A New Principle-Based Model for Motor Skill Learning: Implications for Research and Practice

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UNLVPT Distinguished Lecture Series
Carolee Winstein, PhD, PT, FAPTA, FAHA

Overview

- Theoretical Foundations
- Goal-Action Coupling through motivation and attention
- Introduce Accelerated Skill Acquisition Program
- Simple ways to enable meaningful recovery through conditions that strengthen goal-action coupling
  - Autonomy support
  - Build competence/expectations for learning & performance
Theoretical Foundations

Ellen Langer is a social psychologist at Harvard and is considered by many as the mother of mindfulness.


Social-Cognitive Theory

![Diagram of Social-Cognitive Theory]

Figure 1. Structural paths of influence wherein perceived self-efficacy affects health habits both directly and through its impact on goals, outcome expectations, and perception of sociostructural facilitators and impediments to health-promoting behavior.

Bandura, Health Educ Behav, 2004

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Optimizing performance through intrinsic motivation and attention for learning: The OPTIMAL theory of motor learning

Gabriele Wulf¹ · Rebecca Lewthwaite²,³

DOI 10.3758/s13423-015-0999-9

THEORETICAL REVIEW
Similar to Bandura’s Impediments

Similar to Bandura’s Facilitators
Fundamental Approach

Each patient is viewed as an active problem-solver, and rehabilitation is focused on the acquisition of skills for performance of meaningful and relevant goal-oriented behaviors.

*Skill-based and Patient-centered*

Task is the vehicle that enables capacity building, skill development and self-efficacy (see later example)  
What is the Accelerated Skill Acquisition Program (ASAP)?

- It is a theoretically-defensible, evidence-based, principled approach to enhance recovery of function after stroke*.

*Note: the principles can apply to recovery in general and are not unique to upper extremity function or the stroke diagnostic group.

Key Elements for ASAP

- Motor skill (functional recovery now)
- Self-management skills (sustained activity and participation later)
- Reduce impairments
- Improve strength, ROM, coordination etc.
- Intrinsic drive
- Self-efficacy

Winstein et al., JNPT, 2014
ASAP’s 8 overlapping operating principles

1. Ensure challenging and meaningful practice
2. Address important (interfering) changeable impairments
3. Enhance motor capacity through overload and specificity
4. Preserve natural goal-directedness in movement organization
5. Avoid artificial task breakdowns when possible
6. Assure active patient involvement and opportunities for self-direction
7. Balance immediate and future needs
8. Drive task-specific self-confidence high through performance accomplishments

Winstein et al., JNPT, 2014

Microstructures of ASAP

- Collaboration Agreement
- Collaborate to explore participant’s movement problems (FTHUE)
- Task Collaboration: 6 initial priority tasks in 3 categories: strength, dexterity, bimanual
- Add new tasks as desired, establish order of tasks each session
- Challenge and intensity with every task practiced (video)
- Assess self-efficacy, problem solve for priority task (video)
- Autonomy support throughout (video)
- Action Plans for motor skill generalization and self-management for recovery
The Structure of ASAP Therapy*

1 Evaluation and Orientation session
30 Therapy sessions (60 min each)
over 10 weeks

Special session
Typical + Self-Efficacy Question
Typical session

*In the context of the recent Interdisciplinary Comprehensive Arm Rehabilitation Evaluation RCT (ICARE)

Special Sessions

- (Session A) Evaluation and Orientation
- Therapy session #1 (Typical + Self-Efficacy #1)
- Therapy session #10 (Typical + Self-Efficacy #2)
- Therapy session #20 (Typical + Self-Efficacy #3)
- Therapy session #30 (Typical + Self-Efficacy #4; end-of-intervention)
Collaboration Agreement

- Straightforward, signed, agreement to participate in collaborative way with therapist during training sessions and to participate in the action plans outside of therapy sessions.

Special Session (A): Evaluation and Orientation

- Collaboration Agreement

- Functional Test of the Hemiparetic Upper Extremity (FTHUE) (Wilson et al., 1984)

- Task collaboration procedure (including “Priority Task” identification)
Task Collaboration

- Task collaboration procedure to establish initial list of meaningful tasks for participant (FTHUE can prime discussion).

- Participant will be asked to identify, and state very specifically, at least 6 tasks to spend training time on, including:
  - >= 2 task involving strength (force production)
  - >= 2 task involving dexterity/fine motor control
  - >= 2 bimanual task

- Participant asked to designate one of these as the “Priority Task” that will be used to assess self-efficacy every 10 sessions (Priority Task will remain the same for self-efficacy purposes throughout, but time spent on it can shift to 0).
Brief Self-Efficacy Question (SEQ)

- Training sessions 1, 10, 20, and 30
- Uses the participant’s designated Priority Task
- "How confident are you that you can carry a full bag of groceries from the car into your home?"

0 1 2 3 4 5 6 7 8 9 10
not confident at all very confident

- F/U Question: “What can we do to increase your capabilities and raise your confidence?”

Action Plans: Purpose
(Outside-of-Therapy Practice + Handouts)

- Debrief at beginning, set-up next at end of each training session
- Extend and reinforce movement-related training principles
- Set-up outside-of-therapy practice in home and community contexts
- Develop participants’ self-management skills further
- Provide opportunities for critical conversations regarding expectations, support, and strategies
Action Plan Handouts

• “Considering Use of the Soft Mitt on Your Better Hand”
• “Preventing Arm and Hand Injuries”
• “Family and Friends Support”
• “Helpful Thoughts (Mental Skills) for Performing Challenging Activities in Public”
• “Getting the Most Learning for Your Efforts (Motor Learning Part I)”
• “Turning Science into Skill (Motor Learning Part II)”

Typical Sessions

- Debrief from previous Action Plan
- Take vital signs (including pain, muscle soreness)
- Establish task practice order for session
- **Practice 2 – 3 tasks in short (10-20 minutes each) modules**
- Set-up next Action Plan for out-of-therapy practice
All therapy sessions will involve …

- Determining:
  - the challenge point
  - appropriate intensity of practice (e.g., load, speed)
  - activity and task progression

Example: Task is a vehicle for capacity building, skill acquisition, and development of self-efficacy, and self-management skills

Determining Activity and Task Progression

- Choose one or more task attributes (variables) to modify (e.g., object size, load, speed, accuracy, postural demand)

- Progress activity by changing task variables (e.g., increase load, speed)

- Provide rationale for choice of task variable manipulated, given observed movement dysfunction
Determining the Challenge Threshold

- Challenge threshold: the threshold at which movement form or effectiveness breaks down due to capacity limits.

- Found by deliberately seeking “failure” due to excessive demand, then finding adjacent success.

- Also the point at which further training is applied to efficiently increase capacity.

- Can be described in terms of what can (e.g., lift a 1 kg bottle) and cannot (lift a 1.5 kg bottle) be performed.

- Identify important, changeable, movement dysfunctions (impairments) that contribute to movement breakdown.

Challenge and Intensity of Practice

- What the patients in the ICARE trial perceived at the end of each of the 30 sessions.

- Patient-reported outcomes are important for calibrating the intensity of each session.
Self-efficacy evaluation day early, middle, late

Building competence/expectations for motor learning and performance:

Video examples
Brief self-efficacy video
Self-Efficacy for Priority Task across Visits (Results from ICARE)

Self-Efficacy for Priority Task across Visits (Results from ICARE)

Autonomy support and social relatedness:

Video examples
Subtle conditions that convey freedom of engagement or personal autonomy matter

- Small choices can have large impacts
- Mere choice, incidental choices, can affect learning
- Social interactions and controlling language can threaten autonomy ("I want you to ...")
HEALTH CARE CLIMATE QUESTIONNAIRE
Patient-Centered Care (Autonomy Support)

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<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1</td>
<td>I feel that my therapist has provided me choices and options.</td>
<td>2.0</td>
</tr>
<tr>
<td>2</td>
<td>I feel understood by my therapist.</td>
<td>3.7</td>
</tr>
<tr>
<td>3</td>
<td>My therapist conveys confidence in my ability to make changes.</td>
<td>3.1</td>
</tr>
<tr>
<td>4</td>
<td>I feel a lot of trust in my therapist.</td>
<td>3.7</td>
</tr>
<tr>
<td>5</td>
<td>My therapist listens to how I would like to do things.</td>
<td>3.3</td>
</tr>
<tr>
<td>6</td>
<td>My therapist tries to understand how I see things before suggesting a way to do things.</td>
<td>3.3</td>
</tr>
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(1 = strongly disagree to 7 = strongly agree)

N = 45

ASAP 6.9 (0.2)  DEUCC 6.3 (0.9)  UCC 6.1 (1.1)  UCC 6.1 (1.1)

A > D, p = .0001; A > U, p = .0001; D = U
Commercial Baker video (early practice, later baking tasks at work)

Intense and Challenge

Autonomy Support

Video Example

Special Interest Articles

Infusing Motor Learning Research Into Neurorehabilitation Practice: A Historical Perspective With Case Exemplar From the Accelerated Skill Acquisition Program

Carolee Weinstein, PT, PhD, Rebecca Lewithwaite, PhD, Sarah R. Blanton, PT, DPT, Lois B. Wolf, PT, MMSc, MBA, and Laurie Wishart, PT, PhD

This special interest article provides a historical framework with a contemporary case example that traces the infusion of the science of motor learning into neurorehabilitation practice. The revolution

Key words: neuroplasticity, motivation, motor control, motor learning, recovery, self-efficacy, skill acquisition, stroke

Weinstein et al., J Neurol Phys Ther, 2014
Empowered and Ready to Go

Day 15
large size bean
Competence enhancement, collaboration, celebration, positive affect: better motor learning

Secondary Analyses of the ICARE Trial
Interdisciplinary Comprehensive Arm Rehabilitation Evaluation (ICARE): a randomized controlled trial protocol

Carol J Winstine, Steven L Wolf, Alexander W Rudmik, Christiane J Lane, Monica A Nelson, Rebecca Lewthwaite, Sarah Blanton, Charo Scott, Almee Reiss, Steven Yong Cen, Rahsaan Holley, and Stanley P Azen For the ICARE Investigative Team

Trial Registration: ClinicalTrials.gov, registration number NCT00871715, https://clinicaltrials.gov/ct2/show/NCT00871715

Original Investigation
Effect of a Task-Oriented Rehabilitation Program on Upper Extremity Recovery Following Motor Stroke
The ICARE Randomized Clinical Trial

Carol J Winstine, PhD; Steven L Wolf, PhD; Alexander W Rudmik, MD; Christiane J Lane, PhD; Monica A Nelson, DPT; Rebecca Lewthwaite, PhD; Steven Yong Cen, PhD; Stanley P Azen, PhD; for the Interdisciplinary Comprehensive Arm Rehabilitation Evaluation (ICARE) Investigative Team

IMPORTANCE Clinical trials suggest that higher doses of task-oriented training are superior to current clinical practice for patients with stroke with upper extremity motor deficits.

CONCLUSIONS AND RELEVANCE Among patients with motor stroke and primarily moderate upper extremity impairment, use of a structured, task-oriented rehabilitation program did not significantly improve motor function or recovery beyond either an equivalent or a lower dose of UCC upper extremity rehabilitation. These findings do not support superiority of this program among patients with motor stroke and primarily moderate upper extremity impairment.

TRIAL REGISTRATION clinicaltrials.gov identifier: NCT00871715
Baseline to End-of-Therapy Changes in Secondary Outcomes

For stroke-affected upper limb recovery, the most significant outcome to the patient is the ability to voluntarily and spontaneously use the paretic arm and hand in the natural environment for valued activities (Barker and Brauer, 2005; Barker et al., 2007). From the patients’ perspective, paretic arm use is strongly associated with the perception of overall recovery (Fritz et al., 2007). Importantly, greater engagement in valued activities was found to be significantly associated with subsequent improvement in emotional well-being (Egan et al., 2014). The opportunity to tap the motivational circuits in meaningful ways and in the context of evidence-based interventions is a challenge for the traditional clinical trialist. Once the rehabilitation community accepts the importance of choosing primary outcomes from the quality of life and participation domain of the International Classification of Functioning, Disability and Health (WHO, 2001), it will represent a true paradigm shift in the way clinical trials in neurorehabilitation are conceptualized, designed, and implemented.