Technology to Improve Independent Job Performance of Young Adults with Intellectual Disabilities

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What is an Intellectual Disability?

Significant intellectual and adaptive limitations, which are manifested in conceptual, social, and practical contexts (Schalock et al., 2010)

- Four common classifications (American Psychiatric Association, 2000)
  - Mild
  - Moderate
  - Severe
  - Profound
Our Mission:

The mission of the ClemsonLIFE™ Program at Clemson University is to provide a coordinated course of study that includes career exploration and preparation along with self-awareness, discovery, and personal improvement through a framework of courses, job internships, and community participation.

Students:

- attend ClemsonLIFE classes with a modified functional curriculum
- take a leisure skills course for 1 hr/semester
- participate in a job internship experience
- participate in cooking classes in their apartment (2xs/week in evenings)
- participate in Creative Inquiry programs: TOP Soccer and Challenger Baseball (1x/week in evenings)
Research

Conducted in the areas of:

– Time management
– Health/fitness
– Job performance
Why Focus on Employment Outcomes?

- Only 37.2% of young adults with ID currently have paid employment outside of the home (U.S. Department of Education, 2010)
  - *Compared to other disability categories*
    - Learning Disability: 66.7%
    - Hearing Impairment: 56.4%
    - Emotional/Behavioral Disorder: 48.2%
  - Over half work 34 or fewer hours per week
  - Nearly half have an income of less than $7.25 per hour
- Sheltered employment outcomes more likely (Grigal, et al., 2011)
- Consequences?
Job Loss

• Most common reasons for job loss (Howarth, et al., 2006)
  – Performance problems stemming from excessive absenteeism
  – Not following instructions
  – Not being able to complete assigned work responsibilities
Improving Outcomes

• **Supported Employment** (McInnes, et al., 2010; Rusch & Braddock, 2004)
  - Initial assessment of skills
  - Locating jobs aligned with student strengths
  - Developing a plan to obtain employment
  - Provision of individualized supports
    - Workplace accommodations
    - Environmental prompts
    - Personnel supports
  - **Job coach** (Test, et al., 2000)
    - Provision of direct services to the client
    - Assisting with job identification and placement
    - Providing training on the job-site
Improving Outcomes

• **Self-Management Strategies** (Lancioni & O’Reilly, 2001)
  – Object cues attached to cards
  – Use of picture cues presented on cards
  – Self-verbalizations

• **Assistive Technology** (e.g., Cihak, et al., 2007; Davies et al., 2003; Van Laarhoven et al., 2007)
  – Picture cues presented via computer-based systems
  – Verbal cues stored in audio devices
  – Variety of uses to improve skill acquisition of employment-related tasks
Portable Electronic Assistive Technology

• Advantages over other forms of AT
  – Portable and easy to use (Wehmeyer, et al., 2008)
  – Discrete (Taber-Doughty, 2005)
  – Socially acceptable (Davies, et al., 2002; Gillette & DePompei, 2004)

• Examples
  – Handheld computers
    • PDA
    • Pocket PC
    • iPod
    • iPad
  – Vibrating pagers and watches
  – DVD players
Synopsis of Previous Research

• Research indicates that use of AT is a viable method to assist individuals with ID at employment settings (e.g., Mechling, et al., 2009; Riffel et al., 2005; Van-Laarhoven, et al., 2009)
  • Increased independence
  • Reduction in need of external supports
  • Benefits were derived across multiple settings, participants, and behaviors

• The majority of recent studies used treatment packages (e.g., Lancioni et al., 2000; Mechling et al., 2010; Davies et al., 2002)
  • Need exists to evaluate individual components of each intervention (Banda, et al., 2011; Mechling et al., 2009)

• Need exists to evaluate new and emerging technologies (Wehmeyer, et al., 2008)
Purpose of this Research

1. Can the use of portable and widely-accessible electronic AT (i.e., iPod Touch) improve the independent and correct completion of employment-related tasks among young adults with ID?

2. Does the specific method of prompting (audio, video, or a combination of both) provided by a portable device have an effect on participants’ performance when completing an employment-related task?

3. Is the most effective method of prompting related to the participant’s preferred prompting format?

4. Will performance levels be maintained over time?
Setting and Participants

- **Setting**
  - Clemson University
    - Office setting

- **Participants**
  - Three young adults
    - Selection criteria
      - Currently enrolled in ClemsonLIFE
      - Diagnosis of a moderate intellectual disability

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>Race</th>
<th>Gender (M/F)</th>
<th>Disability</th>
<th>Full Scale IQ</th>
<th>Adaptive Behavior Composite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chris</td>
<td>21-8</td>
<td>Caucasian</td>
<td>M</td>
<td>ID</td>
<td>44</td>
<td>51</td>
</tr>
<tr>
<td>Dan</td>
<td>21-11</td>
<td>Caucasian</td>
<td>M</td>
<td>ID</td>
<td>41</td>
<td>58</td>
</tr>
<tr>
<td>Mark</td>
<td>22-8</td>
<td>Caucasian</td>
<td>M</td>
<td>ID</td>
<td>47</td>
<td>57</td>
</tr>
</tbody>
</table>
Procedures

• Task analysis developed for three novel job-related tasks common to an office setting
  – Making a copy
  – Scanning and emailing a document
  – Faxing a document

• Steps of each task recorded into the Functional Planning System application in three formats using an iPod Touch
  – Video only
  – Audio only
  – Video and audio combined
## Task Analysis Example

<table>
<thead>
<tr>
<th>Skill</th>
<th>Number of Steps</th>
<th>Sequence of Steps</th>
</tr>
</thead>
</table>
| Copying   | 11              | 1) Pick up papers from inside the purple folder that is labeled “Copy”  
2) Place papers to be copied face up in the tray on the top of the machine  
3) Press purple “Copy” button  
4) Press yellow “Reset” button  
5) Press the “2” button on the number key pad for number of copies being made  
6) On the digital screen, touch the gray box labeled “Duplex”  
7) On the digital screen, touch the box labeled “1-sided>>2-sided”  
8) Press the green “Start” button  
9) After copying is complete, remove original papers from the top tray  
10) Remove copies from the side tray on the left  
11) Place all papers in the red folder that is labeled “Finished” |
Materials

iPod Touch 4G
Materials (continued)

Functional Planning System application
Materials (continued)

Functional Planning System application
Design

Alternating Treatments Design

Example
Baseline

• Included several trials for each task
  – No prior training for the task
  – No access to the iPod Touch
• Procedures
  – “Please make a copy of the documents”
  – Verbal encouragement
  – Non-specific verbal praise
  – No assistance or prompting
  – Trial termination
    • Failure to initiate a response within 15 seconds
    • Participant indicated that he was finished or did not know how to do the task
    • Failure to complete the task within 10 minutes
Training

Participants were initially introduced to the iPod Touch and application

- Use of an unrelated task (shredding papers)
- All three modes of presentation used
- Assistance was provided as-needed

Completion of mastery criteria before proceeding
Intervention Procedures

• One session per day
  – Each session included a total of three trials
    • One trial for each office task (copying, scanning, or faxing)
    • One mode of presentation per task (video, audio, or video and audio combined)
    • Counterbalanced across sessions
  • “Please make a copy of the documents while using the iPod to help you”
    • Prompting and/or assistance provided if the participant
      – Failed to initiate a response within 15 seconds
      – Provided an incorrect response
      – Requested help
  • Least-to-most restrictive prompt hierarchy was used
    – Gestural, verbal, imitative, physical
# Sample Presentation Sequence

<table>
<thead>
<tr>
<th>Day</th>
<th>First Task</th>
<th>Second Task</th>
<th>Third Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Video</td>
<td>Audio</td>
<td>Combined</td>
</tr>
<tr>
<td>2</td>
<td>Audio</td>
<td>Combined</td>
<td>Video</td>
</tr>
<tr>
<td>3</td>
<td>Combined</td>
<td>Video</td>
<td>Combined</td>
</tr>
<tr>
<td>4</td>
<td>Video</td>
<td>Combined</td>
<td>Audio</td>
</tr>
<tr>
<td>5</td>
<td>Audio</td>
<td>Video</td>
<td>Combined</td>
</tr>
<tr>
<td>6</td>
<td>Combined</td>
<td>Audio</td>
<td>Video</td>
</tr>
<tr>
<td>7</td>
<td>Combined</td>
<td>Audio</td>
<td>Video</td>
</tr>
<tr>
<td>8</td>
<td>Video</td>
<td>Combined</td>
<td>Audio</td>
</tr>
<tr>
<td>9</td>
<td>Audio</td>
<td>Video</td>
<td>Combined</td>
</tr>
<tr>
<td>10</td>
<td>Audio</td>
<td>Video</td>
<td>Combined</td>
</tr>
<tr>
<td>11</td>
<td>Combined</td>
<td>Video</td>
<td>Audio</td>
</tr>
<tr>
<td>12</td>
<td>Combined</td>
<td>Video</td>
<td>Audio</td>
</tr>
<tr>
<td>13</td>
<td>Audio</td>
<td>Combined</td>
<td>Video</td>
</tr>
<tr>
<td>14</td>
<td>Combined</td>
<td>Audio</td>
<td>Video</td>
</tr>
<tr>
<td>15</td>
<td>Audio</td>
<td>Combined</td>
<td>Video</td>
</tr>
<tr>
<td>16</td>
<td>Video</td>
<td>Audio</td>
<td>Combined</td>
</tr>
<tr>
<td>17</td>
<td>Video</td>
<td>Audio</td>
<td>Combined</td>
</tr>
<tr>
<td>18</td>
<td>Video</td>
<td>Combined</td>
<td>Audio</td>
</tr>
</tbody>
</table>
What Were We Measuring?

1. Number of steps completed correctly and independently
2. Duration per task throughout the intervention phase
3. Participant’s self-reported prompting mode preference
   - Two occasions
Data Scoring Guidelines

• Independent and correct completion
  – If no prompting was provided and if the step was completed with 100% accuracy

• Duration
  – Timing began after the last word of instructions was provided
  – Stopped when the participant placed papers in the “Finished” folder
Video Demonstration
Chris

Copying Task

Graph showing the percent correct copying in different conditions over trials.
Chris
Scanning Task
Chris
Faxing Task

The graph shows the percent correct faxing over trials for different conditions:
- **Baseline**
- **Intervention**
- **Withdrawal**
- **Preferred**
- **Maintenance**

The conditions are represented by different symbols:
- **No Technology**
- **Video**
- **Audio**
- **Video/Audio**

The graph indicates improvements in faxing accuracy over the trials.
# Chris

## Mean Duration to Complete Tasks

<table>
<thead>
<tr>
<th>Mode</th>
<th>First 3 Trials</th>
<th>Last 3 Trials</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copying</td>
<td>210s</td>
<td>162s</td>
<td>-23%</td>
</tr>
<tr>
<td>Scanning</td>
<td>205s</td>
<td>124s</td>
<td>-40%</td>
</tr>
<tr>
<td>Faxing</td>
<td>377s</td>
<td>237s</td>
<td>-37%</td>
</tr>
<tr>
<td>Overall Mean</td>
<td>264s</td>
<td>174s</td>
<td>-34%</td>
</tr>
</tbody>
</table>
Dan
Copy task

Baseline
Intervention
Withdrawal
Preferred
Maintenance

Percent Correct Copying

Trial

No Technology
Video
Audio
Video/Audio
Dan
Scanning Task

![Graph showing percent correct scanning over trials with different interventions. The graph compares baseline, intervention, withdrawal, preferred, and maintenance phases using No Technology, Video, Audio, and Video/Audio methods.]

**Baseline**
- 0% to 100% correct scanning

**Intervention**
- Initial increase in correct scanning

**Withdrawal**
- Drop in correct scanning

**Preferred**
- Plateau or improvement in correct scanning

**Maintenance**
- Consistent correct scanning
Dan
Faxing Task

![Graph showing percent correct faxing over trials for different conditions: Baseline, Intervention, Withdrawal, Preferred, Maintenance.](image)

- **Percent Correct Faxing**
- **Trial**
- **Conditions:**
  - No Technology
  - Video
  - Audio
  - Video/Audio
## Dan

**Mean Duration to Complete Tasks**

<table>
<thead>
<tr>
<th>Mode</th>
<th>First 3 Trials</th>
<th>Last 3 Trials</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copying</td>
<td>287s</td>
<td>163s</td>
<td>-43%</td>
</tr>
<tr>
<td>Scanning</td>
<td>189s</td>
<td>140s</td>
<td>-26%</td>
</tr>
<tr>
<td>Faxing</td>
<td>374s</td>
<td>253s</td>
<td>-32%</td>
</tr>
<tr>
<td>Overall Mean</td>
<td>283s</td>
<td>185s</td>
<td>-34%</td>
</tr>
</tbody>
</table>
Mark

Copying Task

The graph shows the percentage of correct copying over trials for different conditions: Baseline, Intervention, Withdrawal, Preferred, and Maintenance. The conditions are differentiated by line types:

- No Technology: Marked with a dashed line.
- Video: Marked with a dotted line.
- Audio: Marked with a solid line.
- Video/Audio: Marked with a dash-dotted line.

The y-axis represents the percent correct copying, ranging from 0% to 100%, and the x-axis represents the trial number, from 1 to 35.
Mark Scanning Task
Mark Faxing Task

The graph shows the percentage of correct faxing over trials. The x-axis represents the trials numbered from 1 to 35. The y-axis represents the percent correct faxing, ranging from 0% to 100%. The graph compares different conditions: No Technology, Video, Audio, and Video/Audio. The graph illustrates the performance changes across the different conditions during baseline, intervention, withdrawal, preferred, and maintenance phases.
Mark

Mean Duration to Complete Tasks

<table>
<thead>
<tr>
<th>Mode</th>
<th>First 3 Trials</th>
<th>Last 3 Trials</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copying</td>
<td>274s</td>
<td>216s</td>
<td>-21%</td>
</tr>
<tr>
<td>Scanning</td>
<td>223s</td>
<td>172s</td>
<td>-23%</td>
</tr>
<tr>
<td>Faxing</td>
<td>297s</td>
<td>262s</td>
<td>-12%</td>
</tr>
<tr>
<td>Overall Mean</td>
<td>265s</td>
<td>217s</td>
<td>-18%</td>
</tr>
</tbody>
</table>
Summary of Results

Baseline Phase

– All participants were unable to successfully operate the copier, scanner, or fax machine
– Data were consistently stable across all participants and tasks
– Mean percentage correct across participants and tasks
  • 19.0%
Summary of Results

Training Phase

- Each participant successfully completed training in less than one hour
- All participants preferred the video and audio combined mode of presentation
Summary of Results

Intervention Phase

– Abrupt and substantial increase in ability to operate office equipment
– Data stability observed after the first two trials per mode
– No modes of presentation were superior for participants across tasks
– Data resulted in 0% overlap between baseline and intervention phases for all participants
– Discontinuation criteria met for each participant
– Mean percentage correct across participants and tasks
  • Video
    – 98.8%
  • Audio
    – 97.8%
  • Video and audio combined
    – 99.3%
Summary of Results

Withdrawal Phase

– Use of the iPod Touch and application was withdrawn
– Phase continued until data stability was observed across all tasks for each participant
– All participants performed less proficiently for the majority of tasks
  • Results improved from those observed during the initial baseline phase
– Mean percentage correct across participants and tasks
  • 72.8%
Summary of Results

Preferred Mode of Presentation Phase

– iPod Touch and Functional Planning System application reintroduced during this phase
  • All participants preferred to use the video and audio combined mode of presentation
– Abrupt increase in ability to correctly and independently complete the majority of office tasks
  • Exceptions were for those who demonstrated mastery of tasks during the withdrawal phase
– Data were stable throughout this phase for all participants
– Mean percentage correct across participants and tasks
  • 100%
Summary of Results

Maintenance Phase

– Consisted of one follow-up probe two weeks after completing the preferred mode of presentation phase

– *Mean percentage correct across participants and tasks*
  • 100%
Interobserver Agreement and Procedural Fidelity

• IOA Completed during 45% of sessions
• Mean IOA for all phases was 99.9% (range = 91%-100%)

• PF Completed during 45% of sessions
  – Correct verbal instructions
  – Timely initiation of prompts
  – Adherence to the least-to-most prompting hierarchy
• Mean procedural fidelity was 100% for all areas
Social Validity

Participant satisfaction
All participants reported that:
• The technology helped them learn new jobs
• It was easy to use
• It helped them function independently
• They would like to use it to learn other job skills
• They would recommend it to their friends

Research assistant satisfaction
The research assistant strongly agreed that:
• The intervention was helpful for participants
• The iPod Touch and application were easy to use
• The device and application enabled participants to work independently
• The intervention could be successfully applied to other job tasks
• Participants were motivated to use the device and application
• She would recommend this intervention to participants’ employers
Benefits and Implications of This Research

• Extension of the knowledge base (Banda, et al., 2011; Mechling et al., 2009)

• Evaluation of emerging technology (Wehmeyer, et al., 2008)

• Many advantages of using technology (Davies, et al., 2002; Gillette & DePompei, 2004; Taber-Doughty, 2005; Wehmeyer, et al., 2008)

• Potential to improve outcomes (e.g., Lancioni et al., 2000; Mechling et al., 2008; Riffel et al., 2005; Van Laarhoven et al., 2009)
  – Increased independence
  – Increased employment opportunities
Limitations

1. Carryover Effects
2. Practice Effects
3. Small and homogeneous sample size
4. Duration of maintenance phase
Recommendations for Future Research

1. Systematic replication
2. Evaluation of video/audio sequences within task analyses with varying levels of detail
3. Evaluation of new technology
4. Further evaluation of mode of presentation preference compared to performance
Questions?

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References


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