



The Internet Vocabulary Test for Children: preliminary development

Internet
Vocabulary Test
for Children

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Abstract

Purpose – Currently, the only mechanisms to determine children's use of the Internet are interviews and questionnaires. To increase the validity of theory and research and ensure that practitioners and policy-makers are guided by accurate information, an improved method of determining children's patterns of Internet use is required. The purpose of this study is to present the Internet Vocabulary Test for Children (IVTC) as a measure of Internet use in children.

Design/methodology/approach – The IVTC requires oral definition of ten terms (Internet, gamer, e-mail, search engine, chat, online games, instant messaging, cheats, web site, browser). An elementary school in rural western Canada agreed to participate in trial administration of the IVTC. All children in first through sixth grade were invited to participate ($n = 149$). Parents completed a consent form and a questionnaire. A total of 128 children (62 males and 66 females) were administered the IVTC.

Findings – Trial administration of the IVTC established the viability of determining children's use of the Internet with a test of expressive vocabulary.

Originality/value – Given the rate of population penetration coupled with rapidly changing technology, measuring children's Internet use presents challenges. Simple solutions such as the development of software and firmware to monitor children's online behavior may provide misinformation. That is, surveillance influences behavior and children's Internet activities often involve multiple users. The IVTC is not vulnerable to biased responding, is inexpensive, and easily administered.

Keywords Internet, Assessment, Children (age groups), Canada

Paper type Research paper

With the help of a parent, 17 per cent of pre-school children have sent an e-mail message (Rideout *et al.*, 2003). When asked about their activities the previous day, 22 per cent of American 8 to 10 year old children indicated that they had visited web sites (Roberts *et al.*, 2005). Of Canadian 9 year-olds, 20 per cent access the Internet through their own personal computer (Media Awareness Network, 2006); 40 per cent of Australian children aged 4 to 6 years have been online for at least two years (Nielsen//Netratings Internet and Technology Report, 2005). All trends indicate that the number of children accessing the Internet and the amount of time they spend online are steadily increasing (Livingston and Bober, 2005; Statistics Canada, 2004; US Census Bureau, 2005). Not surprisingly, theorists (Johnson, 2006), researchers (Nie *et al.*, 2005), practitioners (Barone *et al.*, 2005), and policy-makers (Subcommittee on Telecommunications and the Internet, 2001) are increasingly focused on the impact of the Internet on child development.



Measuring children's Internet use

Currently, children's use of the Internet is determined in two ways; asking parents and asking children. For example, Roberts *et al.* (2005, p. 5) conducted "a nationally

representative survey of 3rd to 12th grade students, designed to explore their access to and recreational (non-school) use of a full range of media, including . . .the Internet". Rideout *et al.* (2003, p. 2) reported "a nationally representative random-digit-dial telephone survey of more than 1,000 parents of children ages six months through six years". Researchers with the Media Awareness Network (2006) obtained data from more than 5,000 students in grades 4 through 12 via in-class questionnaires that included rating scale items such as What information would you give to register on a game site (e-mail, real name and address, neither). With a fleet of specially trained assistants, Livingston and Bober (2005) collected Internet use data by face-to-face interviews with 1,500 young people and pencil-and-paper questionnaires completed by parents.

While such interview and questionnaire data is useful and frequently cited (e.g. Johnson, 2006), asking children and parents about children's Internet use has obvious limitations, not the least of which is biased responding (Henry *et al.*, 2002). Biased responding includes both conscience and unconscious distortions; respondents under-report or over-report behaviors based on personal values and beliefs (O'Rourke, 2003). For example, if children perceive the Internet as valued by adults, they may exaggerate the extent of their use. Equally, parents may believe that good parents know the details of their children's online behavior. Furthermore, questionnaire items reflect superficial treatment of complex behaviors (McNeill and Chapman, 2005) and inadvertently measure reading ability, attention, and motivation (Czaja and Blair, 2005). Rogers (2003) argued that improved description of online behavior necessarily includes user cognitive understanding and experiential interpretation of the Internet.

Improved measurement of children's Internet use may be guided by psycho-educational assessment instruments that assess individual understanding and experiential interpretation. For example, tests of children's cognitive development often include individually-administered measures of vocabulary (Reynolds and Kamphous, 2003). Such measures assess receptive vocabulary (understanding words), expressive vocabulary (defining words), or a combination of receptive and expressive items. For example, the Peabody Picture Vocabulary Test is a test of receptive vocabulary in which the child points to a picture that best depicts the meaning of a word orally presented by the examiner (Dunn and Dunn, 1997). The Expressive One Word Picture Vocabulary Test consists of 100 pictures of common objects which the child defines (Brownell, 2001). The Wechsler Intelligence Scale for Children includes an expressive vocabulary subtest in which children are asked to provide oral definitions of words (Wechsler, 2003). The Comprehensive Receptive and Expressive Vocabulary Test uses both the "point-to-the-picture-of-the-word-I-say" and "define-the-word-I-say" techniques (Wallace and Hammill, 2002).

Vocabulary tests are easily administered to children and, in the case of expressive vocabulary, require only a list of words and corresponding scoring criteria (Brownell, 2001; Reynolds and Kamphous, 2003; Wallace and Hammill, 2002). While vocabulary tests measure cognitive characteristics such as language and memory (Dunn and Dunn, 1997; Wechsler, 2003), they also reflect experience with activities and concepts (Das, 2002). Internet use is associated with specific vocabulary (Alderman, 2003). For example, NetLingo.com (2006) recently added a link, Top 20 Internet Acronyms Every Parent Needs to Know, which includes vocabulary such as P911 (parent alert).

Statement of the problem

Currently, the only mechanisms to determine children's use of the Internet are interviews and questionnaires. To increase the validity of theory and research and ensure that practitioners and policy-makers are guided by accurate information, an improved method of determining children's patterns of Internet use is required. The ability to define an Internet term (expressive vocabulary) indicates experience with that term, which may be interpreted as a metric of Internet involvement including, and most frequently, actual use of the Internet. This study explores the viability of using a vocabulary test to determine children's use of the Internet.

The Internet Vocabulary Test for Children

The Internet Vocabulary Test for Children (IVTC) is based on three assumptions:

- (1) The ability to define an Internet term may be interpreted as an indication of online behavior.
- (2) A limited number of vocabulary items increases test usability for examiners (e.g. researchers) and children (e.g. with short attention spans).
- (3) Patterns of Internet use can be determined with subsets of vocabulary items.

Selection of vocabulary items

Vocabulary selected for the IVTC emerged from the literature on children's Internet use. Reportedly, online communication is the most common use of the Internet for all populations including children (Statistics Canada, 2004; US Census Bureau, 2005). According to the National Center for Educational Statistics (2003), 65 per cent of users (38 per cent of all persons 5-17) use the Internet for e-mail or instant messaging. The second most frequent online activity is visiting web sites (Nie *et al.*, 2005). Approximately one-third of the time that children are online, they are navigating websites (Johnson, 2006). Playing video games is an increasing popular use of the Internet (Australian Government, 2005). A total of 84 per cent of American children aged eight to ten years live in households with at least one video game system (Roberts *et al.*, 2005). Selection of IVTC items and organization of sub-scores reflected the observation that children use the Internet "primarily for communication, information gathering, and games" (Tarpley, 2001, p. 551).

The IVTC items e-mail, chat, and instant messaging addressed the category of use referred to as Internet communication. Because chat and instant messaging occur in real-time (i.e. require simultaneous participation of communicators), such online communication is more common in older than in younger children (Roberts *et al.*, 2005). In this regard, children were expected to vary in their capacity to define the three Internet communication vocabulary items. The terms web site, browser, and search engine assessed website navigation. Web site is a common term, definable by children with minimal experience navigating sites; the ability to define the item search engine reflects more sophisticated Internet use; the capacity to define browser may identify children with extensive experience accessing web sites. Vocabulary terms associated with children and Internet games were not apparent in the literature. Four Internet users in early adolescence (two males and two females) were queried about terms used by children who play online games. The resultant items, online game, gamer, and

cheats measured children's experience with the category of use referred to as online games. The general vocabulary item Internet was included for a list of ten IVTC items.

Scoring and scores

Children's definition of each vocabulary item received a score as 0 for no evidence of understanding, 1 for some indication of understanding (e.g. specific example), and 2 for the provision of an accurate and complete definition. Full score was obtained by summation of the scores achieved on all ten vocabulary items and could potentially range from 0 to 20. Each sub-score (i.e. Internet communication, web site navigation, and online games) included three vocabulary items; scores potentially ranged from 0 to 6. Table I presents IVTC items and scoring criteria.

Scores and vocabulary items	Scoring criteria
<i>Internet communication (sub-score)</i>	
E-mail	Definition (2 points): use the Internet to send a message/letter/note to someone. Function/example (1 point): specific e-mail address, type on computer to talk to someone.
Chat	Definition (2 points): talk/communicate/type in real time (do not have to wait) on Internet/computer. Function/example (1 point): talk/communicate/type on Internet/computer
Instant messaging	Definition (2 points): talk/communicate/type in real time (do not have to wait) on Internet/computer. Function/example (1 point): MSN messenger, talk/communicate/type on Internet/computer
<i>Web site navigation (sub-score)</i>	
Web site	Definition (2 points): set of interconnected web pages. Function/example (1 point): www; place on the Internet to get stuff
Browser	Definition (2 points): program to view/navigate/access/display hypertext, HTML, files, data on Internet. Function/example (1 point): Netscape Navigator
Search engine	Definition (2 points): get Internet or www documents. Function/example (1 point): site/place/type in words on Internet to help you find stuff
<i>Online games (sub-score)</i>	
Online game	Definition (2 points): game played online/Internet. Function/example (1 point): name of specific game
Gamer	Definition (2 points): person who plays games online/Internet/computer. Function/example (1 point): person who plays (name of specific game)
Cheats	Definition (2 points): codes to cheat (get information) on a computer/Internet game. Function/example (1 point): helps you win (name of specific game); get stuff that tells you about game
<i>Full score – all items above plus:</i>	
Internet	Definition (2 points): network; connected computers. Function/example (1 point): place on the computer where you get information, play games, do research

Table I.
The Internet vocabulary test for children: scores and scoring

Trial administration

An elementary school in rural western Canada agreed to participate in trial administration of the IVTC. All children in first through sixth grade were invited to participate ($n = 149$). Parents completed a consent form and a questionnaire.

Test subjects

A total of 128 (62 males and 66 females) were administered the IVTC. Children ranged in age from six years, three months, 26 days to 12 years, four months, 28 days (mean nine years, six months, 12 days). With respect to the sample of children: 14.8 per cent were in first grade; 12.5 per cent were in second grade; 15.6 per cent were in third grade; 25.0 per cent were in fourth grade; 16.4 per cent were in fifth grade; 15.6 per cent were in sixth grade. Of the 128 children, 12 were funded for special learning needs (e.g. communication disorder, learning disability, behavioral disorder, medical condition).

Approximately 83 per cent of children lived in families defined by their parents as traditional, 11.7 per cent blended, 3.6 per cent single-parent, and 1.8 per cent other. The average number of people residing in each household was 3.67 (SD 0.95). Slightly more than 70 per cent of mothers and 96 per cent of fathers reported being employed. On a rating scale ranging from 1 (elementary school) to 7 (university), average education rating suggested most mothers completed high school and most fathers left high school one semester prior to graduation. Average annual family income was reported between \$60, 000 and \$80,000.

Approximately 83 per cent of families reported home Internet access and, of those, almost 90 per cent indicated that their child used the Internet at home (all children used the Internet at school and the school had high speed Internet connection). On average, parents reported having home Internet access for 5.2 years (minimum two months, maximum 12 years, SD 2.96). Almost 86 per cent of parents with home Internet connection reported dial-up service; 14.2 per cent reported high speed service. A total of 82 per cent of families had wired Internet connection, 11 per cent had wireless, and 7 per cent had both wired and wireless connection. Slightly less than 80 per cent of families reported one home computer (mean 1.3, maximum 7).

The rating scale item, my child uses the Internet at home, included five response-options (rarely, several times a year, monthly, weekly, daily). Parents, on average, expressed the perception that their child used the Internet at home monthly (mean rating 3.01). Based on a rating scale item that ranged from 1 (a few minutes) to 5 (many hours), parents, on average, expressed the perception that when their child used the Internet at home, he/she was online for approximately 40 minutes. In response to the questionnaire item, I am happy with what my child does when he/she is online, 2.2 per cent of parents selected the negative response-option and indicated they wished their child engaged in more educational online activities. With respect to the amount of time their child used the Internet at home, 89.7 per cent of parents were satisfied, 6.9 per cent wanted child use to increase, and 3.4 per cent wanted child use to decrease.

Test administration and scoring

IVTC administration occurred during regular school hours in private offices with minimal distractions. A psychologist with extensive child assessment experience and a psychology student with IVTC training tested children individually. Rapport was initiated by in-class introduction of examiners, explanation of testing procedures, and

response to class questions. Rapport was further established by individual child-examiner interaction walking from the classroom to the testing room and as required on entry into the testing room. The psychologist tested all children with special needs and most of the youngest children. Examiners wrote the exact words (definition) that each child provided to orally-presented Internet vocabulary items. The IVTC developer scored all protocols.

Table II provides the proportion of students achieving each score and the mean score for each IVTC item. Of the 128 children asked to define the word browser, only one child indicated any degree of familiarity with the term. In this regard, the item did not provide sufficient variability across children to be considered an indicator of Internet use. Further, scoring criteria resulted in no child obtaining a maximum score (2) on three items (Internet, web site, and browser) and many children obtaining a score of 1 on two items (Internet and e-mail). In some cases, IVTC scoring criteria appeared to restricted variability of scores; not a desirable test characteristic.

Internal consistency of IVTC scores

Table III provides Cronbach alpha coefficients for IVTC scores. In general, the ten Internet vocabulary items (full score) had internal consistency, suggesting that they measured a relatively unified construct (e.g. Internet use). Proposed sub-scores, however, lacked internal consistency, particularly with respect to web site navigation. That is, children's scores on the vocabulary items that assessed familiarity with using the Internet to access web sites (i.e. web site, search engine, and browser) were largely unrelated. Child familiarity with such terms, or lack thereof, did not reflect a single behavior (i.e. experience navigating web sites).

Table IV presents Pearson-Product Moment correlations for the scores children obtained on each vocabulary item and the four IVTC scores. Scores on IVTC items

Table II.
Proportion of test subjects achieving scores and mean score for each vocabulary item

Vocabulary item	0 points (%)	1 point (%)	2 points (%)	Mean
Internet	19.5	80.5	0.0	0.80
Gamer	89.8	3.9	6.3	0.16
E-mail	21.1	56.3	22.7	1.02
Search engine	84.4	14.8	0.8	0.16
Chat	73.4	13.3	13.3	0.40
Online game	35.9	12.5	51.6	1.16
Instant messaging	69.5	13.3	17.2	0.48
Cheats	64.1	7.8	28.1	0.64
Web site	30.5	69.5	0.0	0.70
Browser	99.2	0.8	0.0	0.01

Table III.
Coefficients of internal consistency for the Internet Vocabulary Test for Children

Score/sub-score	Number of items	Alpha
Full score	10	0.743
Internet communication	3	0.580
Web site navigation	3	0.194
Online games	3	0.539

	Internet	Gamer	E-mail	Search engine	Chat	Online game	Instant message	Cheats	Web site	Browser	Full score	Internet communication	Web site navigate	Online games
Internet														
Gamer	0.34***				0.22**	0.47***	0.28**	0.22**	0.45***		0.55***	0.35***	0.38***	0.40***
E-mail					0.23**	0.23**	0.34***	0.28**	0.27**	0.32***	0.37***	0.71***	0.33***	0.49***
Search engine					0.30***	0.37***	0.36***	0.15*	0.19*	0.45***	0.59***	0.43***	0.73***	0.21**
Chat					0.30***	0.28**	0.32***	0.31***	0.20**	0.61***	0.73***	0.73***	0.38***	0.36***
Online game					0.36***	0.30***	0.36***	0.45***	0.32***	0.76***	0.76***	0.46***	0.40***	0.83***
Instant messaging								0.41***	0.30***	0.18*	0.68***	0.77***	0.45***	0.43***
Cheats									0.29**		0.67***	0.46***	0.24**	0.80***
Web site											0.52***	0.35***	0.77***	0.32***
Browser											0.22**	0.17*	0.15*	0.21**
Full score												0.85***	0.66***	0.85***
Internet communication													0.53***	0.51***
Web site navigation														0.38***

Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table IV.
Correlations among IVTC
scores and sub-scores

intended to measure Internet communication (e-mail, chat, and instant messaging) were strongly and consistently related to Internet communication sub-scores. Scores on items intended to measure Internet game experience (gamer, online game, and cheats) were strongly but less consistently related to online games sub-scores. Scores on items intended to measure web site experience (search engine, web site, and browser) were inconsistently related to website navigation sub-scores. Children's ability to define the term browser was modestly ($r = 0.15$, $p < 0.05$) related to web site navigation sub-scores (although that was the construct the item intended to measure). Relationships, or lack thereof, between IVTC scores and sub-scores further call into question the utility of the term browser and the validity of the proposed sub-score web site navigation.

Criterion validity

Validity of the IVTC was assessed in terms of expected relationships. For example, children who used the Internet at home were expected to have more Internet experience and thus score higher on the IVTC than children who did not use the Internet at home (Internet use at school was assumed equivalent). Child characteristics (age and extent of home use) and home characteristics (number of computers, high speed versus dial-up connection, and number of years of Internet access) were also expected to relate to IVTC scores. Child age was determined via school records; all other child and home characteristics were determined by parental questionnaires.

As presented in Table V, children who used the Internet at home, in many cases, had higher IVTC scores than children who did not use the Internet at home. For example, some children who used the Internet at home correctly defined the term search engine; no child who did not use the Internet at home expressed any understanding of the term. Such significant differences suggest that many IVTC scores are valid measures of children's Internet use. Further, a significant difference in vocabulary scores emerged between children with high speed and those with dial-up home Internet connection. The average score on the IVTC item gamer was 0.56 for the 91 children with dial-up connectivity and 1.07 for the 15 children with high speed connectivity ($t = -2.08$, $df = 104$, $p = 0.04$). Since Internet games require bandwidth

Table V.
IVTC scores for children grouped according to parental response to the questionnaire item "Does your child use the Internet at home?"

IVTC Score	Max. score	Parental response = Score		<i>t</i>	df	<i>p</i>
Internet	1	Yes = 0.86	No = 0.67	2.51	126	0.014
Gamer	2	Yes = 0.18	No = 0.11			
E-mail	2	Yes = 1.08	No = 0.86			
Search engine	2	Yes = 0.23	No = 0.00	3.06	126	0.003
Chat	2	Yes = 0.46	No = 0.25			
Online game	2	Yes = 1.32	No = 0.75	3.22	126	0.002
Instant messaging	2	Yes = 0.58	No = 0.22	2.37	126	0.019
Cheats	2	Yes = 0.67	No = 0.56			
Web site	1	Yes = 0.76	No = 0.53	2.63	126	0.010
Browser	1	Yes = 0.01	No = 0.00			
IVTC full score	14	Yes = 6.14	No = 3.94	3.34	126	0.001
Internet communication	6	Yes = 2.11	No = 1.33	2.54	126	0.012
Web site navigation	3	Yes = 1.00	No = 0.53	3.85	126	0.000
Online games	6	Yes = 2.17	No = 1.42	2.26	126	0.026

and are most often played at home as opposed to school, such a significant difference confirmed the validity of the term as a metric of experience playing online games.

As presented in Table VI, measures of child and home Internet characteristics provided by parents did not consistently related to IVTC scores. On the one hand, it may be that the IVTC lacked criterion validity; on the other hand, parents may not have provided accurate information about their children’s use of the Internet. Indeed, number of home computers with Internet connection and number of years of home Internet access (objective questionnaire items) were more consistently associated with IVTC scores than parental indication of the frequency and duration of child home Internet use (subjective evaluation with questionnaire items vulnerable to biased responding). As previously noted, parents do not necessarily provide accurate information with respect to their children’s behavior (Henry *et al.*, 2002). In this regard, lack of relationships to subjective criterion may not necessarily reflect lack of test validity.

Age is related to experience and to the development of cognitive processes necessary to store and retrieve (remember) information (vocabulary) related to experience. Summarized in Table VI, scores on eight of the ten Internet vocabulary items were moderately correlated with age, suggesting that Internet use was related to age but that age alone did not explain most of the variation in IVTC scores. Scores on the Internet vocabulary item browser were not related to child age, further confirming lack of validity of the term as a metric of Internet use in children. Scores on the Internet vocabulary item gamer were minimally related to child age ($r = 0.16$, $p < 0.05$). Gender differences were subject to further analysis.

Gender differences in online behavior are frequently reported (Kennedy *et al.*, 2003; National Center for Educational Statistics, 2003; Roberts *et al.*, 2005). Independent sample *t*-tests identified four significant differences in IVTC scores between boys and girls, all of which are explained by male dominance of Internet games (Farley-Gillispie and Gackenbach, 2006). On two vocabulary items (gamer and cheats), males scored

Scores	Child age	Child access frequency	Child access duration	Number of computers	Years of access
Internet	0.58***				
Gamer	0.16*			0.26**	
E-mail	0.50***				
Search engine	0.30***				
Chat	0.52***	0.33*			0.19*
Online game	0.56***				
Instant messaging	0.30***	0.20*		0.17*	
Cheats	0.46***			0.26**	0.31**
Web site	0.48***	0.23*		0.18*	0.27**
Browser			-0.18*		
IVTC full score	0.75***	0.28**		0.24**	0.28**
Internet communication	0.63***	0.31**		0.17*	0.19*
Web site navigation	0.53***				0.20**
Online games	0.59***	0.26**		0.30**	0.26**

Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table VI.
Correlations between
IVTC scores and
child/home
characteristics

higher than females (0.27 versus 0.06, $t = 2.393$, $p = 0.018$ and 0.97 versus 0.33, $t = 4.278$, $p = 0.000$, respectively). Further, average IVTC full score and online games sub-score were higher in males than females (6.16 versus 4.92, $t = 4.278$, $p = 0.000$ and 2.53 versus 1.42, $t = 2.037$, $p = 0.044$, respectively). On the one hand, it may be that a valid measure of children's Internet use must include separate forms for males and females, as is the case with measurement of some constructs in children (e.g. self-esteem; Stager and Young, 1982). On the other hand, the observed gender differences may reflect the validity of the IVTC which captures differences known to exist.

Sub-score validity

Only one child obtained a score greater than zero on that IVTC item browser. This outlier was a sixth grade male, unremarkable (average parent level of education, below average family income, traditional family structure, one home computer with dial-up connectivity) except for obtaining the highest IVTC full score (14/20). Removal of the outlier prior to principal component analysis required removal of the vocabulary item browser since remaining scores did not vary (all scores were zero). As presented in Table VII, the remaining nine Internet vocabulary items did not factor into the three proposed IVTC sub-scores (Internet communication, web site navigation, and online games). Rather, items clustered into two principal components that collectively accounted for 47.4 per cent of the variance in children's scores.

Related to measures of internal consistency (full score alpha coefficient 0.743), the first principal component accounted for 34.5 per cent of the variance of IVTC item scores and confirmed that items measured a single behavior such as Internet use. The second component was weighted on the item gamer and inversely weighted on the item search engine. A plausible interpretation of such components is that there are two types of Internet use in children; general-integrated-use which includes communicating, visiting web sites, and playing games and games-only-use which precludes online communication and website navigation. Games-only use may restrict Internet experience and result in limited capacity to define Internet vocabulary. Internet use in children may not be meaningfully organized in terms of specific applications but, rather, requires consideration of more general patterns of use. Future factor analytic studies with increased Internet terms and large samples of children may

Vocabulary item	Component 1	Component 2
Internet	0.623	0.361
Gamer	0.021	0.624
E-mail	0.627	-0.198
Search engine	0.458	-0.577
Chat	0.580	-0.282
Online game	0.739	0.210
Instant messaging	0.662	-0.263
Cheats	0.607	0.121
Web site	0.628	0.235

Table VII.
Principal component
analysis of IVTC items

Note: With one outlier removed, the vocabulary item browser had no variance and was removed from analysis

provide more descriptively accurate organization of actual patterns of Internet use in children.

Conclusion and future IVTC development

Given the rate of population penetration (Internet Usage Stats, 2006) coupled with rapidly changing technology (Tuomi, 2006), measuring children's Internet use presents challenges. Simple solutions such as the development of software and firmware to monitor children's online behavior may provide misinformation. That is, surveillance influences behavior (Rosnow and Rosenthal, 1997) and children's Internet activities often involve multiple users (Roberts *et al.*, 2005). The IVTC is not vulnerable to biased responding and individual children are assessed. An obvious assessment approach may be the development of an Internet skills inventory for children. As is the case with other skill inventories for children (e.g. Brigance, 1999), satisfying specific directives (e.g. open a search engine) may provide a metric of Internet use. Such an approach, however, requires a computer with Internet connection, is time-consuming to administer, and specific directives may quickly become obsolete due to frequent changes in Internet technology. The IVTC requires no equipment and is easy to administer, although vocabulary items may require frequent modification due to technical innovation.

To date, research has painted a one-dimensional picture of children's use of the Internet. Such research has focused on describing Internet use in terms of specific activities such as playing games (e.g. Martinsons, 2005) or developmental outcomes in relation to specific Internet uses such as visiting chat rooms (e.g. Merchant, 2001). Children's use of the Internet is "a new field of inquiry in developmental psychology" (Greenfield and Yan, 2006, p. 391). Internet use reportedly impacts children's social (Cassell *et al.*, 2006), emotional (Whitlock *et al.*, 2006), and cognitive development (Johnson, 2006). The value of research findings is related to the validity of research instruments.

Trial administration of the IVTC established the viability of determining children's use of the Internet with a measure of expressive vocabulary. However, selection of vocabulary based on review of the literature resulted in test items that did not consistently discriminate across children (e.g. browser). Additionally, scoring criteria may be improved by reference to children's definitions of Internet terms rather than standard adult definitions. Further, IVTC sub-scores reflected a simplistic approach to organizing Internet use in children (Internet communication, web site navigation, online games). Results of the current investigation suggest that a meaningfully organization of Internet use in children may be general-integrated-use and games-only-use.

Subsequent research may address a fundamental limitation of the study. That is, children's ability to define Internet terms was validated by parental report of at-home Internet use. The limitation in logic is circular; how is children's use of the Internet to be determined so that the accuracy of IVTC scores as a measure of use can be validated? Next year, with refined vocabulary items and scoring criteria, the IVTC will be re-administered to children in the same rural elementary school. In addition to evaluation of IVTC refinements, individual child improvement in ability to define terms will be determined by comparing scores across administrations. Longitudinal (individual change over the course of one year) and cross-sectional (first grade children

in 2006 and 2007) comparisons are expected to enhance the psychometric properties of the IVTC and to contribute, generally, to improved understanding and assessment of children's Internet use.

References

- Alderman, J. (2003), "A brief Internet vocabulary", University of Northern Florida, available at: www.unf.edu/~alderman/TheInternet/vocabulary.html
- Australian Government (2005), *The Current State of Play*, Department of Communications, Information Technology, and the Arts, Canberra, available at: www.dcita.gov.au/__data/assets/pdf_file/33120/CSP2005.pdf
- Barone, D.M., Hong Xu, S. and Mallette, M.H. (2005), *Teaching Early Literacy: Development, Assessment, and Instruction*, Guilford, New York, NY.
- Brigance, A.H. (1999), *Diagnostic Comprehensive Inventory of Basic Skills*, Curriculum Associates, North Billerica, MA.
- Brownell, R. (2001), *Expressive One-Word Picture Vocabulary Test*, Academic Therapy Publications, Novato, CA.
- Cassell, J., Huffaker, D., Tversky, D. and Ferriman, K. (2006), "The language of online leadership: gender and youth engagement on the Internet", *Developmental Psychology*, Vol. 4, pp. 436-49.
- Czaja, R. and Blair, J. (2005), *Designing Surveys: A Guide to Decisions and Procedures*, Sage Publications, Thousand Oaks, CA.
- Das, J.P. (2002), "A better look at intelligence", *Current Directions in Psychological Science*, Vol. 11, pp. 28-32.
- Dunn, L.M. and Dunn, L.M. (1997), *Peabody Picture Vocabulary Test*, 3rd ed., American Guidance Service, Circle Pines, MN.
- Farley-Gillispie, J. and Gackenbach, J. (2006), *Cyber Rules: Negotiating Healthy Internet Use*, W.W. Norton, New York, NY.
- Greenfield, P. and Yan, Z. (2006), "Children, adolescents, and the Internet: a new field of inquiry in developmental psychology", *Developmental Psychology*, Vol. 42, pp. 391-4.
- Henry, S.L., Smith, E.A. and Hopkins, A.M. (2002), "The effect of active parental consent on the ability to generalize the results of an alcohol, tobacco, and other drug prevention trial to rural adolescents", *Evaluation Review*, Vol. 26, pp. 645-55.
- Internet Usage Stats (2006), "World Internet users and population stats", available at: www.Internetworldstats.com/stats.htm
- Johnson, G. (2006), "A theoretical framework for organizing the effect of the Internet on cognitive development", *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2006, AACE, Norfolk, VA*, pp. 3041-8.
- Kennedy, T., Wellman, B. and Klement, K. (2003), "Gendering the digital divide", *IT and Society*, Vol. 1, pp. 72-96, available at: www.stanford.edu/group/siqss/itandsociety/v01i05.html
- Livingston, S. and Bober, M. (2005), *UK Children Go Online: Emerging Opportunities and Dangers*, London School of Economics, London, available at: www.children-go-online.net
- McNeill, P. and Chapman, S. (2005), *Research Methods*, Routledge, New York, NY.
- Martinsons, M.G. (2005), "Online games transform leisure time for young Chinese", *Communications of the ACM*, Vol. 48, p. 51.

- Media Awareness Network (2006), *Young Canadians in a Wired World*, Media and Internet Education Resources, Ottawa, available at: www.media-awareness.ca/english/research/YCWW/phaseII/key_findings.cfm
- Merchant, G. (2001), "Teenagers in cyberspace: an investigation of language use and language change in Internet chatrooms", *Journal of Research in Reading*, Vol. 24, pp. 293-306.
- National Center for Educational Statistics (2003), *Computer and Internet use by Children and Adolescents in 2001: Statistical Analysis Report*, US Department of Education, Jessup, MD, available at: <http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2004014>
- NetLingo.com (2006), *Welcome to NetLingo the Internet Dictionary*, available at: www.netlingo.com/index.cfm
- Nie, N.H., Simpsen, A., Stepanikova, I. and Zheng, L. (2005), *Ten Years after the Birth of the Internet, How Do Americans Use the Internet in Their Daily Lives?*, Stanford Institution for the Quantitative Study of Society, Stanford, CA.
- Nielsen/Netratings Internet and Technology Report (2005), "Australian kids overtake parents online", available at: www.nielsen-netratings.com/pr/pr_050808_au.pdf
- O'Rourke, N. (2003), "Biased responding, neuroticism, and perceived control among older adults", *Current Research in Social Psychology*, Vol. 9, available at: www.uiowa.edu/~grpproc/crisp/crisp.9.5.html
- Reynolds, C.R. and Kamphous, R.W. (2003), *Handbook of Psychological and Educational Assessment of Children: Intelligence, Aptitude, and Achievement*, Guilford, New York, NY.
- Rideout, V.J., Vandewater, E.A. and Wartella, E.A. (2003), *Zero to Six: Electronic Media in the Lives of Infants, Toddlers and Pre-schoolers*, The Henry J. Kaiser Family Foundation, Menlo Park, CA, available at: www.kaisernetwork.org/health_cast/uploaded_files/102803_kff_kids_report.pdf
- Roberts, D.F., Foehr, U.G. and Rideout, V. (2005), *Generation M: Media in the Lives of 8-18 Year Olds*, The Henry J. Kaiser Family Foundation, Menlo Park, CA, available at: www.kff.org/entmedia/loader.cfm?url=/commonspot/security/getfile.cfm&PageID=51809
- Rogers, B.L. (2003), "Measuring online experiences: it's about more than time!", *Usability News*, Vol. 5 No. 2, available at: <http://psychology.wichita.edu/surl/usabilitynews/52/experience.htm>
- Rosnow, R.L. and Rosenthal, R. (1997), *People Studying People: Artifacts and Ethics in Behavioral Research*, W.H. Freeman, New York, NY.
- Stager, S. and Young, R.D. (1982), "A self-concept measure for preschool and early primary grade children", *Journal of Personality Assessment*, Vol. 5, pp. 536-43.
- Statistics Canada (2004), *Household Internet Use Survey*, available at: www.statcan.ca/Daily/English/040708/d040708a.htm
- Subcommittee on Telecommunications and the Internet (2001), *E-rate and Filtering: A Review of the Children's Internet Protection Act. Serial No. 107-33*, US Government Printing Office, Washington, DC.
- Tarpley, T. (2001), "Children, the Internet, and other new technologies", in Singer, D.G. and Singer, J.L. (Eds), *Handbook of Children and the Media*, Sage, Thousand Oaks, CA, pp. 547-56.
- Tuomi, I. (2006), *Networks of Innovation: Change and Meaning in the Age of the Internet*, Oxford University Press, New York, NY.
- US Census Bureau (2005), *Computer and Internet use in the United States: 2003*, available at: www.census.gov/prod/2005pubs/p23-208.pdf

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17,3

Wallace, G. and Hammill, D.D. (2002), *Comprehensive Receptive and Expressive Vocabulary Test*, Pro-Ed, Austin, TX.

Wechsler, D. (2003), *Wechsler Intelligence Scale for Children*, 4th ed., Harcourt Assessment, San Antonio, TX.

Whitlock, J.L., Powers, J.L. and Eckenrode, J. (2006), "The virtual cutting edge: the Internet and adolescent self-injury", *Developmental Psychology*, Vol. 42, pp. 407-17.

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