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Errors: Friend or Foe? The Use of Errorless or Trial and Error Learning Strategies in Occupational Therapy Practice When Re-Learning Daily Activities

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Errors: Friend or Foe? The Use of Errorless or Trial and Error Learning Strategies in Occupational Therapy Practice When Re-Learning Daily Activities

May 17, 2019

This evidence project, submitted by

Jasmine Evans, Alison Guajardo, & April Millar

has been approved and accepted
in partial fulfillment of the requirements for the degree of
Master of Science in Occupational Therapy from the University of Puget Sound.

Project Chairperson: Chih-huang Yu, PhD, OTR/L

OT635/636 Instructors: George Tomlin, PhD, OTR/L, FAOTA; Renee Watling, PhD, OTR/L, FAOTA

Director, Occupational Therapy Program: Yvonne Swinth, PhD, OTR/L, FAOTA

Dean of Graduate Studies: Sunil Kukreja, PhD

Key words: errorless learning, trial and error, ADL, IADL, cognitive deficit, occupational therapy
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Name:  ________________________________ Date:  ________________________________

Signature of MSOT Student

Name:  ________________________________ Date:  ________________________________

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Name:  ________________________________ Date:  ________________________________

Signature of MSOT Student
We examined literature, within a 20-year period, regarding whether errorless learning strategies or trial and error strategies are more effective for adult patients, with a diagnosis of cerebrovascular accident (CVA) or cognitive deficit, when learning instrumental activities of daily living (IADL) and activities of daily living (ADL). We conducted this in collaboration with Hannah Baldwin, a local practitioner working in an acute care setting, at Swedish Medical Center, in Seattle. The results did not reveal overwhelming evidence to support either strategy, however, we were able to make recommendations within specific situations and for specific diagnoses. Generally, there are a greater number of studies with a more rigorous design that support the use of errorless learning strategies for patients with acquired brain injuries (ABI) than patients with other diagnoses or when using trial and error methods. The evidence that solely supports trial and error strategies is restricted to two level I studies that support its use for those with traumatic brain injury (TBI) to reduce cooking errors and increase functional independence measure (FIM) scores. Multiple studies also supported the idea that both methods can improve function or performance in ADL and IADL.

To translate this knowledge, we created a 16-minute webinar to identify when practitioners can implement trial and error and errorless learning strategies with their patients in the acute care setting using the current evidence. The webinar was sent to therapists at a Seattle hospital via email along with a pre-training and post-training survey. The pre-training survey was completed by two therapists, with no engagement on the post-training survey. The researchers would have liked to see the webinar have more reach and impact but struggled to incentivize therapists to engage with the material given their limited direct communication with the therapist population. To further the knowledge in this area of occupational therapy, practitioners should be able to distinguish application timings for trial and error, as well as errorless learning strategies, and are encouraged to conduct case series or case study research to contribute to the body of available evidence.
Executive Summary

The research process began by meeting with Hannah Baldwin, OTR/L to determine our research question based on her areas of interest and topics that could improve her implementation of evidence-based practice. There were initially three areas of interest from Hannah including treating patients with conversion disorder, treating patients with a comorbidity of CVA and dementia, and finally exploring errorless versus trial and error learning with patients who have cognitive deficits. We, the researchers, decided to investigate the practice question surrounding the use of errorless learning, versus trial and error learning, for patient populations with cognitive deficit regarding ADL or IADL outcomes. We then began a search of the literature using several scholarly databases and created a critically appraised topic (CAT) table highlighting the most relevant and poignant information needed to answer the research question.

After synthesizing the evidence from all 19 articles into the CAT table, we coded the results to determine how they supported the use of errorless learning or trial and error learning for patients with cognitive deficits. The evidence showed mixed results. This made it difficult to report back to Hannah a definitive practice guideline surrounding the use of errorless learning or trial and error learning for patients in her setting. Generally, there was a larger body of research evidence on the use of errorless learning for improving ADL performance as errorless learning is a newer, more experimental, and easier strategy to explicitly label. We then shared the findings with Hannah to gather her feedback and input into how the results were reported and its relevance to her practice. During this meeting, Hannah reported she was not surprised by the results and appreciated that the organization of the findings supported the use of both learning strategies depending on diagnosis and goals. As the current research evidence did not support a definitive clinical practice guideline on the use of these strategies for individuals with cognitive deficits, practitioners should use clinical reasoning and current research evidence in deciding which learning strategy supports their client’s goals. Additionally, given the current status of the literature, more research is needed to truly establish what constitutes best practice and to create an official practice guideline on this topic.
The current research evidence was then synthesized into a 16-minute webinar to share the findings with practicing clinicians at Swedish Medical Center’s acute care unit. The content was uploaded to YouTube and sent in an email to practitioners. In addition, we disseminated a one-minute pre-training and post-training survey to practitioners, through SurveyMonkey, with the goal of tracking changes in clinician perceptions surrounding the use of errorless learning and trial and error learning. The video tracked eight individual views, and the pre-training survey gained two responses, with zero responses on the post-training survey. Unfortunately, this meant that the webinar’s impact on clinician learning and potential changes in perception was difficult to measure. We would prefer to see more engagement with the content overall. However, time restrictions and administrative barriers limited the possibility of clinician follow-up.
Critically Appraised Topic (CAT) Paper

Focused Question

Are errorless learning strategies or trial and error strategies more effective for adult patients, with a diagnosis of CVA or cognitive deficit, when learning instrumental activities of daily living (IADL), activities of daily living (ADL), and other occupations?

Prepared By

Jasmine Evans, Alison Guajardo, April Millar

Date Review Completed

October 30, 2018

Professional Practice Scenario

Hannah Baldwin, OTR/L, works closely with her colleagues from other therapeutic disciplines during her shift in order to coordinate care for the patients that she is treating. The SLP department in the ARU has recently raised a concern regarding the use of errorless learning for clients with CVA and major cognitive deficits. The SLP department strongly supports the use of errorless teaching for these populations and has encouraged the other therapeutic disciplines in the ARU to carry over this approach with shared patients. This has piqued Hannah’s interest regarding the evidentiary support for the use of traditional learning strategies, such as trial and error, versus the use of errorless teaching strategies or a combination of errorless learning and traditional learning methods. Our research will help Hannah and her colleagues to establish practice protocol for these patient populations. The evidence that we will provide on this topic will allow Hannah to make intervention decisions that are supported by current research, as well as present intervention rationale to her superiors and third-party payers.

Search Process

Procedures for the selection and appraisal of articles

Inclusion Criteria

Inclusion criteria are studies that have been published in English, within the last twenty years, adult or geriatric patient populations, patient populations with cognitive deficits, errorless learning interventions used in treatment, and outcomes measures that are related to ADL and IADL. Research at all levels of evidence were included in this review.
### Exclusion Criteria

Exclusion criteria are outcome measures or diagnoses related specifically to speech therapy such as aphasia, anomia, dysgraphia, spelling, name relearning, writing, word retrieval, language; or pediatric patient populations.

### Operational Definition

For the current research review, referencing errorless learning refers to the method of teaching and learning where the information to be learned is presented in such a way that the learner is prevented from making errors, and instead learns from repeated exposure to correct information. Additionally, references to trial and error learning encompass all treatment approaches not deemed to be errorless learning.

### Search Strategy

<table>
<thead>
<tr>
<th>Categories</th>
<th>Key Search Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient/Client Population</td>
<td>TBI, CVA, cognitive deficit, stroke, ABI</td>
</tr>
<tr>
<td>Intervention (Assessment)</td>
<td>Errorless learning</td>
</tr>
<tr>
<td>Comparison</td>
<td>Trial and Error learning</td>
</tr>
<tr>
<td>Outcomes</td>
<td>ADL, activities of daily living, bathing, showering, dressing, eating, feeding, toileting, toilet hygiene, functional mobility, personal hygiene, grooming, IADL, community mobility, financial management, home establishment and maintenance, meal preparation, religious activities, functional performance</td>
</tr>
</tbody>
</table>

### Databases, Sites, and Sources Searched

- Cumulative Index of Nursing and Allied Health Literature (CINAHL)
- Education Resources Information Center (ERIC)
- Pro-Quest
- PubMed
- Cochrane Library
<table>
<thead>
<tr>
<th>Peer-Reviewed Instructional Materials Online (PRIMO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OT Seeker</td>
</tr>
<tr>
<td>American Journal of Occupational Therapy (AJOT)</td>
</tr>
</tbody>
</table>

**Search Outcomes/Quality Control/Review Process**

Three occupational therapy students from the University of Puget Sound conducted this research review. They are supported by three occupational therapy professors at the University of Puget Sound, Chih-Huang Yu, George Tomlin, Renee Watling, and guided by one practicing occupational therapy collaborator, Hannah Baldwin. Their cumulative search history has yielded a total of 27,211 articles. Of these, 609 articles were screened and 58 remained eligible for inclusion. During screening of titles and abstracts for all searches, if three consecutive results pages yielded no eligible articles then screening terminated and a new search was conducted. New searches were aimed at returning results that better correspond with the research question. Articles were advanced for eligibility if the titles or abstracts included relevant search terms. After a review of eligible articles, outcome measures were expanded to include IADL. Two neuroscience textbooks by Glen Gillen, *Stroke Rehabilitation: A function-based approach* and *Cognitive and perceptual rehabilitation: Optimizing function* were searched for articles evaluating errorless learning. All articles found in the books were already retained for this CAT through online databases. Articles that did not meet inclusion criteria or violated exclusion criteria were subsequently discarded. A total of 19 eligible articles were included in this CAT table.
Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) relating to search strategies (see Appendix A for full search history).
### Results of Search

<table>
<thead>
<tr>
<th>Pyramid Side</th>
<th>Study Design/Methodology of Selected Articles</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>__Meta-Analyses of Experimental Trials</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>__Triple-Blind Randomized Controlled Trials:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>_3__Double-Blind Randomized Controlled Trials:</td>
<td></td>
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<tr>
<td></td>
<td>Bertens, Kessels, Fiorenzato, Boelen, Fasotti (2015)</td>
<td></td>
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<tr>
<td></td>
<td>Bourgeois et al. (2016)</td>
<td></td>
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<tr>
<td></td>
<td>Travena-peters, McKay, Spitz, Suda, Renison, &amp; Ponsford (2018)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>__6_Single-Blind Randomized Controlled Trials:</td>
<td></td>
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<tr>
<td></td>
<td>Lee, Yip, Yu, Man (2013)</td>
<td></td>
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<tr>
<td></td>
<td>Mount, Pierce, Parker, DiEgidio, Woessner, &amp; Speigel (2007)</td>
<td></td>
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<tr>
<td></td>
<td>Ownsworth et al. (2017)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thivierge, Jean, &amp; Simard (2014)</td>
<td></td>
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<tr>
<td></td>
<td>Vanderploeg et al. (2008)</td>
<td></td>
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<tr>
<td></td>
<td>Voigt-Radloff et al. (2017)</td>
<td></td>
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<tr>
<td></td>
<td>__Unblinded Randomized Controlled Trial:</td>
<td></td>
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<tr>
<td></td>
<td>_5_Controlled Clinical Trials:</td>
<td></td>
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<tr>
<td></td>
<td>Dechamps et al. (2011)</td>
<td></td>
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<tr>
<td></td>
<td>Goldenberg &amp; Hagmann (1998)</td>
<td></td>
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<tr>
<td></td>
<td>Lloyd, Riley &amp; Powell (2009)</td>
<td></td>
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<tr>
<td></td>
<td>Orrell, Eves, &amp; Masters (2006)</td>
<td></td>
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<tr>
<td></td>
<td>Van Tilborg, Kessels, &amp; Hulstijn (2011)</td>
<td></td>
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<tr>
<td></td>
<td>_2__Single Subject Studies:</td>
<td></td>
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<tr>
<td></td>
<td>Thivierge, Simard, Jean, &amp; Grandmaison (2008)</td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td>__Meta-Analyses of Related Outcome Studies</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>__Individual Quasi-Experimental Studies w/ Covariates</td>
<td></td>
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<tr>
<td></td>
<td>__Case-Control or Pre-existing Groups Studies</td>
<td></td>
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<tr>
<td></td>
<td>__One Group Pre-Post Studies</td>
<td></td>
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</tbody>
</table>
### Qualitative
- Meta-Syntheses of Related Qualitative Studies
- Group Qualitative Studies w/ more Rigor
- Prolonged engagement with informants
- Triangulation of data (multiple sources)
- Confirmation (peer/member-checking; audit trail)
- Comparisons among individuals, w/i a person
- Group Qualitative Studies w/ less Rigor
- Qualitative Study on a Single Person

### Descriptive
- Systematic Reviews of Related Descriptive Studies
- Association, Correlational Studies
- Multiple Case Series, Normative Studies, Descriptive surveys
- Individual Case Studies:
  - Cohen, Ylvisaker, Hamilton, Kemp, & Claiman, (2010);
  - Ferland (2013);
  - Hartmann, Kegelmeyer & Kloos (2018)

<table>
<thead>
<tr>
<th>Total articles</th>
<th>19</th>
</tr>
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</table>

<table>
<thead>
<tr>
<th>AOTA Level</th>
<th>Articles</th>
<th>Total # of articles</th>
</tr>
</thead>
</table>
| I          | Bertens, Kessels, Fiorenzato, Boelen, Fasotti (2015)  
Bourgeois et al. (2016)  
Lee, Yip, Yu, Man (2013)  
Mount, Pierce, Parker, DiEgidio, Woessner, & Spiegel (2007)  
Ownsworth et al. (2017)  
Thivierge, Jean, & Simard (2014)  
Travena-Peters, McKay, Spitz, Suda, Renison, & Ponsford (2018)  
Vanderploeg et al. (2008)  
Voigt-Radloff et al. (2017) | 9 |
| II         | Lloyd, Riley, & Powell (2009)  
Orrell, Eves, & Masters (2006)  
Van Tilborg, Kessels, & Hulstijn (2011) | 3 |
| III        | Dechamps et al. (2011)  
Goldenberg & Hagmann (1998) | 2 |
| IV         | Thivierge, Simard, Jean, & Grandmaison (2008)  
Wilson & Manly (2003) | 2 |
Ferland (2013)  
Hartmann, Kegelmeyer & Kloos (2018) | 3 |

Total articles in all levels: 19
### Table Summarizing the QUANTITATIVE Evidence

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Journal</th>
<th>Country</th>
<th>Study Objectives</th>
<th>Study Design/ AOTA Pyramid/Level of Evidence/</th>
<th>Participants: Sample Size, Description Inclusion and Exclusion Criteria</th>
<th>Interventions &amp; Outcome Measures</th>
<th>Summary of Results</th>
<th>Study Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bertens et al.</td>
<td>2015</td>
<td>J. Int. Neuropsychol. Soc.</td>
<td>Netherlands</td>
<td>Find if a combination of EL &amp; GMT is superior to TEL &amp; GMT for training complex daily tasks in brain-injured pts w/ executive dysfunction.</td>
<td>Pre-post double blind RCT E2 I 10/10</td>
<td>N= 60; Tx= EL + GMT, n= 30, Ctrl= TEL + GMT, n=30</td>
<td>IV: GMT taught to pt. over 8, 1 hr sessions. 2x/wk provided by OT &amp; psychologists using either EL or TEL. 2 ADL Tx goals identified &amp; GAS scheme completed. Sessions 1-4 took place in 1 of 4 diff rehab institutions. Sessions 5-8 in home or pt work office. DV: 1. everyday task performance rated by 3 assessors blinded to tx grp, using Dechamps standardized 3-point rating scale. Raw scores converted to percentages. Both ADL percentages averaged for each pt. 2. GAS to quantify extent that goals were achieved rated by OT/psych (unblinded) &amp; pts.</td>
<td>EL GMT perf sig better on ADL than TEL GMT after adjusting for perf @ baseline. $F(1.57)=8.02$, $p=.006$, $d=0.74$. No sig diff for GAS results scored by pts. $t(58)=1.43$, $p=.16$. GAS results scored by trainers were sig higher for EL GMT. $t(58)=3.38$, $p=.001$, $d=0.87$.</td>
<td>Tx integrity was not systematically monitored. No follow up measures were included &amp; maintenance is unknown.</td>
</tr>
<tr>
<td>Bourgeois et al. 2016</td>
<td>Evaluate the effectiveness of TEL, EL, and MR on relearning of IADL.</td>
<td>Repeated measures RCT E2 I 8/10</td>
<td>N= 74</td>
<td>Attrition: 30% (attrition unrelated to receiving tx)</td>
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<tr>
<td></td>
<td><strong>Evaluation</strong>: 2016 Journal of Nutrition Health and Aging France</td>
<td></td>
<td></td>
<td>Incl: Mild-moderate AD, MMSE 10-26, have DSM-IV-TR criteria for Alzheimer Dementia type, age 60 y/o or older, not able to complete the task during screening w/out cues.</td>
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<td></td>
<td>Excl: Severe deficits in alertness, schizophrenia or depressive disorders, NPI frequency x severity score &lt;6 in one domain, agitation, euphoria, disinhibition, irritability, aberrant motor bx, antipsychotic meds</td>
<td>IV: 2-hr individual training 2x wk, for 6 wks on 3 participants chosen IADL tasks. Trained in: 1) EL, 2) TEL, or 3)MR - performing the task in front of the pt who then completes the task after a delay of 30 seconds. Primary DV: Performance of the task as measured by: physical performance (IK), EKw-patients had to sort written instructions of steps, and EKv- where participants had to sort pictures of the steps in the correct order. Scored 1-3 (1=deficit, 3 = competent) and adjusted to 100-point scale. Participants were assessed 1 wk and 4 wks post-intervention. Secondary DV: cog and behavioral status based on MMSE or NPI scores.</td>
<td>Sig ↑ in performance of IADL task, baseline to follow-up, in all grps (p&lt;.001) for all outcome measures. IK pre-tx to post tx differences in scores were sig higher than EKv or EKw scores (p&lt;.001). Sig diff in scores by evaluation type. EKw scores were sig higher than EKv or IK scores (p&lt;.001) across all grps. No sig diff was found btwn grps. No diff in performance btwn 4 wk and 1 wk post-tx evaluation. Sig positive correlation btwn MMSE and IK score for EL grp (p=.02). No sig diff for MMSE and NPI scores for diff grps.</td>
<td>High attrition rate and no intention to treat for participants who did not complete the study, this may have impacted outcomes.</td>
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<tr>
<td>Cohen et al. 2010</td>
<td>Explore the usefulness of EL for adult w/ executive fxn impairments post TBI.</td>
<td>Single case study</td>
<td>N=1 45 y/o female w/ DD, amygdalo-hippocampectomy @ 28 y/o, &amp; TBI @ 36 y/o. Memory pre TBI was fxnl. TBI S/S→ GCS= 3, diffuse axonal inj w/ subarachnoid hemorrhage. 6 mos post TBI symptoms: emotionally flat, perseverative, lacks initiative, difficulty w/ orientation &amp; fxnl memory.</td>
<td>I= EL tx addressed ADL &amp; communication. Occurred in real world context using cue cards &amp; memory book for social communication. SLP provided tx reduced from 2x/wk to 1x/10wks over 7 yrs. Family &amp; rehab assistants trained to help too. O= 5-point Likert scale of fxn in ADL &amp; social communication. 1 is least fxnl and 5 is most fxnl.</td>
<td>For routine, ADL cue cards were faded after a few mos, social communication reqs ongoing cueing. Change in Likert scale from 12 mos post TBI to 8 yrs post TBI is as follows: Nonverbal communication: ↑ 3 levels, Verbal communication, &amp; initiation of conversation: ↑ 2 levels. ADL: Self-care, cooking, laundry, budgeting &amp; initiation of ADL: ↑ 4 levels. QoL has ↑ through engagement and participation.</td>
<td>Transfer of learning not tested due to concrete thinking. Practice effect. Hard to determine the contribution of EL b/c of multiple tx contexts.</td>
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<tr>
<td>Dechamps et al.</td>
<td>Determine which of 3 learning conditions (EL, LM, TEL) is most effective for relearning IADL in different stages of dementia</td>
<td>Single blind, repeated measures, w/i subject, crossover controlled trial design E3 III 6/10</td>
<td>N=14, no attrition, inpt SNF; Incl: dx of AD, over 60 y/o, MMSE score btwn 10 and 26, competent to give informed consent; Excl: severe deficits in alertness or vision, behavioral disturbances defined by score of 4 on NPI frequency X severity, known psych comorbidities (e.g.: major depression)</td>
<td>IV: 30 min 6x/wk to relearn 3 IADL of choice using one of 3 learning conditions for each - EL (verbal and visual cues at each step), LM (therapists models an increasing # of steps according to pt’s level of mastery), TEL (allowed up to 3 errors or 25 sec before correction) DV: occ performance - each step scored as 1 (competent), 2 (questionable/ineffective), 3 (deficit/absent); explicit knowledge - sort cue cards of action sequence into correct order</td>
<td>Sig. learning condition effect for improving occ performance (p=.002); LM and EL conditions resulted in sig. occ performance ↑ over training period and at 1-wk and 4-wk follow up assessment (p&lt;.01); TEL condition resulted in sig. occ performance ↑ over training period (p&lt;.001) but not at follow up; No sig learning condition effect for explicit knowledge</td>
<td>Possible confounds: lack of wash out period in tx btwn tasks may have resulted in overlap of tx effects, pts trained on diff IADL made it difficult to ensure IRR, possible variation in tx execution as some pts were trained in France (n=10) and some in the Netherlands (n=4); potential bias: evaluator was not blind to learning condition; low generalizability of w/i subject design.</td>
<td></td>
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<tr>
<td>Ferland et al.</td>
<td>Use EL to train a woman w/ ABI on two ADL routines &amp; transfer them to a new home.</td>
<td>Single-subject case study</td>
<td>N=1 22 y/o female w/ hemorrhagic CVA in frontal lobe- anterior cingulate-corpus callosum region. 7 mos post injury moved to residential transitional living program. Evaluation showed impairments in: declarative memory, delayed recall, self-initiation, metacognition &amp; problem solving.</td>
<td>I= EL based morning routine (~40 steps) &amp; diabetes management (~10 steps) every day for 9 mos -- divided into early, middle &amp; late segments. Grocery shopping task perf also rated after admission to act as ctrl. Tx provided by primary life skills counselor, OT &amp; residential living staff, &amp; eventually family. Following discharge, pt evaluated for 9 wks for transfer of skills to new home. Home health team took over Tx &amp; data collection. O= percentage of steps completed ① in the sequence of each ADL task.</td>
<td>Baseline-(1st 3 days of residency) dressing &amp; showering/grooming: 24%, breakfast prep: 34%. Diabetes routine: 0%. 1. Early phase- for both routines: 40-100%. 2. Middle phase- morning routine: 98%, diabetes manage: 89%. 3. Late phase- for both routines: 100% 4. Transfer phase-for both routines: 100% Pilot training phase- morning routine: ( \rho = 0.72, p = 0.02 ), diabetes manage: ( \rho = 0.56, p = 0.09 ). Early phase- morning routine: ( \rho = 0.76, p &lt; 0.001 ), diabetes manage: ( \rho = 0.41, p = 0.0001 ). Grocery task perf: pt did not ↑.</td>
<td>W/o ctrl pts. it’s hard to say improvement was due to EL. Hard to generalize since not all pts have the same family support &amp; pts w/ ABI may not be compliant.</td>
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<tr>
<td>Goldenberg et al. 1998 Neuropsychological Rehab Germany</td>
<td>Determine if EL can restore ADL</td>
<td>Controlled clinical trial w/ repeated measures. E3 III 5/10</td>
<td>N=15 Male n= 12 Female n=3 X age=55.7 X time since onset = 6.1 wks. Convenience sample Incl: R handed, MCA CVA, R sided hemiplegia, aphasia, apraxia Excl: prior ADL training</td>
<td>IV: 3 activities: eating, dressing, grooming. Trained 2x/day, 5x/wk using EL. 1 activity trained per wk w/ alternating wks &amp; immediate post testing. Tx duration was not the same across pts due to varying task trained each wk. Tx provided by OT. DV: assessed by OT &amp; blinded second observer. # of fatal errors &amp; reparable errors. Fatal error= failing to complete task. Reparable= pt moved past the error to complete task. Tx terminated when 0 fatal errors were made (n=10) or therapy was not effective (n=5). Sig ↓ in # of fatal errors Z=-3.2, p&lt;.01 No sig ↓ for reparable errors. Follow up 6-30 mos post tx (n=7) Fatal errors ↑ for pts. who didn’t practice at home so spontaneous recovery unlikely. No generalization of training since tx effect was specific to activities trained (specific to apraxia dx).</td>
<td>Sig ↓ in # of fatal errors Z=-3.2, p&lt;.01 No sig ↓ for reparable errors. Follow up 6-30 mos post tx (n=7) Fatal errors ↑ for pts. who didn’t practice at home so spontaneous recovery unlikely. No generalization of training since tx effect was specific to activities trained (specific to apraxia dx). Follow up results were only examined for 7 pts.</td>
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<td>Hartmann et al. 2018</td>
<td>Journal of Neurologic Physical Therapy USA</td>
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<td>Describe use of EL for rehab of pt w/ dual dx of SCI/TBI; assess outcomes of tx on pt’s ability to learn novel motor tasks</td>
<td>Single case report D4 V 1/3</td>
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<td>N=1 Incl: 44 y/o Somali male w/ TBI, T4 SCI and vertebral fractures of C1, C2, C6 and T4-6; pt treated in IRF</td>
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<td>I- Pt received tx 3hr/day for 51 days Tx 1: TEL, internal problem solving, blocked practice Tx 2: EL, forward chaining, blocked practice</td>
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<td>O- Occ performance: FIM; cognition/orientation: RLAS, O-Log; SCI completeness: Sitting balance: FIST, TSS; Mobility: MWST</td>
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<td>Tx 1: after 19 days of TEL tx no meaningful gains on any outcome measures Tx 2: after 32 days of EL tx - ↓ level of A req on 11/18 FIM items; progressed from RLAS level IV to V; ↑ from 9/30 to 22/30 on O-Log; clinically meaningful ↑ on FIST (9/56 to 18/56); 30 sec to indefinite on TSS; from unable to 16% on MWST</td>
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<td>Possible confounds: Somali language interpreter req complicated tx and instruction; spontaneous recovery/large ↑ on O-Log may have ↑ pt’s ability to learn; washout effect due to no return to baseline; design did not assess carryover to new enviro.</td>
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<td>Lloyd et al. 2009 Neuropsychological Rehab UK</td>
<td>Efficacy of EL vs TEL in a VR 3D route learning task for individuals w/ memory impairment due to ABI</td>
<td>Non-randomized, two-grp, Repeated measures crossover design E3 II 6/10</td>
<td>N=20 Outpt rehab pts w/ ABI Incl- ABI, memory deficit Excl- Visual neglect, severe language difficulties</td>
<td>Desktop 3-D simulation on a Sony Playstation console of a large-scale enviro. Experimenter operating the ctrl pad in response to motor commands from the participants. IV: Tx 1- EL (1) route A, then TEL (2) route B trials Tx 2- TEL (1) route A, EL (2) route B DV- # of errors made during task</td>
<td>Sig more errors were made under TEL versus EL condition (p=.016) Individuals who did not show benefit from EL were able to reduce errors across TEL condition and had a benefit of increased trials in the TEL task (X^2, p = .004)</td>
<td>Small sample size. Effect of first intervention may not be fully washed out due to repeated measures design, limiting ability to determine causality in findings. Experimenter controlled system for participants, meaning there could have been leading. Design has less overall stimulation than in a real-life route navigation, so there may be limited transferability.</td>
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| Lee et al. 2013 | Compare results of a computerized EL based memory training program w/ a therapist led EL grp and a ctrl grp. | Single blind, repeated measures RCT E2 I 7/10 | N=19  
Male n=6  
Female n=13  
X age=77.7  
Tx grp 1= computer EL (CELP), n=7  
Tx grp 2= therapist led EL (TELP), n=6  
Ctrl= waiting list, n=6  
Incl: age >/= 60, early dementia, can follow instructions, attn span = 30-45 mins,  
Excl: visual or hearing impairment, computer phobia, impaired physical fnx preventing use of a touch screen computer. | IV= 30 min/session,  
2x/wk for 6 wks. Led by an OT.  
Tx 1= touch screen notebook computer w/ touch-pen input device.  
Tx2= training manual w/ colored print images used & therapists gave immediate feedback.  
Ctrl= cognitively challenging activities or errorful memory training program.  
DV= MBI, GDS, HKLIADL | W/in grps there was a sig change over time for MBI in Tx grp 1 (p=.02), and Tx grp 2 (p=.04). There was a sig diff btwn grps for GDS, TELP grp had more improvement in GDS than CELP (p=.009). No sig changes for the ctrl grp. No sig changes for IADL w/in any grps. | Small sample size. Limitations in intensity and duration of tx. |
Compare effectiveness of EL vs TEL for teaching ADL to pts w/ stroke who may or may not also have explicit memory impairments.

RCT 2 grp: crossover repeated measure design

N= 47; 30% screened out; inpt rehab adults w/ acute CVA; \( \bar{X} \) age=63; \( \bar{X} \) time post CVA= 21 days; Tx1: \( n=16 \), Tx2: \( n=17 \); Incl- post CVA confirmed by CT scan, MRI, or clinical exam. Excl- knowledge of technique for w/c set up or sock donning, severe weakness, unilateral neglect, apraxia, spatial deficits, dementia, h/o aphasia, inability to understand English directions, inability to perform sock donning task due to obesity or LE amputation, expected hospital stay <1 wk from screen, ↓ arousal.

IV: PTs, OTs, and PTSs trained pts 2x/day for 7 days; IV levels:
Task: 1. Prep a standard w/c for transfer to less involved side. 2. Don a sock w/ a sock donner; Training schedule: Tx1: EL then TEL Tx2: TEL then EL
DV: Carry over to similar task (w/c w/ different design, sock donner w/ different strap): # of correct steps completed; # and nature of errors.

No sig diff btwn tasks in # of errors of sequence or # of verbal errors; sig diff btwn tasks in # of errors of action and errors of no response (Chi, \( p<.001 \)); Carry over for sock donning more likely w/ TEL (\( OR=19.92, p=.03 \)); no sig diff btwn tx for carry-over of w/c task.

Improvement s in pts’ cog may be due to healing during acute care level, high attrition of participants, no washout period due to tx order and no return to baseline; possible confound: variability in tx administratio n across disciplines.
| Orrell et al. 2006 Physical Therapy USA | Investigate the implicit motor learning of a dynamic balancing task after CVA by use of an EL paradigm | Non-randomized, two-grp, repeated measures controlled clinical trial E3 II 5/10 | n=24 (Ex n=12 post-CVA pts, ctrl n=12 neuro intact participants); Tx grp attrition: 8%; Incl for post- CVA tx grp: at least 12 mos post, discharged from all rehab services, able to understand instructions and give informed consent, no obvious cog or perceptual problems on MMSE. Incl criteria given only for tx grp. | IV: Post-CVA and neuro intact grps were randomly assigned to either Discovery learners (TEL) or errorless learners (EL) grps. Acquisition phase: all pts performed 24, 60-sec trials of balance task on a stabilometer platform; DV - degrees of platform deviation from horizontal: RMSE degrees; Retention test: same balance task as acquisition phase; Transfer test: balance task w/ concurrent # recall and balance task w/ concurrent kettle lift | Retention test: no sig diff in balance btwn grps (p=.10); transfer test w/ # recall: sig ↑ for post-CVA EL pts (p=.021), sig regression for post-CVA TEL pts (p=.035); transfer test w/ kettle lift: no sig diff in balance for either grp (p=.63) | Small sample size resulted in only 36% power to detect a large effect; low generalizability: laboratory task is not directly comparable to real life balance |
| Ownsworth et al. | Investigate whether TEL promotes greater skill generalization and self-awareness than EL for pts w/TBI; compare effects of TEL and EL on psychosocial fxn | Single blind, cross over, repeated measures RCT E2 I 8/10 | N=54; attrition: 24%; outpt and community brain rehab services; Incl: 18-70 y/o, dx of severe TBI, medically stable, out of PTA, lived w/i 50 km of test centers, dysexecutive impairment that warrants community support; Excl: unable to provide informed consent, had bx/motor/sensory-perceptual/language/cog impairments that precluded participation; unmanaged psychotic/severe mood symptoms | 8 wk home based tx, 90min/wk; Pts received either: Tx1: EBL (TEL) Tx 2: EL 1st 4 sessions: tx focused on meal prep; last 4 sessions: tx focused on client chosen multi-step activity Primary DV - near transfer of trained skill: Cooking Task Secondary DVs - far transfer of trained skill: The Zoo Map Test from the BADS; awareness: AQ; daily fxn/independence: PCRS, CANS; psychosocial: SPRS, DASS-21 | Primary DV - TEL pts made sig fewer errors than EL pts (p<.05) Secondary DVs - no sig diff btwn grps on The Zoo Map Test, SPRS, CANS or DASS-21; TEL pts did sig better (p<.05) on AQ and PCRS than EL pts; no sig diff btwn EL and TEL pts on AQ, PCRS, SPRS at 6 mos follow up; TEL grp: w/i grp sig (p<0.05) decline in mood Sx (depression, anxiety, stress) | Smaller than planned sample lowered statistical power; high attrition rate; possible confounds: time since injury was highly variable (4-204 mos). |
| Thivierge et al. 2008 Neuropsychiatric Disease Treatment Canada | Assess the efficacy of an individualized training program for indivs w/ AD using EL and SR to relearn IADL in mild AD | Multiple baseline single subject design E4 IV 4/7 | $N=2$, case A: 66 y/o male; case B: 68 y/o male | Case A IV: 3 baseline assessments, Case B IV: 4 baseline assessments, Both cases: EL and SR cog training of chosen task 2x/wk for 4 wks, 2 follow up assessments EL: ↓ levels of A provided according to pt’s performance to prevent errors SR: expanded delays btwn each correct completion of task (30 sec, 1 min, 2 min, 4 min, 8 min) Primary DV: occ performance - DMT Secondary DVs: cog fxn - DRS-2; memory - RBMT; quality of life - DQoL | Case A: occ performance on DMT ↑ from 57.3% at baseline to 93.7% at end of training; performance was maintained at follow ups 1 (90.6%) and 2 (89.1%); scores on DRS-2 and DQoL remained stable, RBMT score fluctuated btwn 0 and 5 across evaluations Case B: occ performance ↑ from 47.9% at baseline to 75.0% at end of training; performance was maintained at follow ups 1 (75.0%) and 2 (83.3%); scores on DRS-2 and DQoL remained stable, RBMT score fluctuated btwn 0 and 9 across evaluations | Low generalizability of results due to study design, timeline for follow ups not reported, potential bias: assessor was not blinded; possible confound: participant A started a new meds 16 days before beginning the study which may have impacted his cognition and learning; participants trained diff tasks |
Thivierge et al.
2014
American Journal of Geriatric Psychiatry
USA

| Determined effectiveness of memory rehab using EL and SR for pts w/ AD to re-learn IADL | Single blind RCT, two grps cross-over w/ return to baseline | N=20; attrition: 15%; Grp1: n=9, Grp2: n=8; Incl: dx of AD, MMSE score 16-27, IADL deficit that could be re-learned through cog training, psychotropic/ nootropic meds stabilized for at least 3 mos; Excl: other medical dxs that alter cerebral/ cog integrity, taking antipsychotic/ cognition altering meds not permitted by incl, current or h/o alcohol/ drug abuse | IV: EL and SR 2x/wk for 4 wks to re-learn an IADL chosen by pt and/or caregiver
Ctrl: no tx 4 wks
EL: ↓ levels of A provided according to pt’s performance to prevent errors
SR: expanded delays btwn each correct completion of task (30 sec, 1 min, 2 min, 4 min, 8 min)
Primary DV - Occ performance: DMT
Secondary DV - memory: RBMT, caregiver burden: ZBI-22, quality of life: DQoL,
Level of cog impairment: DRS-2, DAD, NPI | Statistically sig (p=.001) ↑ on DMT scores following tx. No sig changes on any secondary DV measures for both grps | Small sample/ reduced power restricted possibility of finding sig results on secondary DVs; possible confounds: pts trained on different IADL, could not monitor practice w/ caregiver after training phase |
| Travena-Peters et al. 2018 | Evaluate the efficacy of EL and procedural memory principle-based ADL retraining during PTA compared to standard PT and/or speech therapy | RCT, pre-and post-only E2 I 9/10 | N= 104  
Tx=49  
Ctrl= 55  
Inpt rehab w/ TBI and PTA  
Incl- admitted to hospital btwn 2013-2016,  INCIDENTAL  in personal care premorbidly, medically stable, able to follow single-stage commands in English. Those who were in PTA for at least 1 wk and received at least 2 tx sessions.  
Excl: N/A | IV-  
Tx- ADL task specific training w/ OT using errorless and procedural learning principles  
Ctrl- TEL Tx w/ a PT and or SLP  
DV- FIM scores, LOS, PTA duration, agitated bx scores, community integration scores.  
FIM scores- Tx grp had sig ↑ of 4.90 btwn baseline and PTA (𝑝=0.001); no sig ↑ for ctrl grp.  
No stats sig diff btwn grps for LOS, PTA, agitation, and community integration scores. Clinically sig trend towards shorter LOS and PTA duration, as well as lowered agitation in the tx compared to the ctrl grp. | Possible confounds: ADL retraining was not continuous over the wkend, possible opportunity for task performance errors. Grps received tx from diff disciplines. |
| Vanderploeg et al. | Compare the effect of CD versus FE rehab activities during acute rehab program on 1 yr functioning for those w/ TBI | Multicenter parallel grp prospective, repeated measures RCT E2 I 8/10 | N= 366 CD tx n= 184 FE tx n= 182 IRF | IV: 20-60 days of tx based on discharge, Monday- Friday, 1.5-2.5 hrs daily protocol specific tx and 2-2.5 hours of traditional rehab OT and PT for all grps. CD tx- Practiced increasing difficulty pencil and paper or computerized tasks. TEL used in all sessions. FE tx- grp settings and natural hospital enviro. EL w/ instructional cues used in all sessions. DV: End of protocol and self-reported FI 1 yr post-tx and RTW/school, cog/motor FIM scores and disability rating scale scores. | No sig diff btwn tx conditions at 1-yr follow up for FI and RTW/school. Both tx grps ↑ in FI from baseline. Cog FIM- CD tx scores were sig higher than FE (p=.01) at end of protocol. No sig diff btwn tx grp disability scores or FIM at 1-yr follow up. Younger participants had greater RTW 1-yr post tx if in CD tx (X^2, p<.03). Older participants were more likely to have ⃣ living if they received FE tx (X^2, p<.05). No w/i grp statistics reported. | Possible confounds: Pts received concurrent traditional tx. RTW requirements varied across jobs. Time btwn baseline and 1-yr follow up. No w/i grp statistics reported. |
| Van Tilborg et al. (2011) | Compare effectiveness of implicit (EL) and explicit (TEL) training for healthy adults and pts with dementia performing everyday tasks | Non-randomized, single blind cross over controlled clinical trial w/ repeated measures E3 II 5/10 | N=28, dementia grp n=12, age- and education- matched ctrl grp n=16, attrition=7.14%, Incl (dementia grp): dx of mild to moderate dementia, Excl: h/o psych or neuro disease, hearing or vision impairments that interfere w/ training | IV: Five 15 min sessions per task using implicit (EL) and then explicit (TEL) training methods or explicit (TEL) and then implicit (EL) training methods; task 1: heat water in microwave, task 2: make coffee in Senseo machine | DV: occ performance - # of correct steps completed | Sig ↑ for both grps on both tasks (p<0.001), no sig w/i subject effect for training method, no sig interaction btwn training method and grp, no sig effect of task order, sig w/i subject effect for task in both grps (p=.006) indicating task 1 was more difficult than task 2 | Small sample size. Non-randomized training order allocation introduces possible bias. |
| Voigt-Radloff et al. 2017 | Alzheimer's Research & Therapy GER | To compare the effects of EL vs TEL on ADL performance for individuals/participant/subjects w/ mild to moderate dementia. | Single blind, repeated measures, parallel grp RCT E2I 8/10 | N=161 EL tx- n=81 TEL tx- n=80 Hospital outpatient memory pts w/ AD. Incl-Person living at home, MMSE scores b/wn 14-24. Excl-major depression, major need for physical nursing care, severe behavioral disturbances, unstable medical conditions, lack of attn or understanding of instructions in German. | IV: 30 min training session. 9 1-hour home tx sessions to address two selected ADL/IADL tasks, w/ performance videotapes at wk 11, 16, 26. Follow up assessments at wk 16 & 26 EL tx- continuous verbal instruction given to pts while performing each step of a task. Errors prevented, demonstration provided to correct performance. TEL tx- pts perform task w/o instruction or demonstration. Self-correction. Open ended questions, then verbal instruction provided. DV: Task performance on core elements using a seven-point scale for each task (1 = not performed at all as trained by the therapist; 7 = performed exactly as trained by the therapist). Secondary DV- daily functioning, resource utilization, satisfaction w/ tx. | Sig ↑ in task performance of both tx on both tasks from baseline to wk 16 and wk 26 (p=.05) No sig diff btwn grps on task performance. No sig diff on secondary DV’s btwn grps. | Possible confounding variables: Home enviros varied across pts. |
| Wilson et al. 2003 | Employ SAT & EL to ↑ self-care in pt 2.5 yrs post TBI | Single subject withdrawal, time series ABA design E4 IV 4/7 | N=1 Incl- 40 y/o woman w/ chronic ipsilesional neglect, severe memory disorder and attn deficits 2.5 yrs post TBI. Acute TBI S/S → GCS post TBI = 5 Frontal parietal subdural hematoma w/ midline shift & occlusion of MCA. 7 mos post TBI: L hemiparesis 1 yr post TBI: able to sit (1), and stand w/ max A. 2.5 yrs post TBI: dep for all ADL Complete L eye visual field loss, R eye intact. *Baking tray task used to raise awareness btwn baseline & intervention phases, and to train SAT. IV= All phases were 10 days & included daily dressing, bathing & grooming focused self-care. Rehab assistant administered. Phase A= EL Phase B= EL & additional SAT for 2min30s/day just prior to self-care. Included attending vocally, sub-vocally & silently (self-talk). After phase B SAT was removed to return to EL only. DV= Primary: # of cues (verbal & physical) in all 3 phases. Secondary: baseline & post-intervention performance skill measures: 1. Visual inattn (BIT) 2. Sustained/divided auditory attn (TEA: elevator counting w/ & w/o distraction, & lottery task) 3. Unilateral neglect (Balloons test) 4. Memory (RBMT) 5. auditory verbal learning capacity (AVLT) 6. Personal neglect (Comb & razor/ compact measure) | # of cues during SAT phase $\bar{x}=14 (SD=6.3)$ was sig lower than baseline $\bar{x}=39.6 (SD=17.7)$ $p<.001$, post-intervention phase # of cues $\bar{x}=10.9 (SD=4.8)$ was not sig lower than SAT $p>.05$, but # of cues did not return to baseline. SAT>EL for procedural learning tx. Post-intervention ↑ in personal neglect (worse), washing & dressing (better) (no stats). No sig changes in ipsilesional space neglect, attn deficits or memory post intervention. | Time series analysis was not provided for all outcomes that were described as sig, instead descriptive data was given. |
Abbreviation Key

A: assist
ABI: Acquired Brain Injury
ACU: acute care unit
AD: Alzheimer's Disease
ADL: activities of daily living
AMIPB: Adult Memory and Information Processing Battery
AQ: Awareness Questionnaire
ASIA: American Spinal Injury Association
Attn: attention
avg: average
AVM: arteriovenous malformation
ACE-R: Addenbrookes Cognitive Examination – Revised
AVLT: Rey Auditory Verbal Learning test
b/c: because
BADS: Behavioral Assessment of Dysexecutive Syndrome
BAPM: Brief assessment of prospective memory
BIT: behavioral inattention test
btwn: between
bx: behavior
CANS: Care and Needs Scale
CD: Cognitive-didactic
Chi: Pearson’s chi-squared test
cog: cognitive
CT: computerized tomography
Ctrl: control
CVA: cerebrovascular accident
DAD: Disability Assessment for Dementia
DASS-21: Depression Anxiety and Stress Scales-21
DD: developmental disability
diff: difference
DMT: Direct Measure of Training
DQoL: Dementia Quality of Life Questionnaire
DRS-2: Dementia Rating Scale-2
dx: diagnosis
EBL: Error based learning
EKv: Explicit knowledge with visual cues
EKw: Explicit knowledge with written cues
EL: errorless learning
enviro: environment
excl: exclusion
fxn: function
fxnl: functional
FE: functional-experiential
Fl: functional independence
FIST: Function in Sitting Test
GAS: goal attainment scaling
GCS: Glasgow Coma Scale
GDS: Geriatric Depression Scale
GMT: goal management training
grp(s): group/groups
HKLIADL: Hong Kong Lawton IADL scale
HKLLT: Hong Kong List Learning Test
h/o: history of
HoH: hand over hand
①: independent
IADL: instrumental activity of daily living
IK: implicit knowledge
incl: inclusion
inpt: inpatient
IRF: inpatient rehabilitation facility
IRR: inter-rater reliability
km: kilometers
L: left
LE: lower extremity
LM: learning by modeling
LOS: length of stay
MBI: Modified Barthel Index
MCA: middle cerebral artery
Meds: medications
min: minute
MMSE: Mini-Mental State Examination
mos: months
MWST: Manual Wheelchair Skills Test
MWU: Mann-Whitney U
MR: Modeling with spaced retrieval
MRI: magnetic resonance imaging
NCSE: Neurobehavioral Cognitive Status Exam
neuro: neurological/neurologically
NPI: Neuropsychiatric Inventory
occ: occupational
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O-Log: Orientation Log
OR: odds ratio
OTs: occupational therapists
PCRS: Patient Competency Rating Scale
pop: population
prep: preparation
PTA: Post-traumatic Amnesia
pt(s): patient(s)
PTs: physical therapists
PTSs: physical therapy students
psych: psychiatric
QoL: quality of life
R: right
RBMT: Rivermead Behavioral Memory Test
RCT: randomized control trial
rehab: rehabilitation
req: requiring/required
RLAS: Ranchos Los Amigos Scale
RMSE: Root-mean-square-error
ROCF: Rey-Osterreith Complex Figure Test
RTW: Return to work
SAT: sustained attention training
SCI: spinal cord injury
sec: seconds
sig: significant
SNF: skilled nursing facility
SPRS: Sydney Psychosocial Reintegration Scale
SR: spaced retrieval
S/S: signs and symptoms
TBI: traumatic brain injury
TEA: test of everyday attention
TEL: trial and error learning
TSS: Timed Static Sit
tx: treatment
w/c: wheelchair
w/i: within
w/o: without
w/: with
wk: week
X̅: mean
y/o: years old
yr(s): year/ years
ZBI-22: Zarit Burden Interview
#: number
↓: decrease
↑: increase/ improve
Summary of Key Findings.

Summary of Studies Investigating ADL Performance

The current research evidence indicates that errorless learning and trial and error learning can both be used to effectively improve ADL and IADL performance, though there is insufficient evidence to generalize that either learning method is superior over the other. There is a strong level of evidence, including three randomized controlled trials, which support the exclusive use of errorless learning in improving occupational performance and independence in ADL for patients with ABI and dementia (Bertens et al., 2015; Lee et al., 2013; Travena-Peters et al., 2018). The exclusive use of errorless learning is also supported by six studies with less rigorous design, which concluded that errorless learning is effective in improving ADL performance for individuals with ABI and dementia (Cohen et al., 2010; Ferland, 2013; Goldenberg et al., 1998; Hartmann et al., 2018; Orrell et al., 2006; Wilson et al., 2003). Furthermore, there is a moderate level of research evidence to support the use of both errorless learning, and trial and error learning, to improve performance on ADL and functional independence for patients with dementia and TBI (Vanderploeg et al., 2008; Voigt-Radloff et al., 2017). In comparison, a randomized controlled trial by Mount et al. (2007) provides strong support for the exclusive use of trial and error based learning for improved training of modified dressing techniques for patients with CVA.

The effectiveness of trial and error or errorless learning treatment approaches may vary based on client population, client factors, performance skills, outcome measures, and setting. The following studies support this conclusion: When targeting specific client populations, Vanderploeg et al. (2008) concluded that errorless learning is more effective for improving functional independence for older adults when compared to younger adults. However, when targeting specific client factors, Vanderploeg et al. (2008) indicated that trial and error based learning was more effective in improving cognitive FIM scores compared to errorless learning regardless of age. When targeting the transfer of performance skills, Orrell et al. (2006) and Ferland (2013) indicate that errorless learning improves near transfer of trained skills and ADL performance more than trial and error based learning. Additionally, when targeting outcome measures and client factors, one randomized controlled trial conducted by Travena-Peters (2018) indicated that the use of errorless learning may have a clinically significant impact, although not statistically significant, in decreasing length of stay, agitation, and post-traumatic amnesia in TBI patients compared to trial and error.

Summary of Studies Investigating IADL Performance

In regards to IADL, the current research gathered indicates that both trial and error and errorless learning methods are effective for improving performance of various IADL tasks (Bourgeois et al., 2016; Cohen et al., 2010; Dechamps et al., 2011; Lee et al., 2013; Lloyd et al., 2009; Ownsworth et al., 2017; Thivierge et al., 2008; Thivierge et al., 2014; Van Tilborg et al., 2011). However, there is again insufficient evidence to generalize that either learning method is superior to the other. Overall, there is a moderate level of evidence to support the
exclusive use of errorless learning in IADL training for individuals with dementia and TBI (Dechamps et al., 2011; Thivierge et al., 2014; Thivierge et al., 2008). In contrast, Ownsworth et al. (2017) provided strong evidence to support the exclusive use of trial and error based learning for patients with TBI. Furthermore, there is strong evidence to support the use of both treatment methods in improving IADL performance for patients with ABI and dementia (Bourgeois et al., 2016; Lloyd et al., 2009; Van Tilborg et al., 2011).

Similar to the findings for ADL, the effectiveness of both strategies may vary based on client population, client factors, performance skills, outcome measures, and setting. For instance, Vanderploeg et al. (2008) concluded younger participants were more likely to return to work after receiving trial and error-based learning, as compared to errorless learning. Ownsworth et al. (2017) suggested that the use of trial and error learning is more effective than errorless learning strategies for improving meal preparation skills and overall functional independence in IADL for individuals with TBI. Additionally, Lloyd et al. (2009) found that those who did not benefit from the use of errorless learning methods, benefitted from trial and error methods to improve IADL performance.

**Implications for Consumers of Healthcare**

Consumers of the current research evidence include patients, family members, and caregivers. The research evidence in this review relates to populations with ABI and dementia working to rehabilitate ADL, and IADL occupations, in a variety of settings. Although there is substantial evidence to support the effectiveness of both errorless learning and trial and error learning for training these occupations, consumers of this research should be aware that this review did not provide evidence for a superior training method. Therefore, clients and family members should collaborate with practitioners to form clinical decisions on the most appropriate treatment method.

**Implications for Practitioners**

Practitioners should know that errorless learning and trial and error learning methods were both effective for improving occupational performance of ADL and IADL dependent on client population, client factors, performance skills, outcome measures, and setting. Currently, there is insufficient evidence to address the research question of which learning method is more effective, as the studies gathered do not provide enough cohesiveness to form broad conclusions.

For instance, there is emerging evidence that errorless learning is more effective within certain contexts, such as improving ADL routines for patients with ABI in in-patient settings, residential transitional living programs, and daily life (Cohen et al., 2010; Ferland, 2013; Travena-Peters et al., 2018). Likewise, trial and error learning has been shown to be effective in certain contexts as well. Lloyd et al. (2009) reported that patients in an outpatient rehabilitation setting, who did not benefit from errorless learning methods benefitted from trial and error methods to improve IADL performance. Health care professionals should therefore utilize evidence-informed clinical judgment and client-centered care when deciding which method to utilize.

Furthermore, practitioners can contribute to the body of literature on this subject by conducting case-series studies with rigorous designs. We believe this design to be reasonable for
practitioners to conduct in everyday practice and these would also inform future research using higher level experimental designs.

**Implications for Researchers**

Further research is needed to investigate the effectiveness of errorless and trial and error-based learning for patients of various diagnoses, particularly patients with CVA as there is less research evidence for this population. The low level of evidence provided by descriptive studies on errorless learning, and the mixed results produced by studies at higher evidence levels, provides insufficient evidence to establish a superior evidence-based treatment approach. Future studies should be conducted with higher levels of evidence, investigating the effectiveness of errorless and trial and error treatments on improving occupational performance and increasing occupational engagement. Once a foundation of high-level studies has been established, longitudinal studies should be conducted to assess the retention of therapeutic effects of errorless learning and trial and error-based learning. Additionally, qualitative studies should be conducted to add to the literature on patient experiences when receiving both errorless and trial-and-error based treatment approaches.

**Bottom Line for Occupational Therapy Practice/ Recommendations for Best Practice**

Results of this review suggested that both errorless learning and trial-and-error learning can have beneficial effects on enhancing functional performance in ADL and IADL for persons with ABI or cognitive impairments. However, insufficient evidence exists to conclude whether errorless learning or trial and error learning is the superior treatment approach. To prioritize client-centered practice, therapists should be aware that the potential benefits of both trial-and-error and errorless learning strategies may vary with personal and/or environmental factors, such as diagnosis or setting. Therapists should also consider contributing to the growing body of research on this topic by documenting their clients’ outcomes using both errorless and trial and error learning.
CAT References


Doi:10.5014/ajot.2018.721001


Doi:10.5014/ajot.2017.024752


Involvement Plan

Introduction

During our discussion with our collaborator, Hannah, we summarized the findings of our finalized paper. Additionally, we discussed the specific findings of some of the studies we analyzed and how it applied to specific individuals. As a group, we then asked our collaborator clarifying questions about her practice setting to better understand the structure of her organization and potential constraints, or supports, that would affect the implementation of our involvement plan.

Although we had previously discussed hosting an in-service meeting with Hannah and her colleagues, this conversation exposed a number of barriers to executing this plan. The hierarchical structure of Hannah’s practice setting posed the logistical challenge of getting events such as this approved by higher level management. Furthermore, Hannah informed us that there is limited intra-professional interaction between the occupational therapists (OTs) at Swedish Medical Center, as many of these colleagues work on different floors. We also had concerns about scheduling issues and the matter of limited time available to host an in-service event. These concerns collectively led us to discuss alternative ideas such as a webinar and visual displays to support our findings. We discussed how this would be more accessible to the team of therapists in the acute care and rehabilitation units at Swedish.

Additionally, we discussed the best way to disperse this information, and in discussion with our collaborator decided that email communication would reach the most individuals and allow them to read it when they have time. Our collaborator suggested that she be the primary contact, with our products being forwarded from her work email and then responses forwarded back to us. Thus, our final products included an initial contact survey to assess knowledge and perceptions on errorless, and trial and error learning techniques. The timeline discussed and agreed upon with our collaborator is given below.

Hannah did not report any time constraints on her end.

Context

During our conversation with Hannah, we gained more insight into the structure of her workplace and the organizational factors that would influence our knowledge translation project. Hannah’s team
reports directly to a supervisor named Diana, who is a speech language pathologist (SLP). We asked if Hannah thought reporting to an SLP was a barrier and she did not believe so, since the supervisor’s main role is to support staff and attend meetings. She also has a manager named Frank, who is an OT but works with her less directly. If any large-scale changes needed to take place, Diana would be the one to approve them. Hannah reported that she is fairly accepting of change, but the process could involve a lot of red tape and be slow moving.

Swedish subsidizes occupational therapy continuing education based on each employee’s number of full-time equivalents (FTEs). We believed that this would support our knowledge translation project because it indicated that the organization is invested in their employees’ staying up to date with current practice knowledge. On the other hand, the occupational therapists at Swedish are supposed to have quarterly meetings, but these meetings had been curtailed. Therefore, any intra-professional collaboration had been dependent on therapists initiating that communication during their free time. Checking email was not something done frequently in this setting, and the lack of intra-professional communication, plus the low frequency of email correspondence at Swedish would mean that starting discussion and piquing interest about our webinar would be challenging.

Despite these challenges, Hannah appeared to be a curious therapist, in search of the best available evidence to inform her practice. For this reason, she sought out conversations with other OTs and SLPs frequently. We predicted that once Hannah was able to watch our webinar she could share this information with that same enthusiasm and our research findings would be able to slowly disseminate with greater and greater ease.

The evidence we presented did not include SLP or pediatric research, which Hannah thought might be important in presenting our findings to the entire acute rehabilitation team. However, she stated that what we had was a strong start, and the project would need to be continued by another research group next year. Consequently, Hannah predicted that our knowledge translation project may feel unfinished to the practitioners but should be continued in 2020.
A final, potential barrier to our webinar project involved employee access. Work email at Swedish is secure, and employees needed to find time at work to check their email and watch our webinar. It is possible however, that they could have forwarded this email to their personal accounts to watch the webinar at home. After our meeting with Hannah, we received confirmation that Hannah’s superiors approved the use of Swedish email communication to deliver our products.

Table 1

_Involvement Plan Task, Products, and Target Dates_

<table>
<thead>
<tr>
<th>Task/Product</th>
<th>Date deadline</th>
<th>Steps</th>
<th>Dates steps are completed to achieve the final outcome</th>
</tr>
</thead>
</table>
| Introductory email with survey | March 25th | 1. Submit survey questions to Jeffrey or George for approval  
2. Find online survey platform  
3. Create online survey  
4. Create draft email  
5. Create final email with survey attached | 1. March 4th  
2. March 11th  
3. March 13th  
4. March 13th  
5. March 25th |
| Webinar (10-15 minutes) | March 25th | 1. Create outline of content for webinar & find software to record webinar (get approval from Jeffrey or George)  
2. Record webinar  
3. Create final email and send out finished webinar to collaborator | 1. March 15th  
2. March 18th  
3. March 25th |
| Handout/ visual to support findings that can be attached via email. | March 25th | 1. Submit content of handout to Jeffrey or George for approval  
2. Find template for handout  
3. Create handout  
4. Finalize handout  
5. Create and send final email with visual attached | 1. March 13th  
2. March 18th  
3. March 20th  
4. March 22nd  
5. March 25th |
| Exit email with survey | April 8th | 1. Submit survey questions to Jeffrey or George for approval  
2. Find online survey platform  
3. Create online survey  
4. Create draft email | 1. April 1st  
2. April 3rd  
3. April 5th  
4. April 5th  
5. April 8th |
Involvement Plan: Monitoring and Evaluating the Outcomes of Our Activities

We sent out an email survey to practitioners both before and after distribution of our webinar and visual aide. This allowed us to monitor the perceptions and practices of the therapists at Swedish in relation to errorless learning and trial and error learning techniques. We believed that doing this before and after our webinar, would give us more information about how the perceptions of the therapists at Swedish changed or remained similar after being exposed to the information given in our webinar and visual aide. Since our collaborator works closely with SLPs and errorless learning is used frequently in this profession, we wanted to monitor the effects of our research findings on the perspectives and practices of this population as well.

Description of Activities and Products Completed

Our knowledge translation project consisted of four primary products: a webinar reporting the results of our research, two surveys to assess practitioners’ understanding of errorless learning both before and after watching our webinar, and a quick reference summary of findings detailing the findings of each study included in our systematic review.

Table 2 displays the timeline along which we produced our knowledge translation materials. Our deadlines were originally set for early in the semester to accommodate for any unforeseen obstacles. This ended up benefiting us because we did, in fact, encounter unexpected delays. These included scheduling conflicts between the researchers, health issues among the researchers, and administrative barriers in the collaborator’s setting.

Table 2

<table>
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<tr>
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<th>Steps</th>
<th>Dates steps were scheduled to be completed</th>
<th>Date final outcomes were completed</th>
</tr>
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</table>
In order to create our survey, we utilized the online platform SurveyMonkey. This platform is free and allows users to choose a survey type from options including customer satisfaction, market research, demographics and many more. For our survey, we chose “other” to allow for more flexibility in

| Introductory email with survey          | March 25th | 1. Submit survey questions to Jeffrey or George for approval  | 1. March 4th  
|                                        |            | 2. Find online survey platform                                | 2. March 4th  
|                                        |            | 3. Create online survey                                        | 3. March 4th  
|                                        |            | 4. Create draft email                                           | 4. March 4th  
|                                        |            | 5. Create final email with survey attached                      | 5. April 2nd  

| Webinar (10-15 minutes)                | March 25th | 1. Create outline of content for webinar & find software to record webinar (get approval from Jeffrey or George) | 1. March 15th  
|                                        |            | 2. Record webinar                                               | 2. March 29th  
|                                        |            | 3. Create final email and send out finished webinar to collaborator | 3. April 2nd  

| Handout/visual to support findings that can be attached via email. | March 25th | 1. Submit content of handout to Jeffrey or George for approval | 1. March 13th  
|                                                                  |            | 2. Find template for handout                                    | 2. March 18th  
|                                                                  |            | 3. Create handout                                               | 3. March 20th  
|                                                                  |            | 4. Finalize handout                                              | 4. March 22nd  
|                                                                  |            | 5. Create and send final email with visual attached              | 5. March 25th  

| Exit email with survey                  | April 8th  | 1. Submit survey questions to Jeffrey or George for approval   | 1. March 4th  
|                                        |            | 2. Find online survey platform                                  | 2. March 4th  
|                                        |            | 3. Create online survey                                         | 3. March 4th  
|                                        |            | 4. Create draft email                                            | 4. April 16th  
|                                        |            | 5. Send final email with survey attached to collaborator         | 5. April 17th  

In order to create our survey, we utilized the online platform SurveyMonkey. This platform is free and allows users to choose a survey type from options including customer satisfaction, market research, demographics and many more. For our survey, we chose “other” to allow for more flexibility in
the design. We then were able to quickly and easily enter the questions that we wanted to ask and the response options we wanted available.

In generating questions for this survey, we wanted to make the overall product as respondent-friendly as possible, as we have all experienced surveys that end up taking far longer than expected and require more thought and focus than anticipated. We therefore included questions that would inform us of the degree to which practitioners are familiar with errorless learning and trial and error learning strategies in their practice, while keeping the overall survey short and to-the-point. We chose Likert-Scale response options and limited our survey to eight questions to further increase efficiency and minimize demand on practitioners. Our hope was that, with this increased ease of completion, we would get more survey responses submitted. Appendix B displays how the survey appeared to respondents and the links to the survey.

We utilized the same platform and format for our follow-up survey. This second survey was disseminated two weeks after our webinar and was intended to evaluate the degree to which practitioners’ views on errorless and trial and error learning strategies had changed, given the evidence presented in our webinar. We utilized the same questions and response options to compare results directly to the initial survey. SurveyMonkey automatically organizes responses into both visual and numerical data, this was intended to make comparing practitioners’ responses very easy. Overall, the process of creating these surveys was effortless.

In comparison to the ease of creating our surveys, creating our webinar posed more of a challenge. We began this process by creating a PowerPoint presentation. We carefully curated the information in our CAT table to determine which findings we wanted to highlight. We worked with our project chair, Dr. Chih-huang Yu, to create a balance between information printed on the slides and information provided through our verbal narration, as we wanted our webinar to appeal to both auditory and visual learners. See Appendix C for examples of the way in which we structured our slides to emphasize key points and provide clarity of practitioners, as well as the written script.
Once we finalized our PowerPoint and narration scripts, we set about recording the narration. This process was more challenging than expected for us. We found that, for the narration to sync properly with our PowerPoint slides, it needed to be recorded in one fell swoop. This meant that even if we had recorded the first sections perfectly, a mistake at the very end would force us to re-record the script in its entirety. After several takes, we successfully recorded the full script. Our final product is just over 15-minutes, with a consistent pace of narration. It balances information provided visually and verbally to appeal to a variety of learning styles while remaining succinct and straightforward. See Appendix C for the link to our recorded webinar.

The final product of our knowledge translation project was a “quick reference summary of findings table” summarizing the research we presented. Our intention for this document was that it would be a resource for practitioners to reference in relation to specific clients in the future. We included the 19 studies analyzed through our systematic review. We listed the articles in alphabetical order by author and subsequently color-coded them to represent each article’s level of evidence. Appendix D includes the key for our quick reference summary of findings which delineates what each color represents.

With our system of organization established, we set about reporting the findings of each study in the most succinct way possible. We did not want to include too much detail in this guide, as it was meant to be an index of sorts – a catalyst by which practitioners could subsequently access detailed information as needed. We felt that the most pertinent information to practitioners would be which treatment method was supported by the study, the population involved, and which occupations were trained – ADL or IADL. We also included a notes section to highlight information that would be relevant to Hannah’s specific setting or impact the way practitioners utilize the study. In the end, our document ended up being three pages and was slightly longer than we had hoped, as we had intended for the document to be one-page front and back. However, we were not willing to sacrifice pertinent information to achieve this goal. Appendix D contains a copy of the full document, depicting the way in which we organized the information and utilized the color-coding system described above.
A common challenge that arose in trying to disseminate all of our knowledge translation products was the administrative regulations that Swedish has in place. In order to distribute any of our products to the acute and rehabilitation team at Swedish, Hannah had to receive approval from her superior. This proved to be a time-consuming step and one we had not fully anticipated. We were aware that Hannah would require approval to disseminate our products, however, we were not anticipating this to take over a week. This process of waiting for approval meant that our initial survey and webinar were not truly disseminated until April 12th, ten days after we initially sent them to Hannah. This in turn extended the date on which we were able to send out our webinar reminder and follow up survey, which was sent to Hannah on April 17th but not fully disseminated until April 24th.

**Monitoring the Outcomes of Our Activities**

As previously mentioned, to monitor the outcomes of our knowledge translation products for practitioners at Swedish medical center, an email survey was sent to practitioners both alongside and after distribution of our webinar and visual aide. Sending out a pre-training survey and a post-training survey was intended to allow us to monitor the perceptions and practices of the therapists at Swedish in relation to errorless learning and trial and error learning techniques. This also gave us information about how these perceptions have changed or remained similar after being exposed to the information in our webinar and visual aide. Since our collaborator works closely with SLPs, and errorless learning is used frequently in this profession, our desire was to monitor the effects of our research findings on the perspectives and practices of not only occupational therapists at Swedish, but other therapy professions such as SLP or PT.

After sending out the pre-training survey, we monitored the number of responses we received, as well as views on our webinar. Since we had not received any responses, we thought that it may not have been sent out. In response to this, we sent a reminder via text to our collaborator to make sure that our surveys were distributed to the practitioners. She informed us that she was awaiting her supervisor’s approval and then sent it. After this, we continued to monitor our responses, and continued to have a low completion rate. At this point, it was time for us to send our post-webinar survey to the practitioners due to our deadline. If more time was available, email reminders to practitioners for completion may have
been able to be sent via our collaborator. However, with need for supervisory approval and looming program timelines, our reminder to complete the pre-training survey and webinar was included in the email containing the post-training survey. Additionally, we have continued to monitor pre and post training responses to this date. Due to limited time, we will be unable to remind practitioners to respond to our post-training survey in time for completion of this project but have sent an email reminder to our practitioner in order to see if more responses can be attained beyond the timeline of this project.

**Evaluation of Outcomes and Effectiveness of Products**

As our project outcomes currently stand, we have received two responses on our pre-training survey and no responses from practitioners on our post-training survey regarding their perceptions and use of these strategies. This lack of response from the practitioners at Swedish makes evaluation of the effectiveness of our products difficult to assess. We currently know the pre-webinar perceptions of two of the acute care practitioners at Swedish, but again it is difficult to draw broad conclusions regarding the change in perceptions with such few responses. The results of the pre-webinar survey is as follows: overall practitioners agree or somewhat agree that they know what errorless learning is, half agree and half somewhat disagree that they use errorless learning strategies in practice currently, half agree and half disagree with the idea that they know what patients to use errorless learning with, all agree that errorless learning is better than trial and error strategies when working with patients, all agree that they know what trial and error learning strategies are, half agree and half somewhat agree that they use trial and error learning strategies in practice currently, half agree and half are neutral in knowing which patients to use trial and error learning strategies with, and all are neutral on if trial and error learning strategies are better than errorless learning strategies when working with patients. Due to the lack of response on our post-training survey, we do not know how practitioners’ perceptions or use of these strategies have changed after viewing our webinar and visual aide.

We, as the researchers, feel disappointed that we have not received more responses, both on the pre-training survey and post-training survey. We feel that this does not represent positive outcomes for our knowledge translation project, as we cannot track how practitioners’ perceptions have changed and
how our materials have influenced perceptions, if at all. As our goal with our knowledge translation project was to inform practitioners on the most current evidence available on the use of errorless and trial and error learning strategies, and not necessarily to sway perceptions in a certain direction, we feel that any response on our post-training survey would have provided positive outcomes for our project. It may be said that our products and mode of delivery were not as effective as other types may have been, based on our low response rate. However, it is quite possible that due to the administrative gatekeeping, and restrictions in timeline and distribution, this same provision of materials may have been more effective in a different setting with less internal barriers. Additionally, we feel that high practitioner workload and lack of communication between the various departments at Swedish may have contributed to the lack of responses on our knowledge translation portion of our project.

**Evaluation of the Overall Process of Project**

The process of researching a topic proposed by a practicing clinician in the community presented an opportunity to serve the profession on a local level. Additionally, it acted as a first-hand example of the difficulty clinicians face using interventions that are evidence based, due to the time and resources needed to initiate and follow through with that process. It was motivating to know that the results of the literature review would be implemented in a specific setting and that they could have an immediate observable impact in the local community. Searching the literature was a valuable educational experience, which required our group to hone our database searching skills to find enough relevant articles to answer the research question to the fullest extent possible. After our initial searches we had to make difficult decisions about our inclusion and exclusion criteria, and those compromises allowed us to expand the number of relevant articles for our analysis. While we were originally interested in research surrounding a diagnosis of CVA and cognitive deficit, our expansion to include dementia and acquired brain injuries of different types did not decrease the value of the research for our collaborator since the additional diagnoses also result in cognitive deficits.
The entire process was challenging, especially disseminating the research articles and coding them into a conclusive recommendation in which all three researchers and our mentors were confident. As a result of the mixed evidence, creating a valuable knowledge translation project proved more difficult than we expected it to be at the beginning of the research process. To ensure the viewers of our webinar would walk away feeling we had valued their time, we presented the summary of mixed findings, but also gave viewers small takeaways from specific studies they could implement. Although we thought we planned enough time to monitor the outcomes of the knowledge translation process, we did not receive the engagement we were hoping for. Perhaps, with more time, we could have sent the content out a second time to gain more viewers and added a more enticing introduction message.

The research process including creation of the CAT and the knowledge translation process has required consistent commitment over eight months. We are proud to present our final project after undergoing intensive collaboration with our community practitioner, as well as our department mentor and chair. Moving forward in our careers we feel prepared to create evidence-based presentations and defend our professional decision making to further the profession of occupational therapy.

**Recommendations for the Future**

We, the researchers of this project, feel that the current evaluation of errorless learning versus trial and error learning is an important research area in which future student researchers and practitioners need to investigate and contribute further. Contributing to the small literature pool of current research evidence on this subject will help to inform the possible creation of practice guidelines within occupational therapy. There are a few areas in which we have recommendations for future follow-on student projects. In regard to better understanding the research evidence, we recommend that future student researchers investigate the current research evidence available on the use of trial and error learning strategies for patients with CVA, or cognitive deficit, who are re-learning ADL and IADL tasks. Though our research did touch on this, we focused on research which compared errorless learning strategies to trial and error strategies and did not look at trial and error strategies effectiveness as a standalone. Evaluation of the use of trial and error strategies will provide a wider base of knowledge and
further the creation of practice guidelines for practitioners to use based on diagnosis or outcomes desired, as the current research evidence is limited in its scope and breadth of studies currently available. In regard to similar knowledge translation follow-on projects in acute care hospital settings, we suggest that student researchers use a more interactive and face to face method of knowledge translation, perhaps an in-service with an immediate follow-up survey. This will allow the immediate ability to monitor change in perceptions and increase engagement. We feel that this will reduce the number of barriers experienced, including administrative gatekeeping and delays in dissemination, as well as reduce non-response as practitioners would be required to respond immediately. Finally, we recommend that practitioners add to the knowledge base on this subject matter by completing case-series studies with rigorous designs in everyday practice. These would help to inform future research using higher level experimental designs and build the knowledge base on this subject matter.
References


Acknowledgements

Firstly, we would like to thank our collaborator Hannah Baldwin, OTR/L at Swedish Medical Center for giving us the opportunity to complete this research and for her willingness to work directly with us throughout the last year. Without her we would not have been challenged to explore her practice question or have had this research opportunity. We would like to thank our research chair Dr. Chih-huang Yu OTR/L, for his willingness to share his years of expertise in this field of study, as well as continued support and guidance throughout this year long process. Finally, we would like to thank our project mentor Dr. George Tomlin OTR/L, for his continued support throughout the last two years, his guidance, and willingness to provide his expertise in the field of research.
### Appendix A

**Complete Search History by Database and Date**

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## Functional performance and errorless learning

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A randomized controlled trial on errorless learning in goal management training: study rationale and protocol. Bertens, Fasotti, Boelen, & Kessels (2013)
This study was in progress and the 2015 article is the experimental publication.

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Appendix B

Pre and Post Training Surveys

Pre-training: https://www.surveymonkey.com/r/JXNTRWT
Post-training: https://www.surveymonkey.com/r/QD8GGPK

Pre-training survey

1. I know what errorless learning strategies are.
   - Strongly agree
   - Agree
   - Somewhat agree
   - Neutral
   - Somewhat disagree
   - Disagree
   - Strongly disagree

2. I use errorless learning strategies in practice currently.
   - Strongly agree
   - Agree
   - Somewhat agree
   - Neutral
   - Somewhat disagree
   - Disagree
   - Strongly disagree

3. I know which patients to use errorless learning strategies with.
   - Strongly agree
   - Agree
   - Somewhat agree
   - Neutral
   - Somewhat disagree
   - Disagree
   - Strongly disagree
4. I think that errorless learning strategies are better than trial and error strategies when working with my patients.

- Strongly agree
- Agree
- Somewhat agree
- Neutral
- Somewhat disagree
- Disagree
- Strongly disagree

5. I know what trial and error learning strategies are.

- Strongly agree
- Agree
- Somewhat agree
- Neutral
- Somewhat disagree
- Disagree
- Strongly disagree

6. I use trial and error learning strategies in practice currently.

- Strongly agree
- Agree
- Somewhat agree
- Neutral
- Somewhat disagree
- Disagree
- Strongly disagree

7. I know which patients to use trial and error learning strategies with.

- Strongly agree
- Agree
- Somewhat agree
- Neutral
- Somewhat disagree
- Disagree
- Strongly disagree
8. I think that trial and error learning strategies are better than errorless learning strategies when working with my patients.

- Strongly agree
- Agree
- Somewhat agree
- Neutral
- Somewhat disagree
- Disagree
- Strongly disagree

Post-training survey

1. I know what errorless learning strategies are.

- Strongly agree
- Agree
- Somewhat agree
- Neutral
- Somewhat disagree
- Disagree
- Strongly disagree

2. I use errorless learning strategies in practice currently.

- Strongly agree
- Agree
- Somewhat agree
- Neutral
- Somewhat disagree
- Disagree
- Strongly disagree
3. I know which patients to use errorless learning strategies with.

- Strongly agree
- Agree
- Somewhat agree
- Neutral
- Somewhat disagree
- Disagree
- Strongly disagree

4. I think that errorless learning strategies are better than trial and error strategies when working with my patients.

- Strongly agree
- Agree
- Somewhat agree
- Neutral
- Somewhat disagree
- Disagree
- Strongly disagree

5. I know what trial and error learning strategies are.

- Strongly agree
- Agree
- Somewhat agree
- Neutral
- Somewhat disagree
- Disagree
- Strongly disagree

6. I use trial and error learning strategies in practice currently.

- Strongly agree
- Agree
- Somewhat agree
- Neutral
- Somewhat disagree
- Disagree
- Strongly disagree
7. I know which patients to use trial and error learning strategies with.

- Strongly agree
- Agree
- Somewhat agree
- Neutral
- Somewhat disagree
- Disagree
- Strongly disagree

8. I think that trial and error learning strategies are better than errorless learning strategies when working with my patients.

- Strongly agree
- Agree
- Somewhat agree
- Neutral
- Somewhat disagree
- Disagree
- Strongly disagree
Appendix C

Webinar Slides and Script

Webinar link: https://www.youtube.com/watch?v=XkfENgYa2ko&feature=youtu.be

Slide 1

Speaker: Hi everyone. Welcome to our webinar. We want to thank you for giving us your time. Alison, Jasmine and myself, are masters of occupational therapy students from the University of Puget Sound, completing this research as a capstone project in collaboration with a community practitioner. This presentation will take about 15 minutes. We will discuss the results of our literature review regarding the effects of both errorless and trial and error teaching strategies for adults with a diagnosis of CVA or cognitive deficit and how, as a practitioner, you can use this information in your own everyday practice.
Our research question

- Errorless learning strategies or trial and error strategies
- Adult patients
- CVA or cognitive deficit
- Instrumental activities of daily living (IADL)
- Activities of daily living (ADL)

We conducted this research to answer the following question: Are errorless learning strategies or trial and error strategies more effective for adults with a diagnosis of CVA, or cognitive deficit, when re-learning IADL, ADL and other occupations? Our aim was to address a question in relation to the patient population frequently seen at Swedish Medical Center, while focusing on occupational therapy based ADL and IADL outcomes. While our goal was to review the current literature on the effects of errorless and trial and error learning to determine whether there is an evidence based practice guidelines to improve therapeutic outcomes for this population.

As other therapeutic professions, such as SLP and PT, may have their own practice guidelines regarding the use of errorless learning or trial and error learning to improve therapeutic outcomes, it is important to begin to establish an evidence-based OT practice guideline which practitioners can cite and use.

Operational Definitions

Errorless Learning
- The information is presented so that the learner is prevented from making errors.
- Learns from repeated exposure to correct information.

Trial and Error learning
- All treatment approaches not deemed to be errorless learning.
- The learner is allowed to make errors.

Speaker: We defined errorless learning as a method of teaching and learning where the information to be learned is presented in such a way that the learner is prevented from making errors and instead learns from repeated exposure to correct information. This category included learning methods such as functional experiential training and implicit knowledge training.

In contrast, we defined trial and error learning to broadly encompass all treatment approaches not deemed to be errorless learning in which the learner is permitted to make errors. In this approach, the learner benefits from the opportunity to self-correct his or her own mistakes. Based on this definition, trial and error encompasses various types of therapeutic interventions including, but not limited to, cognitive-didactic training, spaced retrieval, and explicit knowledge training.
Speaker: We began our research by surveying the available literature online and in text. We used a combination of relevant search terms in databases of OT literature, rehab literature, and allied health literature. Our search terms included TBI, CVA, ABI, and cognitive deficit as these are the main diagnoses with which our collaborator works with directly. Errorless learning was also included as a search term and resulting studies with either errorless learning or both trial and error and errorless learning as treatment methods were included in this review. Our search terms also included outcomes of ADL and IADL as defined in the occupational therapy practice framework, or OTPF, which are listed above for reference.

First, we looked at what each study’s results indicated and whether it supports errorless learning, trial and error, both, or neither.

After reviewing the resulting studies, we sorted the relevant studies by targeted outcome area. These outcome areas were based on the definitions of ADL and IADL encompassed in the OTPF on the previous slide. We felt that categorizing these studies by outcome area was the clearest way for practitioners to use this information when addressing specific outcome areas.
Errorless learning and ADL

- Improved ADL independence and occupational performance for patients with ABI and dementia.
  - Bertens et al., 2015; Lee et al., 2013; Travena-Peters et al., 2018
  - Barthel Index - Lee et al., 2013
  - FIM - Travena-Peters et al., 2018
- Improved ADL performance for patients with ABI and dementia.
  - Cohen et al., 2010; Ferland, 2013; Goldenberg et al., 1998; Hartmann et al., 2018; Orrell et al., 2006; Wilson et al., 2003

We will summarize our results first for ADL and then we will move on to the results for IADL.

Starting with ADL, three randomized controlled trials support the exclusive use of errorless learning in improving occupational performance and independence in ADL for patients with an acquired brain injury and dementia (Bertens et al., 2015; Lee et al., 2013; Travena-Peters et al., 2018).

Lee specifically indicated that EL led to improvements in modified barthel index scores for patients with dementia, and Trevena-Peters indicated that EL led to improvements in FIM scores for patients with TBI.

Additionally, six studies with a less rigorous design supported the exclusive use of errorless learning. These studies concluded that errorless learning is effective in improving ADL performance for patients with ABI and dementia (Cohen et al., 2010; Ferland, 2013; Goldenberg et al., 1998; Hartmann et al., 2018; Orrell et al., 2006; Wilson et al., 2003).

Trial and error learning and ADL

- Improved training of modified dressing techniques for patients with CVA.
  - Mount et al., 2007

In regards to TEL and ADL outcomes, Mount et al. conducted one RCT that supported the exclusive use of trial and error-based learning for improved training of modified dressing techniques for patients with CVA.
Two studies with a rigorous design support the use of both EL and TEL when focusing on ADL outcomes. Vanderploog et al. found that both strategies improved performance of an ADL task for patients with TBI, while Voigt-Radloff et al. found that both learning strategies improved functional independence for patients with dementia.
Some studies had population specifics or outcome areas that are especially poignant to the acute care or rehabilitation setting. We have separated these specifics so that practitioners can refer to them when making their decision of which strategy to use based on patient characteristics or outcome areas desired.

Vanderploeg et al. found that errorless learning improved independent living scores for patients who were older when compared to other older adults who received TEL, but that trial and error was more effective in improving cognitive FIM scores. Based on this study, if we are working with an older adult EL may be a better choice, but with a patient who is more cognitively challenged, we may use TEL for improved cognitive FIM scores. This also demonstrates that even within the same study mixed results were evident when separated by population characteristic or outcome area.

Orrell et al. and Ferland indicated that near transfer of trained ADL tasks was improved using EL.

Travena-peters found that, though not statistically significant, there was a clinically significant decrease in LOS, agitation, and PTA in TBI patients.

As practitioners we can use this information to help inform which strategy is used with our patients. Allowing the flexibility in strategy based on needs and outcome area being targeted.
Here is the bottom line of everything we just presented. With the mixed evidence currently available on the use of EL or TEL for ADL outcomes, there is insufficient evidence to decide that either is SUPERIOR over the other. Based on the current research evidence, the learning strategy we use with our patient will depend immensely on the person’s diagnosis or specific ADL outcome desired. For example, if we have a patient with CVA who has a need for dressing, we may choose to use TEL based on the evidence provided by the Mount et al. article. Or perhaps we may choose EL if we are working on improving overall ADL functions (modified Barthel index scores or FIM scores) with patients diagnosed with a TBI or dementia.

In relation to IADL outcomes, there are studies which indicate that the sole use of EL can lead to improved outcomes in some IADL. A single blinded RCT from Thivierge (2014) suggested that the use of EL would benefit patients with dementia to improve IADL functions measured by the direct measure of training or DMT. Several less rigorously designed studies support the exclusive use of errorless learning in IADL training for patients with dementia and TBI. Dechamps specifically found that the effect of training of IADL tasks was retained more at follow up with EL. And finally, Cohen et al. supports the use of EL for improved IADL performance of patients with TBI.
Trial and Error Learning and IADL

- TEL improved performance of IADL tasks for 25 patients with TBI.
  - Ownsworth et al. (2017)

In contrast, Ownsworth et al. (2017), showed evidence to support the exclusive use of trial and error-based learning with 25 patients with TBI.

Use of both and IADL

- Improved IADL performance in patients with dementia.
  - Bourgeois et al., 2016; Dechamps et al., 2001; Van Tilborg et al., 2011
- Improved IADL performance in patients with ABI.
  - Decreased number of errors
  - Lloyd, 2009

Studies with a more rigorous study design support the use of BOTH TEL and EL to improve IADL performance in patients with dementia and ABI.

Lloyd specifically found that EL improved performance on IADL tasks, as measured by a decreased number of errors, more than TEL. This varied by type of learner, those that did not benefit from EL, had a decrease in errors as more practice was given using TEL.
Specific populations

- **TEL**
  - Improved IADL performance for patients with TBI.
    - Ownsworth et al., 2017
  - Younger participants are more likely to return to work
    - Vanderploeg, 2008

- **EL**
  - Improved social communication skills for patients with TBI.
    - Cohen, 2010

- **Mixed**
  - Patients who do not benefit from errorless learning, benefit from trial and error learning to improve IADL performance.
    - Lloyd, 2009

Similar to the findings for ADL, the effectiveness of both strategies may vary based on patient population, patient factors, performance skills, outcome areas, and setting. Again, we have separated these studies for easier reference as these studies had population specifics or outcome areas that are especially poignant to the acute care or rehabilitation setting.

For instance, Vanderploeg et al. (2008) concluded younger participants were more likely to return to work after receiving trial and error-based learning, as compared to errorless learning. Ownsworth et al. (2017) suggested that the use of trial and error learning is more effective than errorless learning strategies for improving meal preparation skills and overall functional independence in IADL for patients with TBI. Cohen found that EL improved social communication skills for TBI patients. Additionally, Lloyd et al. (2009) found that those who did not benefit from the use of errorless learning methods, benefitted from trial and error methods to improve IADL performance.

Take away

- The current research gathered indicates that both TEL and EL methods are effective for improving performance of various IADL tasks.
- There is insufficient evidence to generalize that one learning method is superior over the other. And, again, it will depend on the patient we are working with.
What does all this information mean for us as practitioners? Well, it means a few important things. One, that in using either TEL or EL we are not going against what literature indicates as practice guidelines as there is mixed evidence for the use of both! As we have discussed earlier, due to the current mixed evidence, this means that we can let the evidence inform our clinical judgement based on patient diagnosis and outcome areas desired.

The fact that there is mixed evidence indicates that we need to take a closer look at the specifics of the patient we are treating. What outcome areas are we focusing on improving? What diagnosis does this patient have? What is their age? All of these questions will help in guiding our decision making about the use of EL or TEL. Once we focus on specifics, we can refer to the literature and see which learning strategy is supported. Additionally, asking the family members and collaborating with the patient on what strategy works best for them is an important part of this.

Next, consult with co-workers and peers! Interprofessional collaboration can be an important guide in our decision making when there is mixed evidence to support treatment methods. Ask your colleagues what has worked for them with patients with similar patient characteristics, what has not worked, etc. Collaborating with co-workers or peers provides a valuable opportunity to gain knowledge on how other professions approach similar problems or practice guidelines in their field.

Putting this all together means doing everything that we can in order to provide the best care for our patients. Using evidence-based practice, interprofessional and patient collaboration, as well as our own experience as a therapist will help us understand when a treatment intervention is or is not appropriate.

Now the final question is, since there is mixed evidence, what can we do as practitioners? Generating research is necessary to help build the body of literature available on these topics, as there is an insufficient amount of literature to determine a practice guideline for our patients. Additionally, in our search, we had a difficult time finding OT literature related to EL and TEL. There are far more numerous studies available within the Speech Language Pathology literature and other health care disciplines. It is therefore important for us, as occupational therapy practitioners, to support our profession through research. We can do this by supplying and supporting case studies, case series, and clinical trials.
Attached to our original email is a quick reference for all the studies included in this webinar. This quick guide can be used as a when looking at specific diagnoses or outcome areas being targeted in treatment and what learning method is supported in the literature. It can also be used as a reference in order to look up the original studies found for more detailed information.

Thank you for your time and we hope that watching this has improved your knowledge of the current research base on EL and TEL in regards to ADL and IADL.

Slide 18

Resources used

**Online resources**
- Education Resources Information Center (ERIC)
- Cumulative Index of Nursing and Allied Health Literature (CINAHL)
- Pro-quest
- PUBMED
- Cochrane library
- Peer-Reviewed Instructional Materials Online (PRIMO)
- OT Seeker

**Book resources**

**Cumulative Index of Nursing and Allied Health Literature (CINAHL)**
**Education Resources Information Center (ERIC)**
**Pro-Quest**
**PubMED**
**Cochrane Library**
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**American Journal of Occupational Therapy (AJOT)**


References


Wilson, F., & Manly, T. (2003). Sustained attention training and errorless learning facilitates self-care functioning in
## Appendix D

### Quick Reference Summary of Findings

<table>
<thead>
<tr>
<th>Article</th>
<th>Method Supported</th>
<th>Population Involved</th>
<th>Occupations Trained</th>
<th>Notes</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>EL</td>
<td>TEL</td>
<td>TBI</td>
<td>ABI</td>
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<tr>
<td>Bertens et al. (2015)</td>
<td>X</td>
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<td>Bourgeois et al. (2016)</td>
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<td>Cohen et al. (2010)</td>
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<td>Dechamps et al. (2011)</td>
<td>X</td>
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<td>Ferland (2013)</td>
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<td>Goldenberg et al. (1998)</td>
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<td>Hartmann et al. (2018)</td>
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<td>Lee et al. (2013)</td>
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<td>Llyod et al. (2009)</td>
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<tr>
<td>Study</td>
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</table>
| Mount et al. (2007)                  | X | X | X |   | X | No difference between tasks for number of errors, or carry over with w/c task
Carry over more likely with TEL for sock-donning |
| Orrell et al. (2006)                 | X | X | X |   | X | TEL and EL improved retention of balance skill
EL patients had sig improvement in skill transfer test
TEL pts had sig regression in same transfer test |
| Ownsworth et al. (2017)              | X | X |   |   | X | Compared the effects of EL to no tx - no TEL was used |
| Thivierge et al. (2008)              | X |   | X |   | X | Compared the effects of EL to no tx - no TEL was used |
| Thivierge et al. (2014)              | X |   | X |   | X | Compared the effects of EL to no tx - no TEL was used |
| Travena-Peters et al. (2018)         | X | X |   |   | X | ADL: FIM scores sig improved with EL
EL had clinically sig impact on decreasing LOS, agitation and PTA |
| Vanderploeg et al. (2008)            | X | X | X |   | X | EL and TEL: Improvement in functional independence
TEL improved cognitive FIM score and for younger participants led to improved RTW |
<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>EL improved independent living for older participants</th>
<th>Patients chose ADL or IADL tasks</th>
<th>Combined sustained attention training with EL tx</th>
</tr>
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<tbody>
<tr>
<td>Van Tillborg et al. (2011)</td>
<td>High rigor</td>
<td>X X X</td>
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<td>Voigt-Radloff et al. (2017)</td>
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<td>Wilson et al. (2003)</td>
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Key for level of evidence:

**High rigor study design**
- Randomized controlled trial

**Moderate rigor study design**
- Controlled clinical trial

**Low rigor study design**
- Single subject designs
- Single case study
- Case series
- Multi-case report