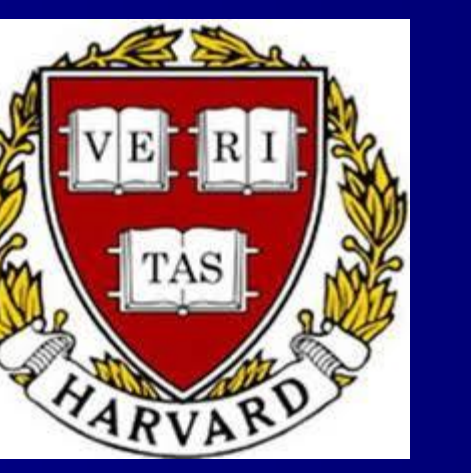# Neuroscience-Informed Workshops for Adults

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Abstract

This survey study evaluated whether a workshop presentation would improve learning if it were altered to marry the findings of neuroscience, biology, and cognitive science with pedagogy—the **Mind, Brain, Health, and Education (MBHE)** approach. In March of 2010, the researcher presented a 90-minute workshop titled "The Secret Work of Normalization" to over 300 Montessori professionals at the American Montessori Society's (AMS) National Conference in Boston. The workshop's design was based on **Neuroscience-Informed Workshop Strategies (NIWS)**. Two surveys were completed by participants immediately upon completion of the session and a post-workshop survey was completed online one month later. Results suggest that the NIWS:

- Were rated as very effective by participants
- Resulted in measurable improvements in classroom schedules
- Resulted in perceived improvements in targeted behaviors

Background

Traditional, lecture-based workshops may not meet the biological, cognitive, affective, and social (MBHE) needs of the learner.[1-4] The NIWS are based on studies of how the brain and body receive, process, act upon, and recall information (as described below).

Recognition Network—"what" is being taught[1]

Figure 1: Recognition Neural Network
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This network of lateral and posterior brain regions (see Figure 1) is used to receive and interpret input from our senses. To activate this network we can:
- Provide varied sensory input (e.g., visual, auditory, kinesthetic)
- Present the same information in different ways
- Assist learners in internalizing new perceptions (e.g., active memorization, pausing)

Strategic Network— "how" will I learn/apply it[1]

Figure 2: Strategic Neural Network
Image © CAST, 2012

These frontal brain regions (see Figure 2) are involved in performing and planning tasks (including executive functions). To activate this network, we can:
- Provide different ways that students can express and exert themselves upon what they are learning (e.g., physical action, story telling, writing, drawing, setting goals, planning projects)
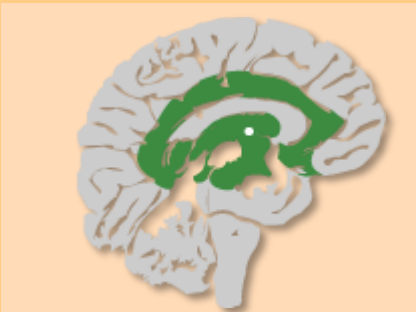
Affective Network— "why" do I care[1]

Figure 3: Affective Neural Network
Image © CAST, 2012

These medial brain regions (see Figure 3) are where we process and generate emotions. This network drives our attention.
- When people are emotionally engaged in learning, they are better able to translate that learning to real world applications.[4]
- People are more likely to remember emotional events.[5]
- Deep engagement and interest with a subject matter can empower us to overcome severe deficits or learning obstacles.[6]

Dynamic Skill Development— Advancing and Regressing[7,8]
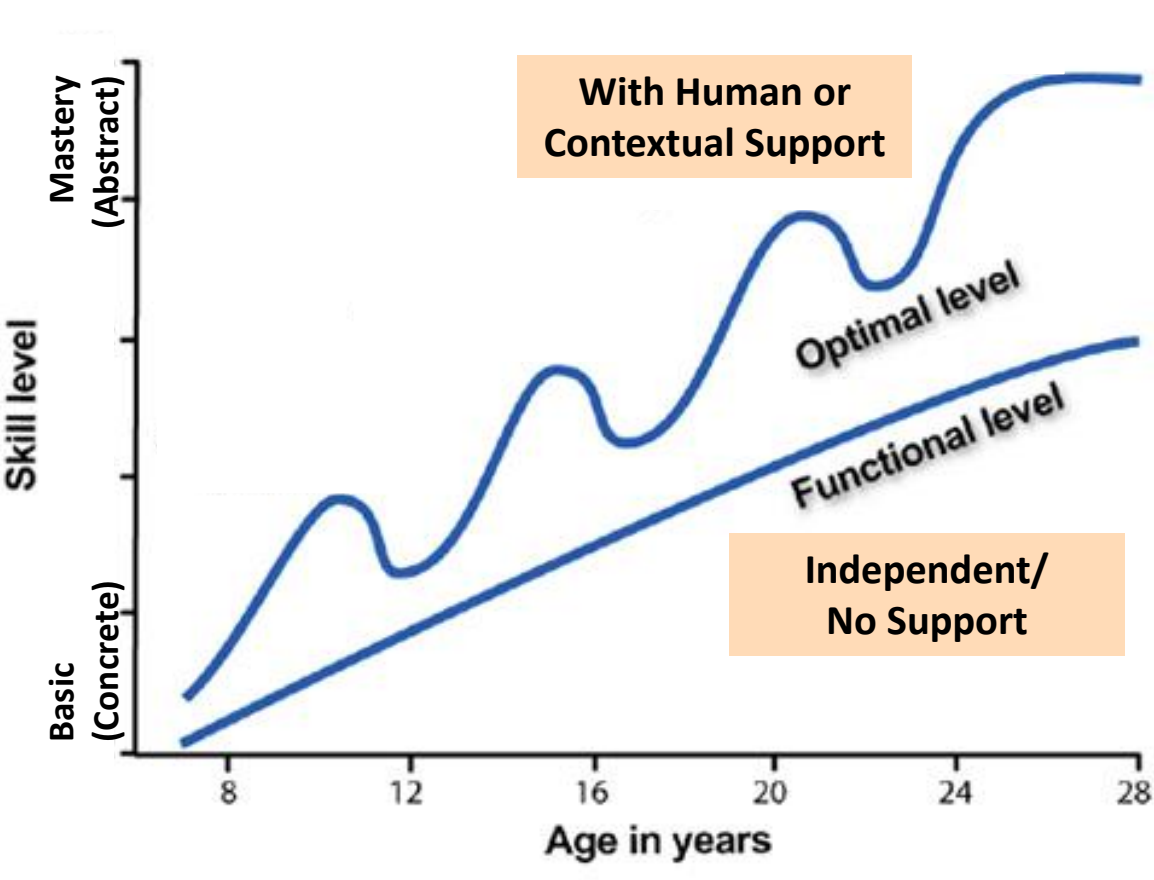
Knowledge is not linear. Over time, it is built, falls apart, and is reconstructed. This cycle of predictable advances and declines (see Figure 4) repeats until we achieve mastery. Repetition and support (e.g., from teachers, peers, books) aids in developing mastery of a topic.[3] When we are supported, performance improves. We can increase the level of support offered by allowing and encouraging learners to build peer relationships.

Figure 4: Dynamic Skill Development. When we receive support, we exhibit an optimal level of performance that shows predictable advances and declines (top, curvy line). Without support, our functional/ independent level of skill mastery appears linear and demonstrates less understanding (bottom line). (Graph adapted from Fischer & Yang[16])

Mirror Neurons—Imitation and Role Modeling[4,9,17]

When we perceive (by any sense) that someone else is doing something, the motor network in our brain becomes active in the same way as if we were doing it ourselves.[10] As such, imitation is an important aspect of learning.[17] Learning is facilitated when we demonstrate in context what we are teaching. If our actions do not match our instructions, learning is more difficult.
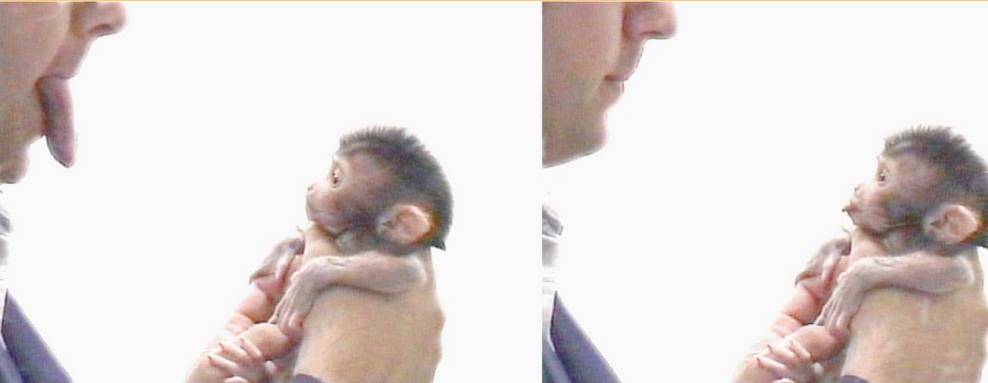
Figure 5: Mirror Neuron Activity. When this monkey sees the researcher stick out his tongue, the same areas in the monkey's brain become active as when the monkeys sticks out her own tongue. (Image: Gross, 2006.)

Methods & Materials

This study used two voluntary-response surveys administered at the end of the AMS "The Secret Work of Normalization" NIWS workshop and a third survey administered online one-month post-workshop. Approximately 300 adults attended the workshop session. A stand up poll indicated that over 95% of attendees were teachers in Montessori primary (ages 3-6) classrooms. 221 participants completed the on-site survey prepared by the researcher, 154 completed the on-site survey prepared by AMS, and 27 completed the researcher's on-line survey one-month post-workshop. The NIWS design & presentation strategies (see Table 1) were the independent variables. Participant reported workshop efficacy and behavioral and classroom changes were the dependent variables.

Table 1: *Neuroscience-Informed Workshop Strategies (NIWS) used to design the "The Secret Work of Normalization" AMS Workshop*

Workshop Strategy	Explanation	NIWS Research Area
Advanced Organizer	• At the start of the workshop, provide participants with a reference that presents and organizes key points.[12]	• Recognition Network
Meet & Greet	• Circulate around the room for the 15-minutes before the workshop start time to meet and greet participants.	• Affective Network
Photo-based Slides	• Limit text-based slides. While reading text is automatic,[14] associating a photo with a concept is not. It requires encoding and association and that improves retention.[15] Tell stories about the photos to explain your points.	• Recognition Network • Strategic Network
Presenter Experience	• The presenter should begin by describing her background, current research, and work to clarify applicability to the learner.	• Recognition Network • Affective Network
Presenter Motivation	• The presenter should tell the personal story of why she is speaking; what is her motivation/inspiration?	• Affective Network
Polling Questions	• Throughout the workshop, recognize that movement is an important component of cognition[13] and find context-based ways to allow physical activity, for example, by asking participants to stand to respond to yes or no questions.	• Strategic Network
Active Memorization[1]	• Repeat key concepts and quiz the learners by asking questions that encourage them to tell you what you just told them.	• Strategic Network
Storytelling	• Tell engaging, true stories demonstrating the value, efficacy, and beauty of the concepts being taught.	• Affective Network
Positive, Inspirational Stories	• When a person feels admiration for another, they gain access to more areas of the brain.[11] • People who have experienced maltreatment and negative emotional experience may develop a negativity orientation. Their attention is drawn towards negative situations and away from positive ones.[16] Ongoing optimism can be applied to remedy this and develop a positivity orientation.	• Affective Network
Be What You Hope to See	• Physically model the words, movements, and posture (e.g., teaching techniques) being taught. • Tell stories that create a visual image of each teaching point in action including the exact words, tone, inflection, and physical postures recommended.	• Strategic Network • Mirror Neurons
Opportunities for Self-Construction of Knowledge	• Give participants a turn to try what you've just demonstrated to allow for immediate application. • Ask open-ended questions that require conceptual processing like, "Does that make sense?" and pause to allow time for processing and response. • Provide follow-up reminders of the workshop content (e.g., post-workshop survey).	• Strategic Network • Dynamic Skill Development
Building Relationship Among Participants	• Ask polling questions throughout the workshop where participants "stand up" for a yes and then look around and see who is standing. This creates a visual representation of the expertise in the room and, thus, opens up the possibility of participants making connections and, then, sharing their own stories. • Recruit volunteers to aid in demonstrations. • Regularly refer back to earlier points not only to create a repetition effect, but also to create the group's larger story. • Encourage participants to set up email lists to provide ongoing peer support after the workshop.	• Affective Network • Dynamic Skill Development

Results

Efficacy Ratings: Participants rated the NIWS as presented in the "Secret Work of Normalization" AMS workshop as excellent and highly effective on two separate scales (see Figures 6 and 7). The vast majority of respondents to the AMS survey noted that they wanted to hear the speaker again (94%; 130 out of 139 responses) and that they learned something they would apply (99%; 139 out of 141 responses).

Figure 6: NIWS Efficacy Rating from the researcher's on-site survey (visual analog scale)

1 Not Effective — Mean 98 — 114 Very Effective

Figure 7: NIWS Efficacy Rating from the on-site AMS survey

| 1 Poor | 2 Fair | 3 Good | Mean 3.8 | 4 Excellent |

Improvements in Classroom Schedules: The workshop recommended that teachers: (1) decrease or eliminate the amount of circle time; and (2) increase the work cycle to as close to 3-hours as possible. The results of the one-month follow-up survey indicate that both of these changes were implemented to some extent. Specifically, the survey found a 9% (11-minute) overall increase in mean work cycle length (see Figure 8) and a 30% (5-minute) overall decrease in mean circle time (see Figure 9).

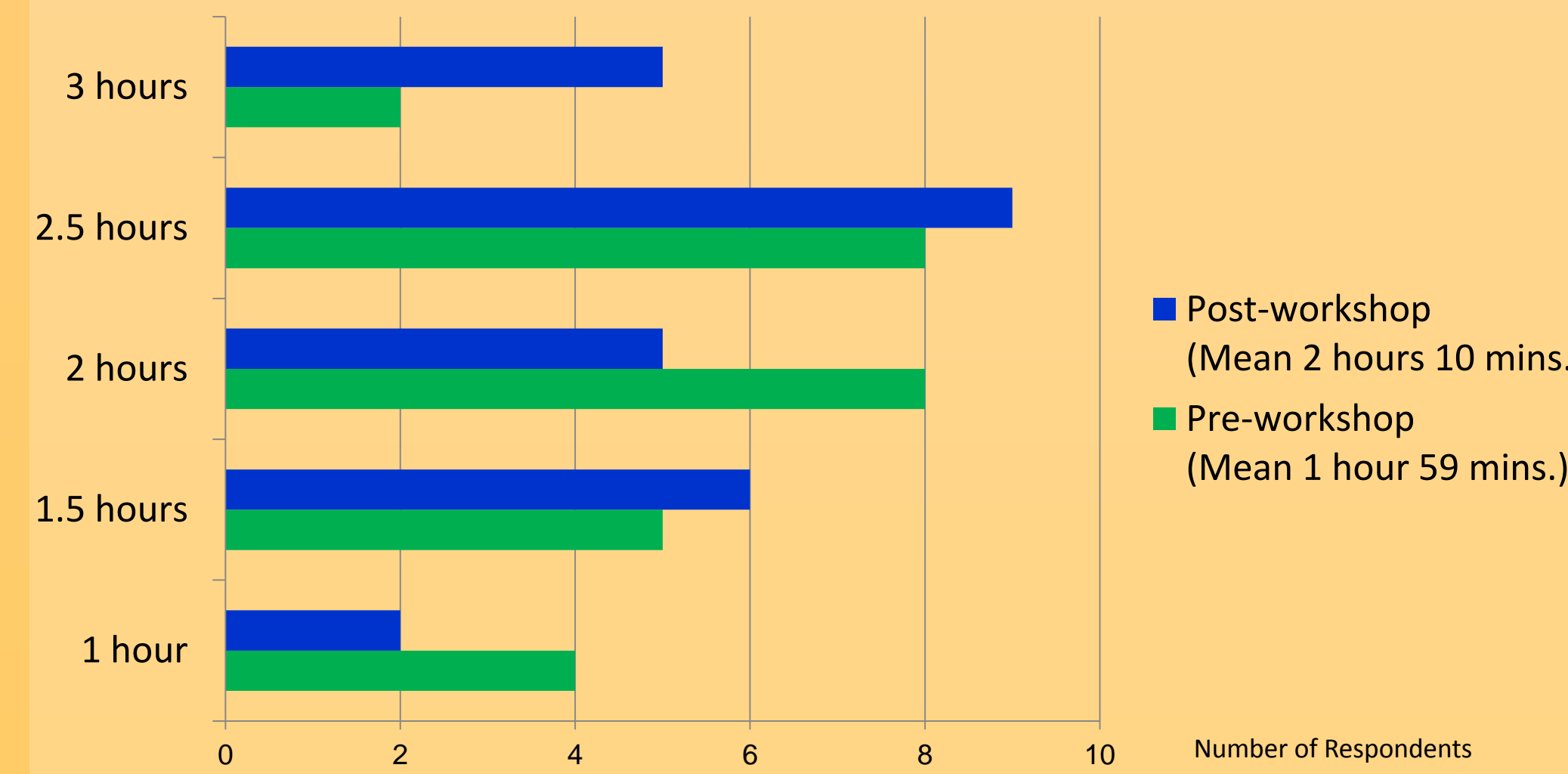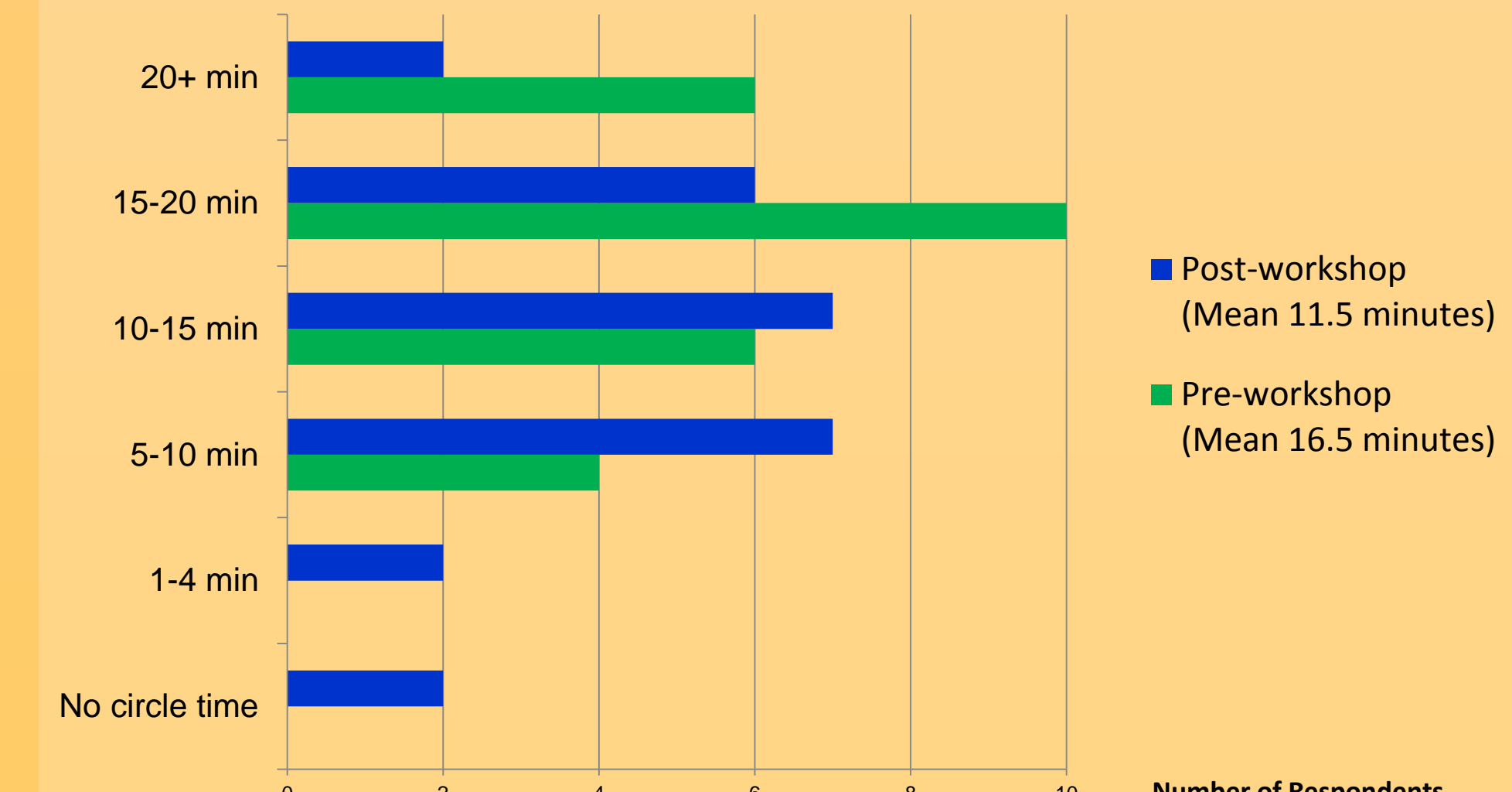*Figure 8: Improvements in length of work cycle one-month post-workshop— 9% increase in mean*

Post-workshop (Mean 2 hours 10 mins.)
Pre-workshop (Mean 1 hour 59 mins.)

Figure 9: Improvements in length of circle time one-month post-workshop— 30% decrease in mean

Post-workshop (Mean 11.5 minutes)
Pre-workshop (Mean 16.5 minutes)

Results (cont'd)

Improvements in Teacher Behavior: In the on-site research survey, all respondents reported an intention to change their teaching behaviors based on the workshop presentation. In the one-month post-workshop survey, participants reported significant improvements in the occurrence of targeted behaviors (see Figure 10).

Figure 10: Percent of respondents noting improvements in selected target behaviors one-month post-NIWS workshop
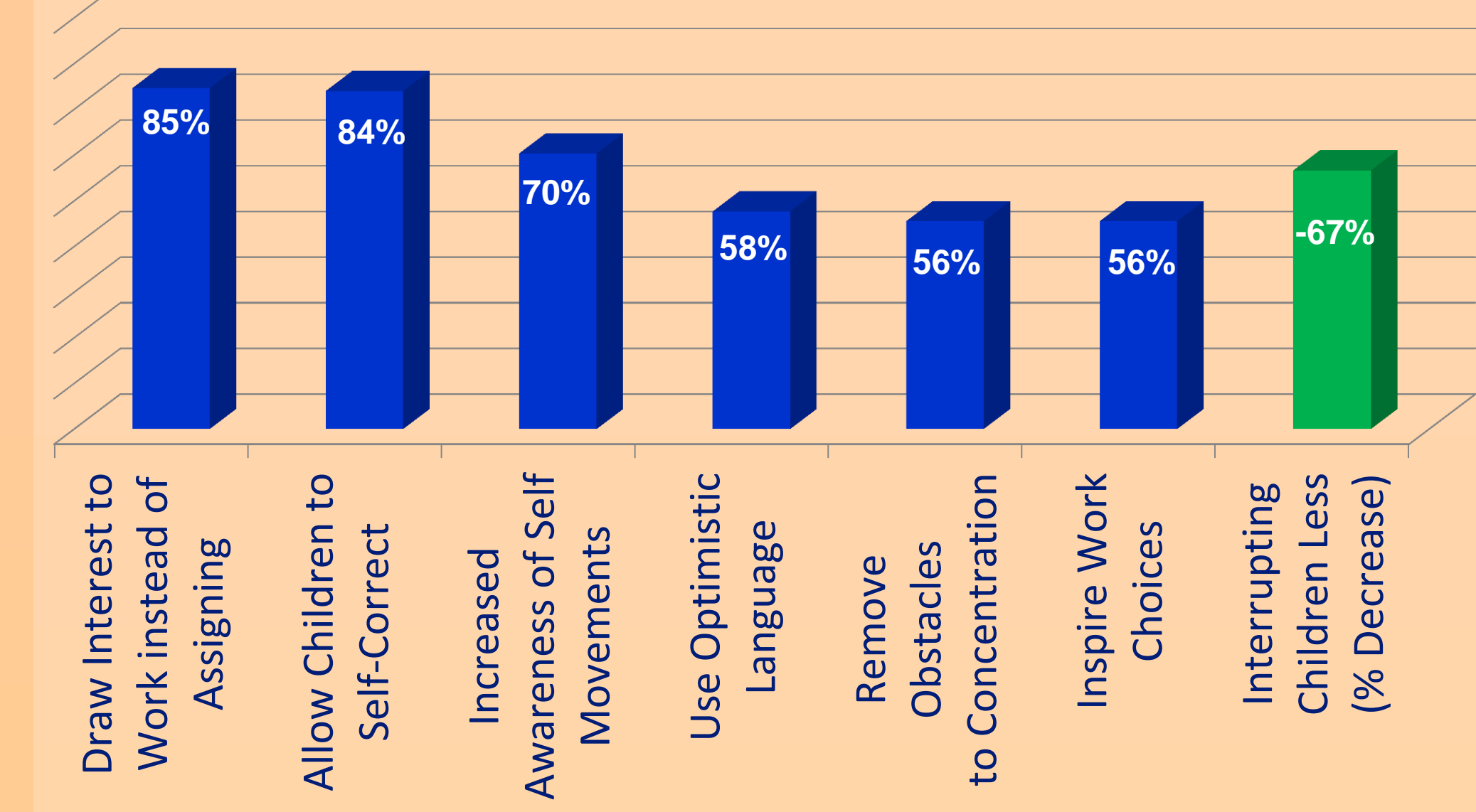
Discussion

The results suggest that the neuroscience-informed workshop (NIWS) was an effective method of adult education. While a learner's enjoyment of a learning experience does not necessarily correlate with the teaching's effectiveness,[5] the high efficacy ratings indicate that the participants felt their time was well-spent and worthwhile.

- *In school settings, cultivating this type of attitude among parents and staff could be particularly important for ongoing parental involvement and staff retention.*

Further, a majority of participants reported that they were implementing key strategies more after the workshop than before and that they had made changes to the daily schedule based on workshop recommendations.

- *School administrators who wish to implement school-wide changes across classrooms may benefit from structuring their staff presentations and professional development sessions following these guidelines.*

Future studies to validate these findings should include random assignment to either a control group (receiving the teachings according to traditional, lecture-based methods) or the study group. Ideally, the same information would be presented in both formats by several different presenters to control for presenter style as a variable. Further, the target population could be expanded to other professions.

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Acknowledgements