National Institute for Literacy

INVESTIGATING THE
Language and Literacy Skills
REQUIRED FOR INDEPENDENT ONLINE LEARNING

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Executive Summary

This investigation was undertaken to investigate the threshold levels of literacy and language proficiency necessary for adult learners to use the Internet for independent learning. As the investigation unfolded, it became apparent that the *interaction* among the learners' skills, the opportunities they encounter, and the supports available determines those thresholds. Understanding how to balance those elements can create new options and opportunities for learning, instruction, program planning, and content development.

This report is structured around three distinct sections that contribute to the investigation: learning from large-scale surveys, learning from the literature, and learning from the field. Triangulating from the three major data sources affords this report solid footing on which to draw key findings from the guiding research questions. The search for thresholds revealed that such thresholds did not exist: Learners at even the lowest levels of literacy and language proficiency can engage with online learning content. Moreover, all reports indicate that they are eager to do so and that they benefit in important ways, such as self-confidence, self-directedness, and independence. Adult learners across the literacy and language spectrum show strong motivation to gain computer literacy skills, perceived as key to work advancement.

Limitations of this report include the gap between the rapid pace of change in technology trends, access patterns among American adults, and delivery platform options develop and the relatively slower pace of data collection, published evaluations, and program planning, rendering guidance from literature difficult. And while this report is not an attempt at an exhaustive literature review, it is clear that the literature base is broad rather than deep, hampering efforts to draw clear conclusions.

The report concludes with the following key findings and the hope that it can join other voices moving the field toward a discussion of evidence-based technology-enhanced solutions.

- Understanding the interrelatedness of the task, skill, and supports necessitates research and development to guide the design of learning environments and activities that are flexible and that can differentiate on all three dimensions. Experimenting with flexible supports, both human and technological—the variable most accessible to adjustments by educators, program managers, and Web designers—is likely to yield a wealth of information to guide further development.

- The centrality of work readiness—what the British call "upskilling"—to adults' learning lives provides a key leverage point for programming and content design to address this goal more directly and, through it, more basic literacy and language skills.

- Adults' existing family and social networks that have proven critical to learning pursuits with technology provide another leverage point that could be tapped with community-based, authentic learning environments, activities, and products.

- Self-directed skills valued in lifelong learners can be nurtured by providing facilitated access to online, independent learning environments. The studies converge on the findings that engagement with these environments fostered the skills associated with successful self-directed learning.

- The large numbers of visitors to the freely available online sites such as *English for All*, *TV 411*, and California Distance Learning Project Online indicate that users are finding them. However, evaluation data are needed to determine how users are interacting and learning with the material and whether these sites are or could be stepping stones into more formal courses of study.

- Rates of access and connectivity in the low-income community are definitely growing, yet high-quality equipment and broadband or wireless access are far from ubiquitous. This reality constrains development and dissemination of online learning portals and sites. Findings from the United Kingdom (Selwyn, Gorard, & Furlong, 2006) do not support an expanded use of public Internet terminals by the low literacy and language proficiency population as a solution to this problem.

- The use of emerging technologies to deliver learning content is only beginning to be reported in the research literature (for example, Kambouri, Mellar, & Logan, 2006). Nevertheless, technology enthusiasts believe strongly that consumer electronics (such as cell phones and personal digital assistants [PDAs]), interactive Web 2.0 platforms (such as blogs, videoconferencing, and immersive environments), and the convergence of media (such as television and radio delivered over the Internet) have the potential to reach new populations and provide authentic learning and communication.

Online environments engage and inspire adults, serve the common adult goal of improving workforce readiness, provide authentic communication channels that tap into adults' family and community involvement, and supply an opportunity to engage in self-study and informal learning. We have confirmation that we are headed in the right direction with the inclusion of online technologies for the instruction and engagement of adult learners, even those with the most limited skills and language proficiencies. What is missing is research and evaluation that could provide guidance on content design and flexible supports to serve users' needs and create new options and opportunities for learning, instruction, program planning, and content development.

Introduction

This report captures a panoramic view of the inter-action of language and literacy proficiency levels and online learning participation among adults with low literacy and low English proficiency. Describing this interaction is of high interest to program managers and practitioners interested in supporting learners not yet enrolled in their programs or during periods of attendance gaps, and for supplementing classroom instruction. Each of these implementation environ-ments poses unique challenges and user expectations for the literacy and language learner. Policymakers are equally intent on the potential of online learning as they look for ways to boost system capacity to meet the needs of a growing population of adult learners.

Both learners and service providers are looking to capitalize on the potential of the Internet and com-puter technology to address the vast needs of adult literacy and language learners. Many practitioners and researchers see technology-enhanced teaching and learning, including distance education, as the future of adult basic, English for Speakers of Other Languages (ESOL), and continuing education, as well as a means of reaching the large numbers of adults who do not participate in formal adult and continu-ing education offerings.

However, the digital divide remains particularly wide in the low-income, low-literacy, and limited English proficiency communities. Access to com-puters and the Internet has improved dramatically around the country, but the explosion of content requiring robust bandwidth and processing speed as well as text at high readability rates continues to fuel the divide. According to 2003 U.S. Census data (Day, Janus, & Davis, 2005), the majority of American households now have computers (62%) and Internet access (54%). These percentages are up from 51% and 41.5%, respectively, in 2000. Yet when disaggregated for family income and head of household's educa-

tional attainment (important correlates for the adult education student population), the rates are signifi-cantly lower. Among households earning less than $25,000, only 41% have a computer and only 30.7% have Internet access. Among households headed by someone with less than a high school education, only 27.9% have a computer and 20.2% have Internet access.

The Children's Partnership (http://www.chil-drenspartnership.org/) studied the existence of acces-sible and relevant online content for the estimated 50 million Americans with low income, low literacy, or low English proficiency. Youth and adults in the low-income, low-literacy communities engaged with the Partnership to identify the lack of local information and cultural diversity on the Web as significant barri-ers to access and involvement with online content. By analyzing online content, the Partnership also identi-fied literacy and language barriers in high readabil-ity levels and few sources of content in languages other than English. In 2000, they found that only 1% of all Internet content was accessible or relevant to this large underserved population (Lazarus & Mora, 2000). On the update to their survey in 2002, they found improvements; the percentage of accessible and relevant online content for users with low lit-eracy skills had increased to 5%, but the gap persisted (Children's Partnership, 2002). The update also high-lighted the emerging necessity for more user-friendly search engines and syndication portals, a topic that was heard repeatedly through this investigation. The lack of accessible content limits adult learners' ability to turn to the Internet for self-study and learning opportunities.

Growing use and access for all subgroups—in the home, in a community venue, and at work—is a trend that is undeniably creating opportunities. Understanding the use, access, and connectivity pat-

terns and rates for various subgroups of the adult population could greatly inform policy and program planning. Understanding the challenges that online content presents to adults with low literacy and English language skills could also inform instruction and content development.

This investigation was undertaken to investigate the threshold levels of literacy and language proficiency necessary for adult learners to use the Internet for independent learning. It synthesizes a wide range of information that fits broadly into three perspectives: learning from large-scale surveys; learning from the literature; and learning from the field. The first section offers the widest angle of view, taking in the entire adult landscape at all literacy and language proficiency levels to see what learning the population as a whole is engaged in and what role technology plays. The report then shifts focus and looks at the research literature on the use of online technologies in adult literacy and language learning. However, adults who are not participating in formal education are largely lost from this view, as the research is nearly completely based on students in programs. The third perspective is found in the voices of practitioners—content developers and educators. Their experiences involve adult learners and can represent the challenges that learners encounter. By triangulating from these three perspectives, the overall panorama is brought into sharper focus and the report can speak to the findings and inferences with greater confidence.

As the investigation unfolded, it became apparent that it is the *interaction* among the learners' skills, the opportunities they encounter, and the supports available that determines threshold levels of literacy and language proficiency. Understanding how to balance those elements can create new options and opportunities for learning, instruction, program planning, and content development.

For the purposes of this investigation and report, key terms were defined as follows:

- **Online:** Activities for which Web-based content and Internet connection and interactivity are integral to the experience for at least a portion of the engaged time.

- **Independent:** Activities that users engage in outside of class time, including supplemental activities, activities recommended by instructors or program personnel, or activities unconnected to class work or programs; the term "independent" does not necessarily mean that learners must work alone, as learners could work with friends, family members, or others to accomplish their goals.

- **Learning:** Activities that are either self-directed inquiries and pursuits (searches, leisure/hobby perusals) or self-study toward an academic or credentialing goal.

- **Success:** Activities that left the learners feeling satisfied that they had fulfilled a question or search, found helpful information, or advanced target skills.

METHODS

Acknowledging the underdeveloped knowledge base about the research questions, this investigation encompassed a broad range of data sources and included in its parameters research and findings from other English-speaking industrial societies with comparable adult education systems. The guiding framework of parameters for this investigation coalesced around the following set of questions to guide the literature review and search for additional sources:

- Is there a threshold of basic skills for successful online learning?

- Is there a threshold of English language proficiency for successful online learning?

- What implementation and design issues have been documented to show online learning by populations with low literacy and low English language skills?

- What do we know about this population's informal learning habits?

These questions were used flexibly as a start to a constant comparison method of data collection. As literature searches were returned or listserv postings were found, each data point's relation to these themes was considered. A multipage spreadsheet was used to capture and catalog data that spoke to each theme. The themes were revisited in discussions about the project at several points through the year as data were or were not being found to inform them uniformly.

Learning from Large-Scale Surveys

Survey data have the potential to provide us with a broad view of patterns of behavior and correlations of factors from a representative sample of adults, not just the fraction of the adult population seen in programs and discussed in the research studies reviewed in the next section. Survey data, therefore, are an important perspective for triangulation in our research design. The findings of four large-scale studies relevant to adult independent online learning are synthesized, starting with the largest survey, the National Assessment of Adult Literacy (NAAL), for which a secondary analysis on technology use was conducted for this report. This is followed by another very large survey exploring patterns of participation in lifelong learning in the United States. In keeping with the inclusion of relevant research from English-speaking industrial countries, recent survey data from Canada and the United Kingdom are examined for findings on adult learning habits and patterns of technology use. These findings are followed by a closer, focused look at the correlation of adult learners' informal learning and technology use through an analysis commissioned specifically for this report from the Longitudinal Study of Adult Learners (LSAL), contributed by the study's principal investigator, Stephen Reder. This analysis reveals new insights into the learning patterns of adults who are not in formal adult education or language classes. Table 1 outlines key parameters of the five surveys.

NATIONAL ASSESSMENT OF ADULT LITERACY (NAAL)—FOCUS ON TECHNOLOGY USE

The first survey examined is the NAAL survey, which was conducted in 2003 with 19,000 U.S. adults ages 16 and older in households or in prisons (Kutner, Greenberg, Jin, Boyle, Hsu, & Dunleavy, 2007). This assessment measured literacy directly through administered and observed tasks in three types of literacy: Prose (the knowledge and skills needed to search, comprehend, and use information from continuous texts), Document (the knowledge and skills needed to search, comprehend, and use information from noncontinuous texts); and Quantitative (the knowledge and skills needed to identify and perform computations using numbers that are embedded in print materials). A related survey on Health Literacy used the same scale (Kutner, Greenberg, Jin, & Paulsen, 2006). Results were scaled into four levels of proficiency: Below Basic, Basic, Intermediate, and Proficient. Below Basic Document literacy, for example, corresponds to the ability to circle the date of a medical appointment on a hospital appointment

Table 1. Large-Scale Surveys

SURVEY NAME (COUN-TRY OF DATA COLLEC-TION)	YEAR(S) AND METHOD OF DATA COLLECTION	SAMPLE SIZE AND DESCRIPTION	KEY FINDINGS	TECHNOLOGY-RELATED FINDINGS
National Assessment of Adult Literacy (NAAL) (USA)	2003; individually administered surveys	19,000 representative of adult population; prison sample of 1,000 not included in technology questions	Describes adults' literacy performance within four levels plus health literacy	Access, use, and connectivity are strongly correlated to literacy level
Participation in Adult Education and Lifelong Learning (USA)	2000–2001; telephone survey	10,873 representative of adults over age 16 not in full-time formal schooling	Confirmed trends that adults with higher educational attainment and incomes participated in more continuing education activities; reported less than 1% participates in ABE-ESOL classes	Technology is increasingly used in instruction, but the Internet and World Wide Web are still a novelty for course delivery
Adult Learning@Home (UK)	2002; individually administered surveys, case studies conducted in homes	1,001 adults over age 21 in western England and Wales	Despite large government investment, few adults had made use of online courses	The most common learning activity on home computers was "learning about" computers; learners were motivated to improve job performance; close social networks provided support
New Approaches to Lifelong Learning (NALL) (Canada)	1998; telephone survey	1,562 Canadian adults over the age of 18 who spoke English and French	Surveyed adults' patterns of informal learning, found more than 95% engaged in self-directed informal learning >15 hours per week	Learning computer skills that would be valued at work ranked as one of the top four informal learning pursuits
Longitudinal Study of Adult Learning (USA)	1998–present; individually administered surveys and literacy assessments	940 adults ages 18–44 who had not finished high school or a GED at time of first recruitment; representative of local (Portland, OR) population	Full analysis not yet complete as Wave 6 is still in the field; preliminary findings point to the prevalence and importance of self-study in the adult population	Wave 5 analysis found significant percentages of adults even at the lowest literacy levels were engaged in self-study with technology options

slip, find the phone number to call embedded in a newspaper ad, or locate the intersection of streets on a clearly marked map. Basic Document literacy extends to the ability to summarize magazine articles using the structure of the magazines' table of contents.

A secondary analysis of the public NAAL dataset was conducted by the primary author of this report to provide a more detailed profile of technology use among populations with low literacy and low English language proficiency.

The extensive background survey questions administered for the NAAL asked several questions about technology use and access. Most of the questions had a scaled answer such as "How often do you…." or "How many times per week…." For the current analysis, these scales were collapsed into dichotomies (such as yes/no questions) to create rough profiles of technology users and non-technology users among the household (i.e., non-incarcerated) population. The parameters of these profiles were that a Technology User was someone who lived in a house with an Internet-connected computer *or* used the Internet at least once per week to find information on public events or news *or* sent or received an e-mail at least once per week. This profile allows for technology users who do not have a computer at home or do not use e-mail. It is slightly confounding that simply having a computer with Internet access with no other indicators of usage would mark a person as a Technology User, but it does represent a commitment to the monthly cost of access in most parts of the country in 2003, and therefore recognition of the value of the connection. The Non-Technology User profile was defined as someone who did *not* live in a house with an Internet-connected computer *or* use the Internet at least once per week to find information on public events or news *or* send or receive an e-mail at least once per week.

The Technology User profile corresponds to approximately 3,500 survey responses, which represent approximately 44 million American adults.

The Non-Technology User profile corresponds to approximately 7,800 survey responses, representing approximately 81 million American adults. These surveys were collected in 2003, and the penetration of technology has increased since then; these numbers and percentages have surely shifted by 2008.

The Technology User profile was matched to Document literacy scores across several demographic variables. Document literacy was chosen as the backdrop because it best represents the type of reading associated with technology and hypertext: skimming and scanning, identifying embedded key information, reading with a specific purpose, etc. The analysis was conducted with AM software that takes into account the NAAL's complex survey design (how the sample was drawn, how the test items were administered, etc.). The software package was used to conduct the statistical procedure of marginal maximum likelihood (MML) with a filter identifying Technology Users or Non-Technology Users. (See the official AM technical manual for use with the NAAL at http://am.air.org/naal.asp.)

A pattern emerged when comparing Technology Users and Non-Technology Users on Document literacy scores that show approximately 10% fewer Technology Users with Below Basic scores and approximately 10% more with Intermediate scores than Non-Technology Users (see charts 1 and 2). To test the strength of the relationship between literacy and technology use, the same profiles were analyzed with Prose, Quantitative, and Health literacy scores. An almost identical pattern is found on all three of these scales as well. Additionally, the following demographic data from the Document Literacy and Technology Use analysis inform the pattern:

- Technology Users across all age groups except 16- to 18-year-olds were more likely to have higher literacy scores;
- Technology Users across income levels were more likely to have higher literacy scores;

- Except for students still in high school, for all other educational attainment levels, Technology Users were more likely to have higher literacy scores;

- Among those who did not complete high school ("less than/some" high school), more than 50% of Non-Technology Users have Below Basic Document literacy scores in this subpopulation, compared to 38% of Technology Users;

- Technology Users with disabilities (learning disabilities and/or other health-related disabilities) were more likely to have higher literacy scores; and

- Technology Users whose native language is English (with or without other languages) generally had higher literacy scores than those who spoke Spanish with or without other languages.

In keeping with the overall NAAL findings that show females having higher average Document literacy scores, females outnumber males in Intermediate and Proficient literacy ranges while more males both Technology Users and Non-Technology Users, are found at the Below Basic and Basic levels.

This pattern—evidenced along the demographic variables of income, education, and age as well as the other available literacy scales—indicates that technology use is strongly associated with higher literacy scores. The direction of the relationship is more appropriately pursued in the research literature than in survey data. However, it appears safe to assume that adult learners of all ages, even at the lowest income and lowest levels of formal educational attainment, could be expected to be or become Technology Users. Given that these data were collected in 2003, we can assume that more of them already have.

PARTICIPATION IN ADULT EDUCATION AND LIFELONG LEARNING 2000–2001

The second survey contributing to this perspective is the National Household Education Survey,

Charts 1 and 2. Technology and Non-Technology Users by Document Literacy Scores
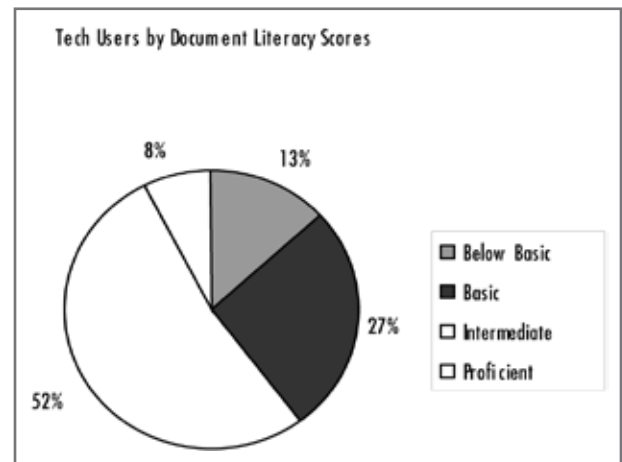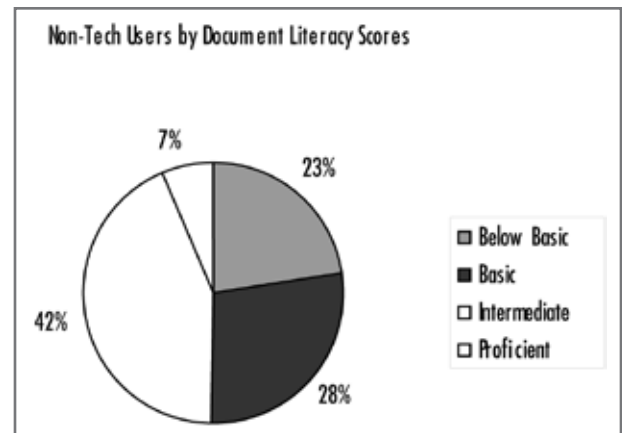
Participation in Adult Education and Lifelong Learning 2000–2001 (Kim, Hagedorn, Williamson, & Chapman, 2004). This telephone survey was conducted by the U.S. Department of Education's National Center for Education Statistics. The sample of 10,873 is nationally representative of adults ages 16 and older who were not enrolled in elementary or secondary school at the time of the interview.

Respondents were asked about both formal and informal learning activities in which they may have participated during the 12-month period prior to the interview. There were seven types of formal learning

activities to indicate: ESOL programs, basic skills education, college or university degree programs, vocational or technical diploma programs, apprenticeship programs, work-related courses, and personal interest courses. Work-related informal learning activities included supervised training or mentoring, self-paced study using books or video tapes, self-paced study using computers, attending "brown-bag" or informal presentations, attending conferences or conventions, and reading professional journals or magazines.

The 12-month overall participation rate for all adults in formal adult education activities (but not full-time enrollment in degree programs) was 46% in 2001, representing a total of 92 million adults. Work-related courses had a 30% participation rate. Only a tiny percentage of adults—less than 1% each—participated in ESOL programs, basic skills education, vocational or technical programs, or apprenticeship programs.

The data show that the use of technology in instruction varied by type of educational activity. Technology use was reported at the highest rates for college or university instruction. Technology use for instruction in work-related courses included the use of television, video, or radio as reported by 54% of respondents) and computer instruction (53%). Much smaller percentages reported the use of computer conferencing and the Internet or World Wide Web (10% and 16%, respectively). The use of technology for instruction in personal interest courses was reported less often than in work-related courses. Almost one-third of adults taking personal interest courses reported the use of television, video, or radio as an instructional mode (32%). A smaller percentage reported the use of computers for instruction (19%). Only 8% reported the use of the Internet or World Wide Web for instruction.

To investigate the reasons adults participate in educational activities, the study asked respondents about their participation in voluntary or compulsory certificate or license courses. Almost half of all college and university students (part- and full-time) indicated that a reason for their attendance was obtaining or maintaining a license or certificate. Thirty-eight percent of adults who took work-related courses provided the same reason. Ninety-five percent of adults who took work-related courses reported that they did so to maintain, improve, or learn new skills, methods, or knowledge. Other reasons included getting a raise or promotion (22%) or getting a new job (10%).

Overall, the survey confirmed earlier findings that in the United States, greater percentages of adults with higher levels of educational attainment and higher incomes participate in continuing education and that higher paid work positions are more likely to offer work-related educational opportunities. The survey also shows that much of adult informal educational participation is work-related. Standing out starkly in this survey is the very low percentage of participation in adult basic education and ESOL classes.

ADULT LEARNING@HOME IN THE UNITED KINGDOM

Researchers from the United Kingdom undertook an ambitious household survey of adults' access, use, and perceptions of information and communication technologies (ICTs) called *Adult Learning@Home* (Selwyn, Gorard, & Furlong, 2006). The authors devised a mixed-method, tiered approach that yielded large-scale demographic data as well as individual case studies. Their focus was on actual "present" engagement of adult learning with technology, partially motivated to disentangle reality from the British government's strong promotion of the "potential" of e-learning. A total of 1,001 adults over age 21 were randomly selected from four sites in Wales and western England, two sites in each that were representative of the general population, to engage in a personally administered survey in their home. Of these respondents, 100 were selected for further semistructured interviews that also took place in the home. Of this group, a further 25 who had been rated as moderate or high users of ICT were asked to participate in a

year-long ethnographic case study that involved three home visits, interviews with family and friends, photographs of the home, and other aspects. A "booster sample" of an additional 100 individuals was purposefully chosen to inform the research about the use of public access sites.

Despite significant investment in online learning content and promotion of its value by the British government, this survey found little evidence of adults engaging in the official learning opportunities. The U.K. data show trends similar to the United States, with very low participation in formal adult education, "over a third of the adult population has not engaged in any further learning at all" (p. 80) after leaving compulsory secondary education, and the same pattern of those with more education continuing to seek education through their lifetimes. From the current study and secondary analyses on other surveys conducted in the U.K. totaling 10,000 adults, Selwyn, Gorard, and Furlong (2006) conclude that the key social determinants predicting lifelong participation in learning are *time* (age cohorts), *place* (geographically mobile adults seem to be more inclined to engage in formal education than those who live close to where they were raised), *sex* (men are more likely to engage, women are reporting delaying it for other responsibilities), *family background* (including parental occupation and educational attainment of parents), and *initial schooling experience*. These variables were found to be just as predictive in the current study of adults' use of ICTs as in other adult education options.

Overall, 44% of respondents were using ICTs at home and 32% at the workplace, but only 21% had ever been taught at least partially via ICT and only 10% had participated in formal training to use computers. In fact, the researchers write, "we found far more sustained evidence of learning *about* computers rather than learning *through* them" (p. 161); that is, if people had computers in their homes, they indicated that their primary use of the equipment was to

learn about using it. They did so informally through a combination of self-learning, experimentation, and learning from others in a close social network (family, close friends, children, and grandchildren). This was often done in order to practice skills that would be valued on the job as "work-based informal learning permeate[d] beyond the workplace and into the home" (p. 115). Despite the efforts to provide widespread public access, the survey found few adults, only 11% of the sample, using public computers. The researchers conclude that the government campaign and investment has overlooked the realities of adults' patterns of access, use, and need for further and online learning.

NEW APPROACHES TO LIFELONG LEARNING (NALL) IN CANADA

The NALL sheds light on independent, informal adult learning and questions the assumptions of participation patterns. It was conducted in 1998 as a phone survey with a representative sample of 1,562 Canadian adults over the age of 18 who spoke English or French. The interview was designed to elicit self-reflection on a wide range of informal learning and explicitly included social networks of learning.

As reported by Livingstone (1999), the findings for adults' engagement in formal continuing education echo the pattern in other industrial nations, with adults with higher educational attainment participating at higher rates than those with less. According to the NALL, of adults without a high school diploma, only 18% had taken a formal course within the past 12 months while 67% of adults with a university degree had done so. Adults with self-reported low literacy skills engaged in very little formal continuing education.

This survey, however, uncovers what Livingstone calls the submerged portion of the "icebergs" of adult learning: the extensive engagement of adults in informal learning activities. Informal learning was categorized as employment related, community volunteer work related, household work related, and other gen-

eral interest related. In each area, respondents reported high rates of learning outside of formal courses or workshops. In fact, more than 95% of respondents reported engaging in "significant" learning activities, at an average rate of 15 hours per week. The learning activities rated the most important in each of the four categories included computer skills related to employment, communication skills related to community involvement, home renovations and cooking in the household category, and health issues in the general interest category.

This survey contradicts the assumptions of participation rates and patterns by demonstrating that levels of engagement in *informal* learning activities were not stratified according to educational attainment, as has been shown in other surveys for adults' participation in formal continuing education.

LONGITUDINAL STUDY OF ADULT LEARNERS

This section concludes with a unique analysis of the Longitudinal Study of Adult Literacy (LSAL). Stephen Reder, at Portland State University, has led the LSAL for the past ten years. This study addresses literacy development, learning, education, and life experiences of out-of-school adults. The analysis is conducted to determine whether there are threshold levels of literacy associated with patterns of independent, technology-enhanced learning.

Although the LSAL collects rich information about a wide range of topics related to adult learning and literacy development, only two areas are relevant to this paper. One is the use of computer technology specifically among adults in the target population who are seeking to improve their basic skills or prepare for the GED on their own rather than by attending a class or program. The second is a "snapshot" of technology use from the most recent LSAL data available. Because previously published LSAL findings have suggested that this "self-study" population is large and potentially important for the adult education field to serve (Reder, 2007; Reder & Strawn

2001, 2006), understanding the role that computer technology might play in serving these adult learners is important. The snapshot affords an understanding of rates of use and access in 2004–2005.

Background

The LSAL is a panel study, representative of a local (rather than a national) target population. This target population is defined as residents of the Portland, Oregon, metropolitan area who were ages 18–44, proficient but not necessarily native English speakers, and high school dropouts (i.e., did not receive a high school diploma and were no longer enrolled in school) who had not received a GED or other high school equivalency credential when first recruited. Participants are interviewed and assessed in "waves" or cohorts. Skills assessments include a standardized functional literacy assessment (alternate forms) administered in each wave and other measures administered once on particular waves, such as oral vocabulary, reading fluency, and writing samples (Reder, 2007; Reder & Strawn 2001, 2006). The instrumentation has been developed to yield data that are comparable with other large-scale surveys, such as the NAAL.

The main data reported here are drawn from Wave 5, a cross-sectional cohort, for which 801 individuals were interviewed in 2004–2005, representing 86% of the total sample. At the beginning of the study, the population had an average age of 28 and was evenly divided among males and females. Approximately one-third were members of minority groups, about one in ten were born outside of the United States, approximately one-third described themselves as having a learning disability, and one in three reported having taken special education classes while in school. By Wave 5, the population had an average age of 34 and ranged in age from 24 to 50.

Technology Use and Access in Wave 5

By Wave 5, 88% of the LSAL population are computer users. This is a dramatic increase from the 38%

who were computer users some six years earlier when the study began in 1998. Seven in ten (71%) have computers in their homes, 90% of which are used by the respondents themselves (rather than only by other household members). Two-thirds (66%) use computers in settings other than or in addition to their homes, such as at work, a friend's or family member's home, a library, or some other public venue. Three in five (62%) use computers that have Internet connections. They spend a median of six hours per week using a computer, including a median of five hours using the Internet.

There is no significant difference between men and women or between minority and non-minority group members in the percentage of computer users. A significantly lower proportion of individuals who report having learning disabilities are computer users (81% versus 91% of those not reporting learning disabilities), but the overall rate is still quite high. The penetration of computers into the LSAL population has evidently progressed quite far in the Portland area, but all indications are that this trend is growing around the country (see Pew Internet and American Life Project trend reports at http://www.pewinternet.org/).

Self-Study and Computer Use

From the Wave 5 interviews, about one in three (32%) reported self-studying in the two years since the previous wave to improve their reading, writing, or math skills or prepare for the GED. An estimated 43% of individuals in the LSAL population with proficiency below 225 (comparable to the Basic or Below Basic levels on the 2003 NAAL) self-studied between Waves 4 and 5.

Individuals who reported self-study at Wave 5 were asked about the media and technologies they used for this self-study. A number of alternatives were mentioned, including the computer, books and workbooks, videos and TV broadcasts, CD-ROMs,

and audiocassettes, and respondents indicated which ones they had used. About half (51%) of those who reported self-study indicated that they used the computer.

The population in the LSAL dataset with low literacy skills, defined as individuals with Document literacy proficiencies below 250 (Basic or Below Basic in the 2003 NAAL), made up 25% of the LSAL population. This compares to 34% of the general population of the nation as sampled in the NAAL. Approximately 38% of this LSAL low-proficiency population engaged in self-study to improve their basic skills or prepare for the GED. Among those in the low-literacy population who self-study, nearly two in five (39%) use the computer to do so.

Likelihood to Use an Online Portal

All individuals who reported self-study in Wave 5 were also asked:

> "If there was a free service available through the Internet to guide your efforts to improve your basic skills, prepare for the GED, or prepare for college and hook you up with resources like Web sites, tutors, homework helpers, or adult education programs, how likely would you try it out?"

They were asked to respond on the following four-point scale: not likely at all, maybe, probably, and very likely. Matching the literacy proficiencies of respondents to how they rate their likelihood of using such systems, as in table 2, shows a trend among those who do self-study that the lower the literacy proficiency, the more apparent interest there is in using such technologies.

Further analysis reveals that nearly half (49%) of the low-literacy subpopulation (Basic and Below Basic in the 2003 NAAL) describe themselves as "very likely" to use the computer, with another 14% responding they "probably" would use it.

Table 2. Individuals Who Self-Studied in Wave 5

LIKELIHOOD OF USE OF ONLINE PORTAL	MEAN TALS* SCORE	N	STD. ERROR OF MEAN
Not likely at all	292.35	32	9.456
Maybe	279.52	26	7.309
Probably	273.88	26	9.910
Very likely	266.63	157	3.803
Total	272.24	242	3.112

*TALS, Test of Applied Literacy Skills

The trend of decreasing self-study with increasing literacy proficiency appears elsewhere in the LSAL analysis, indicating that the proportion of the population that self-studies generally *declines* with increasing literacy proficiency. This possibly reflects that individuals feel less need to improve their basic skills as their literacy proficiency rises. Self-study does not go away completely, however: Some 26% of those with proficiencies above 300 (high Intermediate level in the 2003 NAAL) still self-studied.

These data show that threshold levels of adult literacy may not be interacting with independent learning in the assumed pattern. Indeed, the interaction may be in the *opposite* direction to that commonly assumed. Adults with low levels of literacy may be *more* likely to seek learning opportunities than those with high Intermediate levels. How much success they find in their efforts to self-study with online content is not shown in these data, but their success can be investigated through the research literature in the next section.

SUMMARY

Taken together, the findings in this section converge on a few key points.

- Learners with low skills are seeking and engaging in learning, but mainly outside of formal systems.
- The use of computer equipment and online technologies increases as adults' literacy and language skills increase.
- Much of what adults seek to learn and practice in their leisure time are skills that will improve their work performance—and much of this skill enhancement *is* technology-based.

The penetration of a strong work-related learning motivation into all sectors of the societies studied provides strong evidence that an element of the motivational aspect of learning with technology is the perceived applicability of computer literacy skills to job advancement. This finding is supported by the literature reported in the next section.

Learning from the Literature

An extensive literature search was undertaken to identify information on the topic of independent adult literacy and language learning online. Few published research studies document independent, self-directed learning—after all, finding and following independent learners on self-chosen tasks is not typical research. Therefore, this investigation surveyed broadly to find published articles as well as reports and evaluations shared at conferences or posted on Web sites, and even program-level reports and documentation solicited on listservs and e-mail. The databases ERIC, EBSCOHost, and JSTOR were searched with combinations of the following terms:

adult, education, basic, literacy, ESL, skills, functional, online, computer, computer-assisted, Internet, reading, writing, mathematics

Abstracts were determined to be potentially relevant on the following criteria:

- Sample population (adult learners, not university students);

- Publication date after 1990;

- Intervention (online learning; basic skills or ESL); and

- Setting (relevant secondary or adult settings excluding senior or university focus; United States or English-speaking country; in or out of formal education).

In the end, most research documentation found on adult literacy and language learning online is not about independent self-directed activities, but about online learning that is supplemental to classroom and program involvement. It is not surprising that studies reporting evidence of skill improvement through test scores were evaluations of supplemental activities for students in programs where such tests are administered, rather than independent, out-of-program activities. The implications of this finding, of course, are that this knowledge is based on learners who are already in programs and, as shown above (Kim, Hagedorn, Williamson, & Chapman, 2004), represents only a tiny fraction of the adult population with low literacy and low English language proficiency.

Articles gathered were sorted into the following categories in a database according to the facets of independent online learning they could inform: evidence of basic skills and language proficiency threshold levels or of improvement, implementation issues and evaluations, student skills and dispositions necessary for success, and the design of instructional environment and materials. Key points and findings from each article were extracted and entered into the database. Many articles and reports fell into more than one category, and as articles and reports were read and summarized, some categories were collapsed into emergent themes.

What follows is a series of thematic analyses within and across the categories and identification of emergent subthemes. Descriptions of the research contexts are explicitly described so that extrapolations are clear. There is much to be gained from this literature as an important point of triangulation for an overall investigation that will provide a fuller understanding of the issues surrounding independent online learning by adults with low literacy and English language proficiency.

EVIDENCE OF BASIC LITERACY AND LANGUAGE SKILLS IMPROVEMENT

Reviewed here are reports of single studies as well as previous literature reviews on the topic, all with some reporting of student achievement data. The findings

suggest that adult learners' work with computer-based or online materials that are supplemental to adult literacy and ESOL classes positively contributes to their overall literacy and language acquisition plus complementary learning skills. The following studies were of supplemental materials available to students with some type of program support (on-site trained teacher or support person, support person available online, tech support available through the program, and/or automated feedback system in the program) and varying degrees of integration with the regular class curriculum. The supplemental materials and online interfaces were either uniquely developed or chosen for adult literacy and language learners. This addresses one of the key needs for this population mentioned in the Introduction (Lazarus & Mora, 2000): relevant and comprehensible content with clear navigation. Table 3 provides an overview of the studies and findings reviewed for evidence of literacy and language skills improvements, which are described more fully below.

Basic Literacy

Studies that speak directly to gains in literacy skills represent research conducted in quite different settings, with different materials and interventions, and with different measures of components of basic literacy. They cannot easily be synthesized. Nevertheless, the studies speak collectively to learners engaging in texts and activities in an online environment driven by interest.

AlphaRoute is an online learning environment (available in French and English, with some resources available for learners who are deaf) that is a portal to sites and activities that have been created and selected for adult literacy and language learners. AlphaRoute provides introductory text and activities for off-site links and provides e-mail chat capabilities; facilitator support is available onsite and via distance interaction. It is used extensively as a supplement, but can also be accessed by non-enrolled learners. Evaluators

(Long, Kennell, Moriaty, & Strum, 2003) found that not only were students and teachers reporting literacy gains, but that students were reporting a great difference in their confidence and self-directedness. "The results were astounding: For virtually every skill, competency, or attitude mentioned, learners felt AlphaRoute had made at least some difference in helping them improve, and in many cases they said it had made 'a lot of difference'" (p. 59). Learners who were working with the lowest two levels of materials in AlphaRoute (56% of the participants) reported the greatest gains on "intangible competencies such as confidence, sticking with a task, etc." (p. 60). These competencies, as will be discussed below, have been shown to be critical skills for students being able to work independently. The evaluation showed that "total time spent using AlphaRoute was by far the best predictor of transferability [of skills]" (p. 60).

The National Research and Development Centre (NRDC) in the United Kingdom has researched and published extensively on promising practices in adult literacy, numeracy, and ESOL. In 2004, NRDC conducted an observational study of how ICTs were being implemented in adult basic education and language classes. The authors found a limited range of methods and types of learning technologies and shallow implementation that was strongly correlated to the instructors' personal comfort level with technology (Mellar, Kambouri, Sanderson, & Pavlou, 2004). Research and training projects in recent years have aimed to expand the use and repertoire of methods and tools used by instructors.

The impact of NRDC's professional development and training efforts (Kambouri, Mellar, & Logan, 2006; Mellar et al., 2007) is documented in a series of action research projects by teacher participants to improve adult education and ESOL practice. Using emerging ICTs, this group of teachers documented basic skills improvements as well as technology literacy acquisition. Teachers adopted a range of technologies and techniques, including webquests (Internet inquiry

Table 3. Research in Literacy, Numeracy, and English for Speakers of Other Languages

AUTHOR, DATE	TITLE	CONTEXT	SUBJECTS/UNIT OF ANALYSIS	OUTCOMES
Literacy				
Long, E., Kennell, T., Moriarty, M., & Sturm, M. (2003)	What difference does it make? Literacy learner perspectives on Web-based learning with AlphaRoute	Surveys at sites supplementing basic education in English and French with AlphaRoute materials; 86% of learners logged 1–2 hrs/week, 14% logged 3–25 hrs/week	142 students, teachers at 42 sites across Ontario using AlphaRoute to supplement adult literacy and language classes	Gains in literacy, oral language, confidence, independence, and self-directed learning; time spent on AlphaRoute was the strongest predictor of growth
Mellar, H., Kambouri, M., Logan, K., Betts, S., Nance, B., Moriaty, V. (2007); and Kambouri, M., Mellar, H., & Logan, K. (2006)	Effective teaching and learning using ICT and Adult learners and ICT: An intervention study in the UK	Teachers as practitioner-researchers using technology and media productions as the curriculum of 8-week classes	Individual student data aggregated into 7 intervention classes	Gains in computer literacy, literacy, reading, listening, oral language, and confidence
Silver-Pacuilla, H. (2007) and (2006)	Assistive technology and adult literacy: Access and benefits Access and benefits: Assistive technology in adult literacy	Supplemental supported access to an assistive technology lab 1–2 hrs per week over 2 semesters; control students in basic reading class	10 students with learning disabilities	Gains in phonological awareness, spelling, self-directedness
Numeracy				
Li, Q., & Edmonds, K. A. (2005)	Mathematics and at-risk adult learners: Would technology help?	Adult basic math classes supplemented with online resources, avg. 15 hrs per semester plus avg. 5 hours out of class; two-way random design	48 "at-risk" adult learners at adult education center in western Canada	Gains in math skills for both CAI and teacher-led classes, differential gains based on math unit topic; students greatly valued the online activities

AUTHOR, DATE	TITLE	CONTEXT	SUBJECTS/UNIT OF ANALYSIS	OUTCOMES
Nicol, M. M., & Anderson, A. (2000)	Computer-assisted vs. teacher-directed teaching of numeracy in adults	Adult basic math classes supplemented with online resources, avg. 15 hours per semester; three-way random design	24 adults with LD at an adult education center in Scotland	Gains in math skills for both computer-assisted and teacher-led classes
English for Speakers of Other Languages				
Richmond, M., Thacher, M., & Porter, P. (2005)	Studying ESOL online	Evaluation of the supplemental use of *English for All*	26 students in intermediate ESOL classes	Gains in reading skills were comparable to other students' scores in the regular class at that program; retention was 88% (avg. in CA is 61%)
Rivera, N. V. (2003)	A study of the effectiveness of LAUSD's Adult ESL CBET Program	Evaluation of student data from classrooms in which a suite of ESOL software and online activities was used an avg. 1–2 hrs per week (most commonly used software included *Rosetta Stone, Oxford Picture Dictionary, Focus on Grammar, and Discoveries*)	Individual student data aggregated into 60 classes	Use of CAI materials led to skill gains and greater self-directedness and goal development; students in classes using CAI also showed better post-class outcomes such as getting a GED, finding a (better) job, and being involved in the community
Stiles, R., & Porter, D. (2006)	The California Adult Education 2004–2006 Innovation and Alternate Instructional Delivery Program: A review	Evaluation of California statewide data on 79 adult schools operating Innovative Programs	Data from 51,089 students in 2004–2005; 92% of students were ESL learners	Gains in reading, listening, and completion/persistence for ABE and ESL students attributed to blended models; students in beginning to intermediate ESL levels gained the most

projects), e-portfolios, tablet PCs, mobile learning with handheld devices, digital video, mindmapping software, and specific Web sites. Evaluations on a variety of standardized tests of students' skills after the eight-week trials showed that learners improved in almost all cases in both computer literacy and in literacy and language proficiencies on pre- and post-tests. The authors conclude, "Learners who use ICT for basic skills double the value of their study time acquiring two sets of skills at the same time" (Mellar et al., 2007, p. 8).

In 2004, adults with learning disabilities joined a participatory action research study led by the author (Silver-Pacuilla, 2006, 2007) during which they supplemented their classroom instruction with weekly facilitated access to an assistive learning technology lab. These adults at all levels of literacy skill were taught to use assistive and Internet technologies to engage in self-study of their class materials or for personal interests. The facilitator provided coaching and computer skill tutoring, assisting students to engage with word processors, text-to-speech and voice recognition software, Internet searches, e-books, Web sites, and e-mail programs. In reflective dialogue and praxis, the students shared that not only was facilitated self-study crucial to their ability to learn and retain class material, but that the experience had boosted their self-determination through feelings of confidence and self-efficacy.

Basic Numeracy

Two studies looked directly at the use of online technologies and computer-assisted instruction (CAI) in adult numeracy instruction. Both compared learners in classes of regular teacher-led instruction with classes that supplemented teacher instruction with online activities learners accessed during class with facilitation and outside of class. The online activities were either created by the instructor or chosen specifically by the instructor to complement the curriculum materials. Both studies strongly emphasize that

the role of the teacher-facilitator is key to helping students bridge their understanding of math concepts from class instruction to online activities.

Li and Edmonds (2005) contrasted teacher-led without CAI to teacher-led CAI with adults learning math. The control group was drawn from student scores in the semester prior to the study. The CAI instruction was constructed as supplemental tutorials or simulations, chosen and delivered on a course Web site by a teacher trained in educational technology. Students averaged 15 hours on the CAI and reported an average of 5 additional hours per week on the course Web site outside of class. Final scores revealed little difference between teacher-led and CAI supplemental scores—both groups gained overall—but different patterns of test scores per unit topic. Students' surveys indicated strong positive response to the technology-enhanced experience, expressing appreciation for the immediate feedback and opportunities to practice their skills in an engaging format, but also indicated that the teacher was vital to provide guidance and scaffolding. Qualitative data analysis suggests that students increased their confidence and satisfaction levels in mathematics as well as learning generally, and that there was detectable transferability of the skills, knowledge, and abilities gained. Additionally, technology supports such as text-to-speech software were found extremely helpful to ESOL learners and diverse students.

In Nicol and Anderson's (2000) study conducted in Scotland, 24 adults with mild learning disabilities were randomly assigned to a CAI class (where a teacher taught basic math supplemented with commercial software and Web applications), a teacher-directed basic math class (no CAI), or a non–math class at the adult center (workplace literacy or art). In the CAI class, students worked in pairs with the software one hour per week throughout the semester. At post-test, students in both the teacher-directed and CAI classes had made steady improvement on their math skills; the control students had made none.

Students in the CAI class had larger gains than those in the teacher-directed class, but these gains were not statistically significant.

English for Speakers of Other Languages

Three studies from California inform the research base on how online technologies contribute to achievement gains by adult ESOL students. It is not surprising that California would be investigating this service delivery option: It is the first ranking state in sheer numbers of foreign-born population and the limited English proficiency population (Migration Policy Institute, 2007). In 2005, the state's adult education programs served 429,025 students (U.S. Department of Education, OVAE, 2007), representing nearly 73% of enrollment. Because the state of California uses a common ESOL accounting measure across the programs, the Comprehensive Adults Student Assessment System (CASAS), the findings of the following three studies can be compared and contrasted to state averages.

Rivera (2003) conducted an effectiveness study of Los Angeles Unified School District's adult ESL Community-Based English Tutoring (ESL-CBET) program, which offers Internet access and CAI as a supplement to ESOL classroom instruction. Rivera examined student outcome data from 60 classrooms that used computers. Teachers and students in the computer-using classrooms reported that computer use led to skill improvement and greater self-directedness and goal development; 92% of students indicated that they wanted computers to continue to be a part of their ESOL instruction. Students in classes using computers also showed significantly better post-class outcomes such as getting a GED, finding a (better) job, and being involved in the community. As Rivera pointed out, these outcomes are directly related to students' standard of living and integration into the mainstream of society. The difference in rates for promotion to next level of ESOL between computer users and nonusers were not statistically significant.

The online curriculum, *English for All*, was developed by Los Angeles Unified School District under a federally funded adult education project, Cyberstep. It targets learners of English in the high beginning to low advanced levels. It has been used as a supplemental activity by classes around California and as an online curriculum for distance courses in California, Texas, Massachusetts, and North Carolina.

An evaluation of a supplemental use of *English for All* was conducted (Richmond, Thacher, & Porter, 2005) in several modes: online, via TV, in class, and lab-based individualized instruction. Twenty-six students in intermediate-level ESOL classes in California were recruited to participate. The students who volunteered tended to be computer literate and to have completed formal education in their native countries. Reading gains at post-test for the participants were on par with their peers in the program (average gain of 5 points on the CASAS); retention rates were significantly higher than their peers in the state (88% vs. 61%). Adults' successful participation, the authors felt, was due in part to the presence of a friend or family member who could provide "tech support," and to a thorough orientation before beginning the individualized component.

Evaluations of the California Distance Learning Project (CDLP) consistently show positive outcomes for students in classes where distance learning is a supplement or an option for self-study when a student has to "stop out" of regular class attendance. From an analysis of the 2004–2005 statewide data (Stiles & Porter, 2006), students who participated in blended learning (regular class attendance plus supplemental distance learning) demonstrated greater gains on the CASAS post-test than students in traditional ESOL classes across reading and listening score ranges, with the greatest percentage gains shown in the lower levels of proficiency.

Complementary Literature Reviews

The findings from the individual studies and evaluations are augmented by three literature reviews

conducted on related topics. Condelli and Wrigley (2004) reviewed research in adult ESOL and second language learning. Although they found the literature not yet fully developed in its capacity to recommend particular effective instructional strategies, the review determined that the use of CAI and online learning in adult ESOL indicated potential with English language learners to provide authentic and motivating contexts for practicing language.

Chapelle (2005) reviewed studies of computer-assisted language learning, or CALL, conducted along several lines of second language acquisition research and theory, only a few of which were conducted in adult basic ESOL programs. In particular, the review found studies that strengthened the hypotheses of *noticing*, or the imperative for students to notice particular language elements in order to learn them, and *input modification*, or the practice of elaborating and enhancing teaching materials to make them more comprehensible for students. The technological features of CALL that were found to be beneficial to language learning include hyperlinked e-resources such as annotations, translations, and definitions; dynamic highlighting and narration; and English subtitles on video materials.

A review of effectiveness research conducted for the New Zealand Ministry of Education (Benseman, Sutton, & Lander, 2005) found mixed results in the literature (from research conducted on CAI in English-speaking industrial countries) in adult literacy, numeracy, and language classrooms. The authors summarize their findings with the following:

CAI may be more effective in [teaching] maths and with learners at basic levels. There is some evidence for gains in reading…Teachers are central to making CAI programmes work. The programmes work best as a supplement… Irrespective of its effectiveness compared with other modes of instruction, CAI is consistently reported as valuable for motivating reluctant or hesitant learners…[this] is an essential consideration when participation in programmes is still predominantly voluntary… (p. 49).

The authors lament that in addition to the difficulties researchers face in conducting controlled research in the adult settings, the complexity of comparing quite dissimilar technology applications and implementation models and contrasting an intervention to an ill-defined "traditional mode" of classroom instruction does not readily contribute to a generalizable knowledge base.

The ESOL literature in particular is replete with practice reports of how educators are utilizing computer-assisted and online technologies to enrich English language instruction. Several published resources from technical assistance providers are available to guide implementation (Center for Impact Research, 2002; Florez, 2000; Imel & Jacobson, 2006; NCEL, 2002). Missing is empirical research documenting the outcomes of this work. Synthesizing and legitimizing the practical knowledge and experience in the ESOL field would fill a gap in the research.

Despite methodological weaknesses and dissimilar implementation models, these studies converge on the value of using technology in adult literacy, numeracy, and language classrooms for all levels of students for broad personal development gains such as self-confidence, motivation-retention-persistence, independence, goal directedness, real-world transfer, and reinforcement of skill acquisition, and to meet the secondary goal of learners to become more computer literate. Quantifying academic skills achievement attributable solely to a technology component is less straightforward, but several studies of significant numbers of students report learning gains attributable to the supplemental use of technology in instruction and practice.

IMPLEMENTATION AND DESIGN ISSUES

Online learning, for the purposes of this paper, has been defined earlier as "activities for which Web-based content and Internet connection and interactivity are integral to the experience for at least a portion of the engaged time." Therefore, for this section, the investigation sought findings and recommendations from

evaluations that focused on Web-delivered or distance instruction and learning materials. However, none of the studies evaluated adults' independent online learning outside of a class or program. These evaluations and recommendations are from programs' attempts to offer supplemental online offerings to students in and out of their programs. The findings from these program-based efforts can inform our understanding of where strategic supports could make independent learning more successful.

Many adult, family, and continuing education programs have added distance learning options to their course offerings. In a survey of state directors of adult education (Parke & Tracy-Mumford, 2000), 31 states reported plans for incorporating some form of distance learning into their programs. Often, these options are an attempt to address some of the traditional barriers for student participation: time, transportation, unpredictable schedules, and unease in class environment. In fact, an evaluation of Pennsylvania's pilot effort to offer the online curriculum Workplace Essential Skills via distance learning found that at least 50% of the students would not have been traditional classroom/program students (Askov, Johnston, Petty, & Young, 2003). This trend is echoed in the evaluation of California's distance learning project (Stiles & Porter, 2006). Distance learning can encompass many types of arrangements including video checkout, televised courses, facilitated and synchronous Web conferencing, integrated learning system software available via password login, and Web-based self-directed inquiry assignments.

Wagner and Hopey (1998) sum up the hope about the potential of new technologies for adult literacy and ESOL programs and learners:

[ICTs] hold enormous promise for the future because they can (a) reduce the isolation that many adult literacy providers and students experience, (b) facilitate communication among staff and students within and between programs, (c) increase access to high quality materials and emerging research, (d) streamline administrative and reporting processes, and (e) help to provide the delivery vehicle for innovative instructional and staff development approaches" (p. 1).

However, in a study conducted in Australia, a country with a long history of using all manner of distance learning media, Brennan, McFadden, and Law (2001) report that despite the variety of technologies and distance options, "the new technologies…are being used for searching, for communicating, for providing information, and for processing text in various forms—not for online delivery" (p. 22). This section covers evaluations of programming efforts as well as evaluations of the design of online materials and environments.

Table 4 gives a thumbnail overview of the scope of the evaluations and surveys from blended and supplemental online efforts for adult learners. Following the table is a synthesis of findings and recommendations from these evaluations.

Program Evaluations

Convergence on the following recommendations is found in these evaluations and surveys of students in adult literacy and language programs:

- Online learners and teachers need support—pure online delivery is not best practice for adult literacy and ESOL learners (AlphaRoute, 2003; Daniels, Gillespie, Stites, & Nelson, 2004; FHRD, 1999; NCVER, 2002; Parke & Tracy-Mumford, 2000; Porter & O'Connor, 2001; Stiles & Porter, 2006). Support could include:

  o a facilitator for students at least some of the time;

  o student-to-student communication;

  o readily available tech support for both teachers and students; and

  o peer group for teachers of distance courses as teachers learn the new medium.

Table 4. Program Evaluations

AUTHOR(S); PUBLICATION DATE	TITLE	SPONSOR	PROJECT SCOPE
Askov, E., Johnston, J., Petty, L., & Young, S. (2003)	Expanding access to adult literacy with online distance education	National Center for the Study of Adult Learning and Literacy (NCSALL)	Examines the potential and feasibility of online distance education for adult learners
Brennan, R., McFadden, M., & Law, E. (2001)	All that glitters is not gold: Online delivery of education and training	National Centre for Vocational Education Research (NCVER), Australia	Research review of published and unpublished evaluations of distance learning efforts (most supplemental to program participation) across Australia
Daniels, M., Gillespie, M., Stites, R., & Nelson, E. (2004)	Project CONNECT: Final evaluation report	Project CONNECT, PBS	Formative evaluation of the pilot sites and modules of Project CONNECT, surveyed 9 sites and 292 students
Eady, M. (2006)	Literacy learning at a distance: A new approach	AlphaPlus Centre, Toronto, Canada	Evaluation of AlphaRoute implementation via distance delivery in rural, remote northern Ontario, Canada
Ginsburg, L. (2004)	Adult literacy practitioners' readiness to use technology in the classroom: A five state survey in 2002–2003	National Center on Adult Literacy	Conducted needs assessment of administrators and instructors in 5 states (n = 444 responses) to inform professional development planning
Lock Kunz, J., & Tsoukalas, S. (2000)	Riding the technology wave: Experiences of literacy students and teachers in Ontario	Canadian Council on Social Development, Ottawa, Canada	Surveys and focus groups to gauge use of computer technology in Ontario for literacy education from students' and teachers' perspectives. Gathered data from students (n = 643) and teachers (n = 135) plus analysis of 460 student activity sheets
Long, E., Kennell, T., Moriarty, M., & Sturm, M. (2003)	What difference does it make? Literacy learner perspectives on Web-based learning with AlphaRoute	AlphaPlus Centre, Toronto, Canada	Conducted surveys of teachers at 42 sites and students (n = 142) using AlphaRoute materials as supplement to literacy instruction
National Centre for Vocational Education Research (2002)	Flexibility through online learning	National Centre for Vocational Education Research (NCVER), Australia	Key findings and implications from review of published and unpublished evaluations of distance learning efforts (most supplemental to program participation) across Australia
Porter, P., & O'Connor, L. (2001)	What makes distance learning effective? Support mechanisms to maximize the impact of distance learning in adult education	Massachusetts ABE Distance Learning Project	Evaluation of four ABE distance learning pilot programs
Stiles, R., & Porter, D. (2006)	The California Adult Education 2004–2006 Innovation and Alternative Instructional Delivery Program: A Review	California Distance Learning Project (CDLP)	Evaluation of student and program data from the California Innovation and Alternative Instructional Delivery Program which served 51,089 students in 2004–2005 in 79 programs. Highlights include: most common distance learning option in California is a video checkout plus teacher feedback system that involves *Crossroads Café*; CDLP served mainly English learners (92% of the students) in nearly half (48%) of the offered courses; other DL courses were GED (nearly 20%) and basic literacy (12%); women participate at a rate of 2:1; participation of students with low literacy and low ESL levels increased 8–10% and 3% respectively in the 2004–2005 data.

- Induction programs or computer literacy skills prerequisites set the stage for success (Askov et al., 2003; Hawkins, 2001; NCVER, 2002).

- Students are eager to learn computer literacy skills alongside content (AlphaRoute, 2003; Askov et al., 2003; Brennan et al., 2001; Kambouri, Mellard, & Logan, 2006; Lock Kunz & Tsoulakis, 2000).

- Supplemental online learning can be a positive option that increases students' overall improvement and retention (AlphaRoute, 2003; Daniels et al., 2004; Porter & O'Connor, 2001; Stiles & Porter, 2006).

- The quality of the equipment—on both ends— makes a significant difference for the success of the experience, and surveys point to the reality that most students do not have access to high-quality computers and broadband Internet service, and programs do not take learner costs (such as connectivity) into consideration when planning and offering distance learning (Askov et al., 2003; Brennan et al., 2001; Ginsburg, 2004; Lock Kunz & Tsoulakis, 2000).

The complicating factor of teachers' own comfort and skill level with integrating technology into their instruction is well documented across educational settings (Hughes, 2005; MacArthur, 2001; NCES, 2000). A 2003 survey of adult education teachers in the United States (Carter & Titzell, 2003) found that teachers who self-reported that they were *proficient* technology users rated distance learning in their top four choices. Teachers who self-reported that they were technology users with *enough [skill] to get by* did not include distance learning in their top four choices, preferring instead to indicate their choices as learning more about planning resources or classroom-based activities. Another survey of adult education teachers and administrators (Ginsburg, 2004) confirmed these relationships. Teachers who were only "somewhat comfortable" were far more likely to use computers for practice and drill activities than

teachers who were "extremely comfortable"—62% to 44% (p. 7). As teachers increased their comfort level, they increasingly used computers for problem-solving and learner-directed activities. These findings were echoed in an Australian survey (Javed, 1998) in which teachers who were more comfortable and had easier and more access to equipment and the Internet in their leisure time were more likely to be observed integrating technology into their literacy and language teaching in creative and learner-driven ways. While this issue is beyond the scope of this investigation, this reality must be considered if change is to be effective.

Design of Environments and Materials

Very few evaluations were found of the design of online environments and materials specifically created for students in adult literacy and language programs. The most recently published articles are reviews and evaluations of designs that were completed prior to publication and have since been updated and significantly changed. This lag in published research to guide development is a common problem in other areas of technology implementation as well (Silver-Pacuilla, 2005). Current thinking and advice were shared by the content development experts and by participants on the Institute's listserv, where it is discussed in more depth. Nevertheless, general information can be gleaned from published evaluations, briefly described in table 5.

From these evaluations, researchers identified several key design elements that contributed to learners' engagement, enjoyment, and ultimately, their persistence and success with the materials and environment:

- Authentic writing and communicating activities;

- Readability levels that balanced authentic vocabulary in an easy-to-read format;

- Timely facilitator feedback;

Table 5. Design Evaluations

ONLINE LEARNING ENVIRONMENT STUDIED	EVALUATOR; PUBLICATION DATE	DESCRIPTION OF THE ENVIRONMENT
NIBBLE	Olson, R. B., & Cohen, N. (2000)	Text-based information at an intermediate readability level organized into topics on a Web site that links out to outside Web sites, but does not provide interactivity
Project CONNECT	Daniels, M., Gillespie, M., Stites, R., & Nelson, E. (2004)	Online activities to practice English and learn basic skills at a high beginning level; site has various supports (such as audio, video, and embedded dictionaries) and interactivity features (such as e-mail, work feedback, and online class groups)
Workplace Essential Skills	Sabatini, J. P. (2001); Johnston, J., Young, S. J., & Petty, L. I. (2001)	Online lessons designed for intermediate reading level that present information in text, link to outside Web sites, and provide interactivity (with text answers); correlates with workbooks and TV broadcast lessons

- Tasks that taught computer and media literacy alongside content;

- Embedded video presentations;

- Graphics and images that were clear and that reinforced the content;

- Clear navigation that facilitated organization and did not embed information on subpages; and

- Multiple means of working with the information (online, in print, on portable CD-ROMs or disks) to accommodate various levels of access and connectivity.

Guidance for design and development is available in Cybersteps' *Materials Development Framework* (1999b), *Evaluation of Cyber Products* (1999a), and design framework for multimedia (Wrigley, 2001) which can guide future evaluations and designers in the development of online learning environments for adult learners. Cybersteps' list of criteria emphasize that language and literacy:

- Are social processes that involve interaction with others;

- Require risk taking;

- Develop when the target language is slightly above the current proficiency level of the user;

- Require focus, engagement, and practice;

- Are multidimensional and require different kinds of interactions with different kinds of genres;

- Develop through interactions with tasks that require cognitive involvement; and

- Develop more deeply if skills are connected to an overall topic or theme.

Also useful are design suggestions from the League of Innovation in the Community College (2005), a coalition to guide research and development of innovative instruction in community colleges. Echoing the findings from the program evaluation section above, these criteria lists converge on the emphasis of active learning, authentic reading and writing activi-

ties, multiple means of engaging with the information, available support, and an integration of content and computer skills. Other guidance may be found in the extensive databases and online forums of general consumer Web design and usability, but it must be adapted to adult literacy and language learners with consideration to users' specific needs and habits.

STUDENT SKILLS AND DISPOSITIONS

What does it take to be successful with independent online learning? The definition of success stated above is "activities that left users feeling satisfied that they had fulfilled a question or search, found helpful information, or advanced target skills." Adult literacy and language learners are confronted by interfaces and information presentations that are written above their reading level, devoid of local content, and developed predominantly in English (as described above), but also by their own learning habits that were developed in very different environments, such as traditional classrooms. Both the skills and dispositions are discussed below.

Skills Necessary for Independent Online Learning

Observational studies of technology users are particularly useful for providing examples of the types of challenges online environments present to adult literacy and language learners. Two studies, Birru, Monaco, and Charles (2004) and Harrysson, Svensk, and Johansson (2004), engaged small groups of adults with low literacy skills to participate in observed trials of online information searching. In the first study, adults were given health scenarios and asked to generate information searches. In the second study, adults were asked to find consumer information. The researchers' observations converge on the following difficulties adults with low literacy experience in the online environment:

- Difficulty generating optimal search terms (i.e., could not remember if search terms were to be separate words or "all one word" as in "lungcancertreatment");

- Difficulty interpreting the search results;
- Difficulty finding health information in easy-to-read language;
- Difficulty comprehending and interpreting found information due to inappropriate reading level; and
- Difficulty distinguishing between commercially sponsored and informational links (i.e., understanding the value of .com vs. .gov).
-

These difficulties were compounded by the adults' misinterpretation of the information they did find. Some adults reported reading about topics that the researchers could not later verify as present on the visited sites. This raised grave concerns among the researchers as to the veracity of information these adults felt they had gathered during the search experience.

The usability of the interface, search tools, and presentation of the information found on the Internet impede adult literacy and language learners from using the Internet effectively and independently finding the information they seek. In fact, as shown in the Birru et al. study (2004), adult literacy learners can misinterpret the information they do find, casting doubt on their ability to benefit from their searches.

Rouet (2006) looked closely at the skills necessary to comprehend documents and information found online. He presents a detailed review of the research on the cognitive processes involved in "the skills and mental processes that underlie our ability to read, comprehend, and make use of complex documents in real life situations" (p. xix), what he defines as *functional literacy* in print and online. Across multiple studies conducted with youth and adults of various ages and educational levels, Rouet documents the difficulties users have evaluating information found on the Web. Users are often "misled by surface markers found on the web pages" (175) and have little or no criteria for evaluating information.

Drawing on studies that sought to identify the most effective and comprehensible information and Web portal design for online learning, Rouet concludes that the following three elements must be balanced for creating productive Web-based learning activities:

- **Comprehension skills** that support the student "to identify and evaluate source information, to integrate information across sources, and to assess the quality of content information from a given perspective";

- Well-designed **tasks** that are "explicit and require in-depth processing of the materials"; and

- An **environment** that provides the informational and organizational resources and tools to complete and manage the task (p. 171).

More needs to be done to understand effective instructional methods for supporting adults' reading and navigating the Web and emerging technologies. While it is beyond the scope of this investigation, research and best practice guidance on this topic is underway in the K–16 educational area that could inform the adult literacy and language field.

Dispositions Necessary for Independent Online Learning

Self-directedness and active learning are repeatedly emphasized as the hallmarks of successful online learning in the program evaluations and descriptions, no matter the literacy and language proficiency levels of the students. Self-directedness has been defined by Brookfield as "the dispositions and capabilities of learners to accept responsibility for planning, seeking out learning resources, implementing and evaluating their own learning" (1984, p. 61). Added to these dispositions are unique skills (as detailed above) and dispositions necessitated by the online environment. The American Center for the Study of Distance Education (ACSDE) at Pennsylvania State University

(1999) identified the skills and dispositions necessary for any learner to succeed in online learning: basic computer literacy; reading and writing skills; skills in searching for, navigating, and organizing found information; netiquette; self-motivation; independent learning skills; and time management skills. *Expanding Access* (Askov et al., 2003), which is focused on adult language and literacy learners, presents a parallel list of skills, knowledge, and learning dispositions: "distance education requires that the student be able to function independently, be able to structure and organize time, and have a high level of self motivation… [and] be comfortable working with the appropriate technology and have access to a computer" (p. 34).

The challenges and the knowledge, skills, and dispositions necessary to address them have been documented by practitioners working to offer and improve online and flexible delivery courses. An evaluation of the implementation in Pennsylvania of the Workplace Essential Skills (WES) online distance education program identified a list of skills and characteristics of successful students, including the following (Askov et al., 2003, p. 34):

- They were employed or actively seeking employment;

- They had a clear goal for their participating in the program;

- They read at a seventh-grade level or higher;

- They had the ability to organize their time and work independently;

- They either had a computer at home or easy access … at a place they felt comfortable; and

- They had computer skills that allowed them to navigate the [WES] site and the Internet.

These skills and dispositions reappear in other descriptions of successful online literacy and language learners, including those in Australia (NCVER, 2002)

and the United Kingdom (Selwyn, Gorard, & Furlong, 2006). Recognizing the importance of these skills to students' success, programs have begun implementing courses or elements specifically designed to teach computer and media literacy as well as foster self-directedness and personal organizational skills.

In Australia, Certificate in Adult General Education (CAGE) courses are presented through flexible delivery, which means that students can study on- and/or off-site with some teacher facilitation. Success in such a flexible environment requires students to "meet deadlines, manage their own time, be appropriately assertive and seek support and assistance, and show a preparedness or willingness to take control of their learning" (Hawkins, 2001, p. 69). In an effort to address the difficulties students were facing with the course and the high attrition rate (up to 62%) of students from CAGE in Queensland, an additional Bridge course was designed to teach the prerequisite skills and dispositions. Hawkins (2001) interviewed and surveyed 28 students and their teachers and analyzed student outcomes in CAGE to determine the effectiveness of the 150-hour Bridge program or a more intensive, 500-hour personal development and skills readiness course called Newstart, which eight students had completed. Overall outcomes indicated that students who had engaged in some other course before attempting CAGE had higher satisfactory participation and completion than those who did not. Also, youth under age 18 had higher rates of unsatisfactory participation and correspondingly low rates of progress toward goals (mainly since goals were ill-defined). Hawkins concludes that more work needs to be done to prepare students for flexible online delivery in both skill and disposition development.

Other distance and Web-based learning materials build computer and media literacy into the curriculum. *Project CONNECT* and *TV 411*, both online and in supplemental print and video materials, promote media literacy and dispositions of self-directed learning. For example, *TV 411* includes a "Learning" subject area with lessons on Time Management and Knowing Your Learning Style, and weaves media literacy into the subject areas.

Respondents to the evaluation of AlphaRoute (2003) indicated that they had learned significant amounts about computer literacy and self-directedness. More than 92% of respondents said they were now "very comfortable" using a computer, compared with 50% before they worked in AlphaRoute, and more than 80% of students said that they were "better able to figure things out for themselves before asking for help" (p. 71). Additionally, the transferability of personal growth skills emerged as a major finding:

Most striking was AlphaRoute's effect on learners' feelings of confidence, as measured in several different ways. About nine out of ten "have more confidence in themselves, and 56% reported "a lot of difference". This was confirmed by an equal number (89%, with 58% finding "a lot of difference") who feel they can do things they didn't think they could since starting AlphaRoute. More than eight out of ten agreed AlphaRoute helped them to feel they are smarter than they thought, with 50% saying it made "a lot of difference" (p. 68).

The interdependence between learner skills and the demands and supports of the task and environment are illustrated in many of the studies cited throughout this paper and by the experiences shared by practitioners. Understanding how to plan for the balance of skills, supports, and challenges is an area of great need in the field of technology-enhanced adult literacy and language learning.

SUMMARY

Determining threshold levels of language or literacy associated with successful learning or demonstrating causal achievement gains solely to a technology intervention cannot be done at this time. Instead, the field is amassing reports, evaluations, and evidence of the catalytic nature of technology-enhanced learning for even the lowest skilled learners. The motivational draw of learning with and about new technology

applications energizes learners' literacy, numeracy, language, and self-development. It is no longer a question of *whether* enhancing literacy and language learning with technology is appropriate for low-skilled learners, but rather *how*. The lack of replicable studies or interventions (published curriculums or shared online programs) is an impediment to creating an evidence base in this area that could guide future professional development, teaching, and research. However, waiting for a traditional research base to be amassed is impractical: practitioners need guidance, adults need opportunities to grow their skills, and advocates need to represent the learners to content developers and syndicators. The following section captures how the field is moving forward with the research, technical assistance, and practice experience that already exists.

Learning from the Field

A third perspective on the research questions comes from the adult literacy and ESOL field. A great deal of professional knowledge about adults' online learning has not yet been documented in the published literature. Various programs are creating and offering online opportunities to their learners and to adults on their waiting lists, professional organizations are creating and hosting content for adult learners, teachers are creating or aggregating supplemental online materials for their students, and so on. Several outreach activities were undertaken to capture this knowledge: teleconference calls with experienced content producers and researchers, e-mail conversations with content managers, requests for information posted on the Institute's Technology listserv early in the spring of 2007, and a discussion around preliminary literature findings on the listserv in the summer of 2007. Key insights from these sources are presented below and then synthesized to articulate a perspective from the field.

TALKING WITH EXPERTS

Several researchers, developers, and practitioners who have been working in and leading the conversation on adult online learning were identified and invited to participate in teleconference calls to discuss the research questions from their experience. Their experience spans several decades and a variety of delivery media. Their names, affiliations, and online content efforts are listed in table 6.

Before the calls, these individuals were sent an article from the literature review (Birru, Monaco, & Charles, 2004) and a set of scenarios (appendix A) to review. This provided a common set of examples from which to discuss issues related to online learning and adult literacy and language acquisition.

The challenges outlined in Birru et al. (2004) resonated with these experienced literacy providers and content producers. They shared the following insights about the potentials of online learning:

- Reading levels, amount of text, and conventions of online text present real challenges for adult literacy and language learners, given the vast amount, readability levels, and complexity of text online. Adult learners' reading skills and styles put them at a disadvantage; particularly problematic are word-by-word reading rather than skimming habits, ineffective interpretive and synthesis strategies, and vast amounts of unknown vocabulary.

- Media and Web literacy skills and knowledge need to be recognized as necessary skills, and the adult education and ESOL field needs to determine appropriate methods of teaching them. These skills include evaluating credibility, understanding

Table 6: Contributing Experts

Contributor	Main content development effort
Eunice Askov	Formerly of Pennsylvania State University, evaluator of Workplace Essential Skills
John Fleischman	Executive director of the Outreach and Technical Assistance Network (OTAN), developer of *English for All*, co-developer of *TV 411*
Steve Quann	Web design and curriculum specialist at World Ed
Alex Quinn	Executive director of Games for Change; former project director for the Adult Literacy Media Alliance (ALMA), co-developer of *TV 411*
Steve Reder	Project director of the Longitudinal Study of Adult Learners, producer of the Learner Web syndication pilot
David Rosen	Independent consultant, manager of adult ed wiki, contributor to eSquare

search terms and results, building navigation skills, becoming familiar with information architecture conventions, and understanding netiquette.

- Generational and attitudinal differences within the adult learner and ESOL population challenge designers and practitioners to accommodate user preferences; younger users generally navigate more aggressively than older users, who prefer a more linear presentation.

- The consequences of the shift toward user-generated content and interactivity are unclear for adult learners as well as content producers.

- Practitioners are not always aware of appropriate and relevant Internet content that is written in easy-to-read language, translated content, sites with embedded text-to-speech features, or sites with instructional videos. There are few formal channels of information dissemination to literacy and language instructors.

- Practitioners are not always aware of technology options available on most operating systems and browsers that could greatly enhance adult learners'

access to Internet and computer-based information. These options are customizable, and include text readers, translation tools, font size and color contrast controls, input choices, and icon and menu item enlargement or reordering.

- Aggregation and syndication of online content especially chosen for adult learners is a valuable service, but not a substitute for the media and Web literacy skills that would allow adults to engage more successfully in self-directed learning on the Web.

The enthusiasm of this group of experienced content creators for the potential of literacy and language learning through technology was sustained by their personal experiences of adult learners' success with online learning. These success stories energize leaders to continue to innovate and create solutions and opportunities. Several new projects to offer online, mobile, and interactive content delivery in the adult literacy and language learning field were discussed on the calls, including promising improvements and exciting new directions.

From their experiences designing and hosting online content, the experts shared these success stories:

- *TV 411* (www.tv411.org) was developed for adult learners to use on their own (with supplemental print materials). Usability testing with adult learners helped developers to determine a successful balance of information and graphics (graphics should reinforce, not compete with the message), iterativeness, and linearity. It also encouraged them to pay special attention to what happens when a learner makes a mistake. The Web site features more than 100 lessons, six of which are in Spanish. In 2006, the site had more than 17 million page views, and nearly 500,000 unique visitors, and nearly 27,000 downloads of teacher resource materials.

- The California Distance Learning Project site (www.cdlponline.org), maintained by OTAN, offers hundreds of "repurposed" news stories from mainstream media organizations. Each story provides a simple-to-read version with accompanying audio narration, and some with video. Users can complete a variety of vocabulary, spelling, and reading comprehension activities about the story. The site averages more than 3.5 million visitors per month. The popularity of this site is attributed to its extensive audio assistance and the repetitive, controlled nature of the learning environment.

- *English for All* (www.myefa.org), the online curriculum developed under Cyberstep, has been adopted around the country and the world by English language learners. Analysis of the Web data shows that the site receives 1,000 unique visitors per day. Thirty-five percent of visitors (75% of the total from the United States) are from California.

These experts recommend that adult literacy practitioners and policymakers should be providing guidance to mainstream Web designers, content producers, and syndicators on the features and tools that could make the Internet, browsers, and search engines more user-friendly to adults new to the Web and with low levels of literacy and language proficiency.

SHARING WITH THE NATIONAL INSTITUTE FOR LITERACY TECHNOLOGY LISTSERV COMMUNITY

In the summer of 2007, preliminary findings from the literature review were shared with the Institute's Technology listserv, an online community of educators who are interested and involved in incorporating technology into their instructional programming (at various levels of education). The overarching research questions and direction were shared with the group. Subscribers were asked to provide feedback on the findings to date and to share experiences from their work that confirmed or questioned those findings. Over the period of a month, the list was very active, with a robust conversation about the three findings shared: program implementation issues, evidence of improvements of basic literacy and language skills, and student skills and dispositions associated with successful technology-based and online learning. (See the full posting in appendix B.)

A thematic analysis was then conducted on the more than 30 posts that were directly related to the findings, although many related conversations were also generated during and after the assigned guest moderation. Contributors included program coordinators, instructors, instructional designers, and fellow researchers. As would be expected from this group of dedicated technology enthusiasts, they shared a belief that technology creates enthusiasm, incentives, and motivation for adult learners—even for those with the lowest literacy and language proficiencies. Two listserv comments capture this value:

- *Students do enjoy working at computers. For many of them, it's a reassurance that they are really part of the modern world.*

- *Learning technology is in and of itself a great incentive for the lowest skilled people we serve.*

The following themes emerged from the listserv about incorporating technology into adult literacy and ESL instruction.

- Aging equipment at programs and at students' homes is a barrier to using multimedia options for supplemental or distance learning.

- The multimedia, multimodal engagement of technology-based learning is key to its effectiveness and engagingness for adult learners.

- Video games and online multiuser virtual environments offer compelling delivery alternatives, yet are underdeveloped as educational options.

- Orientation activities for distance learning options have been found to:
  - o Promote retention;
  - o Provide an opportunity to assess students' technical skills and learning dispositions; and
  - o Provide a safe, penalty-free way to try out new learning modes; yet
  - o There is no clear guidance on how much orientation is sufficient, what an orientation should include, or how to orient students to every different platform.

- Computer literacy courses are an important offering that complements both academic and workforce development skills, and have been offered as courses that are:
  - o Folded into distance learning courses;
  - o Taught as a stand alone programs; and
  - o Offered as drop-in labs with onsite support.

- As students recommend resources to each other, they develop an important referral network.

Online resources were shared extensively on the listserv, from typing practice sites to language practice via voice-over Internet protocol.

Reinforcing the literature findings, the majority of models shared were of the supplemental use of online learning resources and options matched with some type of facilitated support from an adult literacy program. Programming models seem to be designed based on programs' infrastructure and available teacher expertise rather than theory or research. Offering orientation or try-out periods was resoundingly endorsed as an effective way of boosting retention in supplemental and distance learning options; orientations have been evaluated informally in Project IDEAL and through AlphaRoute. A major concern, among listserv participants, however, was that there was no clear guidance related to orientation and matching supports to students' abilities: how and on what dimensions to screen adults, what supports to offer based on screening results, or how to structure orientation experiences to be most effective.

Instructors noted that students, like as teachers, are sharing and recommending resources and Web sites to each other. This informal networking is encouraging to technology enthusiasts and indicates that more students are looking to self-study online. However, it is clear that reviewers have few common evaluation criteria to guide recommendations. Most of these types of posts said *Program X software is good, Program Y is better, We use program Z, etc.* without providing further information to guide the receiver(s) of the message. Only one participant shared her process for finding resources:

> *I Google the type of help [a student] needs and pick out a site that looks helpful and not full of advertisements. I have also learned of some valuable resources when taking a DL102 class through the University of Michigan's Project IDEAL…*

Guidance on how to evaluate and/or a clearinghouse of learning resources evaluated on a common set of guidelines might help guide decision making and save instructors significant time. The sites shared on the listserv were mainly stand-alone, not aggregated on one easy-to-find and navigate site; nor were they in any way developed with similar design principles. Users have to negotiate new vocabulary and interfaces on each site. As is discussed in the literature review, this lack of consistency presents additional challenges for users with low literacy and language proficiency.

A resounding gap in the listserv conversation was a lack of discussion about of students' engagement with technology as a goal related to their role as family members and parents. Contributors discussed students' motivation to improve workplace skills, but there was no mention of family roles. This may have been an anomaly, and it remains for further research to pursue the connection often heard from students that, as parents, they want to be able to assist their children with homework on the computer.

SUMMARY

It is clear that many educators are committed to integrating technology into all skill levels of adult literacy, numeracy, and language learning because of the synergistic quality of the learning and development they see in students. It also is apparent that the efforts of educators in most instances are not coordinated above the program level. Project IDEAL, funded since 2002 by the U.S. Department of Education, Office of Vocational and Adult Education, has been a lighthouse project and is recognized in the field, but it does not reach all programs and educators. Content developers likewise remain committed to harnessing new technologies and options for the low literacy and language proficiency population, and their efforts are meeting with enormous demand.

Key Findings

Triangulating from the three major data sources—large-scale studies, research literature, and experts and practitioners in the field—affords this report solid footing on which to draw some key findings to the guiding research questions. The search for thresholds, foremost, revealed that such thresholds did not exist: learners at even the lowest levels of literacy and language proficiency can engage with online learning content. Moreover, all reports indicate that they are eager to do so and that they benefit in important ways such as self-confidence, self-directedness, and independence. Matching the content and interface to the learners' skill and language level, however, remains challenging. Programs' efforts to implement supplemental and alternative learning options with online content are being documented. Yet technology trends, access patterns among American adults, and delivery platform options develop and change ahead of the pace of data collection, published evaluations, and program planning.

Although not all of the findings below are wholly new to the field, finding them again as the result of a systematic investigation adds credibility to commonly known realities in adult literacy and language learning, such as the importance of work-related skills. It is hoped that this report can join other voices moving the field toward a discussion of evidence-based technology-enhanced solutions.

- Understanding the interrelatedness of the tasks, skills, and supports necessitates research and development to guide the design of learning environments and activities that are flexible and that can differentiate on all three dimensions.

Experimenting with flexible supports, both human and technological—the variable most accessible to adjustments by educators, program managers, and Web designers—is likely to yield a wealth of information to guide further development.

- The centrality of work readiness—what the British call "upskilling"—to adults' learning lives provides a key leverage point for programming and content design to address this goal more directly and, through it, more basic literacy and language skills.

- Adults' existing family and social networks that have proven critical to learning pursuits with technology provide another leverage point that could be tapped with community-based, authentic learning environments, activities, and products.

- Self-directed skills valued in lifelong learners can be nurtured by providing facilitated access to online, independent learning environments. The studies converge on the findings that engagement with these environments fostered the skills associated with successful self-directed learning.

- The large numbers of visitors to freely available online sites such as *English for All*, *TV 411*, and California Distance Learning Project Online indicate that users are finding them. Evaluation data, however, are needed to determine how users are interacting and learning with the material or whether these sites are or could be stepping stones to a more formal course of study.

- Rates of access and connectivity in the low-income community are definitely growing, yet high-quality equipment and broadband or wireless access is far from ubiquitous. This reality constrains development and dissemination of online learning portals and sites. Findings from the U.K. (Selwyn, Gorard, & Furlong, 2006) do not support an expanded use of public Internet terminals by the low literacy and language proficiency population as a solution to this problem.

- The use of emerging technologies to deliver learning content is only beginning to be reported in the research literature (for example, Kambouri, Mellar, & Logan, 2006). Nevertheless, technology enthusiasts believe strongly that consumer electronics (such as cell phones and PDAs), interactive Web 2.0 platforms (such as blogs, video conferencing, and immersive environments), and the convergence of media (such as television and radio delivered over the Internet) have the potential to reach new populations and provide authentic learning and communication.

Discussion and Conclusion

This report is a panoramic look at online learning participation by adults with low literacy and low levels of English proficiency. As such, it is neither overly detailed nor focused on particular elements of the field. The large-scale studies afford a broad view of adults' patterns of technology use, access, and connectivity and reinforce the strong connection between literacy and technology use, but they do not answer many questions about how and why, what if and for whom. The research literature provides a view of how adults are learning with online technologies, but there are too few studies with student achievement data to aggregate to make conclusive statements; furthermore, this literature is almost completely limited to the population of students already in programs. Practitioners point the way to creative solutions to program planning and engaging students, but the knowledge base is too informal and program-specific to prescribe actual development.

This investigation set out to determine whether thresholds of basic skills and/or English language

proficiency for successful online learning were identifiable with what was known in the field to date. Specific test scores or ESL levels have not been identified. Instead, this investigation triangulated from multiple data sources to reveal some of the access, implementation, and design issues for the target populations and their online learning habits. Together, these data suggest that it is the *interaction* among learners' skills, the online environments they encounter, and the supports available that determines those thresholds, and that even learners with very low literacy or language proficiency have been successful with some online environments. Supports—in the form of an online avatar, distance coach, tech support hotline, drop-in facilitator, or tutor—are critical to helping learners strike and maintain a balance and be successful.

Existing online and hybrid learning options could serve as ready platforms for investigations that could yield the guidance the field craves for development and implementation. Observation studies could demonstrate how adult learners use online content, and quasi-experimental studies could document vocabulary, language, and skill acquisition trajectories and the types of support that are most beneficial and efficient for different groups of learners. Understanding how to design flexible environments that provide the elements of skills, content design, and supports to serve multiple users' needs could create new options

and opportunities for learning, instruction, program planning, and content development.

And finally, the report focused on online, desktop-computer based learning portals and content. The convergence of television, radio, and Internet content as well as the penetration of powerful mobile, Internet-enabled personal devices will challenge the dominance of this mode. In the United States, mobile access is currently estimated at 62% (Pew Internet and American Life, 2007) of the adult population and is projected to grow. Around the world, offering learning opportunities through cell phones and mobile devices is a growing reality with great potential, especially for migratory populations and those without the infrastructure to support high-quality desktop equipment or broadband Internet connections.

Online environments engage and inspire adults, serve the common adult goal of improving workforce readiness, provide authentic communication channels that tap into adults' family and community involvement, and supply an opportunity to engage in self-study and informal learning. We have confirmation that we are headed in the right direction with the inclusion of online technologies for the instruction and engagement of adult learners, even those with the most limited skills and language proficiencies. What the field needs now in is a compass and a few strategic landmarks to chart a course forward with online technologies—our learners already inhabit the landscape.

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Appendix A: Scenario Shared with Expert Panelists

Scenario 1: Searching and Determining Quality

You (an ABE student) receive this note from your child's school.

You take your child to the library and research the topic together.

What skills must be in place in order to be successful?

Please help your student prepare for the 4th Grade Science Fair by:

1. Researching the chosen topic
   My topic: *Dinosaurs*

2. Researching the key question(s)
   My question: *Were dinosaurs warm or cold blooded?*

3. Identifying three sources of high-quality information
   Source 1: _____
   Source 2: _____
   Source 3: _____

4. How can you tell if the source is trustworthy?
   These sources are trustworthy because:
   _____

Scenario 2: Practicing English

After attending a semester of beginning ESOL, you (an adult student) can no longer attend classes.

The teacher had shown the class how to find www.pumarosa.com.

Can you study English online?

What skills and environmental conditions must be in place in order to be successful?

Scenario 3: Searching for Health Information

You (an adult with limited literacy not attending ABE classes), are presented two challenges:

1. Imagine that someone you care about has lung cancer. This person would like to know about treatments for lung cancer. Can you find out the three main types of treatments?

2. Imagine that you are at a doctor's office and you are told you have a disease called diabetes (sometimes called sugar). You are given a pill called Metformin to take for it. What does Metformin do?

Appendix B: Posts to the National Institute for Literacy Technology Listserv

POST 1:

My charge from NIFL has been to investigate the literacy and language proficiency thresholds necessary for adults to participate in online learning successfully. Every noun in that sentence is, I realize, loaded with assumptions and in need of definition.

My participation on the listserv for the week of June 11–15 is to host a discussion with all of you on my preliminary findings from the literature as well as to solicit your input to the research based on your experiences in programs.

Mariann has been kind enough to let me post a request for documentation or background information on the topic through the listserv before, and I very much appreciate all the responses and productive leads I received about how programs are providing learning opportunities to adults not actively involved in classes.

Here then, to begin, are *preliminary* findings (and not my full methodology or bibliography since both are currently incomplete) from the published and posted literature on adult online literacy and language learning. I hope you find them validating or provocative (or both!) and can join in a lively discussion of what's actually happening in your school or program.

It is not surprising that few published research studies document independent, self-directed learning—after all, finding and following independent learners on self-chosen tasks is not typical research. Therefore, the nets were cast as widely as possible. In the end, most of what I found is about computer-assisted and online learning that is supplemental to classroom and program involvement. The implications of this, of course, are that this knowledge is based on learners who are already in programs and, as we know, these

learners represent only a small fraction of the adult population with low literacy and English language proficiency.

Nevertheless, the findings are useful as an important source of information about the issues and complexities of online learning by adult learners as well as offering signposts to where strategic supports could prove helpful for learners working with minimal program or teacher/facilitator involvement.

There are three main areas I would like to share with the listserv: program implementation issues, evidence of improvements of basic literacy and language skills, and student skills and dispositions associated with successful technology-based and online learning. I'll share them in successive posts through the week.

To start, here are some key findings on implementation issues from a review of program and project evaluations:

- Online learners and teachers need support—pure online delivery is not best practice for adult literacy and ESOL learners. Support could include:
  - o a facilitator at least some time for students,
  - o student-to-student communication,
  - o readily available tech support for both teachers and students, and
  - o a peer group for teachers of distance courses as teachers learn the new medium
- Induction programs or computer literacy skills pre-requisites set the stage for success
- Students are eager to learn computer literacy skills alongside content

- Supplemental online learning can be a positive option that increases students' overall improvement, retention, and persistence

- The quality of the equipment and the connection—on both ends—makes a significant difference for the success of the experience and all surveys point to the realization that most students do not have access to high quality computers and broadband Internet service nor do programs take learner costs (such as connectivity) into consideration.

So, how do these findings correlate with your experience and knowledge? Can you share an example that confirms, challenges, or adds to them?

POST 2:

To recap, I am posting *preliminary* findings (and not my full methodology or bibliography since both are currently incomplete) from the published and posted literature on adult online literacy and language learning. I hope you find them validating or provocative (or both!) and can join in a lively discussion of what's actually happening in your school or program.

This is the second of the three main areas I am sharing with the listserv: program implementation issues, evidence of improvements of basic literacy and language skills, and student skills and dispositions associated with successful technology-based and online learning.

Here are some key findings from the review of studies reporting evidence of improvement of basic literacy and language skills:

There is growing evidence that adult learners' work with computer-based or online materials that are supplemental to adult literacy and ESOL classes contributes positively to their overall literacy and language acquisition plus complementary learning skills. The evaluations reviewed were of supplemental materials available to students with some type of program support (on-site trained teacher or support person, support person available online, tech support

available through the program, and/or automated feedback system in the program) and varying degrees of integration with the regular class curriculum.

Importantly, the supplemental materials and online interfaces were either uniquely developed or chosen for adult literacy and language learners. Programs have documented successful use of these materials with all levels of students, including those with the lowest levels of literacy and English proficiency.

Quantifying specific academic skills achievement is difficult to pinpoint, but several significant studies report learning gains attributable to the supplemental use of technology in instruction and practice. It must be acknowledged that there is still no "body of evidence" with repeated and comparable studies that can definitely answer questions about particular interventions used with particular literacy or language levels with predictable results.

How do these findings correlate with your experience and knowledge? Can you share an example that confirms or challenges them? What has been your experience with the lowest skilled students?

POST 3:

To recap, I am posting *preliminary* findings (and not my full methodology or bibliography since both are currently incomplete) from the published and posted literature on adult online literacy and language learning. I hope you find them validating or provocative (or both!) and can join in a lively discussion of what's actually happening in your school or program.

This is the third of three main areas I am sharing with the listserv: program implementation issues, evidence of improvements of basic literacy and language skills, and student skills and dispositions associated with successful computer-assisted and online learning.

What follows are some key findings from the review of studies reporting student skills and dispositions that are associated with successful computer-assisted and online learning. This area includes a few studies of pilot programs closer to the target inquiry into independent

online learning that looked specifically at students' performance and skills and dispositions. Self-directedness and active learning are repeatedly emphasized as the hallmarks of successful online learning in the program evaluations and descriptions, no matter the literacy and language proficiency levels of the students.

Most studies' findings converge to the following list of defining skills and dispositions of successful independent online students published by Askov et al. (2003: Expanding Access to Adult Literacy with Online Distance Education. Askov, Eunice N.; Johnston, Jerome; Petty, Leslie I.; Cambridge, Massachusetts, National Center for the Study of Adult Learning and Literacy, p. 34):

- "They were employed or actively seeking employment.
- They had a clear goal for their participating in the program.
- They read at a seventh grade level or higher.
- They had the ability to organize their time and work independently.
- They either had a computer at home or easy access to a computer at a place they felt comfortable.
- They had computer skills that allowed them to navigate the site and the Internet."

These skills and dispositions reappear in other descriptions of successful online learners, including those in Australia (see Flexibility through online learning: At a glance (2002), at http://www.flexible-learning.net.au/flx/go) and the United Kingdom (see Selwyn, N., Gorard, S. and Furlong, J. Adult Learning in the Digital Age [London: Routledge, 2006]).

Also, a reciprocal relationship seems to emerge: technology-based learning environments foster the very skills necessary for success (you learn by doing it). From the program evaluations come the documentation of gains in personal growth (mainly self-reported or teacher-observed) in the following dimensions:

- self-confidence
- motivation-retention-persistence
- independence and self-directedness
- goal directedness
- real-world transfer and reinforcement of skill acquisition.

Additionally, assisting learners to meet their goal to become more computer literate help adult literacy and language learners feel a part of the mainstream digital and information age.

How do these findings correlate with your experience and knowledge? Can you share an example that confirms or challenges them? How are you involving learners new to technology or independent learning situations?