REVIEW OF

Research on Teaching Digital Skills

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The following reference document provides a brief review of academic research and relevant reports on best practices for teaching and assessing digital skills. The purpose of this research was to support the development of the Skills for Success Practitioner Competency Framework and was part of a series of research reviews on best practices for teaching each of the Skills for Success. This summary provides an overview of evidence-based teaching methods in the area of digital skills, key considerations when applying these practices, and a list of resources for further consideration.

METHODOLOGY

Several search queries were conducted on Google and Google Scholar using combinations of the following keywords: teaching, strategies, intervention, approach, pedagogy, digital skills, essential digital skills, digital literacy, digital competence, adults, and workplace.

STATE OF THE LITERATURE

There is substantial literature on topics such **bridging the digital divide** (e.g., helping seniors citizens improve their digital literacy), **effective online learning practices**, and the effective **integration of technology in teaching**. However, there is very limited research on effective practice in teaching digital skills (Moss, 2021; Jimoyiannis and Gravani, 2010; Pendell et al., 2013).

Most of the findings from the literature on teaching digital skills are best characterized as suggested or established practice rather than evaluative evidence to support teaching practices. Literature mentioned in this report are mostly taken from pilot projects, case studies, instructional guides, and rapid reviews of the literature.

The types of programming and interventions mentioned in the literature for improving digital skills largely fall within the following categories: self-paced learning, volunteer-based tutoring programs, and face-to-face teaching.

CONCEPTS

The definition and integral constructs of *digital skills*, as specified in the Skills for Success Framework (SRDC, 2021), are as follows:

DEFINITION:

"Your ability to safely use digital technology and tools to find, manage, apply, create, and share information and content. For example, at work we use this skill to take measurements, create spreadsheets, safely use social media, and make online purchases using digital devices such as smartphones, sensors, and computers."

CONSTRUCTS:

- Use digital devices including computers, tablets, smart phones, and other handheld devices
- Use common digital tools to complete tasks
- Use digital information
- Use online tools and platforms
- Apply safe and responsible practices online
- Update and upgrade digital skills

APPROACHES TO TEACHING DIGITAL SKILLS

Conducting a thorough needs assessment is critical given that adults taking digital literacy courses often lack common backgrounds and may have diverse learning needs (Defino et al., 2008).

- Adults seeking to improve their digital learning skills often come from **marginalized or disadvantaged communities** and have related issues of low confidence or little expectation of success (Moss, 2021).
- There are **disparities between younger and older clientele**, with steep declines in computer and online confidence with increasing age (McGillivray et al., 2017).
- Given the above, it is **important to take a flexible approach when designing and delivering training** to help ensure appropriate starting points are established for each learner (Jimoyiannis and Gravani, 2010; Jimoyiannis and Gravani, 2011; Moss, 2021; Vanek, 2017).

To address low levels of confidence and motivation, Moss (2021) highlights the following approaches:

- Higher levels of **one-to-one support and positive feedback**;
- **Ability to put learning into practice**, building confidence through tangible evidence of success;
- **Providing a welcoming learning environment** to help learners overcome negative attitudes and poor previous learning experiences;
- **Friendly and informal relationship between learner and tutor**;
- **Sense of community** within the learner population.

Vanek (2017) provides an i**nstructional guide for adult educators who teach problem solving in digital contexts**. The instructional guide was developed and informed by the Programme for the International Assessment of Adult Competencies (PIACC) assessment titled *Problem-Solving in Technology-Rich Environments*. The guide suggests the following teaching practices:

- **Identify the overall goals** of the instruction;
- **Start with simple examples** to allow learners to develop proficiency and build confidence, and then gradually add complexity, but do not push challenging concepts while introducing new technology;
- **Use a problem-based approach** where participants learn by doing and get the opportunity to develop metacognitive awareness;
- **Provide explicit instruction**, as problems are difficult to solve by trial and error;
- **Contextualize instruction** and reinforce the relevance and real-world applicability of the skills being learned.

The Problem-Solving in Technology-Rich Environments guide **outlines four stages to teaching digital skills** (Vanek, 2017):

1. Teach learners why problem-solving in digital contexts is important and have broad classroom discussions that allow students to share the technologies that they use and problems they have faced.
2. Determine needs;
3. Spell out the process (explain steps to solve technology-based problems);
4. Describe the complexity levels associated with various problems in digital contexts and stage instruction to appropriate levels in accordance with learners' abilities.

Building long-term retention and autonomy of digital skills: Moss (2021) suggests that varying practice conditions may improve retention, despite this making the material harder to learn in the short-term. Some suggestions include:

- Spreading out practice and using different devices that transfer to real world scenarios;
- Using tests that require learners to generate an answer may lead to better retention and transferability of skills than simply having students study and practice without assessments;
- It may be beneficial to offer a qualification earned through the training.

McGillivray et al. (2017) conducted a review of **evidence for improving basic digital skill acquisition**.

- People learn best from **repeated, informal, face-to-face, and one-on-one support**.
- **Understanding learners' motivation to learn something new is critical**. Programming must recognize the importance of relevance, and learner interest and motivation. Hence, the need for effective needs assessments.
- Importance of **building trusting relationships** between mentors and mentees.
- Importance of **trainers having a passion for passing on digital skills**.

Delfino et al. (2008) conducted a study on a digital literacy course that aimed to help beginners become digitally literate by fostering their **capability to learn something new in an autonomous way**. These competencies are critical to future proof their digital skills given the constant change associated with digital technologies.

- The course focused on the concept that **digital literacy should be taught in a problem-based manner**. Courses should not spend too much time emphasizing computer technicalities, or the "how to do something". Rather, learners should also learn the "when" or "why" to help them better problem solve and complete tasks (Delfino et al., 2008).
- Students involved in the study scored high on the final assessments of practical tasks and the acquisition of basic concepts and skill, and the study found a **positive correlation between test scores and confidence level** (Delfino et al., 2008).
- **Features of the course and suggested teaching practices** include:
  - Face-to-face instruction;
  - Focus on a small nucleus of basic concepts and skills;
  - Providing learners with a number of complex situations to solve, focusing on a problem or task-based learning approach;
  - Promotion of habits and attitudes that facilitate effective problem solving when troubleshooting and working with technology;[1]
  - A gradual approach to new concepts and operational skills to foster the development of stable learning and to avoid cognitive overload;
  - Frequent switches from explanations to practice to the reinforcement of new concepts through hands-on activities or the use of practical tasks to introduce new concepts;
  - Strong emphasis on stable concepts and skills rather than on technology-dependent aspects; avoiding unneeded technical terms, discouraging rote learning, stressing the importance of giving priority to the problem and its definition before focusing on technical ways to solve it.

[1] Likewise, Moss (2021) highlights evidence from cognitive psychology that suggests viewing problems as "desirable difficulties" may be helpful.

Jimoyiannis and Gravani (2010; 2011) identified the following teaching practices based on an exploratory study of teachers' and learners' experiences and perceptions of a program aimed at combating social exclusion through teaching digital skills:

- **Conducting a thorough needs identification**;
- **Involving learners in the instructional planning process** to ensure adequate flexibility to meet learner needs;
- **Providing a supportive learning climate** (e.g., ensuring adequate number of computers and resources);
- **Providing a range of instructional activities, approaches, and evaluation** (e.g., information and communications technology (ICT) competence activities for 2-3 hours per week; ICT-based projects; individualized teaching).
- Combining the following **instructional practices and pedagogical approaches:**

INSTRUCTIONAL PRACTICES	PEDAGOGICAL APPROACHES	OBJECTIVES
ICT competence sessions	• Active learning • Constructivist and discovery learning	• ICT knowledge • ICT competence • Computer and software usage skills • Societal aspects of ICT
Interdisciplinary and multi-literacy lessons	• Task-based learning • Cross-thematic	• ICT knowledge • Two or more literacies involved
ICT-based projects	• Project-based learning • Collaborative learning	• Information skills (search, select and evaluate information) • Critical and analytical thinking • Strategic and problem solving skills • Collaboration skills
Individual instruction sessions	• Face to face instruction in the computer lab	• ICT competence • Information skills • Project related skills

Jimoyiannis and Gravani (2010; 2011) list the following adult teaching principles for teaching digital skills to adults:

- **Self-directed learning** is the preferred model;
- **Adults' prior experience and interests are a rich resource** for the course design;
- **A task-based rather than ICT-centred approach** is better; and
- The importance of the **including the wider social context in the cultivation digital skill learning**.

Self-paced learning

- Learners will often have different needs and move through material at different rates;
- A common intervention is to have volunteers or tutors monitor a computer lab and provide "just-in-time" teaching when a learner encounters a challenge (Pendell et al., 2013);
- Numerous websites and programs allow learners to complete trainings in a self-paced manner, including:
  - *Google for Education – Applied Digital Skills*[2] (teachers can utilize resources and content via this website as well);
  - *Youth Teaching Adults*[3]- a Canadian-based digital literacy program that is free and led by youth volunteer-tutors.

ASSESSMENT OF DIGITAL SKILLS

Chinien and Boutin (2011) released a report on essential digital skills in the Canadian workforce, which describes several assessment approaches[4], and found that existing approaches often focus on people's perception of their own skills, rather than systematic or standardized assessments that are more objective in nature. The following types of assessments were included in the report.

- **PIACC – Problem Solving in Technology-Rich Environments:** This assessment measures ones' ability to solve problems using multiple sources of information on a laptop, with emphasis on information, access, evaluation, retrieval, and processing.
- **Educational Testing Service:** A test of digital skills based on a model of digital literacy, which includes the following proficiency domains: cognitive, technical, and ICT;
- **UK Skills for Life Survey:** Designed to test the ICT skills of the entire population using a large-scale survey, which covers a number of basic skills and several Windows-based tasks;
- **Eurostat's Adult Education Survey:** A self-report survey that can assess ICT skills. Self-reports on frequency of use and familiarity with ICT are used as proxies to assess ICT skill levels;
- **Qualitative assessment features,** such as direct observation and scenario-based testing – these approaches are difficult to scale to large populations;
- **Certifications:** Demonstrate proficiency or digital skill competence and requires the completion of an assessment/exam or training. An example is the International Computer Driving License, which offers training in basic to more advanced digital skills and can certify individuals for ICT workforce readiness[5];
- **Complexity-rating scales:** There is debate between various approaches, with some rating scales specific to proficiency levels on given tasks (e.g., sending a digital message), and others focused more holistically on the digital competence or proficiency of the learner (novice vs. advanced).

Vanek (2017) suggests approaches for assessing problem-solving in digital contexts:

- The *Problem Solving in Technology-Rich Environments* assessment in the Education and Skills Online Assessment[6] is a possible resource for measuring students' progress;
- Continuous formative assessment where teachers monitor the demonstration of task completion, as well as the learner's use of effective problem-solving steps;

2 Teach & Learn Practical Digital Skills - Applied Digital Skills
3 Digital Literacy Program For Adults | Youth Teaching Adults
4 Note: In our review of existing resources, we found that there is a shortage of tools for assessing workers' digital skills.
5 https://icdl.org/workforce/icdl-workforce/
6 https://static1.squarespace.com/static/51bb74b8e4b0139570ddf020/t/52276bd2e4b0ae4ae05ae899/1378315218944/Education+and+Skills+Online.pdf

- Peer feedback: teachers can use problem-solving charts or maps to help structure peer support and feedback by asking students to explain their approach to working through the problem;
- Self-assessment: teachers can create rubrics to help students self-assess and monitor their learning.

CONSIDERATIONS FOR TEACHING DIGITAL SKILLS

Instructors' confidence in teaching digital skills: The ability to teach digital skills depends largely on the confidence instructors have in their own digital abilities, along with their comfort with new technologies. Hamalainen et al. (2021) report that teachers largely feel competent regarding their digital skills but there are differences between groups, such as older teachers feeling less competent. The authors report that two in five teachers have weak digital skills, which creates potential barriers for effectively teaching digital skills.

Challenges to learners' development of digital literacy in instruction sessions: Research emphasises the need for instructors to pay particular attention the varied experiences with and attitudes towards digital technology of their adult learners. The following table is drawn from Jimoyiannis and Gravani's (2010) research on programs for individuals at risk of social exclusion in Greece, and outlines the possible factors that impact adult learners' abilities to improve their digital skills:

ITEM	SPECIFICATION
Adult personal factors	• Negative attitudes toward ICT • Lack of confidence in using computers • Fear towards ICT and the Internet • Personal characteristics (e.g., age, social income, physical condition) • Lack of time and ICT usage opportunities at home, work or other places • Lack of basic reading and writing skills (in Greek and in English also)
Adult learning factors	• Existing learning habits and beliefs • Lack of collaborative skills and spirit • Lack of effectual representations and notions about computational systems and their operation • Pre-existing attitudes about the societal role of ICT • Perceptions about the usefulness of ICT in everyday life

ITEM	SPECIFICATION
Educators' pedagogical factors	• Previous experiences and practices at typical secondary schools • Inadequate training about adults' education • Lack of skills to apply in practice the basic principles of andragogy (i.e. adult learning) • Lack of collaborative culture to work with other educators in the school (SCS) • Lack of knowledge to design and promote interdisciplinary and multiliteracy lessons • Lack of knowledge to support ICT-based projects
School factors	• Technical and space problems in the computer laboratory • Quality of infrastructure in the school (lack of new generation PCs, broadband connections to the Internet, etc.) • Lack of computers available in every classroom and subject • Lack of appropriate educational software • ICT is not adopted as a learning tool across the SCS curriculum

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