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WHAT IS IN A TECHNOLOGY COMPETENCY?

A recipe for the skill(ed) use of digital tools

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Introduction

Digital skills are on the table. These skills are on the table for governments that are focusing on getting people back into the workforce after the economic crisis. These skills are also on the table for educational institutions that are maximizing their reach and profits. These skills are on the table for adults who are trying to meet the demands for the skills needed at work and life-long learning in the 21st century.

What are digital skills and how do they relate to the way adults live, work, and learn? Do adults need digital literacy to participate fully and succeed in places of work, families, and communities? We think so. What's more, we strongly believe that digital technology has become integrated in our lives in a variety of ways and in ways that these tools have become the pen and paper of today. This technical paper provides a basis for discussion and further development of defining the skills that adults need to use digital technology tools effectively to enable full civic participation and fulfill their role as agents of change in their immediate environment.

The objective of this paper is to provide the project background and report on the results of the research and development work undertaken to define and shape a digital technology competency. Based on the preliminary development work of a technology-related competency within but not limited to the context of the Ontario Adult Literacy Curriculum Framework (OALCF) Initiative, it also intends to provide the rationale and methodology of the work in developing the performance indicators within the context of a curriculum framework development process. It is our hope that our work to-date serves as a foundation for discussion with stakeholders and the further development of it in the form of a curriculum competency and an Essential Skill (ES) for all adults in Canada.

This paper is intended for administrators and practitioners in the field of adult literacy education and employment training. The benefits of this work are not limited to the use of program coordinators, curriculum developers, and professional development providers but may also prove to be of interest to researchers and policy makers in the areas of digital skills for workplace training and life-long learning.

Digital literacy and digital technology

Although there is considerable discussion about what it is to be digitally literate,[1] every jurisdiction has to define its own standards and the skills required to fully contribute to, participate in, and benefit from a digital society need to be determined. These skills go beyond simple technology skills and "*include a deeper understanding of, and ultimately the ability to create a wide range of content with various digital tools.*"[2] Further, according to the Media Awareness Network in the 2010 report Digital Literacy in Canada: From Inclusion to Transformation (p. 4), the National Broadband Plan Connecting America (Section 9.3), the Digital Britain Media Literacy Working Group (Section 3.16), and Australia's Digital Economy: Future Directions (p. 44), "established and internationally accepted definitions of digital literacy are generally built on three principles:

- The skills and knowledge to use a variety of digital media software applications and hardware devices, such as a computer, a mobile phone, and Internet technology
- The ability to critically understand digital media content and applications
- The knowledge and capacity to create with digital technology"

The scope and context of a digital technology competency within an adult literacy and basic education framework such as the OALCF works hand-in-hand with the principles of a definition of digital literacy. Given that much of the skill competency development is based on the essential skills[3] (ES), a digital technology competency has to be understood and developed with ES in mind.

Background research for the competency development

The background work involved two objectives. On one hand, necessary research and analysis were undertaken to inform and support the work of the OALCF Initiative in relation to the discrete skills identified in the ES area of Computer Use in the Independence, Employment, Adult Credit, Post-Secondary, and Apprenticeship pathways. On the other hand, research was conducted to analyze the work of the OALCF Initiative in terms of the integration of digital and information technology (non-discrete skills) in the other competencies: communicate ideas and information, self-direct and act autonomously, find and use information, numeracy, and engage and work with others. Work on these two objectives was approached in an integrated way that ensured the areas where discreet and non-discreet skills overlap are investigated while concentrating on developing a discreet skill competency called 'use technology' at the same time.

[1] For a discussion on these complexities and challenges, see the brief prepared for the Australian Communications and Media Authority by Dr. Robyn Penman and Dr. Sue Turnbull. Media Literacy - Concepts, Research and Regulatory Issues. (2007), from http://www.acma.gov.au/webwr/_assets/main/.../media_literacy_report.pdf

[2] Digital Literacy in Canada: From Inclusion to Transformation (2010). Media Awareness Network, from http://www.media-awareness.ca/english/corporate/media_kit/reports-publications.cfm

[3] "The nine essential skills were identified by Human Resources and Skills Development Canada in the mid-90s in response to the results of the International Adult Literacy Survey", from http://www.nald.ca/literacybasics/essentl/history/01.htm

Initially, the competency was to be called ‘computer use’ in the context of the OALCF Initiative and was widened to ‘use technology’ to encompass the use of technology commonly used in work, home, and community contexts. During our preliminary research and throughout the further development process of the competency, we determined that the description of the use of technology is often described as too narrow in terms of computer-based applications, for instance in the description of computer use in the ES materials, on which the development of the other competencies within the OALCF was built.

Furthermore, there was little evidence for the use of technologies other than digital ones that we found or were brought forward. Our ongoing discussions centred around the need to focus our understanding of the use of technology so that it was not too narrowly defined and did not become too broad at the same time, given the context of basic skills upgrading and the development of a curriculum framework for adult literacy. The term ‘use digital technology’ was deemed the most appropriate in terms of scope and relevance.

A competency like ‘use digital technology’ appears to be of a slightly different nature than competencies that centre themselves on a clearly defined purpose, such as communicating ideas and information or finding and using information, in two ways. First, the use of digital technology is not an end in itself but rather a means with which activities in other competencies can be taught using digital technology as a medium. Second, many of the skills necessary to use technology cannot be viewed as skills that learners already have and need to be taught on a granular level, such as keyboarding and word processing skills.

Digital technology and essential skills

The ES developed by Human Resources and Skills Development Canada (HRSDC) were used as a major reference for the OALCF competency development as well as the background research for the development of a digital technology competency. “Essential skills are the skills that people need for work, learning and life.”[4] A complete definition of the ES and the identified nine skill areas are listed in Appendix A.

While all ES formed the basis for the development of competencies within the OALCF, they also informed the development of the digital technology where applicable. In particular, the Computer Use ES was looked at to evaluate the scope of the skill, including self-assessment modules and tip sheets.

[4] For an overview of Human Resources and Skills Development Canada’s Essential Skills, see http://www.rhdcc-hrsdc.gc.ca/eng/workplaceskills/essential_skills/what_are_essential_skills.shtml

After extensive discussion about the Computer Use ES as described in the Readers Guide to Essential Skills Profiles[5] and the description of the Computer Use ES appearing in the Computer Use Self-Assessment,[6] we determined that the scope of the Computer Use ES was too narrowly defined to be useful for the development of a digital technology competency. The description and containing task examples were out-of-date when considering the current use of digital technologies in a work, family, and community context. Defining the scope and context of the digital technology competency became, therefore, a crucial step in the development of the competency.

Criteria for defining scope and context of the digital technology competency

Some defining characteristics were established to guide the development of the scope and context of the digital technology competency. The defining characteristics should

- be broad, not narrow or granular, in terms of overall scope, context of application, and skill
- described in a current context, open-ended to continuing technological development
- encompass digital technology tasks conceptually different from print-based activities
- have familiarity to the contexts of work, family, and community
- include digital technologies that are versions or extensions of usually or previously print-based activities
- describe transitional values as adapting to changing landscapes
- be able to account for a culture and landscape shift in terms of location, access, and mediation of information
- allow adults to confidently and critically engage with work, family, and community

The following approach for determining the scope of digital technology was proposed:

- assess digital technology task examples through a filter of defining features to determine if they are within or outside the scope of a digital technology competency, using a set of
- required features (all features need to be met)
- optional features (one or the other of each optional feature pair needs to be met)
- optional features (one of the features needs to be met)

[5] For the Human Resources and Skills Development Canada's Readers Guide to the Essential Skills, see http://www.hrsdc.gc.ca/eng/workplaceskills/essential_skills/general/readers_guide_whole.shtml#a65

[6] For more information on Human Resources and Skills Development Canada's Essential Skills, Computer Use Self-Assessment, see http://www.hrsdc.gc.ca/eng/workplaceskills/essential_skills/computer_use_self_assessment.shtml

Required features (all need to be met)	Optional features (one or the other in each row needs to be met)		Optional features (one needs to be met)
Familiarity to context of work, family, and community	Independent in nature, incl. tech. enabled print-based activities	Participatory in nature, incl. social, enhanced, or extended print-based	Enables daily activity in contexts of work, family, community
Current not out-of-date and open-ended to continued tech. dev.	Broad not narrow in scope, context, and skill	Granular skills such as in application software	Provides better access to education, training, or work
Conceptually different from non-digital activities	Constant value in terms of technology skill and application area	Transitional value as skill is being absorbed into basic knowledge	Improves personal capacity (quality of life and life chances)
Allows to confidently and/or critically engage with environment	Defined area of application replicating print-based contexts	Culture/landscape shift in terms of location, access, or mediation	Enhances social networks and civic participation

Development of a digital technology competency

The process below outlines the steps the working team carried out to collect task examples, sort task examples, and establish task groups for a 'use digital technology' competency.

Research: Review the literature and collect task examples

Following our assessment of the Computer Use ES, we scanned literature and framework resources about technology skills in educational contexts in the United States, the United Kingdom, Ireland, Australia, and New Zealand. Additional sources consulted are listed in the Appendix. To collect further task examples we also looked at the Skill Levels, the Computer List, and the Computer Use Self-Assessment of the Ontario Skills Passport,[7] as well as LearnToLearn (L2L)[8], an intake and assessment module to determine if a student has the academic, personal, and computer skills to participate successfully in ACE Online.

[7] For more information on the Ontario Skills Passport Skill Level Computer Use, see http://skills.edu.gov.on.ca/OSPWeb/jsp/en/SkillLevels.jsp#12

[8] For more information on Learn2Learn, see http://www.acedistancedelivery.ca/learn-to-learn.php

Task collection: Consult with the field

To ensure that the collection of task examples included tasks that are commonly part of the learning activities in LBS programs and/or activities adults are required to engage in at work, in the family and in the community, the representatives of the LBS delivery streams were asked to provide task examples relating to a 'use technology' competency. Task examples were provided in several ways:

- Task examples were generated during a Community Literacy Ontario (CLO) Board Session
- The OALCF Francophone Research Team created a list of tasks
- A list of task examples was provided by the Deaf Literacy Initiative (DLI)

The task examples provided were added to the collection of task examples for consideration during the task sorting process. In our preliminary assessment, we found that these task examples were mostly related to the use of different kinds of digital technology; no task examples of non-digital technology were provided.

Task sorting: Organize, agonize, and organize

The main activities during this stage of the process encompassed the sorting of tasks identified during the review of related research and frameworks from other jurisdictions, as well as the sorting of tasks that were provided by the basic skills agencies in Ontario.

In considering how to approach the development of a 'use technology' competency within the context of the OALCF, we identified the need to be clear about the separation of the use of digital technology as a discrete set of skills related to occupational skills, and as foundational or enabling skills to perform tasks within other competencies using digital technology as a medium. In the long run, these skills are viewed as embedded in the performance of a task and enable a learner to complete it successfully. These skills are transitional in nature until the use of digital technology is as much second nature to learners as the use of print-based materials. It is understood that as some skills related to the use of digital technology become more embedded, the emergence of new technologies will lead to a demand that other skills be taught more overtly.

To illustrate, a discrete set of foundational or enabling skills may include the following task examples: Open the Start menu, open an Internet browser, key in a URL, and create an email account. An embedded skill taught in the context of task examples in other competencies may include the following: read and reply to an email message, use 411 to find a telephone number, create a word-processing document, and complete an online math activity.

How to connect the embedded foundational or enabling skills related to the use of digital technology was identified as a challenge since an instructor would have to be aware that a task example in a competency other than 'use digital technology' may require learners to apply skills that are articulated in the 'use digital technology' competency.

Task groups: Develop and sort sample tasks

As with the development of the other competencies within the OALCF, the purpose of this step was to ensure that the competency was treated comprehensively. In doing so, the framework would then address the learning needs of adults in all streams and pathways.

After sorting and organizing the collected sample tasks, task groups naturally emerged. These task groups appeared to represent the foundation of a 'computer use' competency with some elements of the use of other technologies. However, we soon realized that there were large gaps between the emerged task groups and task groups that could be informed by the increasing need for skills inherent in the use of digital technology other than the enabling or foundational skills necessary to use them as a medium to perform tasks analogue to a print-based context.

In today's work, family, and community contexts, adults are expected to have the skills to use computers and other various digital technologies in ways that are inherently different and beyond the foundational skills of using computer software, such the fundamental operations of word processing. Because of this, we also developed task groups that speak to the use of digital technology in ways that address learning how to use digital technology to participate fully in the world of the web as well as understanding how the use of digital technology is conceptually different than the use of print-based materials and the skills required to navigate these materials in a digital context. These sets of task groups were combined under one comprehensive competency as shown in Figure 1.

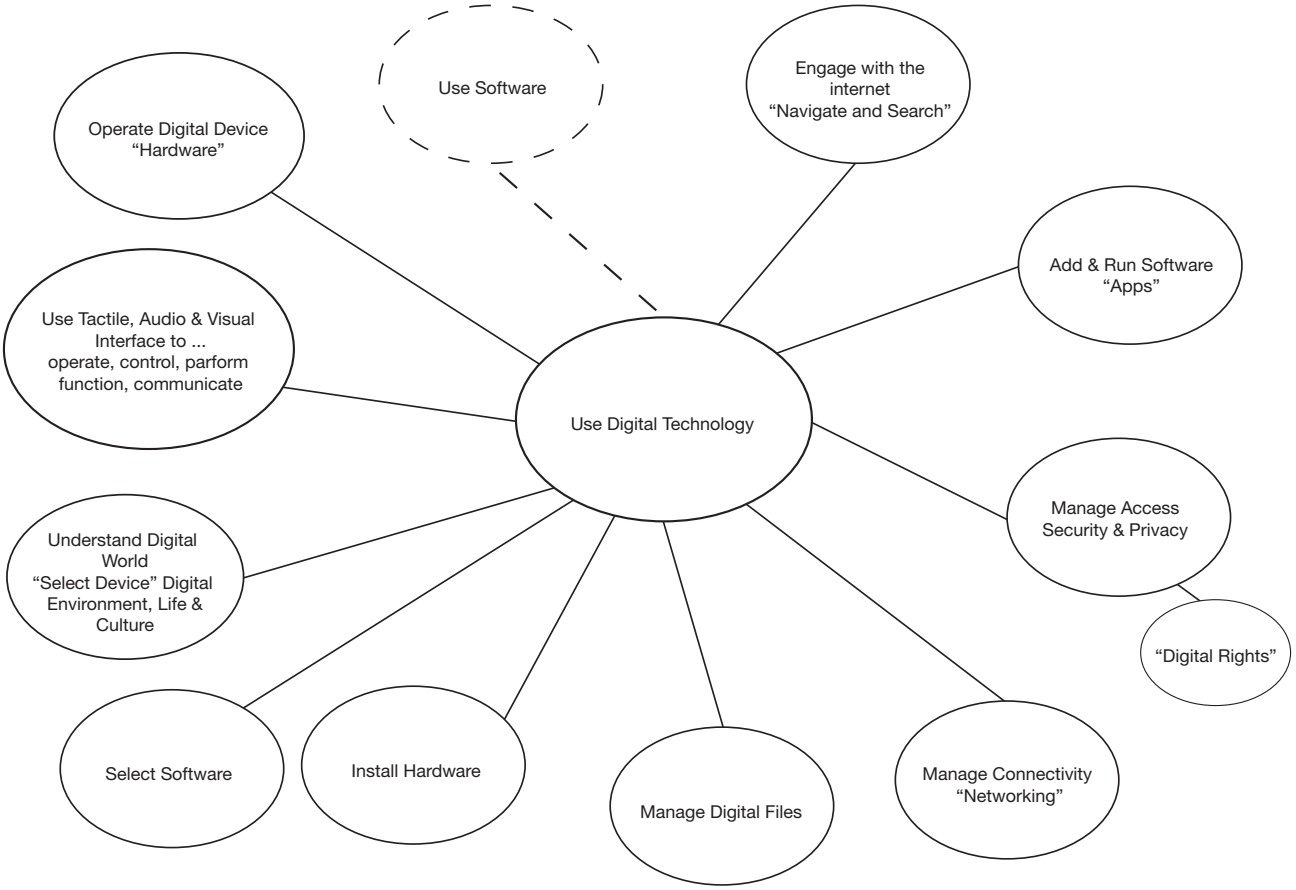

Figure 1: Task groups combined under one comprehensive Use Digital Technology competency

Task group review: Revise and refine

Given that we had to consolidate task groups that emerged from two opposing directions of the development process, one from forming task groups by grouping collected task examples and the other by forming task groups to address the identified gaps between the emerged task groups and the real-life context of the use of digital technology, a lengthy process of revision and refining the boundaries ensued, and there was a reorganization of sample tasks among existing, split, merged, or new task groups.

In our ongoing discussion, we found that task groups may differ in two ways from one another. A large number of tasks collected during the research and consultation process appeared to have a natural connection to task groups in other competencies in that they were the same task but performed with a digital technology medium. After approaching this competency as a comprehensive competency that addresses all things technological, we began to bring the natural connections to tasks groups in other competencies to the forefront by identifying the tasks’ foundational skills. The tasks in these task groups may have transitional value in enabling learners to use technology with the same ease and effectiveness as print-based materials and should be taught in connection with the other competencies.

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Figure 2 illustrates the connections between task groups of the Use Digital Technology competency to other competencies.

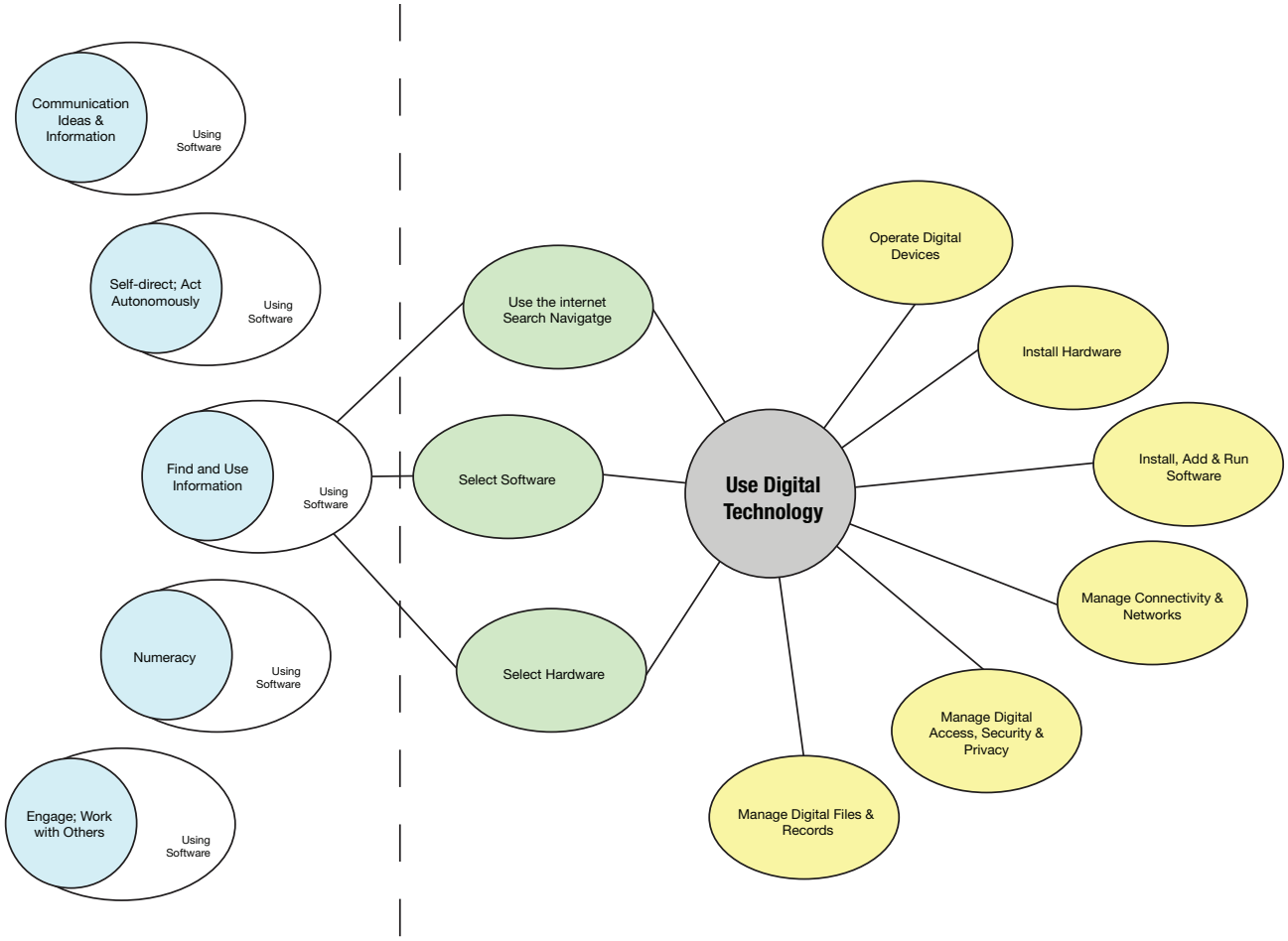

Figure 2: Use Digital Technology competency task group connections to other competencies

Taking into account the continuous advancements in technologies and the constant demand for new skills associated with their operation, some specific tasks may be transitional and there will be a constant need for task groups to address teaching new technology skills, especially when it comes to using new hardware and software products, and navigating and searching the Internet. Combined with task groups that exhibit qualities that are inherent to the use of digital technology, we identified a number of task groups that can be considered the core of the 'use digital technology' competency. Taking these considerations into account, the task groups were reorganized and split in two distinct sets of task groups.

The next step in the ongoing development of a 'use digital technology' competency would have been to examine the task groups in relation to task complexity and the articulation of learning levels within the OALCF, including task groups that have been identified as independent from and embedded in other competencies. For details on the work of and recommendations for the further development of a 'use digital technology' competency within the OALCF see the Appendix.

To further develop a digital technology competency as a stand-alone competency modelled on HRSDC's Computer Use ES, we decided to examine the existing description of the Computer Use ES and learning levels and consider how the ongoing work on the digital technology competency could inform the re-articulation of the Computer Use ES.

Digital technology use is an essential skill

Our work to date focused on the identification and grouping of technology tasks as well as on exploring possibilities for describing increasing complexity for technology tasks within the OALCF. These efforts included analyzing the ES complexity scale for Computer Use as well as identifying the factors that drive complexity for ES tasks in general. To develop a digital technology competency further in a way that is consistent with the treatment of complexity in frameworks such as the OALCF or the Australian Core Skills Framework, the identified complexity factors needed to be tested to ensure they are sufficiently robust in describing increasingly complex digital technology tasks. One aspect of this work was to examine whether this competency should have one set of descriptors for the three levels or multiple sets of descriptors for different task groups. See Appendix B for a background examination of the use of the ES scale for Computer Use within our development of a 'use digital technology' competency.

Task scaling: Think about performance and task complexity

A draft scale of indicators for performance and task complexity within the domain of Use Digital Technology was developed. The purpose of this activity was to describe the features of increasingly complex digital technology tasks. Consistent with our earlier work on the development of a digital technology competency, efforts were made to ensure that the resulting scale:

- is inclusive of tasks appropriate for literacy development, and that those tasks can be interpreted and rated using it
- addresses technology tasks broadly, rather than focusing on computer software applications typically used in office settings
- describes complexity in a way that it is not restricted by current-day interpretations of technology

In the process of drafting these indicators, we also began to explore ways to integrate this scale into other competencies, the extent to which the scale works independently, and considerations in integrating the scale into other competencies. This exploration is described following the draft scale.

Task analysis: Use the draft scale to describe task complexity

To identify the features that drive complexity, we used the Computer Use ES scale as our starting point, and ensured that the levels described in the draft scale are consistent with those. However, given that technology is not addressed in a comprehensive manner, and that complexity factors are not consistently described or applied across the scale, we also applied our knowledge of text and task complexity from the ES and the scales from the International Adult Literacy Survey (IALS). We chose to include and adapt some indicators from other competencies of the OALCF, namely 'find and use information,' 'use numbers,' and 'think in quantitative terms.' Finally, we developed new statements to complement the existing indicators in an attempt to fully describe features of task complexity and learner performance across Levels 1, 2, and 3.

At this juncture, we chose to develop indicators that apply to technology tasks as a whole, rather than organizing tasks into subgroups. There were a number of reasons for doing this. Firstly, the categories explored to date were limited in their capacity to capture the full range of technology tasks. Secondly, there was some justifiable concern that by specifying technology types too much, aspects of the framework will be rendered obsolete as technology advances. Finally, we felt it was important at this stage to focus on factors that drive complexity more generally, and explore the full range and dimensions of tasks without limiting ourselves to predetermined categories.

The draft performance indicators were categorized as indicated below. We used these categories in part to ensure we were exploring a full range of complexity dimensions. Once the scale is fully developed, a decision can be made as to whether these categories are informative for end users. We have included "Interface" as one aspect of task complexity unique to the digital technology scale. And while both context and interface are features of task complexity, we have separated them out to make it easier for the user to understand all the aspects of tasks and in particular how these aspects change as tasks become increasingly complex.

1. **Context** – identifies the degree of familiarity learners are likely to have with the task and the situation in which the task occurs
2. **Task qualities** – features of tasks at each level that affect complexity
3. **Interface** – includes features such as layout and text that are visible to the user as they interact with the technology
4. **Performance qualities** – expected features of a technology user's performance at each level
5. **Examples** – tasks that illustrate the complexity described within each level

Begin with the identification of a series of task examples

A list of 54 task examples were identified and reviewed to determine whether these could be rated using the draft scale. This effort was undertaken to evaluate the comprehensiveness of the scale. We found that all task examples could be placed along the existing scale. From this we can conclude that the technology scale drafted adequately captures the full range of technology tasks as defined earlier. There were a few examples in the list of collected tasks that would not be considered tasks, primarily because they are not complete actions in and of themselves, but instead a means to complete another task. These include 'use the function menu' or tabs in electronic documents; using a digital pen on a portable digital device; and using a touch-screen keyboard on a digital device. The inclusion of these activities did not pose a problem for scale revision activities; however, they are noted here for future reference.

Use the draft scale to identify the complexity of task subsets

A subset of the example tasks was examined to identify tasks' complexity levels. Levels were assigned for each performance and task quality, rather than to the task overall. Although this is not the standard way of using a scale,[9] this approach offered an opportunity to examine the scale and performance indicators very closely. For example, the task 'program a universal TV remote' was assigned Level 3 ratings for most performance indicators but Level 2 ratings in a couple of cases. The performance indicators for each of the ratings that differed from the majority to evaluate the clarity of the performance indicator were examined. From this activity, we were able to conclude that the performance indicators are sufficiently clear. In the few cases where additional clarity was required, changes were made to descriptors in the scale.

An overall complexity level was independently assigned to each rated task. Once completed, tests were conducted to see whether the scale could be used to assign complexity levels to tasks constructed by others. Through the rating and discussion activities, we concluded that the scale very clearly helped us identify the complexity of tasks.

Some challenges occurred when tasks were not specified fully, which led each rater to different conclusions about the complexity of activities under examination. For example, download and save photos from a digital camera was determined to be insufficiently specific to rate reliably. Some raters concluded it to be a simple task requiring only a few relatively obvious steps to complete. They reached this conclusion because the software they are familiar with enables users to download and save at the same time. Others concluded the task could be rated higher, if the software required users to identify or create folders to specify where photos should be saved. From this, we concluded that the challenges encountered did not arise from the scale, but rather from trying to rate tasks that were not specific enough. This directed us to review examples in the original draft of the scale to specify them more precisely.

[9] Typically, each level within a scale is examined holistically to identify which level is the best description of the task in question. While each and every performance indicator may not precisely address one task example, raters look for the predominant qualities of the task and how they rate on the scale to decide on a final rating.

In other cases, rating challenges occurred when tasks as described could be completed in different ways depending on the technology used. Again, specifying tasks more precisely helps produce more reliable ratings. We considered the implications of these challenges for users of the scale and concluded they are not likely to limit practitioners or curriculum developers. If they were to use the scale, they would either be constructing new tasks or examining tasks they already have learners carry out. In either scenario, they would know which software they intend to use with learners.

In an effort to specify the scope of a digital technology competency, we concluded that "The lack of meaningful interaction with the digital component of the device, either integrated as a digital display or connected to it as an on-screen menu, was judged to be the determining factor if the task was within or outside the scope of a digital technology competency." For example, tasks that lack a meaningful interaction with digital technology are using a glucose meter with a digital display, using a blood pressure sleeve with a digital display, and using a stud finder with a digital display. We used these criteria to define a draft definition for the competency and this definition precedes the scale itself.

Identify a way of defining the scope of digital technology

Tasks within digital technology require meaningful interactions with the digital component of a device. Digital technology tasks require users to make one or more choices in the course of their completion. This includes tasks where users must make or change settings, and use digital interfaces to create and adapt products. Tasks that require nothing more than turning on a device and interpreting a reading, or responding to one visual or auditory cue, would not be considered within the scope of digital technology.

For refining and specifying the scope of digital technology, the role of digital tools in the world of life-long learning is critical. To further guide the development of a digital technology as an ES, the following tenets were established:

- Technology is a critical competency in adult education: Understanding and using digital tools is becoming increasingly important; using them in educational settings is motivating
- Technology is not used in isolation from other competencies: Integration is one of the strengths of a competency-based approach in that it requires adults to draw on multiple skills at the same time; an integrated approach reflects the realities in places of work, families, and communities
- Understanding what makes digital technology tasks complex in themselves: A stand-alone competency helps to ensure that educators fully understand difficulty of integrated tasks; the demands of tasks used to instruct and assess learners are fully understood; connections to what adults may already feel comfortable doing can be made more easily
- Technology changes but features of task complexity remain the same: Advancements in the use of existing and emerging digital tools can be rated using the same factors that drive complexity; the complexity scale can possibly be applied to digital tools not yet conceived

Examine the task examples whether they were appropriately placed

We examined the examples in the draft scale and concluded that some revisions needed to be made to the task examples included in the draft scale. The revised scale is below.

Categories/Levels	Level 1	Level 2	Level 3
Context	• Have concrete and familiar contexts	• May have unfamiliar content and contexts	• May have unfamiliar content and contexts
Task complexity	• Scope of task is limited, set by others	• Tasks are well-defined	• Scope of task may not be clearly defined; is often set by learner
	• Requires up to a few steps to complete	• Requires multiple steps to complete	• Requires multiple steps to complete
	• Require the use of a limited range of features or options	• Require the use of a limited range of features or options	• Require the use of a wide range of features or options
	• Has a set procedure	• More than one way of completing the task; each way has a set procedure	• Have many options to complete; may not have a set procedure
Interface	• Uses a very simple format	• Uses a simple format	• Uses a somewhat complex format
	• Contains brief text, icons or both	• Contains text, icons or both	• May contain extended text, icons or both
	• Text and icons required to complete tasks are apparent	• Text and icons required to complete tasks are easy to interpret	• Text and icons required to complete tasks may require interpretation
	• Contains little or no distracting information	• May contain distracting information	• May contain distracting information
	• Contains familiar vocabulary	• May contain unfamiliar vocabulary	• May contain technical vocabulary
	• Offers very few options	• Offers a variety of options through menus	• Includes options in multiple menus and sub-menus

Categories/Levels	Level 1	Level 2	Level 3
Performance qualities	• Follows simple prompts	• Follows appropriate steps to complete the task	• Experiments and problem solves to achieve desired results
	• Understands meaning of brief text and icons	• Locates and recognizes functions and commands needed to complete the task (e.g., finds save button)	• Applies knowledge of software or other technologies to carry out unfamiliar tasks
	• Locates specific functions and information	• May make inferences to interpret icons and text	• Makes inferences to interpret icons and text
	No performance qualities at this level	No performance qualities at this level	• Selects appropriate software when required by the task
EXAMPLES	• Use a debit or credit machine to make a purchase • Set or disarm an alarm system • Log in to a user account on a computer • Change the temperature setting on a digital thermostat • Delete photos from a digital camera	• Send a text message • Create and save an Excel spreadsheet • Establish a wireless connection • Use on-line banking to check a bank balance or pay a bill • Program a street navigation GPS unit to find directions to a destination • Post messages on a social networking account • Send and receive emails • Conduct a keyword search to find a website • Purchase a bus ticket on-line • Organize digital files into folders • Create a new user account on a computer	• Create a Word document, using a variety of formatting tools • Use a handheld GPS unit to record points along a route (use menus, etc.) • Find and install a freeware version of a software • Upload a file and post it on a wiki page • Browse several websites to explore career options • Program a universal remote to use with a television, DVD player, and digital tuner • Re-establish an inoperative web connection

Implications for the competency development within a curriculum framework

In a competency-based framework like the OALCF, tasks can be integrated in any number of ways, which requires adults to draw on multiple skills at the same time. In fact, the potential for integration is one of the strengths of a competency-based approach. At the same time, it is useful for educators to understand what the real demands are of each element in integrated tasks.

Using the OALCF as an example, one could analyze the demands of participating in an online learning course from the perspective of 'find and use information' and 'use digital technology.' By understanding the complexity features along both scales, educators can compare the demands between the two competencies to ensure the task is reasonable. In other words, through such an analysis an educator could come to understand that a course's content is aimed at 'find and use information' Level 1, while the technological demands for the learner are Level 2.

The scale developed to date suggests there are features of complexity that apply uniquely to technology and that are not addressed in other competencies. If digital technology were subsumed into other competencies, educators might be less likely to identify where and how technology forms part of specified tasks. Having a stand-alone digital technology scale is one way to help educators understand what the real demands of tasks are, both from a literacy or numeracy perspective, and from a technological perspective.

Another benefit of examining technology independently is that educators see a full range of activities across levels, and help draw connections between what a learner may already feel comfortable doing (e.g., sending a text message) and new learning (e.g., buying a bus pass on-line).

The table below lists OALCF examples from the complexity scale for a digital technology competency and shows the other competencies that come into play when these technology tasks are carried out.

Task examples/OALCF competencies	Find & use information	Communicate ideas & information	Use numbers & think in quantitative terms
Use a glucose meter to check blood sugar level			✓
Send a text message		✓	
Create and save a spreadsheet		✓	✓
Use on-line banking to check a bank balance or pay a bill	✓	✓	✓
Post messages on a social networking account	✓	✓	
Send and receive email	✓	✓	

Task examples/OALCF competencies	Find & use information	Communicate ideas & information	Use numbers & think in quantitative terms
Conduct a keyword search to find a website	✓		
Purchase a bus ticket on-line	✓	✓	
Create a text document using a variety of formatting tools		✓	
Find and install a freeware version of a software	✓		
Add content to a wiki		✓	
Browse several websites to explore career options	✓		

Another way to understand the relationship between the other competencies and a digital technology complexity scale is to examine task examples in other competencies that require an adult to use digital tools. Continuing to use the OALCF competencies to illustrate this point, the table below lists tasks in other competencies, some of which can only be completed with the use of digital technology. In other cases, using digital tools is not a critical factor, although the tasks are most likely to be completed using digital technology. An asterisk denotes this second group.

Find & use information	Communicate ideas & information	Use numbers & think in quantitative terms
Task group: Read continuous • Read an email confirming the date and time of a meeting **Task group: Interpret visual representations** • Refer to a labelled diagram to find the brightness control button on a computer monitor **Task group: Extract information from films, broadcasts, lectures and observations** • Listen to a podcast to learn about recent events • Watch an ASL VLOG to learn about a health related topic	**Task group: Create lists and tables** • Create a directory of contact information* • Create a table to compare products, suppliers or services* • Create a budget template with subcategories for expenses and income* • Create a multi-phase project or production schedule* **Task group: Write continuous text** • Write an email to request information • Write a letter expressing appreciation* • Write an email to explain steps involved in a project • Write an email to explain steps involved in a project	**Task group: Manage money** • Keep a running total of travel expenses over the course of a month* • Prepare an invoice calculating unit costs, subtotal, taxes and total* • Prepare and monitor a household budget* • Calculate and compare the annual costs of owning a car, carpooling and using public transportation* **Task group: Use measures** • Convert kilobytes to megabytes to determine remaining capacity of an electronic device

Find & use information	Communicate ideas & information	Use numbers & think in quantitative terms
Task group: Conduct research • Use Internet job search tools to find appropriate job postings • Consult consumer guides, Internet reviews, and vendor websites to identify a suitable computer	• Write a summary to express an opinion on a topic* • Write an announcement to advertise an event* • Write a research essay* • Write a letter to a public official*	

The way the digital technology complexity scale was constructed allows it to maintain its integrity and relevance in the face of technological advances. While any such advances would not affect the scale itself, it is likely that task examples will need to be reviewed to verify their relevance and their complexity levels. For example, some tasks that are currently rated as Level 2 could become easier to perform as technology evolves, and merit a lower complexity rating as a result. Our recommendation would be to establish a review schedule for the task examples to ensure they reflect current technological demands.

Development of performance indicators

The next step in the development of a curriculum framework towards an implementation process that will have direct impact on the development of curriculum resources for the purposes of instruction and assessment, is the development of performance indicators from the task groups in the digital technology competency, the ones that are closely connected to other competencies as well as the ones that can be taught independently of them. The development of performance indicators should convey:

- What a person can do at each level
- Features of tasks, texts, and operations described at each level
- Notes about quality of performance

Performance indicators are then developed for groups of tasks within the competency. Breaking down a digital technology competency in the same way as other competencies helps to situate the ES within a framework as much as possible.

As with other competencies in a curriculum framework, the purpose of this process is to write performance indicators for each task group to describe the features of tasks within the group at each level and how well adults are expected to perform the tasks at each level. Through the process of developing performance indicators, the common features of tasks in a task group can be confirmed, following the process below:

- Writing a generic task statement to summarize the grouping
- Identifying the qualities of tasks that situate them clearly within the level
- Identifying the qualities of performance that are particular to the task group
- Writing performance indicators for each task group and each level independently
- Reviewing the performance indicators across levels to verify consistency

Recommendations

Our research and development work for a 'digital technology use' competency that would be useful in the context of the development of curriculum frameworks and would serve as a foundation for discussion with stakeholders in the context of an essential skill for all adults in Canada will hopefully lead to more exploration of the types of digital skills adults need to be familiar with in today's society and how these relate to the way we live, work, and learn. What could be next for program administrators and coordinators, practitioners and instructors, curriculum developers, professional development providers, researchers, and policy makers? What could the next steps be to support literacy programming and skills upgrading, the development of skill frameworks and digital technology standards, and further research and development of our skilled use of technology tools?

For literacy programming and skills upgrading:

- Adapt and develop resources for instruction and assessment
- Design and make professional development available for educators
- Support the integration of more digital technology and make programs and funders accountable
- Foster the development of vision and leadership of program administrators to further the integration of technology in adult literacy programming

For the development of skill frameworks including digital technology skills:

- Update and add to the current Computer Use ES descriptions with the proposed 'digital technology use' competency
- Explore the challenges presented by the ubiquity and ever-increasing use of digital technology devices and the current culture shift with regard to the use of digital devices and social media in defining digital technology and conceptualizing the development of a dynamic competency

For the development of digital technology skill standards:

- Support the development of provincial and/or national digital technology standards for the adult literacy, employment training, and adult basic education sector

For further research and development:

- Development of performance indicators that would be applicable and transferable to any competency-based curriculum and curriculum framework
- Pilot the ‘digital technology use’ competency presented in this paper and analyze the pilot research results to assess its applicability

Appendix A: Essential Skills and Computer Use

Human Resources and Skills Development Canada (HRSDC) describes Essential Skills (ES) as follows:

"*Essential skills are the skills that people need for work, learning and life. They are used in the community and the workplace, in different forms and at different levels of complexity. Definitions, typical applications and examples are outlined below to help you understand each essential skill.*"

The nine ES identified by HRSDC are:

- **Reading:** Understanding materials written in sentences or paragraph (e.g., letters, manuals)
- **Document use:** Finding, understanding, or entering information (e.g., text, symbols, numbers) in various types of documents, such as tables or forms
- **Numeracy:** Using numbers and thinking in quantitative terms to complete tasks
- **Writing:** Communicating by arranging words, numbers, and symbols on paper or a computer screen
- **Oral communication:** Using speech to exchange thoughts and information
- **Working with others:** Interacting with others to complete tasks
- **Thinking:** Finding and evaluating information to make rational decisions or to organize work
- **Computer use:** Using computers and other forms of technology
- **Continuous learning:** Participating in an ongoing process of improving skills and knowledge

Computer Use ES are described in the Readers Guide to Essential Skills Profiles[10] as follows:

"*Computer Use indicates the variety and complexity of computer use within the occupational group. […] Computer use is rated on a 5-level scale of complexity [and] describes, in a standardized way, all of the computer use performed in the occupational group. […] There are nine computer use applications .*"

The following description of the Computer Use ES appears in the HRSDC Computer Use Self-Assessment[11]:

"*Computer use is the ability to use computers and other electronic equipment (e.g., fax machine, calculators, and automated bank machines.) The importance of strong computer use skills continues to grow as we become increasingly dependent on technology to carry out our work and daily activities. Complete this self-assessment to help you understand your computer use strengths and areas for improvement.*"

[10] For the HRSDC's Readers Guide to the Essential Skills Profiles, see http://www.hrsdc.gc.ca/eng/workplaceskills/essential_skills/general/readers_guide_whole.shtml#a65

[11] For more information on HRSDC's Essential Skills, Computer Use Self-Assessment, see http://www.hrsdc.gc.ca/eng/workplaceskills/essential_skills/computer_use_self_assessment.shtml

Appendix B: Essential Skills scale for Computer Use

There are a few challenges inherent in the Computer Use ES with regard to scaling. The first challenge is the way in which factors that drive complexity are treated. Specifically, technology is not addressed in a comprehensive manner, nor are the complexity indicators consistently described or applied across the scale. Secondly, the scale has not changed since its initial implementation in the late 1990s. The increased use of computers, the simplification of technological interfaces, and the degree to which computers and other technologies have become integrated in daily work tasks has outstripped the scope of the current scale. This results in a scale that is of limited applicability for the OALCF.

Factors that describe task complexity

The ES scale for Computer Use describes increasing task complexity by considering a number of factors. These include:

- number of operations
- familiarity of the operations
- extent of software knowledge required
- extent of software features used
- responsibility of the user for setting up the software
- option to select software

Although some of the items listed above are the same factors that drive complexity in other ES domains, there is limited consistency in how these factors are treated within the Computer Use scale. This can be seen in the use of examples within the scale to help illustrate complexity. The following are verbatim excerpts from the scale found in the Reader's Guide to Essential Skills (HRSDC, n.d.)

Level 1	Level 2	Level 3	Level 4	Level 5
• basic interaction with computer - controlled equipment	• simple formatting of a text • one-dimensional search of a database • conversion of files from one format to another	• setting up of software • customizing the interface • configuring software and hardware • creation and/or use of macros, templates or scripts	• integrated use of several software packages • manage an existing network • add/modify user accounts • perform routine maintenance and system management	• assessment of information technology needs • selection of appropriate computing and software solutions • design, write and customize computer programs

The scale depicts that at Level 1, workers interact with computer-controlled equipment. At Levels 2 and 3 the scale relies heavily on how workers interact with software functions such as those typically encountered in office environments. At Levels 4 and 5, the scale only supports tasks carried out by workers who provide technical support or workers who develop software. This narrow interpretation of computer use limits what can be rated and described using the scale. This is in contrast to other ES scales, such as writing, which describe features of increasingly complex tasks without restricting the upper limits of the scale to tasks that require significant technical, job-specific expertise. To illustrate this point, writing tasks at the upper end of the writing scale can be found in various occupations, and are not limited to the occupational group of Authors & Writers (NOC 5121).

A scale that describes increasingly complex technology tasks must take into consideration that, as technologies become increasingly complex and robust, they are also becoming more intuitive and easier to use. The Computer Use ES scale, in its current form, does not adequately describe the true complexity of technology tasks given that technology is rapidly evolving.

In light of these limitations, the ES scale for Computer Use does not appear ideally suited to describe developing proficiency for the technology competency in the OALCF.

Factors that drive task complexity

The OALCF draws on common complexity factors for the three competencies currently under development: Find and Use Information; Communicate Ideas and Information; and Use Numbers and Think in Quantitative Terms. These factors include the extent to which context is familiar, as well as the factors that make text and tasks increasingly complex. It is the interplay of context, text complexity and task complexity that contribute to how challenging a task is. Below are the factors used to rate complexity in the OALCF followed by brief explanations of these factors:

Context	Text complexity	Task complexity
• Degree of familiarity • Background knowledge	• Vocabulary • Structure of sentences, format of information displays, and nature of numerical information • Familiarity of elements • Length	• Scope of task • Degree of integration • Extent of inference required • Number, type of steps, and operations • Number of options • Distracters present • Intended audience and formality of the situation

Context

This is the notion that the prior knowledge and experience a person brings to a situation can make a significant difference to performance. This includes familiarity with vocabulary, contexts, task content, and text content. While familiarity is always worth examining, it is particularly the case with learners whose skills are not fully developed. Literacy learners may rely heavily on their familiarity in a given context to assist them in carrying out tasks. As an individual develops skills and knowledge along the continuum, the requirement for tasks and texts to be familiar lessens. Learners who are able to complete higher level tasks can apply their skills and knowledge from one context to another, and are able to manage tasks that are unfamiliar.

Text and task complexity

Text refers to continuous text as well as documents that include visual displays. Text complexity is derived primarily from how the information appears on a page (or screen) and the length of the text. However, to assign task complexity, one must look beyond just the appearance of the text or document and also examine how a reader must interact with it in order to perform the required task. Kirsch and Mosenthal (1990) and Kirsch (2001) argue that a number of variables interact to determine the level of difficulty of information-processing tasks.[12] Elements of Mosenthal and Kirsch's task complexity construct include:

- Text length and complexity
- Process required to respond to a question. They identify four processes: locate, cycle, integrate and generate, which are progressively more challenging to perform.
- Information 'requested' by the task, i.e., information required to respond to a question
- Inference required to complete the task

[12] Australian Core Skills Framework. Key Features of the Australian Core Skills Framework (not paginated). http://www.deewr.gov.au/Skills/Programs/LitandNum/ACSF/about/Pages/keyFeatures.aspx

Appendix C: Consulted sources

Arizona Technology Education Standards http://www.ade.state.az.us/standards/technology/

Australian Core Skills Framework. Key Features of the ACSF
http://www.deewr.gov.au/Skills/Programs/LitandNum/ACSF/about/Pages/keyFeatures.aspx

Basic Computer Skills Curriculum (St. Paul Community Literacy Consortium) http://www.spclc.org/curriculum

Computers for Life Course (Adult Literacies Online) http://www.aloscotland.com/alo/viewresource.htm?id=1141

Computer Skills for Life http://www3.hants.gov.uk/computer-skills.htm

Cyberstep http://spcic.themic.org/Resources.html

Human Resources and Skills Development Canada (HRSDC), Essential Skills
http://www.rhdcc-hrsdc.gc.ca/eng/workplaceskills/essential_skills/what_are_essential_skills.shtml

Human Resources and Skills Development Canada (HRSDC), Readers Guides to the Essential Skills
http://www.hrsdc.gc.ca/eng/workplaceskills/essential_skills/general/readers_guide_whole.shtml#a65In

Introduction to the Internet for Adult Literacies http://www.aloscotland.com/alo/viewresource.htm?id=1539

How does an information and technology curriculum stay relevant and meaningful in the 21st century?
http://newliteracy.wikispaces.com/#toc6

Human Resources and Skills Development Canada (HRSDC), Computer Use Self-Assessment
http://www.hrsdc.gc.ca/eng/workplaceskills/essential_skills/computer_use_self_assessment.shtml

Literacy Basics (NALD) http://www.nald.ca/literacybasics/essentl/history/01.htm

Learn2Learn (ACE) http://www.acedistancedelivery.ca/learn-to-learn.php

Log on to Learn (Literacy Volunteers of New Jersey) http://lvnj.org/content/log-and-learn

Media Awareness Network (2010). Digital Literacy in Canada: From Inclusion to Transformation.
http://www.media-awareness.ca/english/corporate/media_kit/reports-publications.cfm

Online courses for beginners http://www.aloscotland.com/alo/viewresource.htm?id=1539

Ontario Skills Passport Computer Use http://skills.edu.gov.on.ca/OSPWeb/jsp/en/SkillLevels.jsp#12

Penman, R. & Turnbull, S. (2007). Media Literacy-Concepts, Research and Regulatory Issues.
http://www.acma.gov.au/webwr/_assets/main/.../media_literacy_report.pdf

Skills for Life (UK) ICT Curriculum
http://www.qcda.gov.uk/libraryAssets/media/skill_for_life_ict_curriculum_jan07.pdf

Using ICT to Develop Literacy and Numeracy - Research Summary
http://cursos.inea.gob.mx:8082/eed-conevyt/paginas/docs/Using_ICT_to_develop_literacy_numeracy.pdf


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www.alphaplus.ca