy for today and tomorrow. Princeton, N.J. Educational Testing Service. Available at http://www.ets.org/media/tests/Information_and_communication_technology_literacy/ictwhitepaperfinal.pdf

Empirica (2007). Benchmarking in a Policy Perspective, Final Summary Report. Available through Empirica , Gesellschaft für Kommunikations- und Technologieforschung mbH, Oxfordstr. 2, D-53111 Bonn, Germany. ©Bonn and Brussels, December 2007

ETS (Educational Testing Service). 2005. ICT Literacy Assessment. Available online at: http://www.ets.org/ictliteracy/ Last accessed

Educational Testing Service (2007) Testing Information Literacy in Digital environments: The ETS iSkills Assessment by I.R.

Empirica (2007) Benchmarking in a Policy Perspective. Report No. 6 Digital Literacy and ICT Skills. Available at

http://ec.europa.eu/information_society/eeurope/i2010/docs/benchmarking/wp6_digital_literacy_and_ict_skills.pdf

Eshet-Alkalai, Y. (2004). Digital literacy: A conceptual framework for survival skills in the digital era. *Journal of Educational Multimedia and Hypermedia, 13 (1): 93-106*

Eshet-Alkalai (2005). Thinking skills in the digital era. In: Haward, C., Bottcher, J. V., Justice, L., Schenk, K., Rogers, P. L., Berg, G, A. (eds.) (2005). *Encyclopaedia of Distance Learning,* Vol. I. London, Idea Group Inc., (pp. 1840-1845).

European Commission, (2002) eEurope 2005: an information society for all. An action plan to be presented in view of the Sevilla European Council, 21/22 June 2002. Brussels: Commission of the European Communities.

European Commission (2003) Directorate-General for Education and Culture. Elearning: better elearning for Europe. European Commission. Directorate-General for Education and Culture. Luxembourg, Office for Official Publications of the European Communities. Available at http://europa.eu.int/comm/dgs/education_culture/publ/pdf/elearning/en.pdf

European Commission (2004) From World Conference on Educational Multimedia, Hypermedia and Telecommunications (EDMEDIA) 2006 June 2006, Elaine Pearson & Paul Bohman, AACE

European Commission, (2008) i2010 Midterm Review. ICT Country Profiles, Commission Staff Working Document, SEC (2008) 470

European eLearning Summit Declaration, 2001 Final document 18/5/2001 Available at http://ec.europa.eu/education/archive/elearning/summit.pdf. Last accessed 08th April, 2009.

European e-Skills and Career Portal, available at http://www.e-skills-ilb.org

Eurostat Community Survey on ICT use in Households and by Individuals, 2005 Available at http://ec.europa.eu/information_society/eeurope/i2010/docs/benchmarking/051222%20Final%20Benchmarking%20Report.pdf Last accessed 09 03 09

Eurostat, 2006. Community ICT Household Survey. From Empirica Report 7/2007.

Gilster, P. (1997). Digital *Literacy*. New York: Wiley Computer Publishing.

Hargittai, Eszter (2005) Survey measures of Web-Oriented Digital Literacy. From Social Science Computer review Volume 23, Issue 3, (August, 2005) Pages 371 to 379.

Hutton (1990), From Research Methods in Educational Leadership and Management, By Ann R. J. Briggs, Marianne Coleman, Edition: 2, illustrated, Published by SAGE, 2007

INSEAD eLab Skills Pyramid, 2009. Taken from INSEAD eSRI database and research, Network Readiness Index and Global Information Technology Report (conducted in collaboration with the World Economic Forum)

INSEAD, 2009. Who cares? Who dares? Providing the skills for an innovative and sustainable Europe, Background report prepared for the European Business Summit, 2009.

ISTE, (1998) International Society for Technologies in Education, Technology Standards. The national educational technology standards (NETS) projects. Washington D.C. International Society for Technologies in Education. Available at http://www.iste.org/standards/

Kearns, P. and Grant, J. (2002). The enabling pillars: learning, technology, community, partnership. A report on Australian policies for information and communication technologies in education and training. Kambah, Australian capital territory: Global Learning Services. Available at http://www.dest.gov.au/NR/rdonlyres/D4C7D055-D510-40DA-9B15-32170EB2227C/911/aust_ict_report.pdf

Langhorne, M.J., Donham, J.O., Gross, J.F. & Rehmke, D (1989) Teaching with Computers: a new menu for the 90's. USA: The Oryx Press.

Lankshear, C. & Knobel, M. (1997) Literacies, text and difference in the electronic age. In C. Lankshear, J. P. Gee, M. Knobel & M. Searle, Changing literacies (pp 133-163) Buckingham, Philadelphia: Open University Press.

Lee, J. (1986) The effects of past computer experience on computerized aptitude test performance. Educational and Psychological measurement, vol 26, pp727-733.

Markausite, L. & Dagiene, V. 2004. Computer Literacy in Lithuanian secondary schools: contemporary discourses of literacy and ICT implementation.

Markausite, L. (2005) Notions of ICT Literacy in Australian school education. Informatics in Education, 4(2) 253-280. Available at http://www.vtex.lt/informatics_in_education/htm/INFE057.htm

Martin, A. (2000) Concepts if ICT Literacy in higher education. CITSCAPES project. Report. Glasgow. University of Glasgow. Available from http://www.citscapes.ac.uk/citscapes/products/backgroundreports/files/concepts_ict_HE.pdf

Martin, A. (2005) DigEuLit – a European Framework for Digital Literacy: a Progress Report. From Journal of eLiteracy, Vol 2, 2005. Available at www.jelit.org/65/01/JeLit_Paper_31.pdf Last accessed 19/02/09.

Martin, A. 2009, Digital Literacy for the Third Age: Sustaining identity in an Uncertain World. From ELearning Papers No. 12 2009. ISSN 1887-1542 Available at http://www.elearningeuropa.info/files/media/media18500.pdf. Last accessed April 08 2009.

NRC, (1999) Being fluent with Information technology. Washington: National research Council, national Academy Press.

OECD (2000) Learning to Bridge the Digital divide, 2000. Results of a Roundtable in December 1999. Organised jointly be OECD/CERI and the US National Center on Adult Literacy.

OECD (2001a) “Understanding the Digital Divide”, Paris

OECD (2001b) “The Digital Divide: Diffusion and Use of ICTs” DSTI/ICCP/IE (2000)9/REV2, October.

OECD (2002) “ICT Diffusion and the Digital; Divide”, DSTI/ICCP/IE (2001)9/CHAP6/REV1, prepared as Chapter 6 for the Information technology Outlook, 2002, February.

OECD (2003) “Programme for International student Assessment” (PISA) The ISA framework for assessing ICT Literacy: Draft Report to Network A.

OECD (2004) Information Technology Outlook, Paris Available at www.oecd.org/sti/ito

OECD (2005) Learning a Living, First Results of the Adult Literacy and Life Skills Survey. Published by the Ministry of Industry, Canada and Organisation for Economic Cooperation and Development, (OECD, Paris). Available at www.oecd.org/dataoecd/44/7/34867438.pdf. Last accessed 19/02/09.

OECD (2007) Broadband and ICT access and Use by Households and Individuals. Learning a Living, First Results of the Adult Literacy and Life Skills Survey. Published by the Directorate for Science, Technology and Industry. DSTI/ICCP/IE (2007)4/FINAL

Partnership for 21st Century Skills, (2002) A report and mile guide for 21st Century Skills. Available at http://www.21stcenturyskills.org

Pelgrum, W., Jansenn Reinen I., and Plomp, T. (1993) School, Teachers, students and computers: a cross national perspective. (IEA-COMPED Study stage 2), ERIC Document reproduction Service No. ED 372 734)

PISA (2007) Brochure: PISA The OECD programme for International Student Assessment.

PISA and OECD (2005) Are students ready for a technology-rich world: What PISA studies tell us. Paris: OECD.

Prensky, M. (2001) Digital natives, Digital Immigrants. From On the Horizon, Volume 9, No. 5, 2001, pp 1-6.

QCA, (2005) Information and Communication Technology. Standards for adult ICT skills. London: Qualifications and Curriculum Authority. Available at http://www.qca.org.uk/2791.htm

RAND Europe: The supply and demand of E-Skills in Europe. September 2005: from http://ec.europa.eu/enterprise/ict/policy/doc/eskills-2005-10-11.rand.pdf

Ridgeway, J. & Passey, D. (1995) Using evidence about teacher development to plan systematic revolution. In D. Watson D. & D. Tinsley (Eds.) Integrating Information technology into Education (pp 59-72). London: Chapman & Hall, IFIP.

Rivoltella, P.C. (2008) Digital Literacy Tools and methodologies for Information Society. Published by Idea Group Inc (IGI), 2008

Sciadas, G. (2002). “Monitoring the Digital divide”, an Orbicom-CIDA project, National Research Council of Canada, March.

Sciadas, G. (2003). “Monitoring the Digital divide… and Beyond”, an Orbicom-CIDA project, presented at World Summit on the Information Society (WSIS), Geneva, December, 2003.

Smith, G & Kirsch, I. (2004) Innovative Assessment of ICT Literacy. In G. Richards, (Ed) Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher education, 2004. (pp 443-448) Chesapeake, VA. AACE.

Tannenbaum, R. J., Katz, I. R. (2008) Settings Standards on the Core and Advanced iSkills Assessments. Published by ETS, February, 2008 (ETS RM-08-04)

Tech Literacy Confusion: What Should You Measure? January 21, 2009 Vol. 02, Issue 03, Pages 20-22

U.N. (2001) Information and Communication Technologies Task force. Report of the Secretary General, February.

U.S. Department of Commerce (1995) Falling through the Net. A survey of the “Have Nots” in Rural and Urban America. Available at www.ntia.doc.gov/ntiahome/fallingthru.html. Last accessed 19/02/09.

U.S. Department of Commerce (1998) Falling through the Net. Toward Digital Inclusion.

U.S. Department of Commerce (1999) Defining the Digital Divide. Available at www.ntia.doc.gov/ntiahome/fttn99/

U.S. Department of Commerce (2000) Toward Digital Inclusion. Available at www.ntia.doc.gov/ntiahome/fttn00/contents00.html

Venezky, R. L. (2001) Assessment of ICT concepts and skills: Summary and recommendations for PISA. Unpublished manuscript, University of Delaware.

Weert, T. (1995) Integration of Informatics into education. In D. Watson & D. Tinsley. (Eds), Integrating information technology into education (pp 127-137). London: Chapman & Hall, IFIP.

Williams, K. (2003) Literacy and computer literacy: analyzing the NRC’s being fluent with information technology. The Journal of Literacy and Technology, 3(1). Available at http://www.literacyandtechnology.org/v3n1/williams.htm

World Bank, 2002. Information for Development program: Annual report 2001. Available at www.infodev.org

Yin, R. (1984). *Case study research: Design and methods* (1st ed.). Beverly Hills, CA: Sage Publishing.