Abstract

The study examines the effect of access to student behavior and motivation on trainer response. 66 minority college student were assigned to receive training on a logic and reasoning task under 3 conditions (Control, Wizard, One-on-one). Implications for creating technology that replicates teacher response.

Introduction

Cognitive training has been used to enhance the cognitive and academic skills of minority students (Hill, Serpell & Turner, 2010; Mariachi, 2008). The most effective training uses one on one methods (Hill & Serpell, 2009), however, such methods are not practical for widespread use in public schools that frequently lack the human resources to provide individualized instruction. Automated training systems can play an important role in this regard. This project is designed to improve our understanding of why one on one methods work better than computer-based training. A primary goal is to examine the degree to which students’ nonverbal behavior can be used to effectively structure cognitive training sessions and thereby improve student outcomes.

Methods

Participants: 66 Minority, mostly female (77%) college students. Mean age=19.71 years. Most students had little to no experience with iPads.

Procedures & Materials: Students were randomly assigned to receive training in one of 3 conditions:

◆ Control: The trainer remotely controls the exercises—switches tasks, designates levels of difficulty, and administers prompts and hints based ONLY on a visual of students’ moves on the iPad.

◆ Wizard of Oz (WOZ): Just like the control condition, the trainer remotely controls the exercises—but has access to BOTH the student’s moves on the iPad and a live real-time video of students’ facial expressions and upper body movements.

◆ One-on-One: traditional face to face training but restricted as the trainer can only use hints and prompts available to trainers in the control and WOZ conditions.

Prior to training, students completed Patterns of Adaptive Learning Scales (PALS; Midgley et al., 2000) subscales: mastery goal orientation, self-handicapping, skepticism about the value of math, and cheating orientation.

During training students engaged 3 cognitive skills tasks on an iPad: 1) Set—a logic and reasoning task that requires students to make sets of 3 cards that are either all different or all the same on multiple dimensions. (2) Remember—a 1-back picture memory task. (3) Sum—a short-term memory and math problem solving task. The iPad included audio and visual hints (card highlight, “try making sets where all the dimensions are different”, “what’s missing”) and motivational prompts (“keep trying”, “good job”, “that’s OK”) available for activation by the trainer.

Training sessions were approximately 30 minutes. Students were video-taped and the number of sets they were able make before, during and after training were recorded, as well as the number and types of hints and prompts they received.

Results

A one-way ANOVA examining differences in the number of sets made during training and change from pre-test to post-test did not yield significant differences among the groups. However, an inspection of the means suggests a trend toward higher performance in the WOZ condition (see Table 1 below). In addition, males (M= 3.43 pre/post change; 43.78 total sets) appear to perform better than females (M=1.94 pre/post change; 37.97 total sets).

A second ANOVA examined whether the groups differed on time on Set, and time until the first task switch. Results approach significance (F(2,97) = 3.03, p<.056) and post-hoc analysis indicate students in the WOZ condition are switched from Set earlier (M= 5.90 mins) than those in the One on One group (M = 9.56 mins).

The Control and WOZ conditions did not significantly differ in the total number of hints nor the total number of motivational prompts used. Overall, “good job” is given more than any other prompts.

Table 1: Correlations Among All Variables for Control & WOZ

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control (n=13)</th>
<th>Wizard of Oz (n=21)</th>
<th>One on One (n=18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post</td>
<td>.497**</td>
<td>.303**</td>
<td>.174*</td>
</tr>
<tr>
<td>Pre Post</td>
<td>-.062</td>
<td>-.161</td>
<td>-.065</td>
</tr>
<tr>
<td>Numbers</td>
<td>-.228</td>
<td>-.291</td>
<td>-.169</td>
</tr>
<tr>
<td>Keep trying</td>
<td>-.123</td>
<td>-.397</td>
<td>-.941</td>
</tr>
<tr>
<td>Good job</td>
<td>-.013</td>
<td>-.03</td>
<td>-.491**</td>
</tr>
<tr>
<td>Mastery Goal</td>
<td>.756**</td>
<td>.333**</td>
<td>.450**</td>
</tr>
<tr>
<td>Self-handicapping</td>
<td>-.042</td>
<td>.186</td>
<td>-.287</td>
</tr>
<tr>
<td>Skepticism</td>
<td>-.550**</td>
<td>.372</td>
<td>.379</td>
</tr>
</tbody>
</table>

Conclusions

Preliminary results suggest that trainer access to students’ non-verbal behavior improves the effectiveness of the training session. This is evident in the performance gains of students in WOZ. Also worthy of note is the positive relationships between the use of motivational prompts and performance outcomes in the WOZ condition which is not evident in the control condition. These findings provide further support that training in WOZ conditions is more tailored.

Limitations & Future Directions

Given the small sample size, results must be interpreted with caution. In future work, procedures will need to be standardized to ensure consistency across trainers.

The next set of studies will lengthen the duration of each session and have multiple sessions over time. Future work must also consider gender differences and the role of students’ motivational styles. Results from the next set of studies will help meet the overall goal of building the foundation for automated training systems that sense the state of the student and adapt accordingly.

References


Hill, O., Serpell, Z., & Turner, J. (2010). Transfer of Cognitive Skills Training to Mathematics Performance in Minority Students. Poster presented at the annual meeting of the Association for Psychological Sciences, Boston, MA.
