The Centre for Literacy
Le centre d'alphabétisation

Problem-Solving in a Technology Rich Environment and Related Topics:

A Centre for Literacy Research Scan for Fall Institute 2013

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Introduction

This research scan has been prepared for Fall Institute 2013 – Interpreting PIAAC Results: Understanding Competencies of the Future. It is a companion piece to our research scan on PIAAC prepared for Summer Institute 2013. This scan features documents on digital competencies and the PIAAC domain of **"**Problem-Solving in a Technology-Rich Environment (PS-TRE)**,** tracing the origin of PS-TRE as a specific domain to the 2003 U.S. National Assessment of Educational Progress. It also includes documents and video presentations on the literacy and numeracy domains in PIAAC, as well as the Background Questionnaire. We will add more summaries after the Institute.

Background: International Adult Literacy Survey (IALS) and Adult Literacy and Life Skills (ALL) Survey

Murray S, Clermont Y, & Binkley M. (2005). *Measuring Adult Literacy and Life Skills: New Frameworks for Assessment*. http://www5.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=89-552-MIE2005013&lang=eng

> This report documents the development of the International Adult Literacy and Life Skills Survey (ALL). It looks at the policy issues that motivated the previous survey (IALS), the objectives of the ALL, the practical considerations that shaped its development, the domains originally considered for possible inclusion, the approaches taken to assessment in each domain and the criteria used to decide which domains would actually be used. The report documents where the ALL survey succeeded in extending the range of skills assessed and in improving the quality of the assessment methods used.

The Centre for Literacy. (2013). *IALS and Essential Skills in Canadian Literacy Policy and Practice: A descriptive overview.*
http://www.centreforliteracy.qc.ca/sites/default/files/IALS_ES_CdnLtcyPlcy_Prctce.pdf

> This paper, produced for Summer Institute 2013, gathers descriptions on the uses of IALS (and IALSS) and the essential skills framework in policy contexts across Canada. The information was taken from federal, provincial, and territorial governments' web sites searched between January and March 2013. The final section looks at literacy organizations and their uses of IALS and essential skills.

Digital Competencies in the Workplace

This section features publications on the growing importance of digital competencies in the workplace and the economy at large, and proposed policy responses.

Chinien, Chris, & Boutin, France (2011). *Defining Essential Digital Skills in the Canadian Workplace: Final Report*. Office of Literacy and Essential Skills, Human Resources and Skills and Development Canada. http://www.nald.ca/library/research/digi_es_can_workplace/digi_es_can_workplace.pdf

From Feb. 2012 scan

> This is the final report of a project that proposed a Canadian digital skills framework to Human Resources and Skills Development Canada (HRSDC). It was based on an international literature review and key informant interviews with employers in small and medium-sized enterprises in Canada focusing on issues related to digital skill needs. Using the literature review, researchers Chris Chinien and France Boutin developed a framework that included four skill clusters: (1) foundational skills; (2) transversal skills; (3) technical digital skills; and (4) digital information processing skills. They then interviewed informants from different economic sectors to validate the framework, and found that a large majority rated the framework as useful and comprehensive.
>
> The researchers found widespread agreement in the literature that digital skills development is of growing importance – and is recognized as a top priority of economic recovery policy in the majority of OECD countries. "Foundational skills" (i.e. reading, writing and numeracy) were included in the framework because they are considered to be necessary for digital skills, and their inclusion was supported by the informants interviewed for the study. The authors recommended that the proposed framework be further validated through a series of focus group meetings, that it be used as a foundation to update HRSDC's Essential Skills occupational profiles, replacing "computer use" with "digital skills", and that further research be conducted into appropriate assessment tools and to support periodic updates of the framework

Davies A, Fidler D, & Gorbis M. (2011). *Future Work Skills 2020.* Institute for the Future (IFTF), University of Phoenix Research Institute.
http://www.iftf.org/uploads/media/SR-1382A_UPRI_future_work_skills_sm.pdf

> This report looks at how workplace demand for skills is likely to evolve over the next decade in the United States. It does not attempt to identify the "jobs of the future" but provides a forecast of what work skills will be most in demand over the coming decade. To do this, the researchers reviewed previous IFF research into shifts in work, conducted interviews on workplace trends with experts such as temp agency executives, educators, to economists, and then synthesized the material into a preliminary set of work skills which was validated in workshops held with a

new group of experts. The report identifies six "drivers" of change, including longer human life spans, and "smart" machines replacing workers in rote, repetitive tasks. The report identifies "ten skills for the future workplace", including "sense-making", social intelligence, "novel and adaptive thinking", cultural competency, the ability to analyze and synthesize data, "new media" literacy, and interdisciplinary thinking. The report calls for a greater focus in educational institutions on lifelong learning, critical thinking and digital competencies.

Ontario Literacy Coalition (OLC) (2011). *Menial No More: A Discussion Paper on Advancing our Workforce through Digital Skills*. Retrieved March 15, 2012, from http://www.nald.ca/library/research/olc/menial_no_more/menial_no_more.pdf

from March 2012 Research Scan [pdf]

This report explores the implications of a major finding from the OLC's workplace literacy and essential skills (WLES) demonstration projects implemented in fifteen workplaces across Ontario from 2009 to 2011. They found that due to emerging technology, pressures to increase productivity, and legislative changes to health and safety standards, low-status, low-paying jobs which were assumed to be low-skilled now require increasing levels of literacy and other essential skills, particularly digital skills. The report presents a number of case studies that demonstrate this trend, looks at how jurisdictions in the US and UK are trying to ensure that workers will have the required skills, and makes some recommendations for Ontario.

Digital Media and LES

The first of these documents looks at the relationship between use of digital technologies and skill levels; the others look at how these technologies can be used in LES programs.

Veenhof, B., Clermont, Y., & Sciadas, G. (2005). *Literacy and Digital Technologies: Linkages and Outcomes*. Statistics Canada. Retrieved September 20, 2013, from http://www.nald.ca/library/research/stats/ldtlo/cover.htm

Using data from the 2003 Adult Literacy and Lifeskills Survey (ALLS), this paper investigates relationships between adult literacy skills and use of information and communications technologies (ICTs). The paper includes information for Canada, its provinces and territories, and five other countries, including Norway, Bermuda, Switzerland, the United States, and Italy. The study found that people who used computers more intensively and for a more diverse array of uses generally had stronger prose, document, numeracy and problem-solving skills.

Donna M. Chovanec and Amy Meckelburg (2011). *Social Networking Sites & Adult Literacy Learning: Raising the Issues.* AlphaPlus. Toronto, ON. Accessed at http://www.alphaplus.ca/en/about/alphaplus/annual-reports/cat_view/66-social-networking-sites-and-adult-literacy-learning.html

from December 2011 Research Scan [pdf]

> This report looks into how adult literacy learners use social networking sites (SNS), and how those sites could be used to facilitate adult literacy learning. The researchers studied adult literacy learners in Edmonton, AB, through observation and through group interviews, and conducted a literature review. They found that adult literacy learners use SNS for social purposes but in the process informally acquire literacy, technical and social skills. However, the author says that few are using SNS to their full potential due to lack of access or of technical know-how. The report also suggests that literacy programs could help learners safely and effectively use SNS.

Eaton, Sarah Elaine (2011). *The Need for Increased Integration of Technology and Digital Skills in the Literacy Field in Canada*. Retrieved February 28, 2012, from http://www.nald.ca/library/research/eaton/need_tech_literacy_field/need_tech_literacy_field.pdf

from February 2012 Research Scan [pdf]

> This report, directed at people involved in the literacy sector in Canada, notes that digital technology has become an integral part of both the learning experience and everyday life in Canada. The notion of literacy has expanded to include "digital skills". However, the literacy sector has been slow to integrate learning technologies. The report makes recommendations for people and organizations working in adult literacy on how to incorporate technology into professional practice.

AlphaPlus. (2012). *Learning Together with Digital Technologies: Illustrative Case Studies.* Retrieved August 7, 2012, from http://alphaplus.ca/en/web-tools/online-publications-a-reportsgroup1/learning-together-with-technologies-2012.html

from July-August 2012 Research Scan [pdf]

> In 2011 the province of Ontario introduced the Ontario Adult Literacy Curriculum Framework (OALCF) which requires programs to teach six competencies, including the use of digital technology. This report provides case studies of four community-based adult literacy programs in Toronto using digital technologies for teaching and learning. These case studies explore how programs are integrating digital technology and e-learning into adult literacy programming, and the opportunities and challenges that programs face in doing this. The researchers found that

> each organization's integration of digital technology was aligned with its values and vision. Challenges included: developing and maintaining technology infrastructure, lack of technical support for instructors, and limited resources in terms of money and staff time.

Greig, Christopher, & Hughes, Janette. (2012). *Adult Learners and Digital Media: Exploring the usage of digital media with adult literacy learners.* Retrieved October 26, 2012, from http://www.alphaplus.ca/en/web-tools/online-publications-a-reportsgroup1/adult-learners-and-digital-media-2012.html

from October 2012 Research Scan *[pdf]*

> This report sets out the findings of a study in which the researchers used small group and one-on-one interviews to explore attitudes towards, and experiences with, digital media of twelve adult literacy learners in adult education programs in Windsor and Oshawa, Ontario. After the interviews, the researchers conducted small group sessions on the use of digital media, and then carried out follow-up interviews to find out whether learners' perceptions of digital media had changed. Initial interviews found that the adult learners were not using digital technologies much – however, when participants were shown how to create things using these technologies, this increased their confidence and interest. The learners lacked easy access to technologies such as the Internet, and there is a discussion about how lack of access to these technologies could deepen the economic marginalization of those who are already marginalized, although public resources like libraries can provide some access. One limitation of the study may be the very small sample size.

The PS-TRE Concept in NAEP

The publications featured here show how the concept of "Problem-solving in a technology-rich environment" was developed and used in the U.S. National Assessment of Educational Progress in the early 2000's before it was adopted and adapted for PIAAC. The TRE study was one of three field investigations in the National Assessment of Educational Progress (NAEP)'s Technology-Based Assessment Project. Nationally representative samples of 8th graders were assessed on two computer-delivered, extended problem solving scenarios. One scenario measured skill in searching for electronic information, while the other assessed skill in using "what-if" simulation to discover physical relationships. Each scenario was taken by a different sample of approximately 1,000 students. The two main components of PS-TRE assessed were computer skills and scientific inquiry, and performance was judged by both the quality of answers given to open-ended and multiple-choice questions and of the process undertaken to reach those answers. Data were collected in the spring of 2003.

Bennett RE, Persky H. (2001). Problem Solving in Technology-Rich Environments. (Research Memorandum). Educational Testing Service. http://www.ets.org/Media/Research/pdf/RM-01-02-Bennett.pdf

This paper describes the Problem Solving in Technology-Rich Environments (TRE) study which was to be carried out in 2003 and explains the principles guiding the creation of the TRE modules. The purpose of the study would be to show how computer technology could be used in the NAEP assessment.

Problem Solving in Technology-Rich Environments – National Center for Educational Statistics
http://nces.ed.gov/nationsreportcard/studies/tba/tre/

This page describes the "Problem Solving in Technology-Rich Environments (TRE)" demonstration study of Grade 8 students in the United States. The description includes a definition of "TRE" as use of the computer to do things that cannot be done easily on paper and as "the type of problem solving done with computers in educational and work environments.

Bennett RE, Persky H., Weiss AR, Jenkins F. (2008). *Results and Lessons Learned from the NAEP Problem Solving in Technology-Rich Environments Study.*
http://www.iaea2008.cambridgeassessment.org.uk/ca/digitalAssets/180465_Bennett_R.pdf

Bennett, R.E., Persky, H., Weiss, A., & Jenkins, F. (2010). Measuring Problem Solving with Technology: A Demonstration Study for NAEP. *Journal of Technology, Learning and Assessment, 8*(8). Retrieved September 11, 2013, from ejournals.bc.edu/ojs/index.php/jtla/article/view/1627

These two papers discuss the methodology and results of the Problem Solving in Technology-Rich Environments (TRE) study. Since this was an exploratory study, the focus of the data analysis was to find out how well the TRE scenario scores captured the skills they were intended to measure, rather than on the scores themselves. The authors find that the study "did not provide convincing evidence of the validity of scores for making strong statements about students' skills", since only the most basic psychometric analyses were conducted. However, they say it did produce a useful definition of problem-solving technology and produced scores that seemed to function "in a reasonable way psychometrically". They also noted serious challenges in doing an operational national assessment of problem solving with technology since there was no widely accepted syllabus in which to ground test development, since designing performance tasks for computer was still a new activity and many schools still did not have the necessary infrastructure.

PS-TRE in PIAAC

These documents describe the "Problem-Solving in Technology Rich Environments" (PS-TRE) domain in PIAAC, and how it was developed for the PIAAC survey of 2012.

Britt, Anne. (2013). PIAAC PS-TRE [presentation on video]. Educational Testing Service
http://www.youtube.com/watch?v=Ulqirbv9Q5g

> Anne Britt, Professor in the Psychology Department at Northern Illinois University and member of the PIAAC Expert Group on Problem Solving in Technology-Rich Environments, explains aspects of the PIAAC problem solving in technology-rich environments domain.

PIAAC: Problem-Solving in Technology-Rich Environments and the Survey of Skills Used at Work- *Essential Skills Bulletin* 2013, Issue 2, Essential Skills Ontario
http://www.essentialskillsontario.ca/sites/www.essentialskillsontario.ca/files/Essential%20Skills%20Bulletin%202_2013%20PIAAC.pdf

> Essential Skills Ontario devoted an issue of the *Essential Skills Bulletin* to provide an overview of two new elements of PIAAC – the "problem-solving in technology-rich environments" (PS-TRE) competency, and the Survey of Skills Used at Work. It explains how the PIAAC Expert Group used earlier research to develop the PS-TRE framework. The research base included studies conducted in the early 2000's by Levy, Murnane and Autore on work tasks in US workplaces from 1969 to 1999 that confirmed the growing importance of problem-solving and complex communication skills and a decline in routine tasks due to technological change. The Group also drew on other research that suggested using computers and other digital technology effectively requires a mix of technological aptitude with abstract problem-solving skills. The bulletin includes a diagram of the PS-TRE framework.

Literacy in PIAAC

PIAAC Literacy Framework *[presentation on video]* **-** Educational Testing Service
http://www.youtube.com/watch?v=WCNk9Y9cl6w

> John Sabatini, Principal Research Scientist in the Research & Development Division at Educational Testing Service, member of the PIAAC Literacy Expert Group, and co-designer of component assessments for PIAAC and NAAL survey, explains aspects of the PIAAC literacy domain, including how literacy is defined for PIAAC, and how the framework developed for PIAAC builds on the assessments of literacy in the IALS and IALSS.

Numeracy in PIAAC

PIAAC Numeracy *[presentation on video]* - Educational Testing Service
http://www.youtube.com/watch?v=HFeNln9e10g

> Kentaro Yamamoto, Deputy Director of the Center for Global Assessment at the Education Testing Service, who designed and directed data analysis for the first International Adult Literacy Survey (IALS) and the Adult Literacy and Life Skills Survey and directed its data analysis since 1998, explains aspects of the PIAAC numeracy domain. He looks at the Conceptual Framework (*see the Summer Institute 2013 research scan),* what is covered by the PIAAC numeracy construct, and design of the assessment instruments (computer-based and paper-based).

PIAAC Background Questionnaire

Sabatini, JP, & Bruce, KM. (2009). PIAAC Conceptual Framework of the Background Questionnaire Main Survey . OECD.
http://www.oecd.org/site/piaac/PIAAC%282011_11%29MS_BQ_ConceptualFramework_1%20Dec%2011.pdf

> This paper provides an overview of the conceptual framework developed for the PIAAC Background Questionnaire (BQ). The authors set out the criteria for the inclusion of concepts and items in the BQ and also discuss the policy questions the BQ seeks to answer, including: "How are skills distributed?", "Why are skills important?", and "What factors explain gains and losses in skills?". They also discuss the use of the Job Requirements Approach (JRA) module to assess the relevance of skills not covered by the direct assessments and to obtain information on the demand for skills in the workplace *(see Survey of Skills Used at Work below)*

How Does PIAAC Enrich the Meaning of Literacy Assessment? A Look at the BQ *[video presentation]*
http://www.youtube.com/watch?v=XtybHoCcbGg

> Matthias von Davier, Research Director in the Research & Development Division at Educational Testing Service, explains aspects of the PIAAC background questionnaire, including how computer delivery allows for greater adaptability. He gives an overview of the different sections of the BQ including: general information; education and training; current labour force status and work history; current work or last job; skills used at work; literacy, numeracy and ICT at work; literacy, numeracy and ICT at home; information on learning strategies, civic activity, social trust, health; and background information such as relationship status, family, immigrant status, languages, and parent's education. Von Davier also discusses issues of data quality, and continuity with previous surveys

OECD. (2010). *PIAAC Background Questionnaire* . http://www.oecd.org/edu/48442549.pdf

The PIAAC background questionnaire gathers information on factors influencing the development and maintenance of skills, including education, social background, and engagement with literacy and numeracy and digital technologies. It also collects information on respondents' employment status, income, health status, volunteering, and social trust.

Survey of Skills Used at Work

PIAAC: Problem-Solving in Technology-Rich Environments and the Survey of Skills Used at Work- *Essential Skills Bulletin* 2013, Issue 2, Essential Skills Ontario
http://www.essentialskillsontario.ca/sites/www.essentialskillsontario.ca/files/Essential%20Skills%20Bulletin%202_2013%20PIAAC.pdf

Part of the issue of *Essential Skills Bulletin* 2013 discusses the Survey of Skills Used at Work, part of the Background Questionnaire of PIAAC. The Survey uses the Job Requirements Approach (JRA), a methodology that has been used in the United States, UK and Italy. JRA asks workers to indicate the importance of types and levels of generic skills for their work. The Survey results are expected to enable policymakers to better understand the extent to which people's skills are being effectively used in workplaces, and the extent to which there is a "mismatch" between the skills people have and the skills that employers need.