Efficacy of Problem-Solving Interventions for Improving Executive Functioning Outcomes in Patients with Acquired Brain Injuries: A Systematic Review

Rebecca Booth  
*University of Vermont, rjbooth@uvm.edu*

Emily Heckler  
*University of Vermont, emily.heckler@uvm.edu*

Molly Reese  
*University of Vermont, molly.reese@uvm.edu*

Follow this and additional works at: [https://scholarworks.uvm.edu/csdms](https://scholarworks.uvm.edu/csdms)  
Part of the Speech Pathology and Audiology Commons

**Recommended Citation**

Booth, Rebecca; Heckler, Emily; and Reese, Molly, "Efficacy of Problem-Solving Interventions for Improving Executive Functioning Outcomes in Patients with Acquired Brain Injuries: A Systematic Review" (2019). *Communication Sciences and Disorders: Systematic Review Publications*. 8.  
[https://scholarworks.uvm.edu/csdms/8](https://scholarworks.uvm.edu/csdms/8)

This Project is brought to you for free and open access by the College of Nursing and Health Sciences at ScholarWorks @ UVM. It has been accepted for inclusion in Communication Sciences and Disorders: Systematic Review Publications by an authorized administrator of ScholarWorks @ UVM. For more information, please contact donna.omalley@uvm.edu.
**Executive Function Outcomes in Patients with Acquired Brain Injuries: A Systematic Review**

**Background**

- Individuals with brain injury often have deficits in executive functioning (EF) that impact their ability to successfully plan for and find solutions to everyday problems.
- An individual must possess the four following skills in order to effectively problem-solve: 1) define and formulate the problem, 2) generate solutions, 3) make decisions, 4) implement and assess the solution.
- Problem-Solving Therapy has been used as a metacognitive strategy to support problem-solving abilities in individuals with acquired brain injury (ABI).
- The following systematic review synthesizes the available research supporting the use of problem-solving therapy based on the framework first proposed by D’Zurilla and Goldfried (1971) to support EF improvement in individuals with ABI.

**Methods**

- Three of the four studies were searched: CINAHL, PsycINFO, Ovid Medline.
- The subject headings were: “brain injury” or “traumatic brain injury” and “problem solving”.
- Inclusion criteria: problem-solving intervention; EF outcomes.
- Exclusion criteria: family-centered outcomes; case studies.
- Studies assessed for quality and validity.
- Results and data were extracted for analysis.

**Selected References**


**Table 1. Study Characteristics**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Study Size</th>
<th>Age Range</th>
<th>Study Design</th>
<th>Name of Intervention</th>
<th>Outcomes Measures</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cantril et al., 2014</td>
<td>98</td>
<td>31-69</td>
<td>Randomized Controlled Trial (RCT)</td>
<td>Short-Term Controlled Trial Executive Profile (STEP)</td>
<td>Executive functioning (EF), e.g., Behavioral Assessment of the Dysexecutive Syndrome</td>
<td>EF: Statistically significant (p&lt;0.008) Emotional Regulation: No significant improvement Attention: No significant improvement Generalization: No measured improvement BRIEF: Statistically significant (p&lt;0.003) Goal-Directed Behavior: Improved Abstract Reasoning: Improved Metaexecutive function: Improved</td>
</tr>
<tr>
<td>Chan &amp; Fong, 2011</td>
<td>32</td>
<td>7-16</td>
<td>Problem-solving skills training (i.e. metacognitive strategies)</td>
<td>EF (e.g., BRIEF)</td>
<td>Metacomponential Interview: Statistically significant (P&lt;0.003) Effective for people with moderate ABI; ≥ 1 year post injury</td>
<td></td>
</tr>
<tr>
<td>Fong &amp; Howie, 2009</td>
<td>33</td>
<td>18-55</td>
<td>Explicit problem-solving skills training (metacomponential approach)</td>
<td>EF (e.g., Behavioural Assessment of the Dysexecutive Syndrome; Metacomponential Interview)</td>
<td>Metacomponential Interview: Statistically significant (P&lt;0.003)</td>
<td></td>
</tr>
<tr>
<td>Karver et al., 2014</td>
<td>132</td>
<td>12-17</td>
<td>Counselor Assisted Problem-Solving (CAPS)</td>
<td>EF (e.g., BRIEF)</td>
<td>Correlation between low vocabulary and EF: Statistically significant (p&lt;0.003)</td>
<td></td>
</tr>
<tr>
<td>Kurowski et al., 2013</td>
<td>132</td>
<td>12-17</td>
<td>CAPS</td>
<td>EF (e.g., BRIEF)</td>
<td>Caregiver rated EF in older adolescents; Statistically significant (p&lt;0.01), moderate effect size No statistically significant changes in younger adolescents</td>
<td></td>
</tr>
<tr>
<td>Kurowski et al., 2014</td>
<td>132</td>
<td>12-17</td>
<td>CAPS</td>
<td>EF (e.g., BRIEF)</td>
<td>EF: Statistically significant in older adolescents (p&lt;0.05)</td>
<td></td>
</tr>
<tr>
<td>Man et al., 2006a</td>
<td>103</td>
<td>18-55</td>
<td>Analogical problem-solving skills training (computer-assisted, online, and therapeutically administered)</td>
<td>Problem-Solving (e.g., author developed questionnaire, Category Test for Adults)</td>
<td>Problem-solving: Statistically significant (p&lt;0.01) Self-efficacy: Improved (p&lt;0.01)</td>
<td></td>
</tr>
<tr>
<td>Man et al., 2006b</td>
<td>50</td>
<td>18-55</td>
<td>Analogical problem-solving skills training</td>
<td>Problem-solving (e.g., Category Test of the Halstead Reitan Test Battery; HRTB; Lawton Instrumental Activities of Daily Living IADL Scale)</td>
<td>General problem-solving: Statistically significant (0.0055) IADL skills: Statistically significant (p&lt;0.0005) Spaced problem-solving tasks (e.g., convergent and divergent): Not statistically significant</td>
<td></td>
</tr>
<tr>
<td>Marshall et al., 2004</td>
<td>22-63</td>
<td>Phase I Study</td>
<td>Interactive Strategy Modelling Training (ISMT)</td>
<td>Task Specific Problem-Solving (e.g., Rapid Assessment of Problem-Solving)</td>
<td>General problem-solving: Statistically significant (p&lt;0.005) IADL skills: Statistically significant (p&lt;0.0005) Spaced problem-solving tasks (e.g., convergent and divergent): Not statistically significant RAPS-specific problem-solving: improved Learning effect: Modest; no significant difference between pre and post (p&lt;0.05)</td>
<td></td>
</tr>
<tr>
<td>Miccio, 2008</td>
<td>30</td>
<td>25-60</td>
<td>Randomized Controlled Crossover Study</td>
<td>Attention and Problem-Solving Intervention (APS)</td>
<td>EF (e.g., Wisconsin Sorting Test; Virtual Planning Test; Verbal Fluency; Questionnaire from the Behavioral Assessment of the Dysexecutive Syndrome, Modified Multiple Endards Task)</td>
<td>EF measures: Not statistically significant MMET: Statistically significant</td>
</tr>
<tr>
<td>Rath et al., 2003</td>
<td>60</td>
<td>20-65</td>
<td>Problem-solving skills training (e.g., “Antecedent- Behavior- Consequences” analysis framework)</td>
<td>Problem-Solving/EF (e.g., Wisconsin Card Sorting Test; Problem-Solving Inventory)</td>
<td>EF: Problem-solving: Statistically significant improvement (p&lt;0.05) Problem-solving self-appraisal: improved (p&lt;0.005) Attention: Correlated with improved problem-solving self-appraisal (p&lt;0.004) &amp; EF (p&lt;0.03)</td>
<td></td>
</tr>
<tr>
<td>Soong et al., 2005</td>
<td>15</td>
<td>18-55</td>
<td>Pilot Study</td>
<td>Analogy problem-solving skills training</td>
<td>Problem-solving (e.g., Lawton IADL; HRTB)</td>
<td>Problem-solving: statistically significant (Lawton IADL p&lt;0.00; Category Test of HRTB p&lt;0.001)</td>
</tr>
<tr>
<td>Wade et al., 2010</td>
<td>40</td>
<td>11-18</td>
<td>Problem-solving training Teen online problem-solving (TOPS)</td>
<td>EF (e.g., BRIEF, BRIEF-SR)</td>
<td>EF: Improvement on self-reported measures; no improvement on parent-reported measures</td>
<td></td>
</tr>
<tr>
<td>Wade et al., 2018</td>
<td>152</td>
<td>11-18</td>
<td>TOPS - Family and Teen Only versions</td>
<td>EF (e.g., BRIEF)</td>
<td>EF: Greater improvements in TOPS-TO; family stress measured</td>
<td></td>
</tr>
</tbody>
</table>

**Conclusions**

- The overall quality of the studies reviewed was judged to be moderate.
- Many of the studies revealed statistically significant results, although most of the outcomes were not clinically meaningful.
- Problem-solving interventions alone are not sufficient for long-term EF improvements.
- Problem-solving treatments should be used in conjunction with other treatment strategies for individuals with ABI.

**Recommendations**

- More longitudinal studies are needed to evaluate generalization of EF skills post intervention.
- A larger sample size should be used for future studies.
- Sample population should be diversified in order to better represent the clinical population.
- Implementation of outcome measures should expand beyond parent/self-report.