

Application of Computer Simulation to Teach ATM Access to Individuals with Intellectual Disabilities

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Abstract: This study investigates use of computer simulation for teaching ATM use to adults with intellectual disabilities. ATM-SIM is a computer-based trainer used for teaching individuals with intellectual disabilities how to use an automated teller machine (ATM) to access their personal bank accounts. In the pilot evaluation, a prototype system was developed and used to train nine adults with intellectual disabilities how to use a local ATM. Participants were pre-tested on their ability to use an ATM and then were trained using the ATM-SIM prototype. After a brief training period, participants were again tested on their capacity to operate the actual ATM. Results demonstrate preliminary evidence that computer simulation can be used effectively to teach a specific independent living skill to adults with mental retardation. Participants required significantly fewer help prompts and made fewer errors when operating the real ATM after ATM-SIM training. Potential for electronic and information technologies to promote community inclusion was discussed.

Money management skills are frequently identified as critical to ensuring community inclusion for people with intellectual disabilities (Alper & Ryndak, 2003; Browder & Grasso, 1999; Wehmeyer, Sands, Knowlton, & Kozleski, 2002). In the past, efforts to teach money management skills focused on traditional methods of dealing with financial resources: using cash (Schloss, Kobza, & Alper, 1997; Stith & Fishbein, 1996), maintaining a

checking account and register (Asha & Nolet, 1995), and interacting with a bank (Borbeau, Sowers, & Close, 1986; McDonnel & Ferguson, 1989). While these skills are still relevant, financial and money management skills required today have expanded considerably. Debit and cash cards are slowly replacing checks and, to some degree, cash as a primary mode of transactions; banking online is becoming more prevalent; e-cash payment systems allow for online purchases; and the traditional means of interacting with banks has changed. Instead of going to a central bank to make deposits, cash checks, or withdraw money, bank customers now interact with smaller satellite branches and, even more frequently, automated teller machines, or ATMs. At an ATM, one can deposit paychecks, withdraw cash, make payments, check balances, transfer funds, place an order for new checks, submit a change of address, and more. Most automated teller machines in the United States are connected to one or more computer networks that allow access to accounts from virtually anywhere; hotel lobbies, gas stations, airports, school campuses, and more. Possibly more importantly, ATMs are increasingly being used for non-banking transactions. For example, Seafirst Bank of Seattle pioneered vending of stamps through its ATMs

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and has begun selling other items, such as bus tickets. More and more basic services are offered via ATMs.

Benefits for people with mental retardation learning how to use ATMs seem fairly self-evident. Generally, people with intellectual disabilities who live or work in the community are within walking distance of grocery and convenience stores and, in most parts of the country, ATMs are standard equipment in those establishments. Teaching people with intellectual disabilities to use ATMs can increase access to personal bank accounts and to the other services that are available through ATMs now and which will be in the future.

There has been only one reported effort to teach a person with mental retardation to use an ATM or, more accurately, an automated banking machine. Shafer, Inge, and Hill (1986) showed that an adult with mental retardation could learn skills to use an automated bank machine to make deposits. Shafer and colleagues noted that there were several advantages to using this means of interacting with the bank, including 24-hour access, proximity to work and home, and the fact that bank machines had fairly stable routines that could facilitate generalization. While this may be less true for ATMs today, it is true that basic features of ATM use are often replicable across machines, from having the machine read the magnetic stripe on the card (typically by inserting the card into a slot or by swiping the card along a reader), to punching in a password and amounts (usually on a number pad), to removing cash or submitting the envelope for deposit, to taking the receipt. There are enough similarities in this process that some people with mental retardation might be able to learn the basic steps and apply them to various machines.

Typically, teaching a person to perform community-based activities is done by instructing the person in ecologically-valid environments. Thus, teaching a person with mental retardation to shop for groceries would occur at the grocery store that the person might typically access. This approach is often impractical as a means to teach ATM use for the primary reason that public ATMs are not intended for the type of training required by individuals with intellectual disabilities. In fact, many ATMs will not return the ATM card

if repeated errors are made in accessing the system, as is likely in a training situation. Thus, while 'simulated learning settings' may not be optimal for many training purposes, there are circumstances under which it may be the preferred option. Shafer et al. (1986) used a simulated banking machine to teach use of the automated banking machine to a person with mental retardation, but that machine was simpler and easier to reproduce than today's electronic versions of ATMs.

Simulation has been used effectively in many settings to teach skills that require both complex problem solving abilities (e.g., nuclear power plant operators) as well as specific rote tasks (e.g., switchboard operators). Recently the increased availability, decreased cost, and emerging technological advances associated with computers have made computer simulation a viable alternative teaching method in a variety of settings. As a result, computer simulation has been used increasingly as a cost-effective alternative to actual hands-on training. Davies and Hamel (1985) reviewed benefits of using computer simulation for training. These include low-cost, ability to tailor training to individual needs, "cognitive" fidelity, and provision of a "safe" environment for training. These benefits apply directly to the population of individuals with intellectual disabilities.

Ensuring transfer of skills acquired through use of the simulator to community settings has long been recognized as essential for assessing effectiveness of training in the simulated environment. For example, Bates (1980) found that for social-skills trained in a simulated setting, experimental group scores that were significantly higher in the simulated setting were not observed in the "real world" environment. Clearly, the final measure of effectiveness of simulation training cannot be determined until the skill is evaluated in the community setting.

Computer simulation offers potential for utilizing technology as an adjunct training method to enhance skill-training for people with intellectual disabilities. With more complex technology, such as ATMs, in which simulations may need to be used in training, it is likely that computers can provide reasonably priced and realistic simulations that might provide for transfer of skills to community

settings. Innovative application of computer simulation and multimedia can help train specific tasks thus enabling individuals with intellectual disabilities to acquire the necessary skills for successful independent living. Automation and effective training techniques, for example, computer simulation, are both ways of using technology to increase the opportunity for individuals with intellectual disabilities to learn and master key skills necessary to achieve increased levels of residential independence (Davies, 1992).

To test this, we evaluated the prototype of a simulation-based trainer for teaching individuals with intellectual disability how to use an ATM. Specific aims of this pilot project were to research the applicability of computer simulation techniques for training a specific skill necessary to increase community access for individuals with intellectual disabilities. Evaluation was based on the key requirement to assess performance as measured on actual ATM use rather than only on success of the simulated task. The basic hypothesis for this study was that the *ATM-SIM* system will be effective for teaching individuals with intellectual disabilities how to use an ATM and that these skills will be transferable to the community setting.

Device Design

ATM-SIM is designed as a multimedia training tool that provides individuals with intellectual disabilities step-by-step instructions for learning how to use an ATM. Each step in the process, from entering the ATM card, keying in an access code, selecting the desired transaction and completing the transaction was simulated on the computer and presented to the user with step-by-step visual and audio cues. Users interacted with the *ATM-SIM* system using a touch screen similar to actual operation of an ATM. Each button and displayed message from a local ATM in the PLUS system of ATMs was incorporated into the *ATM-SIM* system. Users were guided through each step of a desired transaction via computer generated audio instructions and by visually highlighting the buttons that needed to be pressed. For example, a session could be configured to guide the user through the process of taking \$10.00 from a checking account.

As the user stepped through the process, the system presented specific instructions to follow and then monitored whether correct options were selected on the simulator. If incorrect choices were made (e.g., selecting savings account instead of checking account), feedback was provided to guide the user to correct the action and continue following the correct path. At the end of a successful session, the simulator would provide a simple animation of the money coming out of the ATM and would then remind the user to take the money as well as the ATM card before leaving the machine. Through this process, users could practice performing various transactions and experience success with the simulator without the anxiety associated with learning in a community setting on a real ATM.

Method

Participants

Study participants were adult volunteers with intellectual disabilities receiving supports from a community-based agency. A total of nine participants were identified who were appropriate to participate, based on their classification as having mental retardation and based on the potential that they could understand certain aspects of the transaction (e.g., basic money skills). Ages of participants ranged from 25 to 58 years, with a mean of 35.8 years of age. There were five males and four females in the study group. Intelligence quotient scores (using the WAIS-R) ranged from 56 to 72, with an average score of 65.1. Informed consent was obtained from all participants prior to beginning the study, and each participant was paid \$20.00 for their involvement in the study. All study data was kept confidential and was traceable to individuals by study ID number only.

Procedure

The pilot study used a within-subjects design. Participants were pre-tested on their ability to operate an ATM after a single demonstration at an ATM. The frequency with which participants made errors while trying to withdraw money from an ATM pre- and post-intervention (e.g., before and after training on the

ATM-SIM) and the number of prompts needed by the person to accomplish the transaction were the dependent variables for the study.

Prior to beginning the training on the *ATM-SIM*, each study participant was taken to an ATM. The process for withdrawing \$10.00 from a checking account was demonstrated to the participant. After that demonstration, each person was asked to perform the same task. Number of help prompts required by the participant and number of errors made trying to perform the task were recorded. Participants were given all the help they needed to successfully perform the task to ensure that each person's experience was a positive one, even if he or she couldn't operate the ATM without help. After this initial attempt, participants were provided support to complete training using the *ATM-SIM*. Training was performed in a conference room at the agency's headquarters, a location familiar to all participants. Each person was trained between 20 and 45 minutes using the *ATM-SIM* depending upon how quickly he or she reached mastery. Criterion level of performance for mastery was correct operation of the simulated ATM three times without making any unrecoverable errors. An unrecoverable error was defined as an error that would not have been correctable without starting over on the real ATM. For example, choosing the wrong account to withdraw cash from was an unrecoverable error because the user would have to cancel the process and start over to get back to the right account. Entering the incorrect dollar amount initially was not an unrecoverable error as the system allows the user to change the dollar amount after it has been entered. In addition to correct operation for three times, the user was required to operate the ATM simulator correctly without voice instructions and feedback. For this part of the training, the digital voice messages were turned off. This provided the most realistic simulation of device operation, as there were no voice instructions provided by the real ATM. After participants completed their training session, they were taken back to the real ATM. They were then requested to use the machine to withdraw \$10.00 from a checking account. Again, number of help prompts required were recorded as well as number of errors made in

performing the transaction. In both the pre- and post-intervention data collection periods, participants kept the \$10.00 withdrawal and each received the full \$20.00 for participating.

Data Analysis

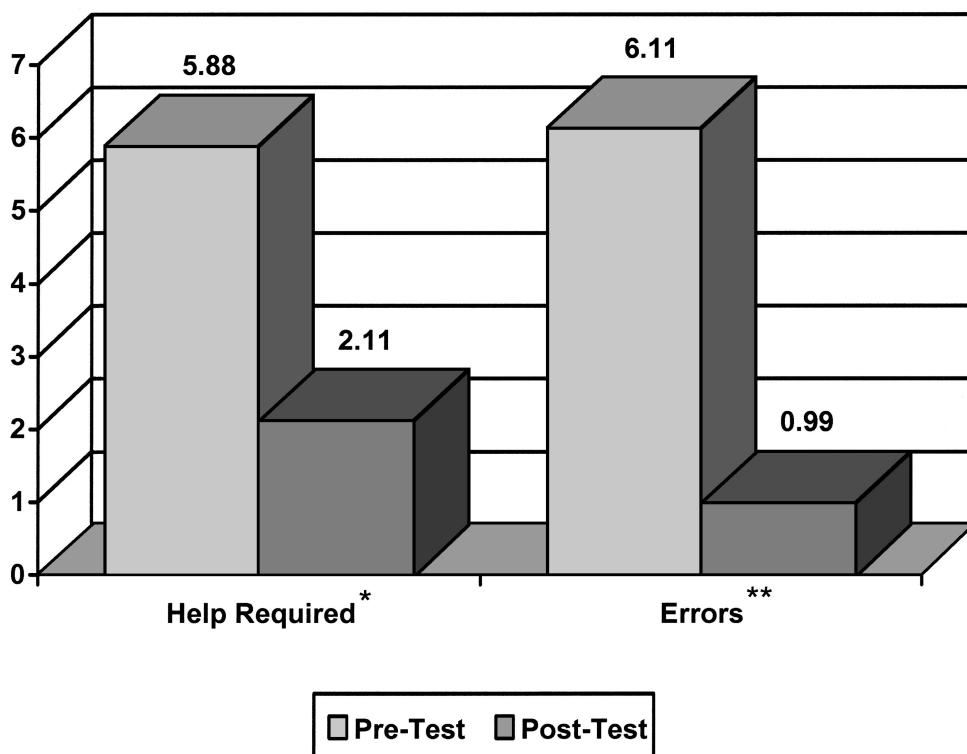
Data were analyzed using SPSS. Pre and post-intervention frequency of errors and prompts were analyzed using Sandler's *A* statistic. This test is derived from student's *t* ratio and is appropriate for testing mean differences when correlated samples are used. Mean differences in errors and help prompts were tested for significance at the .05 level with a one-directional test.

Results

There were significant differences between the pre-test and post-test scores for both of the dependent measures. Figure 1 presents the mean comparisons for the pre-test and post-test conditions. In the pre-test condition, there were an average of 5.88 help prompts required for participants when trying to take \$10.00 out of a checking account using the ATM. In the post-test condition the average number of prompts required dropped to 2.11. This difference was significant ($p < .003$). In the pre-test condition there were an average of 6.11 errors out of a total possible of 11. After *ATM-SIM* training participants were able to perform the task at a much higher proficiency level as indicated by the very small number of errors that were observed in the post-test condition (M errors = 0.99). This difference was also significant ($p < .001$).

Discussion

Results of this study provide preliminary support for the hypothesis that computer simulation and multimedia can be effectively used to teach adults with intellectual disabilities to use an automated teller machine. Training on the *ATM-SIM* successfully improved the proficiency level of nine adults that were trained how to use an ATM in the community. Adults with disabilities made fewer errors and required less assistance after having completed the computer-based *ATM-SIM* training. This pilot study demonstrates technical merit and



* Significant difference ($p < .003$)

** Significant difference ($p < .001$)

Figure 1. Mean comparisons for pre-test and post-test conditions.

feasibility of using computer simulation and multimedia for teaching independent living skills.

These results must be considered preliminary as the research scope and time available for evaluation was quite limited in this project. Moreover, the small sample size and lack of a control group or condition limits the generalizability of these findings. A number of issues (in addition to larger sample sizes and control group designs) should be addressed in subsequent research. For example, the longer-term impact of this training approach on the ability for participants to maintain this skill over time must be assessed. The study period did not provide sufficient time to assess how well participants will be able to perform the skill as time passes between training sessions and actual operation of the ATM in the community setting. Overall, however, preliminary results were very encouraging.

One of the more interesting observations during the study was that every one of the participants, without exception, seemed to thoroughly enjoy operating the *ATM-SIM* program. Participants did not want to stop their interaction with the program, regardless of their skill level. Participants were able to learn the task very quickly and wanted to retry the ATM simulator repeatedly. Similarly, participants who were slower at learning the task did not want to quit. The opportunity to experience success with the computer simulation appeared to be personally rewarding. One of the agency support staff observed that the *ATM-SIM* system seemed to have a positive effect on self-esteem for some of the study participants. The ability to participate in "computer technology" was viewed as a very desirable thing for these persons who, for the most part, have been left behind by the computer revolution. The high level of motivation

on the part of the participants may have contributed to their success at learning the task at hand. This study adds to findings from similar studies we have conducted using various electronic and information technologies (Davies, Stock, & Wehmeyer, 2001, 2002a, 2002b) with people with intellectual disabilities to support a wide array of activities (time management, scheduling, vocational task completion) that result in increased community inclusion and integration. The role of computer simulations to enhance such inclusion warrants further consideration.

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