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[Interactive Version of Mathematical Reasoning Analysis Tool¹ for K-12 Teachers to Analyze and Improve Students Mathematics Language and Explanations](#)

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tiny.cc/williamspractical is a link to this document.

(Disclaimer: This document is a recently created rough draft and needs substantial improvements and updates, but is made available to provide some illustrative practical examples of online educational resources I've developed in trying to link research and practice).

Integrative Application Paper

Williams, J.J. (2013). *Applying Cognitive Science to Online Learning*. *Data Driven Education Workshop at NIPS, MOOCshop workshop at AIED*.

Presents application of research on prompting with questions or explanations, to [online videos](#) and [exercises](#) – relevant to Lessons/Videos & Mathematics Exercises below.

Lessons/Videos in MOOCs

- **Content Creation:** Using website and Google Documents to allow real-time access to slides, presentation, collaborative note-taking: tiny.cc/lyticsseminar
- **Augmentation:** How general question prompts can be added to encourage reflection: tiny.cc/augmentedvideo [Pre-Video Prompts to consider while watching video](#)

Mathematics Exercises (Khan Academy)

All of these demos illustrate practical math exercises and content I have created or improved while doing work that combined research and practical insights and goals.

- **Content Creation:** Original Math Exercises I developed with collaborators, accompanied by analyses of what makes good/bad Math Exercises & Videos: tiny.cc/khanexamples
- **Adding Prompts to Explain.** Adding Prompts to Explain to Online Math Exercises tiny.cc/augmentedexercise (Williams, 2013; Williams & Lombrozo, 2010)
- **Step-by-Step Prompts to Explain + On-Demand “Instructional” Explanations.** Showing definitions of key terms on mouseover, showing answers to explanations in drop-down text upon clicking. tiny.cc/khanexercise1
- **Allow students to Ask & Get Answers concerning Frequent Questions/Key Misconceptions.** Allowing students to have additional questions answered upon reading each new hint or line of the solution. tiny.cc/clickablequestions

- **Post-Problem Prompts to Explain + Provision of Instructional Explanations + Request to Compare Self-Generated & Instructional Explanations.** This demonstration shows the complete (and rapid) [re-implementation of Khan Academy exercise dynamics into Qualtrics](#), offering new pedagogical flexibility in personalization, and excellent instrumentation and collection of data for research purposes. (Williams & Poldsam, 2013)

General Instructional Principles tested in Randomized Experiments

- Benefits of motivational messages in learning from Khan Academy mathematics exercises. tiny.cc/kamindset vs. tiny.cc/kapositive vs. tiny.cc/kamindsetcon
- Benefits of embedding unobtrusive hyperlinks that provide on-demand instruction about general metacognitive self-questioning strategies for Problem Solving (tiny.cc/whatwhyhow2), Reflecting on Meaning (tiny.cc/whatwhyhow). These were compared to “Control Conditions” of Writing out Thoughts (tiny.cc/writethoughts) and typical exercises without any links (tiny.cc/practiceasusual).

Cognitive Support instructional modules for psychotherapists to improve learning of therapy concepts

- [Add]

Example Application of *Cognitive Support* - Instructional Design Principles based on Cognitive Science Experiments

- [Augmentation of Growth Mindset article](#)

Cognitive Support Rating Scale (CSRS) - Instrument for measuring the extent to which an instructor, tutor, or online resource uses evidence-based CS principles

- [Request Access]

Motivational Videos & Text Lessons to promote belief that intelligence is malleable

Condensed Growth Mindset Intervention relevant from PERTS:

- [Animated Video](#) Explaining that Intelligence is Malleable ([text script for video](#))
- [Powerpoint Slideshow Video](#) Explaining that Intelligence is Malleable ([script](#), [slides](#))
 - (Control Condition [Powerpoint Slide Show Video](#) Explaining how the brain works. It is matched in length, format, discussion of brain) ([script](#), [slides](#))

MOOC Growth Mindset & Belonging Interventions by Instructors:

- Growth Mindset video by Course Instructor [to be added] [script]
- Growth Mindset video by Generic Instructor
- Belonging video
- News Article [to be added]

- Blog Posts [to be added]
- [Newspaper Article Mindset Intervention adapted to add Cognitive Support](#)
- [Interactive Online Tool for encouraging a Growth Mindset](#)

[Worksheet for Instructors on how to foster a Growth Mindset](#)

tiny.cc/idstrategy mindset

Modules/MOOClets to improve Motivation & Study Strategies

Designed so they can be drag-and-drop into a range of courses.

- Explains overall point of Modular MOOClets on Motivation and Learning Strategies that can be readily used cross- course: tiny.cc/mm gdoc
- Rough Draft of Lessons explaining key concepts: tiny.cc/mmdemo lesson
- Rough Draft of Interactive Tool for participants to put key concepts into practice: tiny.cc/mmdemo tool
- “Learning Assistant” prototype that is simpler, integrates lesson and tool into one: tiny.cc/learning assistant

Open Learning Initiative module on the Reflective Questions Strategy

tiny.cc/williams demos

Interactive Online Tools for students to use to put ideas into practice

Keeping Engaged Tool - available on request for students to express plans and keep engaged

tiny.cc/keeping engaged

Study Strategy Tips for Videos and Problems (Biochemistry course)

Pre-Course Survey Interventions on Planning and Goal Setting

Motivation Tool - encourage students to re-appraise judgments and adopt a Growth Mindset in interpreting their experience

Go to tiny.cc/learning assistant and then to the “Coach-Growth Mindset” section

Learning Strategy Tool

- tiny.cc/mmdemo tool is a Rough Draft of Interactive Tool for participants to put key concepts into practice, which come from the lessons tiny.cc/mmdemo lesson

tiny.cc/williamspractical

Management Workshop Tool & Lasting Digital Resources for Applying Lessons like Negotiation to everyday life

tiny.cc/managementmatterstoolkit

tiny.cc/managementmatterstool

Interactive Khan Academy Learning Coach embedded in Mathematics Problems

tiny.cc/kalearningcoach

Interactive & Data Collecting Version of the Conversation Analysis Tool¹ to help K-12 Teachers Analyze & Improve Student Peer-to-Peer Conversations as required by Common Core

Tool as implemented in the Professional Development MOOC offered on NovoEd - tiny.cc/icat

Tool as a stand-alone resource: tiny.cc/icatdirect

Interactive Version of Mathematical Reasoning Analysis Tool¹ for K-12 Teachers to Analyze and Improve Students Mathematics Language and Explanations

Tool in the Professional Development MOOC offered on NovoEd - tiny.cc/mrat

Tool as a stand-alone resource: tiny.cc/mratdirect

Cognitive Aid/Digital Coach/Prompter/Electronic Performance Support System

tiny.cc/cbtcoach

Identified system for coordinated use of free, simple products for rapid authoring of online course websites

tiny.cc/adaptinggooglesites

Digital Support for a Research Community/Collaborative

www.learnnetwork.net

¹ The original paper & PDF worksheet was created by Sara Rutherford-Quach, Kenji Hakuta, and other members of the Understanding Language group at Stanford's Graduate School of Education

Preserving In-Person Instruction/Workshop in Digital Format

tiny.cc/learnlab2013

Applying Research to Practical Resources

Created worksheet guide for instructors/designers to apply research on motivation to MOOCs.

[\[Request Access\]](#)

Recordings and Digital Resources

Featured presentation & panel at the Special Interest Group on Computer and Internet Applications in Education, Annual Meeting of the American Educational Research Association ([Blog Post](#), [Summary and More Information](#))