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Improving Adult Literacy Instruction: Supporting Learning and Motivation (2012)

Chapter: Technologies to Support Adult Literacy

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Technologies to Support Adult Literacy

Technologies with the potential to support literacy development in adults and adolescents are rapidly emerging and becoming more affordable. Internet technologies also have the potential to alleviate barriers associated with limited times and places of instruction, allowing adults to learn and practice when and where it is convenient for them. And because the use of digital technologies is required for literacy in a digital age, it is important to incorporate technologies into literacy instruction.

Although it is likely that using technologies will add to the initial cost of literacy programs, the degree of differentiated and sustained support they can provide to adult literacy learners is great enough that investments in

technology may be the most cost-effective solution. Thus, it is worth developing and testing the most promising new approaches so that their costs and benefits are better understood.

Many studies of the effectiveness of technologies in education have shown minimal and sometimes null results. This is not surprising. Technology does not of itself produce learning; it simply amplifies and extends instructional strategies. Too often, studies of technology effectiveness have paid inadequate attention to the content of the instruction and assumed that any technological strategy to amplify it would be effective. Neither do the studies attend sufficiently to the engineering and training required to implement the technologies effectively.

If well engineered and supported, the technologies described in this section could be used to amplify and extend effective instructional approaches.

Existing and Promising Technologies

Some of the following technologies for learning are available already and should be tried with adult learners, recognizing that they should also be evaluated since they have not been used or proven effective for adult literacy instruction. Other technologies are in development and not commercially available yet, but have promise for improving adult literacy.

Group collaborative communication software. This category includes the kinds of tools used in offices and homes every day—electronic calendars,

email, text messaging, Facebook, wikis, and collaboration portals. New technologies for group communication, including tools for exchanging comments on written materials, are emerging regularly and may be especially helpful for adult learners.

Word processing software. The most basic tools that can help with literacy are standard word processing tools, which facilitate writing and especially editing. Controversies remain about features that make it easy to circumvent mastery of some literacy skills, notably spelling correction. However, for most adults and adolescents with limited literacy, the ability to get ideas on paper, read those of others, edit initial writing, and exchange ideas is dramatically enhanced by word processing tools and should therefore be encouraged. Word processing tools also can help adult learners engage in the many hours of practice they need to develop their

literacy. Related tools, such as presentation software, are standard ways adults express their literacy in civic and work situations; part of being functionally literate today is the ability to use such tools effectively.

Bulletin boards and discussion tools. Once students are creating compositions and exchanging them, they need ways to hold conversations with each other about the texts. All of this is easily possible via bulletin board systems. On such systems, threads of conversation can be started about particular topics or posted texts. Students read additional documents and peer comments and then prepare and post their own comments. This approach is promising because it provides students with multiple and engaging ways to practice as well as natural experience with the need to write for others' understanding.

Commenting tools embedded in programs. Contemporary online word processing programs provide commenting tools in online texts. Adobe Acrobat provides such tools for commenting on PDF files, and software packages on wiki or Moodle sites allow students to annotate texts individually as they read. Students can benefit from seeing which parts of a text prompt annotations and what their peers wrote in their notes. The use of commenting tools also mimics real-world work, providing both motivation and practice in some of the skills needed in the 21st century workplace.

Virtual meeting tools. A variety of new systems support online meetings with components that permit word processing and other tools to be

shared over a network. That is, multiple people can talk to each other, write to each other, show each other diagrams and other media, and jointly edit a single text, PowerPoint file, or other document. Virtual meeting tools used in the world of work, partly to support working from home, could also benefit the education world. For adult learners, such tools can help overcome barriers to learning caused by the need to travel regularly to places of instruction and increase the time they spend engaged in learning beyond the classroom.

Speech-to-text and text-to-speech tools. Computer-generated speech (called text-to-speech) and speech recognition facilities (called speech-to-text) occur throughout society. Phone calls are answered by computers that then respond to spoken commands by consumers. High-end automobiles can respond to hundreds of voice commands, generally without training to handle a specific person's voice. It is entirely possible to develop texts that read themselves to a student and also systems that listen to students reading texts aloud and give corrective assistance if they make errors in their reading. A number of intelligent tutoring systems allow spoken student input as an alternative to typed input.

Embedding low-level coaching in electronic texts. One way to prompt students who may get caught up in word recognition to also think about meaning is to embed pop-up questions in texts that are presented on screen. The basic idea is that the prompts can be embedded in machine-readable text and then can appear automatically alongside the text to which they apply when the student encounters it. For example, pop-up questions can be tailored to match a system's best understanding of how

the reader is processing the text in question. If the student is not spending enough time on important

but difficult content, a generic pop-up question might ask, “Are you sure you understand this section?” or specific pop-up boxes could offer strategies to apply and other background information or content to help learners understand the main ideas.

Automatic essay scoring. In many classrooms students are given relatively few writing assignments because of the time it takes instructors to read and comment on them. One possible approach is for students to comment on each other's work; demonstrations in college courses have shown that it is an effective teaching strategy, though this needs to be studied in the adolescent and adult literacy population.

In addition, recent advances in computational linguistics have made the automated scoring of texts possible. Some automated scoring systems have had agreement with human scorers over 80 percent of the time. Just as impressive, levels of human-machine agreement have been slightly higher than those achieved between pairs of trained human raters.

Intelligent tutoring systems. Since 1985, a number of intelligent tutoring systems have been developed that can track the performance of individual students on various tasks, provide tailored feedback, and intelligently guide students in ways that promote learning. Intelligent tutoring systems operate by trying to discover what pattern of present and missing knowledge best accounts for a student's performance. In the context of reading development, such systems would model the comprehension skills that a learner exhibits and then provide feedback to improve comprehension of text that is tailored to the learner's current level of knowledge.

Detection and tailoring to emotion and engagement level. Although just beginning to be developed, some intelligent systems already exist that are sensitive to emotion and, thereby, to the motivational state of the learner. Such systems suggest the potential of machines to be more flexible in

engaging students by understanding when a text is not interesting to a person, for example, or when a task is producing an emotional response that leads to avoidance rather than deep engagement.

Serious games. These games are designed with the explicit goal of helping students learn about important subject-matter content, strategies, and cognitive or social skills. The learner engages with curriculum content that provides learning opportunities as part of the game context. Many researchers believe that serious games have revolutionary potential because learning difficult content becomes an enjoyable, engaging experience for the learner; intellectual hard work is transformed into play. Very few serious games have been around for very long, however, so some researchers and game developers are unsure whether game design can be compatible with pedagogy. The more optimistic view is that there needs to be careful analysis of how to align the features of games with the features of effective pedagogy and curriculum. A better understanding is also needed of which learners are most likely to benefit from serious games as part of a program of literacy instruction.

Immersion environments. An example of the sophisticated level of intelligent training environments is the system called Tactical Iraqi, which has intelligent tutoring system components embedded in virtual reality with multiple fully embodied animated agents. This system was developed to help junior officers prepare for duty in Iraq, where they would need to interact with local tribal leaders in a new language and culture. The

learners in this system are confronted with realistic situations, such as having to interact with graphically rendered actors in order to negotiate movement of a medical clinic to ensure that it is not damaged during needed military maneuvers. The system is highly engaging, presumably in part because the responses to learners' actions are both cognitive and emotional.

It is not yet clear that this level of realism is needed to engage adult and adolescent literacy learners or which learners would benefit most, but the mere fact that it might be possible sets the stage for research to examine what level of intelligent technology is cost-effective for enhancing effective literacy practice.

Electronic entertainment technologies and social media. While systems like Tactical Iraqi are expensive in the economic context of adult education, it may be possible to get similar effects from various kinds of entertainment tools, like role-playing environments and social media. These range from simple games to rather elaborate possibilities, such as Second Life, an online virtual world where people can interact using avatars to represent themselves. Funding agencies and public-private partnerships should be encouraged to explore possible uses with adult literacy learners. Even if the approaches add little content to what can be taught in other ways, the motivational

value of immersion environments can be substantial, and motivation and engagement remain a critical barrier to progress in literacy for adult

learners.

Finally, there is a range of new social media, including Facebook, MySpace, and others, that generate large amounts of multimedia communication and might be useful for adult literacy learners. (Second Life also has a social medium component.) Because it is text-rich, social media has the potential to provide a portion of the practice that adults need to develop their literacy skills. Recently researchers have begun to design and implement social networking sites specifically to support and encourage literacy-rich educational activities for youth. Such approaches could be tried and studied further to improve adult literacy instruction.

Investing in New Technologies

Technologies, regardless of the form, should not entirely replace face-to-face instruction. It is vitally important to explore combinations of

classroom-based and Internet- or computer-supported activity that may be effective for adults, depending on their literacy development needs and skills. Technologies can also help learners overcome barriers to learning that arise from needing to be in a particular place at a specific time to receive instruction. Several challenges will need to be addressed, however.

One challenge in using technology for adult literacy instruction is that institutions are often slow to adopt technologies that much more rapidly penetrate the general world of consumers. A further challenge is the learning curve for any new technology, during which initial costs are high and utility is not fully developed.

It is worthwhile to consider promising technologies that could be adopted across the adult literacy education system so that a single program would not bear the cost. Initial versions of instructional software can be very expensive because of the steep learning curve involved in the development of new software programs, but the cost becomes much lower with subsequent versions. Moreover, first-generation development costs for many of the instructional approaches likely to benefit adult literacy learners may be

borne by early adopters, such as the military.

Understanding whether a particular technology is worth the investment will require a sophisticated research funding strategy. Such a strategy would place good bets and sustain investment long enough for the technologies and their implementation to be refined sufficiently to affect

learning, while maintaining the agility needed to adjust approaches given the rapid evolution of technology.

Directions for Future Research

- Studies are needed to establish how the efficacy of instructional approaches can be enhanced by technology and to clarify which subpopulations of learners benefit from various technologies.
- The benefit of instructional technologies is likely to depend on the particular subpopulation of adults using them. Studies are needed to examine the effects of technologies for those learning English as a second language, adolescents and adults with less than high school levels of literacy, learners with disabilities, and college students who need to enhance their reading and writing skills.
- Many specific uses of technology for adolescent and adult literacy instruction have been shown to be effective in small-scale, controlled studies. The next step will be to evaluate these technologies in studies with larger populations and in diverse settings. Also important is translational research that can show the ways in which an existing instructional system or organization can benefit from promising technologies.

In conducting this research, it will be important to develop the skills of adult literacy instructors so that they are able to use the technologies effectively to support adult learners.

ABOUT THIS BOOKLET

This booklet was prepared by the Division of Behavioral and Social Sciences and Education (DBASSE) based on the report *Improving Adult Literacy Instruction: Options for Practice and Research* (2012) which was authored by the Committee on Learning Sciences: Foundations of and Applications to Adolescent and Adult Literacy. The study was sponsored by the U.S. Department of Education. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the National Research Council and do not reflect those of the Department of Education.

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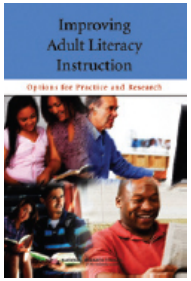
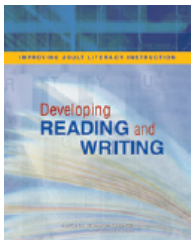
Drawing on the latest research evidence, this booklet, *Improving Adult Literacy Instruction: Supporting Learning and Motivation*, explains principles that instructors can follow to support literacy learning and students' motivation to persist in their studies. The booklet also explores promising technologies for adult literacy instruction.

Also of Interest...



This booklet is drawn from the National Research Council's report *Improving Adult Literacy Instruction: Options for Practice and Research*. The report recommends a program of research and innovation to gain a better understanding of adult literacy learners, improve instruction, and create the supports adults need for learning and achievement. The report also identifies factors that affect literacy development in adolescence and adulthood and examines their implications for strengthening literacy instruction for this population. In addition, the report explores technologies that show promise for supporting adult literacy learners.

The report is a valuable resource for curriculum developers, federal agencies, literacy program administrators, educators, and funding agencies.



A companion to this booklet, *Improving Adult Literacy Instruction: Developing Reading and Writing*, gives an overview of how literacy develops and explains instructional practices that can help adults learn to read and write. Intended to be a useful resource for those who design or administer adult literacy courses or programs, this booklet may also be of interest to teachers and tutors.

Copies of both booklets are available from the National Academies Press, 500 Fifth Street, N.W.,
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