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Effects of Internet Connectedness and Information Literacy on Quality of Life

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Abstract The goal of this exploratory research is to examine the inter-linkage among Internet connectedness, information literacy, and quality of life. Results from a telephone survey, based on a probability sample of 756 Internet users, found that Internet connectedness is not related to quality of life. However, there is a significant relationship between Internet connectedness and information literacy, and a strong link between information literacy and life quality. These findings encourage further exploration of life quality that underlies the concepts of Internet connectedness and information literacy. The hope is that additional discoveries will aid curriculum design, both at the K-12 and university levels, and the future development of Internet applications and services so as to enhance overall life quality. In particular, the intent of the study was to determine what factors might have the most positive effect on quality of life.

Keywords Internet connectedness · Information literacy · Quality of life (QoL)

1 Introduction

Technology is the portal through which we interact with information, but there is growing belief that people's ability to handle information (i.e., to solve problems and think critically about information) tells us more about their future success than does their knowledge of specific hardware or software (Farmer and Henri 2008). These skills—known as information technology (IT) literacy—can be considered a 21st-century form of literacy in which researching and communicating information in a digital environment are as important as reading and writing were in earlier decades (Partnership for 21st Century Skills 2003; Rivoltella 2008a, b). Although today's knowledge society challenges students with over-abundant information of often dubious quality, university administrators have recognized that the solution cannot be limited to improving technology instruction. Instead,

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there is an increasingly urgent need for students to have stronger information literacy skills (i.e., to be able to recognize when information is needed and have the ability to locate, evaluate, and effectively use the required information) and apply those skills in the context of technology (Scales and Lindsay 2005).

Information technology literacy can be seen as an integration of what are commonly known as two separate literacies: *technology literacy* and *information literacy*. In broad terms, technology literacy is having the ability to use technology as a tool to research, organize, and communicate information. Being technology literate alone is not enough to be a competent individual in an information society (Badke 2008). Information workers should also be information literate—able to identify information needs, locate and retrieve information, evaluate it and present it to others (Cochrane 2006). To succeed in today's workforce environment, scholars have argued that one cannot rely solely on either technological or information literacy skills. The two are complementary, and they must be interlocked to provide a complete inventory of needed skills and knowledge (Sharkey and Brabdt 2008).

The Net Generation (netgeners), those born between 1977 and 1997 (Tapscott 1998), have grown up with the Internet and might be impressively technologically literate, more accepting of new technology, more technologically savvy; their lives are more connected and reliant on the Internet than those of their parents and teachers (Oblinger and Oblinger 2005). Netgeners' connectedness to the Internet has allowed them to achieve a whole range of daily activities and goals—whether it is shopping, banking, learning, staying in touch with family, socializing with friends, or just taking time out to play games or listen to music. However, the new "illiteracy" concerning many educators today is the netgeners' lack of skill at being critical consumers and ethical producers of information (Rockman 2002). Although the Internet has become an important resource for daily information, and we are more and more dependent on the Internet, little is known about how factors of Internet connectedness affect the perceptions of how information literate we are and, in turn, how our future success is impacted. In many respects, the interactive nature of the Internet makes our lives more connected to it than to television, radio, and newspapers. Such connectedness to the Internet affects our literacy perceptions and helps us fulfill much of our communication needs; this in turn affects our perceived life quality.

Given that the topic of quality of life (QoL) is severely under-researched in various Chinese contexts while majority of QoL studies were conducted in the west (Shek et al. 2005), the purpose of this study is to identify and define the concept of information literacy and Internet connectedness and their components, so as to examine the extent to which such concepts can affect quality of life evaluation in Hong Kong. Therefore, the intent of this exploratory research is to determine the specific factors of Internet connectedness and the specific dimensions of information literacy that might best explain perceived quality of life in a population with over 95% Chinese.

2 Literature Review

2.1 Defining Information Technology Literacy

The Association of Colleges and Research Libraries (2000) defines information technology literacy skills as those associated with an individual's use of computers, software applications, databases, and other technologies to achieve an academic, work-related, or personal goal. To distinguish information literacy from one of its component skills,

technology literacy (i.e., competence in using information technology), the Association has re-defined information literacy as "a set of abilities requiring individuals to recognize when information is needed and have the ability to locate, evaluate, manage, and use effectively the needed information" (Farmer and Henri 2008, p. 4).

What comprises technology literacy? People in a university setting tend to view technology literacy as either the ability to work with technology within a given discipline, such as scientific instruments in chemistry and physics (Kock et al. 2002). Educators in K-12 settings more narrowly view the skills of "computer literacy" as being able to use the computer for keyboarding, basic programming, and so forth (Murray 2003) or a variety of technology competencies including specifics such as demonstrating knowledge and use of appropriate connectivity methods, networking, data bases, Web/Internet, desktop publishing, and communication hardware and software. Industry views things in very applied and outcome-based terms; technology literacy can be described as mastery over technological tools, usually specific to a company and the products it produces (Bailey and Stefaniak 1999).

On the other hand, information literacy encompasses a different domain of skills and knowledge from those involved in finding, retrieving, and using information. Dupuis (1997) indicates that information literacy must include knowledge and understanding of the context of information in today's society, its composition and organization, as well as its use in life-long learning. Others also think of information literacy as skills that go beyond locating and using information, to the knowledge for interpreting and evaluating it (Banta and Mzumara 2004; Murray 2003).

In recognizing the importance of information literacy, the University of Albany, State University of New York, requires all freshmen to take and pass an information literacy course as part of their general education requirement. The course meets the information literacy standard and has four components: "(1) locate, evaluate, synthesize and use information from a variety of sources; (2) understand and use basic research techniques appropriate to the course discipline; (3) understand the various ways in which information is organized and structured; and (4) understand the ethical issues involved in accessing and using information" (University of Albany, State University of New York 2006–2007).

Dunn (2002) describes an institutional assessment project, carried out at California State University (CSU); a system that raised questions about how to test and measure a wide range of information and critical thinking skills. Such assessment exercises confirmed the importance of assessing information literacy and information-seeking skills as effective strategies to improve student performance and confidence in finding and using information. CSU defined information literacy as a set of seven core competencies including: "(1) formulate and state a research question, problem, or issue within a discipline; (2) determine the information requirements for a research question, problem, or issue to formulate a search strategy that will use a variety of resources; (3) locate and retrieve relevant information, in all its various formats, using appropriate, technological tools; (4) organize information in a manner that permits analysis, evaluation, syntheses, and understanding; (5) create and communicate information effectively using various media; (6) understand the ethical, legal and social-political issues surrounding information; and (7) understand the techniques, points of view, and practices employed in the presentation of information from all sources" (Dunn 2002).

Similarly, Shapiro and Hughes (1996) proposed and operationalized information literacy as a seven-dimensional construct: (1) *Tool literacy* refers to the ability to understand and use practical and conceptual information technology tools in respective professional life; (2) *Resource literacy* means the ability to understand the form, location, access

methods, and formats of information resources; (3) *Social-structural literacy* reveals the understanding of how information is socially situated and produced; (4) *Research literacy* indicates the ability to understand and use relevant information technology tools for research; (5) *Publishing literacy* reflects the ability to format and publish research and ideas in textual and multimedia formats; (6) *Emergent technology literacy* refers to the awareness and the ability to adapt to, understand, evaluate, and make use of emerging information technology; and (7) *Critical literacy* reveals the ability to critically evaluate the strengthens and weaknesses, capabilities and limits, of information technologies (Farmer and Henri 2008).

In summary, the information technology literacy has been treated as an umbrella concept which encompasses both technology literacy and information literacy. Therefore, in short, information literacy provides people with "awareness, analysis, reflection, action, and experience leads to better comprehension, critical thinking, and informed judgments" and "critical skills by which people learn to discriminate all types of information" (Buckingham and Willett 2006, p. 169). Using the straight-forward definition of information literacy by Shapiro and Hughes (1996), this study explores if different dimensions of information literacy are related to the perceived importance of the Internet in a person's everyday life using a concept called Internet connectedness (Jung et al. 2001).

2.2 Internet Connectedness

A considerable amount of Internet research adopts either a conventional dichotomous measure (access/non-access) or a time-based measure (e.g., number of hours spent); doing so ignores the importance of other contexts, such as the goals or functions of the Internet. To fully capture the many contexts at play, Jung et al. (2001) devised a multidimensional construct called the Internet connectedness index (ICI) based on media system dependency theory (Ball-Rokeach 1998; Loges and Jung 2001). The ICI is a multilevel and contextual approach for assessing the overall relationship between a person and the Internet, and it encompasses a number of conventional measures such as time, history, contexts, and also goes beyond these to capture the scope, goal, intensity, and centrality of the Internet in one's life (Jung et al. 2001). As a measure using multiple items, ICI has a greater likelihood of providing deeper contextual meaning than conventional single-item measures with regard to the extent to which we are dependent on, or connected to the Internet. The ICI is composed of nine factors: (1) *Internet use history* assessed in relation to the number of years a person has used the Internet; (2) *task scope* reflected the breadth which included the kind and number of tasks for which a person connects to the Internet, whether they are work-related, school-related, or personal-related tasks; (3) *site scope* involved the types and numbers of places where a person connects to the Internet, which includes the home, work, school, a community center or organization, a public library, and a cybercafé; (4) *goal scope* involved six media-system dependency goals by Ball-Rokeach (1985, 1998); the six response categories of how the Internet affects our lives including: two understanding goals, (a) to stay on top of events and groups that you care about (social understanding) and (b) to express yourself or your opinions (self-understanding); two orientation goals, (c) to accomplish business, financial, or work tasks (action orientation) and (d) to get advice on how to deal with other people, such as doctors and other health professionals (interaction-orientation); and two play goals, (e) to play or amuse yourself (self play) and (f) for social reasons like making new

friends (social play); (5) *activity scope* indicated the breadth of participation, other than e-mail, on the Web; it covered bulletin boards (BBS), chat rooms, game playing/online gaming, mailing lists, newsgroups, research/information, shopping, and surfing the Web, (6) *time spent* on interactive online activities showed the intensity of people's connectedness to interactive online activities; (7) *evaluation of the Internet* assessed the overall positive or negative effect of the Internet in their lives; (8) *personal computer (PC) dependency* relations; and (9) *Internet dependency*. Responses from PC and Internet dependency capture the subjective centrality of personal computers and the Internet in people's daily lives.

With Internet connectedness being conceptualized as a multi-dimensional indicator of a person's overall relationship to the Internet, the objective of this study is to describe and analyze the goal, scope, and intensity of Internet use, its centrality, and the context in which Internet connectedness is related to information literacy. This study raised the following research question and hypothesis:

RQ_1 To what extent can demographics and components of Internet connectedness predict different dimensions of information literacy?

H_1 The more Internet users feel that they are connected to the Internet, the more information literate they will perceive themselves to be

2.3 Quality of Life

In reviewing the quality of life literature, two constructs have been used to explain the determinants of life satisfaction or quality of life: subjective and objective perspectives (Diener 1984). The subjective construct hypothesizes that perceived quality of life is influenced by personality or dispositional factors (e.g., optimism, pessimism, isolation, self-worth, and neuroticism). On the other hand, the objective construct proposes that life quality is affected by environmental or situational factors (e.g., family, job, leisure, neighborhood, community, and satisfaction with standard of living). According to the objective determinants of life quality, people's quality of life tends to be a direct function of their evaluations of important life domains such as social support, leisure activities, and *standard of living* of overall life (e.g., Andrews and Withey 1976; Diener 1984). Satisfaction or dissatisfaction with standard of living is likely to spill over to influence subjective well-being. Therefore, the greater the satisfaction with one's standard of living, the greater the satisfaction with life and vice versa. Here, standard of living is usually meant as "being materially better off" than a typical family (Andrews and Withey 1976; Diener 1984; Prenshaw 1994).

In order to maintain or have a high standard of living, technologies and innovations have always played a major role in the past (McPheat 1996). Household technologies introduced around the middle of the last century, such as televisions, refrigerators, air-conditioners, vacuum cleaners, and clothes dryers, are permanently embedded in society. Even more taken-for-granted are changes in technologies in both the workplace and at home such as the use of personal computers, mobile phones, faxes, and e-mail. The impact of the Internet on society as a whole has been debated continuously since its widespread adoption in the 1990s (Kraut et al. 1998; Nie 2001). Industry, consumer groups, academics, and policymakers have sought to better understand how the Internet contributes to or detracts from society. Communications media are so fundamental to society that new media forms have the capacity to reshape our work, leisure, lifestyle, social relationships,

national and cultural groups and identities in ways that are difficult but important to predict. As the Internet continues to expand its technological capabilities and global penetration, one of the most pressing questions is: Does Internet connectedness have a positive or negative effect on life quality? Similarly, how does information literacy relate to quality of life?

Extensive qualitative and quantitative evidence also supports the Internet's potential (via home Internet access) to enable informationally disadvantaged or low-income families to experience powerful emotional and psychological transformations in identity (self-perception), self-esteem, personal empowerment, a new sense of confidence, and social standing or development of personal relationships on the Internet (Anderson and Tracey 2001; Bier and Gallo 1997; Henderson 2001). The appropriate use of the Internet in areas such as online news, online forums, and online counseling, etc. can help to promote self-sufficiency, psychological empowerment, lifelong learning, and rehabilitation (Bier and Gallo 1997; Hu and Leung 2003; Leung and Lee 2005; Wellman and Haythornthwaite 2002). Wright (2000) found that greater involvement with the online community was predictive of lower perceived life stress for older adults. A trend toward decreased loneliness and improved psychological well-being among older adults was observed when e-mail and Internet access was provided (White et al. 1999).

Based on these theoretical frameworks, this study emphasizes the importance of information literacy and Internet connectedness and their effects on quality of life. At the same time, other predictors for life quality are also considered, including the use of both new and traditional mass media. Thus, this study raised one research question and two additional hypotheses:

RQ_2 What is the relative influence of demographics, Internet connectedness, information literacy, new media use, and mass media use on quality of life?

H_2 The more information literate Internet users feel they are, the more satisfied they will be with their life quality

H_3 There is a positive relationship between Internet connectedness and quality of life

3 Methods

3.1 Sampling

Data for this study were collected from a telephone survey with a probability sample of 997 respondents aged 16 or above, randomly chosen from the latest Hong Kong telephone directory. All calls were made from a central location during evening hours with close supervision by trained advanced undergraduates at the Survey Research Laboratory using its Computer-Assisted Telephone Interviewing (CATI) system. Non-eligible respondents (i.e., younger than 16), nonworking numbers, and numbers that were not answered after five attempts were excluded. The next birthday method was used to select a respondent if more than one individual within the household qualified. In addition, the survey instrument was pilot tested on 27 university students. Actual fieldwork was conducted from September 4–17, 2008. Of the 997 completed interviews, 84.5% ($n = 842$) had PCs at home, and 89.8% ($n = 756$) of these had Internet access. Of the 756 Internet users, 47.5% were male and the median age category was between 45 and 49 years of age. Median education was Grade 12, and median family monthly income was in the range US $3,846–5,128. The response rate was 57.7% and the margin of error is ±3.1%.

3.2 Measurements

3.2.1 Internet Connectedness

The Internet Connectedness (IC) used in this study is a variation of the nine-factor ICI concept used by Jung et al. (2001). As more users are now accessing the Internet via broadband and 3G mobile phones, these access channels were added to the original theoretical dimensions to better capture the meaning of IC. Thus, the IC construct in this study consisted of three dimensions in ten factors. As shown in Table 1, the *history and context* dimension included number of years of PC ownership, 3G mobile Internet access, broadband access, and site scope. Personal computer history (1) at home is operationalized as the number of years a respondent has owned a PC at home ("1" = less than a year, "2" = 1–2 years, "3" = 3–6 years, "4" = 7 years or more). 3G mobile Internet access (2) relates to respondents who have access to the Internet at any time, and anywhere. Respondents were asked: "Do you personally own a 3G mobile phone with Internet access?" with "0" = 2G and "1" = 3G. In addition, broadband Internet access (3) asked respondents: "Do you have broadband access at home?" with "0" = no and "1" = yes. Site scope reflects the total number of locations where respondents have access to the Internet including home, work, school, a community center, a public library, and a cybercafé. To facilitate the construction of the ICI, responses were limited to four locations. Thus, data ranged from 0 to 4.

The *Scope and intensity* dimension of IC included goal scope, activity scope, and activity intensity. Goal scope (5) assessed six goals respondents pursued in online activities by asking: "How helpful is the Internet for you in achieving the following goals (e.g., stay on top of events and groups that you care about; express yourself or your opinions; accomplish business, financial, or work tasks; get advice on how to deal with other people, such as doctors and other health professionals; play or amuse yourself; and make new friends for social reasons. The scale used was "1" = strongly disagree and "5" = strongly agree. Correction for positive skew in responses to goal scope was performed with responses of 6–13 recoded to "1"; 14–19 recoded as "2"; responses of 20–24 recoded as "3"; and responses of 25–30 recoded as "4". Activity scope (6) asked respondents: "Besides e-mail, do you do the following (e.g., IM, chat rooms, Facebook, blogs, online news, download music, download movies, online games, shopping, and web surf) on the Internet?" with "0" = no, and "1" = yes for each activity. The total number of responses represents the breadth of participation and was recoded to "1" when none of the activities was chosen, and coded to "2" when one or more activities was chosen. Activity intensity (7) was measured by asking respondents "How often do you use IM, chat rooms, Facebook, blogs, online news, download music, download movies, online games, shopping, and web surf?" and rated on a 5-point scale with "1" = never, "2" = seldom, "3" = sometimes, "4" = often, and "5" = very often. Data ranged from 10 to 50. To correct the negative skew in the responses, activity intensity was recoded with responses of 10–15 recoded as "1"; 16–23 as "2"; 24–34 as "3"; and responses of 35–50 as "4".

Centrality dimension consisted of questions assessing positive and negative evaluations of the Internet and the degree to which the Internet is connected to one's life and the extent to which respondents were dependent on the medium. For Evaluation (8), respondents were asked: "Thinking about all the pros and cons of the Internet, would you say it has an overall positive or negative effect on your life?" and responses were on a 5-point scale where "1" = very negative, "2" = somewhat negative, "3" = neutral, "4" = somewhat positive, and "5" = very positive. To correct the positive skew in this variable, responses

Table 1 Factor analysis of the internet connectedness index (ICI)

Theoretical dimensions	Rotated factor loading
History and context	
1. Years owned a PC[a]	.504
2. 3G mobile internet access[b]	−.596
3. Broadband access[c]	.739
4. Site scope[d]	.592
Scope and intensity	
5. Goal scope[e]	.555
6. Activity scope[f]	.757
7. Activity intensity[g]	.770
Centrality	
8. Evaluation[h]	.572
9. PC dependency[i]	.876
10. Internet dependency[j]	.912

Notes: rotated factor loadings are derived from oblimin rotation with Kaiser normalization

[a] How long have you owned a personal computer at home? 1 = less than 1 year, 2 = 1–2 years, 3 = 3–6 years, 4 = 7 years or more

[b] Do you go online with a 3G mobile phone? 0 = No and 1 = Yes

[c] Do you have broadband access to the Internet at home? 0 = No and 1 = Yes

[d] Have you accessed the Internet at the following locations (home, work, school, a community center or organization, public library, cyber café) in the past three months? 0 = No and 1 = Yes. Responses to this question were capped at four or more for purposes of scale construction

[e] How much do you agree that the Internet helps you achieve the following goals: (1) stay on top of events and groups that you care about; (2) express yourself or your opinions; (3) accomplish business, financial, or work tasks; (4) get advice on how to deal with other people, such as doctors and other health professionals; (5) play or amuse yourself; and (6) make new friends for social reasons. Scale used: 1 = strongly disagree and 5 = strongly agree

[f] Do you do the following (e.g., IM, chat rooms, Facebook, blogs, online news, download music, download movies, online games, shopping, and web surf) on the Internet? 0 = No and 1 = Yes

[g] Besides e-mail, do you use IM, chat rooms, Facebook, blogs, online news, download music, download movies, online games, shopping, and web surf? 1 = never, 2 = seldom, 3 = sometimes, 4 = often, and 5 = very often

[h] Thinking about all the pros and cons of the Internet, would you say it has an overall positive or negative effect on your life? 1 = very negative, 2 = somewhat negative, 3 = neutral, 4 = somewhat positive, 5 = very positive

[i] Imagine that you woke up tomorrow to find that the mobile phone has vanished, how much would you miss being able to use the PC? 1 = wouldn't miss it at all, and 10 = miss it extremely

[j] Imagine that you woke up tomorrow to find that the Internet has vanished, how much would you miss being able to go online? 1 = wouldn't miss it at all, and 10 = miss it extremely

with 1 and 2 were recoded as "1"; responses of 3 were recoded as "2"; 4 as "3"; and 5 as "4". Personal computer dependency (9) was measured by asking respondents: "Imagine that you woke up tomorrow to find that the PC has vanished, how much would you miss being able to use the PC?" ranked on a 10-point scale with "1" = wouldn't miss it at all, and "10" = miss it extremely. The distribution of responses to dependency on the PC was skewed such that responses were collapsed into four categories with original responses of 0–1 recoded as "1"; 2–5 as "2"; 6–8 as "3"; and 9–10 recoded as "4". The same question was asked for Internet dependency: (10) "Imagine that you woke up tomorrow to find that

the Internet has vanished, how much would you miss being able to go online?" Again, the distribution of responses to Internet dependency was skewed such that responses were collapsed into four categories with responses of 0–2 recoded as "1"; 3–5 as "2"; 6–8 as "3"; and responses of 9–10 as "4".

As shown in Table 1, the ICI for this study is composed of 10 factors. To produce compatible scale items, each variable was multiplied by a value to yield a common factor of 12. As such, ICI scores were calculated by taking the overall average of the 10 items, with the mean of the ICI scores equal to 7.3 (SD = 1.29) and ranging from 1 to 12. The reliability alpha was .71. To test the ICI's dimensional structure, factor analysis was conducted with oblique rotation. The results yielded three distinct factors (with Eigenvalues > 1) accounting for 56% of the variance. Table 1 shows the factor loadings (in excess of .5 in all cases), with each item loaded in its predicted dimension.

3.2.2 Information Literacy

An inventory of 15 items was used to assess the 6 dimensions of information literacy as proposed by Shapiro and Hughes (1996). Respondents were asked to indicate, "How confident were you in performing the following tasks?" on a 5-point scale with "1" = not very confident, and "5" = very confident. Sample tasks included: edit and format a document according to a set of editorial specifications; create content in blogs, on YouTube, and on personal webpages for different audiences; and critically judge whether information on websites is authentic and accurate. Table 2 shows that factor analysis of the 13 tasks yielded a five-factor information literacy structure. Reliability alphas were high and ranged from .80 to .88.

3.2.3 Quality of Life

To measure quality of life, the Satisfaction with Life Scale (SWLS) developed by Diener et al. (1985) was employed. With good internal consistency and high reliability, SWLS is narrowly focused to assess global life satisfaction. Respondents were asked about their agreement with a 5-item scale using a 5-point scale with "1" = strongly disagree, and "5" = strongly agree. The five items include: (a) in most ways my life is close to my ideal; (b) the conditions of my life are excellent; (c) I am satisfied with my life; (d) so far I have gotten the important things I want in life; and (e) if I could live my life over, I would change almost nothing. Reliability alpha was high at .82.

3.2.4 New Media Use

Respondents were asked how much time they spent on the three most popular new media technologies in their leisure time, namely, watching VCDs and DVDs in minutes per week, playing computer games, and viewing programs on pay-TV (e.g., cable TV and IPTV). Only these three were assessed because they are entertainment-oriented activities. A 5-point Likert scale was used with "1" = never, and "5" = very often.

3.2.5 Traditional Media Use

Four traditional mass media variables were included in the analyses: printed newspaper reading, TV watching, radio listening, and book reading. Respondents were asked to report

Table 2 Factor analysis of information literacy

How confident are you in performing the following tasks?	Factors					Mean	SD
	1	2	3	4	5		
Critical literacy							
1. Compare and evaluate critically whether the information collected is credible and relevant	.90					2.88	.95
2. Judge critically whether information on websites is authentic and accurate	.86					2.89	.94
3. Compare and evaluate critically whether the information is timely and appropriate	.68					3.19	.92
Tool literacy							
4. Edit and format a document according to a set of editorial specifications		.85				4.10	1.02
5. Create a presentation slide to support a position on a controversial topic presentation		.84				3.90	1.10
6. Browse online databases to locate pertinent information		.70				4.17	.86
Publishing literacy							
7. Create contents in blogs, for YouTube, and personal webpages for different audiences			.79			3.00	1.23
8. Format and publish ideas electronically in textual form			.79			3.33	1.10
9. Format and publish ideas electronically in multimedia form			.74			2.98	1.08
Social-structural literacy							
10. Understand the ethical and legal issues surrounding how information is socially situated				.87		3.22	.96
11. Understand the socio-political issues surrounding how information is socially produced				.86		3.16	.94
Emerging technology literacy							
12. Aware of the latest product development in new information technologies and decide when to adopt					.87	3.28	1.10
13. Evaluate how well the continually emerging innovations in information technology met the information need and decide when to adopt					.84	3.08	1.10
Eigenvalues	5.87	1.35	1.16	1.12	.93		
Variance explained	45.17	10.35	8.89	8.64	7.12		
Cronbach's alpha	.86	.80	.82	.86	.88		

Notes: scale used: 1 = not very confident, and 5 = very confident. $N = 756$

the average time spent on these media in a typical day. Newspaper reading, TV watching, and radio listening were measured in minutes per day while book reading was on a 5-point scale with "1" = never and "5" = very often.

3.2.6 Demographics

Social demographic variables were included in the present study as control variables: gender (male = 1), age, education, monthly family income, and hours worked per week.

4 Findings

4.1 Hypotheses Testing

The correlation results in Table 3 indicate that IC is significantly linked to four different dimensions of information literacy: critical ($r = .15$, $P < .001$), tool ($r = .31$, $P < .001$), publishing ($r = .36$, $P < .001$), and technology literacy ($r = .14$, $P < .01$). These relationships support the notion that the more Internet users perceive themselves to be connected to the Internet, the more information literate they feel. Thus, H_1 was largely supported. Data also show that critical literacy ($r = .14$, $P < .01$), tool literacy ($r = .18$, $P < .001$), and social-structural literacy ($r = .13$, $P < .01$) were significantly related to quality of life. This indicates that the more information literate Internet users feel they are (especially in critical, tool, and social-structural dimensions), the more satisfied they are with their life quality. Therefore, H_2 was largely supported. However, a separate correlation analysis revealed that the relationship between the ICI and life quality was not significant ($r = .04$, $P = .37$). This indicates that the perceived importance of the Internet in one's life has no effect on perceived quality of life. Thus, H_3 was not supported.

4.2 The Information Literates

To examine how demographics and components of IC predict the dimensions of information literacy, five parallel regression analyses were run. The results in Table 4 show that individuals who can critically assess information (i.e., they can compare, evaluate, and critically judge whether information collected is credible, relevant, authentic, accurate, timely, and appropriate) tended to be high income earners ($\beta = .13$, $P < .01$). Individuals who are information tool literate (i.e., can edit, format, and create a document or a presentation, and know how and where to locate relevant information) tended to be young ($\beta = -.08$, $P < .05$), highly educated ($\beta = .16$, $P < .001$), and have a high monthly family income ($\beta = .09$, $P < .05$). The information tool literates tended to have owned their PCs longer ($\beta = .07$, $P < .05$), have access to the Internet through multiple venues ($\beta = .14$, $P < .001$; including home, work, school, community center, public library, and cyber café), and believe that the Internet has an overall positive effect on their lives ($\beta = .08$, $P < .05$). Data also show that the publishing literates tended to be female ($\beta = -.09$, $P < .05$), believe that the Internet can facilitate them to accomplish multiple goals ($\beta = .24$, $P < .001$), and tended to be very active in using various Internet applications (e.g., MSN, chatrooms, Facebook, blogs, online news, download music or video, gaming, shopping, and surfing online; $\beta = .23$, $P < .001$). The social-structural literates tended to be older ($\beta = .09$, $P < .05$) and heavily dependent on the Internet in their daily lives, without it they feel lost ($\beta = .15$, $P < .05$). Furthermore, the technologically literates tended to be male ($\beta = .11$, $P < .05$), feeling that the Internet can help them complete a

Table 3 Correlations between information literacy and ICI and Qol

Information literacy	ICI	QoL
1. Critical literacy	.15***	.14**
2. Tool literacy	.31***	.18***
3. Publishing literacy	.36***	.03
4. Social-structural literacy	.07	.13**
5. Technology literacy	.14**	−.03

$N = 756$

*** $P \leq .001$; ** $P \leq .01$; * $P \leq .05$

Table 4 Regression analysis of demographics and components of ICI on information literacy

Predictors	Information literacy				
	Critical literacy, β	Tool literacy, β	Publishing literacy, β	Social-structural literacy, β	Technology literacy, β
Demographics					
Gender (male = 1)	.05	−.08*	−.09*	.04	.11*
Age	.02	.06	−.03	.09*	.04
Education	−.01	.16***	−.03	.01	.00
Family income	.13**	.09*	−.00	.06	.03
Work hours	−.07	.05	.00	.03	.02
Internet connectedness index (ICI)					
History and context					
Years owned a PC	−.02	.07*	−.06	−.03	.01
3G mobile Internet access	.01	−.00	.01	.04	.07
Broadband access	−.00	.00	−.00	−.02	.02
Site scope	−.05	.14***	.05	.03	−.02
Scope and intensity					
Goal scope	.04	.05	.24***	.06	.20**
Activity scope	.04	.10	.02	−.09	−.13
Activity intensity	.06	−.01	.23***	−.06	.19*
Centrality					
Evaluation	.00	.08*	−.04	.08	.07
PC dependency	.04	.05	−.05	−.01	−.03
Internet dependency	.01	.02	.09	.15*	−.13
R^2	.09	.15	.20	.06	.08
Adjusted R^2	.05	.14	.19	.04	.04

$N = 756$

*** $P \leq .001$; ** $P \leq .01$; * $P \leq .05$

wide range of tasks ($\beta = .20$, $P < .01$). As a result, they are very active in a large number of Internet activities ($\beta = .19$, $P < .05$). The variances explained by these five regression equations ranged from 4 to 19%.

4.3 Predicting Quality of Life

To examine the relative influence of demographics, IC, information literacy, new media use, and mass media use on quality of life, a hierarchical regression was run. The results in Table 5 indicate that people who reported a superior life quality tended to be those who are highly educated ($\beta = .19$, $P < .01$), older ($\beta = .17$, $P < .05$), and female ($\beta = -.22$, $P < .001$). As the first block of predictors, demographics explained most of the variance at 10 percent. When variables from Internet connectedness entered into the equation in the second block, PC dependency ($\beta = -.21$, $P < .001$) and evaluation ($\beta = .17$, $P < .01$) were found to be significant predictors. This indicates that the more reliant people are on their PC, the less satisfied they will be with their life. In contrast, the more positively they

Table 5 Hierarchical regression analysis of demographics, components of ICI, information literacy, new media use and mass media use on QoL

Predictors	QoL, β	ΔR^2
Block 1: demographics		
Gender (male = 1)	−.22***	
Age	.17**	
Education	.19**	
Family income	−.01	
Work hours	.02	.10
Block 2: internet connectedness index (ICI)		
History and context		
Years own PC	−.04	
3G mobile internet access	.07	
Broadband access	.04	
Site scope	.06	
Scope and intensity		
Goal scope	.03	
Activity scope	.02	
Activity intensity	−.01	
Centrality		
Evaluation	.17**	
PC dependency	−.21***	
Internet dependency	−.05	.03
Block 3: information literacy		
Critical literacy	.13**	
Tool literacy	.11*	
Publishing literacy	.06	
Social-structural literacy	.18***	
Technology literacy	.02	.04
Block 4: new media use		
VCD and DVD viewing	.00	
Computer games playing	.13**	
Paid TV	−.11*	.02
Block 5: mass media use		
Newspaper reading	−.08	
TV watching	.14**	
Radio listening	.00	
Book reading	.05	.02
R^2		.23
Adjusted R^2		.21

$N = 756$

*** $P \leq .001$; ** $P \leq .01$; * $P \leq .05$

evaluate the Internet, the higher the life quality they will report. The IC block explained 3% of the variance. Information literacy is the third block, and the results show that people scoring high in quality of life tended to be people who are critical literates ($\beta = .13$, $P < .05$), tool literates ($\beta = .11$, $P < .05$), and social-structural literates ($\beta = .18$, $P < .001$). This block explained 4% of the variance. New media use and traditional media use were the fourth and fifth blocks in the analysis. The results show that computer gamers

($\beta = .13$, $P < .01$), non-pay TV subscribers ($\beta = -.11$, $P < .05$), and heavy TV viewers ($\beta = .12$, $P < .05$) were significant predictors, explaining 2% of the variance in each block. The hierarchical regression explained 21% of the variance in total.

5 Conclusions and Discussions

This paper investigated the inter-relationships among the concepts IC, information literacy, and quality of life. First, built on studies by Loges and Jung (2001) and Jung et al. (2001) which linked the IC concept to the digital divide and inequality, this study reported the development of a modified measure of the ICI. The new measure employs a comparable taxonomy of theoretical dimensions conceptualizing the importance of the Internet in one's life in a broader context, one that goes beyond the traditional dichotomous adoption, and time- and need-based measures. We believe that the new measure is more complete because it included additional indicators such as Internet access via 3G mobile phones and broadband, as the Internet is becoming increasingly ubiquitous. Another improvement is that the Internet activity scope is much wider and includes the trendy Internet applications of recent years, such as the use of instant messaging (IM), social network sites (SNS; e.g., Facebook and blogs), online news, and music and video downloads, in addition to BBS, MUDs/MOOs/MUSHs, and USENET as used in previous studies.

Second, exploratory factor analysis successfully confirmed the notion that information literacy is a multi-dimensional construct similar to the one proposed by Shapiro and Hughes (1996) and Dunn (2002). Findings suggest that information literate individuals, in addition to being technology literate, are typically able to (1) critically compare, evaluate, and judge the authenticity, credibility, and accuracy of information found on the Internet; (2) access, locate, retrieve, edit, and format information for a presentation; (3) create and communicate information in the form of a webpage and/or using multimedia such as on YouTube and through personal blogs; (4) understand the ethical and legal issues surrounding how information was produced in different social and cultural contexts; and (5) keep abreast of the latest developments in information technology products. Such results support past research that to be information literate, one must not only be competent in technology, but also possess skills that go beyond locating and using information, as suggested by Murray (2003), by having the knowledge to interpret and evaluate it.

Third, there was strong support for our expectation that information literacy would be significantly associated with IC. In particular, individuals who are familiar with the tools required to access, locate, and retrieve information online tended to have deeper connections to the Internet with greater PC experience, a wider scope of venues to Internet access, and to make a more positive evaluation of the Net in their lives. As expected, those who scored high in publishing and technology literacy tended to use the Internet to accomplish a large number of goals for social and self understanding, for action and interaction, and for play. This suggests that information literate people, especially in publishing and technology, generally use the Internet to socialize, interact, seek information, and for entertainment. Such users satisfy their social and psychological needs through various Internet activities such as instant messaging, using Facebook, blogs, online news, and music and video downloads. However, it is interesting to note that the lack of significant predictors (except a small influence from Internet dependency) for the critical and social-structural literacy dimensions of information literacy from various theoretical factors of IC highlight the inconsequentiality of Internet connectedness in impacting both critical literacy and social-structural literacy in our sample of Internet users. An

interpretation of this may be that the ability to critically evaluate information, and to be knowledgeable of the legal and ethical background of when and why information was created, is not influenced by how connected one is to the Internet. Thus, this research has practical implications for educators, both at the K-12 and university levels. Educators must recognize the urgency of the need for students to obtain such critical skills, not just technology literacy, before they leave school; these skills should be imparted by broad liberal studies (Mackey and Jacobson 2007).

Fourth, this study also supported the notion that information literacy is significantly linked to life quality. Specifically, Internet users who reported that they were more critical, tool, and social-cultural literate tended to enjoy a higher quality of life. This reinforces Internet users' profound belief, regardless of race, gender, and culture, in the fundamental right to the free flow of information and the importance of evaluating and judging if information is accurate and trustworthy. As expected, Internet users competent with Internet tools such as keyboarding, basic programming, knowledge and use of appropriate connectivity methods, networking, data bases, desktop publishing, and communication hardware and software tended to be knowledgeable in accessing the information necessary for making important life decisions (Lee et al. 2008; Murray 2003). These decisions may include getting information on school, university, or career training; helping to find or move work; getting information on a cure or treatment to deal with a major illness or health condition; making a major investment or financial decision; finding a way to save or to make money; and developing lasting interpersonal relationships and/or finding romance. As a result, this helps them enhance their life quality. In summary, as argued by Buckingham and Willett (2006), information literacy provides people with "awareness, analysis, reflection, action, and experience that leads to better critical skills such as comprehension, critical thinking, and informed judgments to discriminate all types of information" (p. 169).

Fifth, as a combined measure, ICI was not significantly linked to quality of life. This is why the study returned to micro-level analysis to examine the predictive power of individual variables within the broader concept of IC. The results indicate that variables such as history, context, and the scope and intensity of Internet use are insufficient for affecting perceived life quality. As indicated in Table 5, it is how one evaluates the Internet and its relationship to life and how one "does not" rely on a PC in one's job that determines life quality. One possible explanation is that the convenience and portability of personal computers in the form of notebooks allows the spillover of work into home, and this might negatively affect our perceived life quality.

Sixth, the main aim of this study was to compare the contribution of these independent variables to life quality. The hierarchical regression model included a number of important variables that tested the demographics, the breadth (i.e., the activity scope and goal scope), the depth (i.e., the activity intensity), and the centrality of IC. It also looked at the dimensions of information literacy, the use of new media and the traditional mass media to see if they have a significant effect on the quality of life. As reported earlier, the results found that both evaluations of the Internet and PC dependency had significant effects on quality of life. This supports the findings of past studies; those who have a positive attitude and past experience with the Internet (e.g., rely on the Internet for social support, reducing stress, social compensation, mood-management, leisure, and entertainment) rate higher on life quality (Leung 2007, 2008; Leung and Lee 2005). Although small, the information literacy block explained 2% of the variance, and it also had three significant predictors for life quality. It is important to point out that individuals who rate their life quality higher tended to be those who are literate in critical and social-structural skills and in evaluating

and judging information, and do not only have technical know-how. The IC and information literacy blocks together were the second most powerful predictors influencing the life quality perception; explaining a total of 7% of the combined variance after demographics. In contrast, being female, older, and well-educated explained 10% of the variance.

The remaining 4% of variance was accounted for by three media use variables. The exciting and interactive computer games and traditional entertainment from free TV were two significant variables predicting life quality. Paid TV was negatively linked to the quality of life. This indicates that the hectic work lifestyle in Hong Kong occupies much of our time, and that leaves little time for paid TV.

In the new multimedia environment, information literacy is arguably more important than ever. As Kellner (2002) puts it, information literacy can help people "to use information intelligently, to discriminate and evaluate media content, to dissect information forms critically, and to investigate media effects and uses" (p. 93). "Literacy thus involves gaining the skills and knowledge to read and interpret the text of the world and to successfully navigate and negotiate its challenges, conflicts and crises" (Kellner 2002, p. 92).

The results of the current study may partly demonstrate this ongoing social transition. Information literacy is a vital skill for e-learning and should be promoted by educators preparing students for careers and lifelong learning. As a result, young adults should have obtained the combination of technical and cognitive skills needed to be productive members of society and to enjoy a high quality of life in an information-rich, technology-based society.

6 Limitations and Suggestions for Future research

Although the conceptual relationships in this study are based on sound theoretical assumptions and are empirically supported, the present results should be interpreted in light of the methodological limitations of the study. First, although the findings are consistent with the predictions of information literacy and quality of life, they do not demonstrate a cause and effect relationship. Use of quasi-experimental and longitudinal designs would improve the strength of the findings. Second, it is important to note that future research should pay attention to the important moderating influences of the bidirectional nature of information literacy and IC as well as information literacy and quality of life.

Second, despite there being 13 information literacy items applied to this study, the failure to include other items from a list of 15 gathered in six dimensions in the literature (Shapiro and Hughes 1996; Dunn 2002) may be due to the social and cultural differences between Hong Kong and the West. Future research should consider items that are developed locally and are reflective of the characteristics of Internet users in their native culture. Studies could also entail a focused cross-cultural study comparing the differences between cultures in relation to distinct characteristics of information literacy. Third, identifying information literacy clusters using exploratory factor analysis is admittedly a weakness. Future research should undergo more rigorous testing, such as using confirmatory factor analysis, with alternative solutions and interpretations to make predictions or to test the presence of a hypothesized structure in a different population. Fourth, after controlling for demographics, the effect size from both Internet connectedness and information literacy in the multivariate regression analysis was still small at 7%. This indicates that further studies are needed to examine other predictors such as leisure activities, social support, social capital, and other aspects of standard of living which may also have significant effect on

overall life quality. Fifth, while this study treats quality of life as the ultimate dependent variable, future studies could also examine the possible effects of life quality on both information literacy and Internet connectedness.

Finally, social media and emerging technologies are gaining attention for use in education. The list of tools grows daily, and includes wikis, Ning, podcasts, Twitter, Second Life, cloud computing, surface computing, and mobile learning. Future studies should explore the potential, trends and implications of "social media" for learning so as to expand the meaning of the concepts of IC and information literacy.

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