



Web-Based Instruction: Design and Technical Issues which Influence Training Effectiveness

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Overview

- Examine relative effectiveness of Web-based instruction (WBI) and blended learning (BL) to classroom (CI) instruction
- Provide recommendations for designing more effective WBI
- Investigate effect of an intervention to increase learning in WBI
- Study the effect of technical glitches on learning and attrition





Purpose of Meta-Analysis

- Compare WBI and BL to CI in terms of their effectiveness for teaching declarative and procedural knowledge
- Examine training design characteristics which influence the effectiveness of WBI





Participant Demographics

- 208 training courses
 - 143 undergraduate courses
 - 34 graduate courses
 - 31 corporate training courses
- 26,460 trainees
- Average age = 25 years old





Analyses

- Hedges and Olkin's (1985) procedure → mean corrected d effect
 - $d > 0$ indicates WBI is more effective than CI
 - $d = 0$ indicates WBI and CI are equally effective
 - $d < 0$ indicates CI is more effective than WBI

Do students learn more in Web-based or classroom instruction?





Web-Based Instruction

- Declarative knowledge $d = .09^*$
 - WBI is 4% more effective than CI for teaching declarative knowledge
- Procedural knowledge $d = -.06$
 - WBI and CI are equally effective for teaching procedural knowledge





Blended Learning Courses

- Declarative knowledge $d = .29^*$
 - BL is 11% more effective than CI for teaching declarative knowledge
- Procedural knowledge $d = .29^*$
 - BL is 11% more effective than CI for teaching procedural knowledge





Delivery Media vs. Instructional Methods

- Delivery media include CI, computer-assisted instruction, WBI, etc.
- Instructional methods include lecture, practice, discussion, assignments, etc.

Do instructional methods or delivery media have a larger effect on learning outcomes?





Comparing Instructional Methods

- Same instructional methods in WBI and CI
 - $d = .00$
 - WBI and CI are equally effective
- Different instructional methods in WBI and CI
 - $d = .27^*$
 - WBI was 11% more effective than CI

Instructional methods rather than delivery
media predict learning outcomes





Designing Effective Web-Based Courses

- Looked across the studies to identify characteristics of the most effective Web-based courses
- Results from these analyses suggested six actionable lessons





Lesson 1: Provide Trainees with Control Over Instruction

- Learner-controlled environments allow trainees customize their learning experience by spending as much time as they want or need to learn the material
- Providing trainees with control encourages them to take responsibility for their learning and accommodates differences in prior knowledge and aptitude





Lesson 2: Provide Practice and Feedback

- Practice is essential for skill acquisition and trainees need feedback to know whether they are effectively using their newly acquired knowledge and skills
- One of the benefits of WBI is the ability to incorporate a opportunities for practice (e.g., assignments and practice tests) and receive immediate feedback





Lesson 3: Require Trainees to be Active

- Trainees are active when they ask questions, collaborate with others, discuss training content, or complete exercises and are inactive when listening to lectures or reading
- Instructors should look for ways to incorporate active learning into the course by including tutorials and collaborative activities to keep trainees engaged





Lesson 4: Incorporate a Variety of Instructional Methods

- One of the benefits of Web-based instruction is the ability to incorporate a variety of instructional methods (e.g., online lectures, tutorials, discussion boards, online readings)
- Incorporating a variety of instructional methods allows trainees to tailor the course to be consistent with their learning styles





Lesson 5: Incorporate Synchronous Communication

- Include opportunities for synchronous communication—communication that occurs in real time (e.g., instant messaging, voice chat)
- Synchronous communication reduces frustration from lengthy time delays between asking a question and receiving a response





Lesson 6: Provide an Internet Skills Course

- Some trainees may not have the computer and Internet skills that are required to navigate Web-based training courses
- Offering computer and Internet skills courses can help ensure that all trainees have the requisite skills to succeed in a Web-based training environment





Examining Time to Train

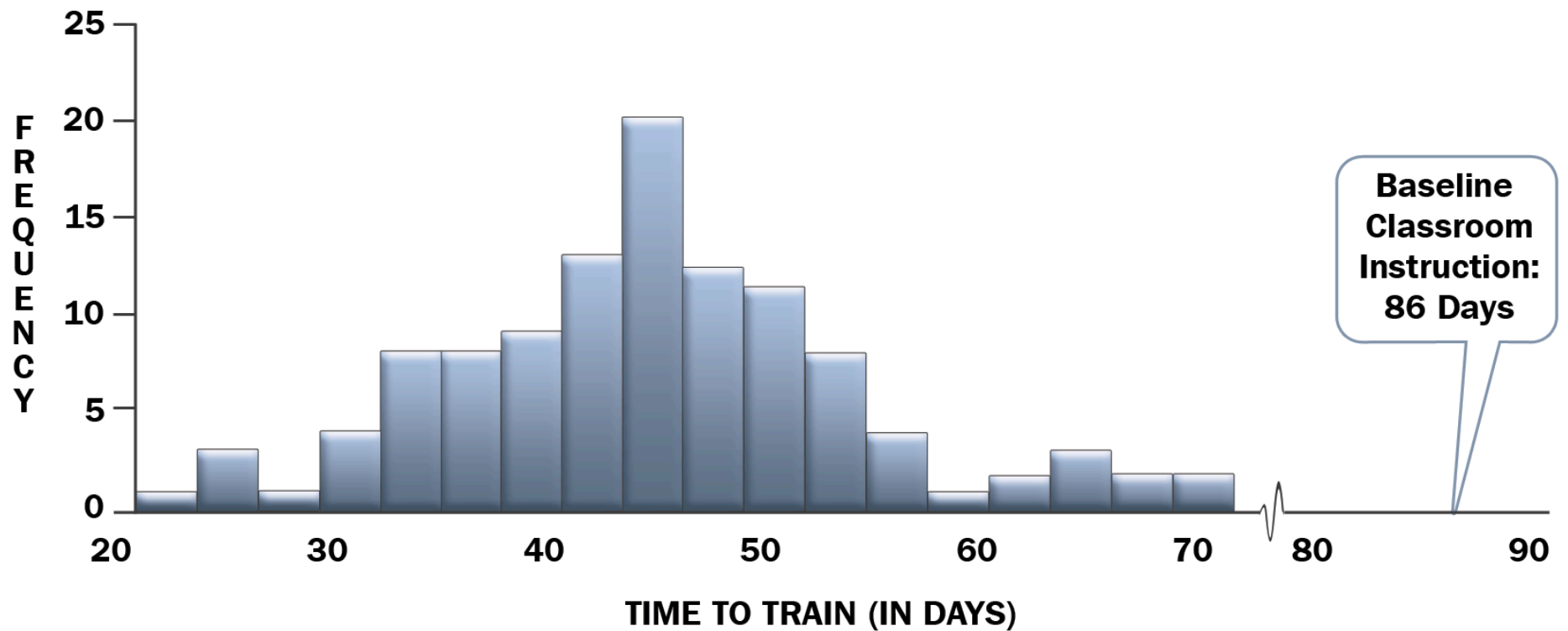
- Goal is to examine the amount of time trainees spent in a self-paced training course
- 111 trainees going through occupational training consisting of 33 self-paced modules
- To advance to the next module trainees had to pass an exam

Classroom instruction lasted 86 days, on average how long did it take trainees to complete in Web-based instruction?





Variability in Time to Train





Metrics: Time to Train

- Classroom time was 86 days, the average time in Web-based instruction was 45 days, a 48% reduction in time
- Although there was great variability in time to train (from 21 to 72 days), reductions in time to train did not reduce knowledge levels

Result: With online, self-paced instruction, students can train at their own pace and still master the material





SOMETIMES WE JUST NEED REMINDERS



Self-Regulation

- Self-regulation is a process that enables individuals to guide their goal-directed activities over time and across changing circumstances
- Iterative process with a gradual effect on learning over time





Self-Regulation Prompts

Am I concentrating on learning the training material?

Do I need to continue to review before taking the final exam?





Self-Regulation Prompts

Am I setting learning goals to ensure I have a thorough understanding of the training material?

Do I understand all of the key points of the training material?





Self-Regulation Conditions

- Continuous self-regulation
 - Prompt self-regulation throughout the entire course
- Delayed self-regulation
 - Prompt self-regulation in the latter half of the course
- Control
 - Do not prompt self-regulation





Multiple Studies

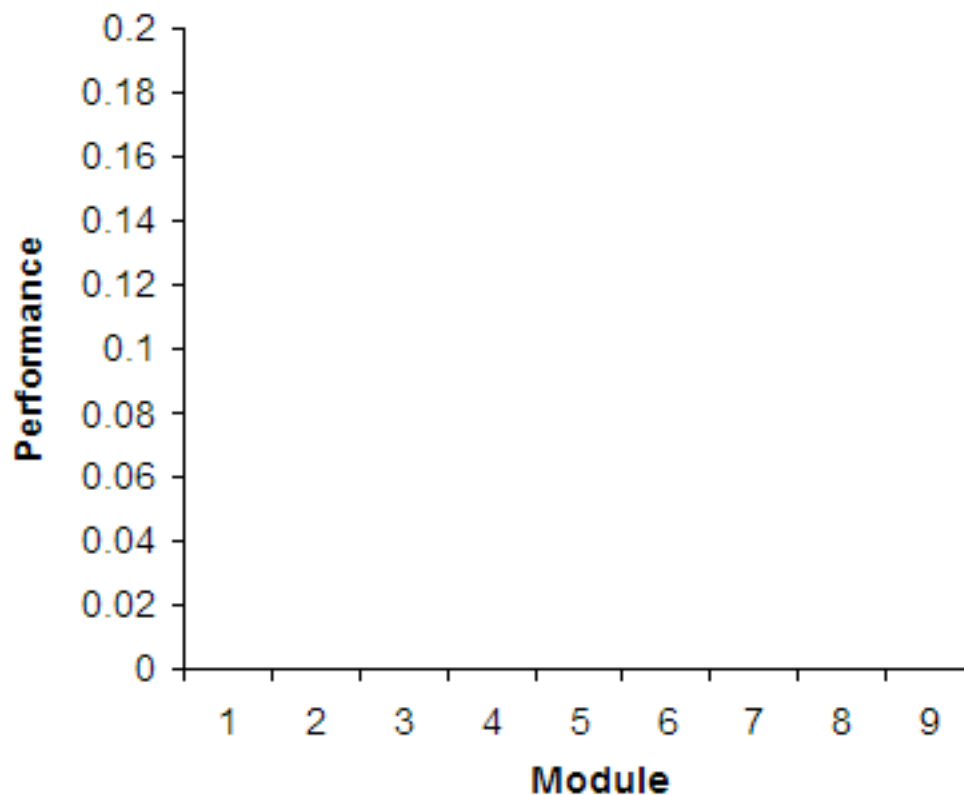
- Study 1
 - Online training course on Blackboard LMS
 - 93 trainees; Average age = 44 years
- Study 2
 - TANDEM, a PC-based radar-tracking simulation
 - 171 undergraduates; Average age = 19 years
- Study 3
 - Online training course on Microsoft Excel
 - 479 trainees; Average age = 42 years





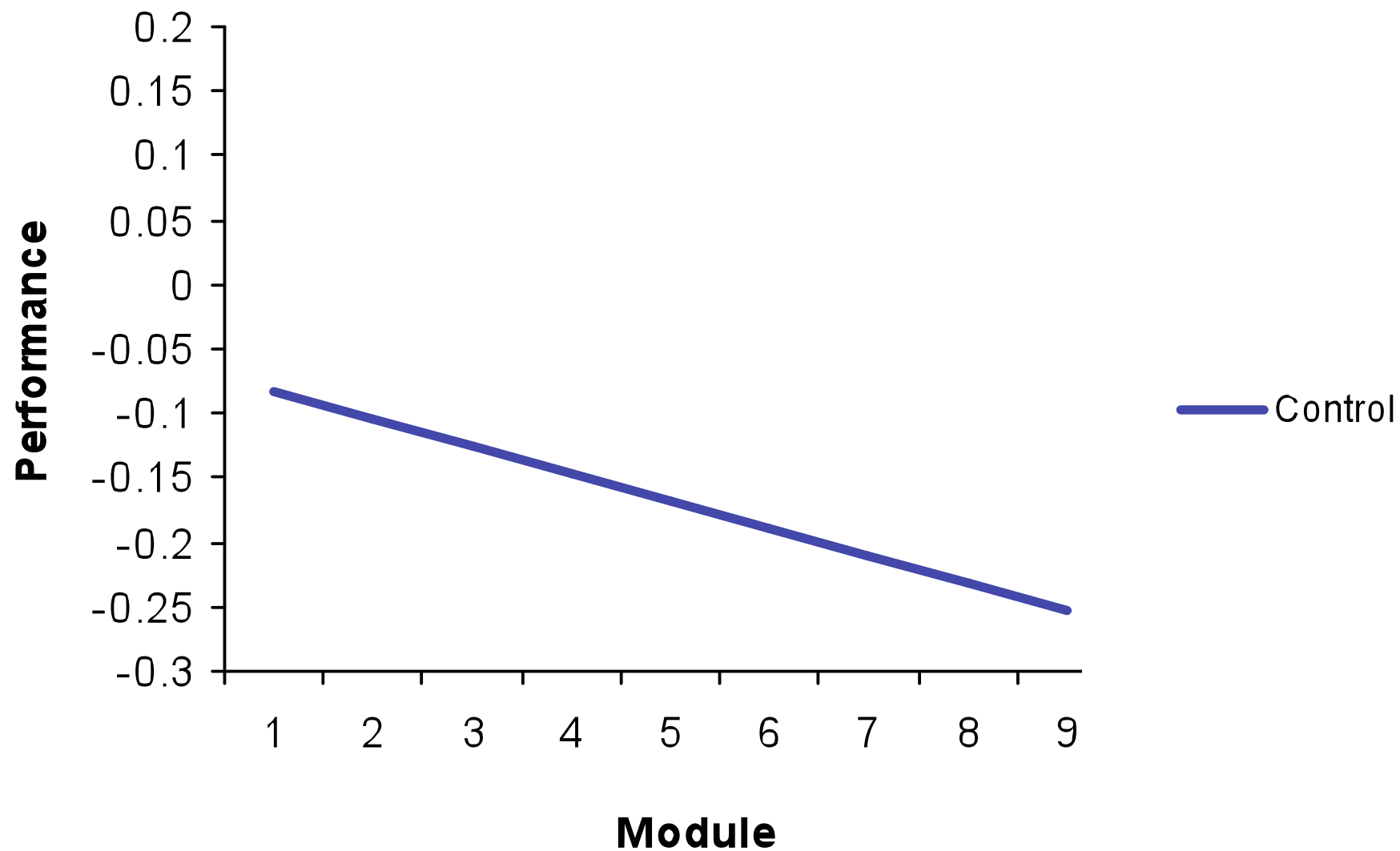
Method

- Examine changes in performance over time
- Standardized test scores



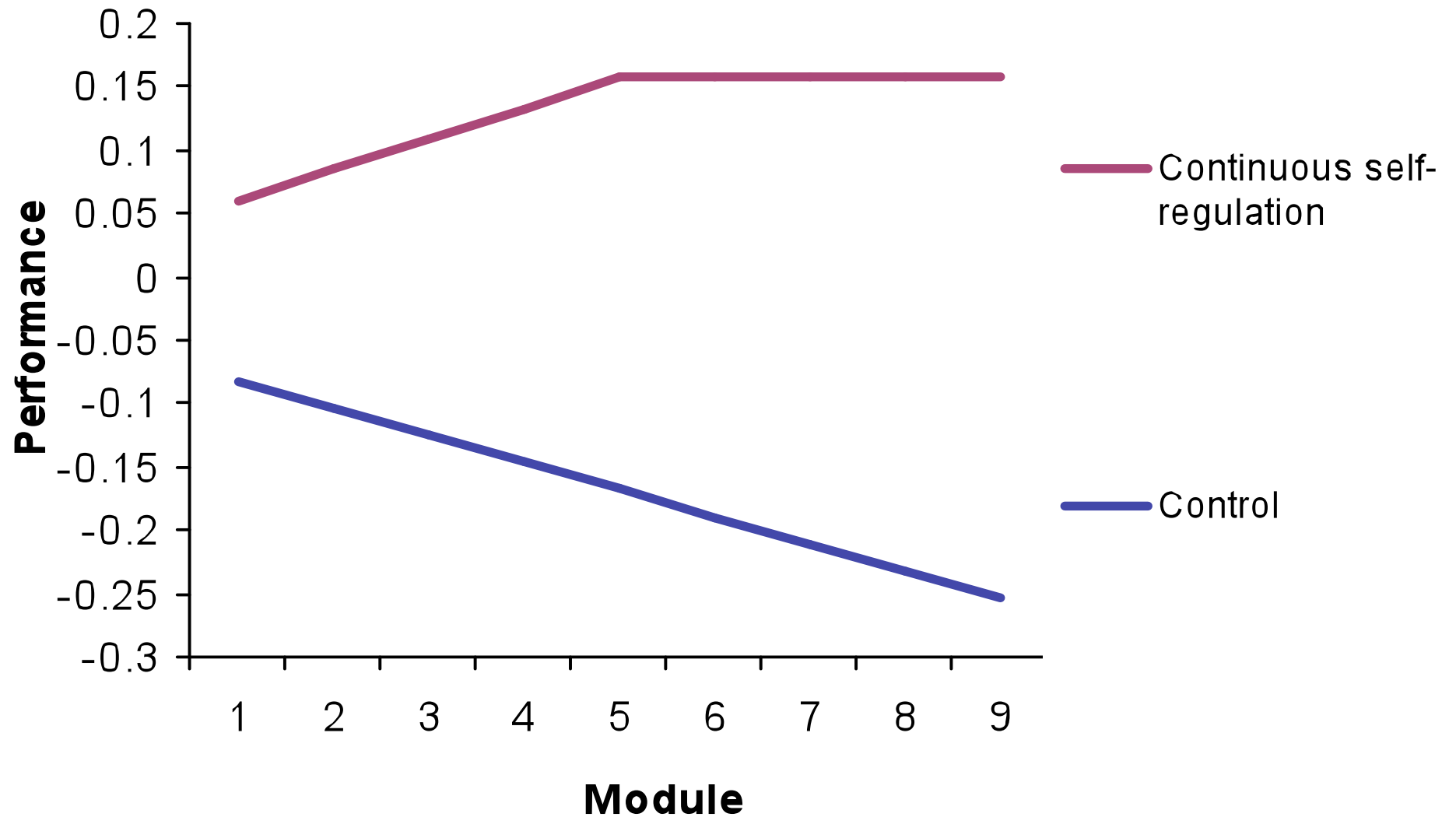


Learning Results



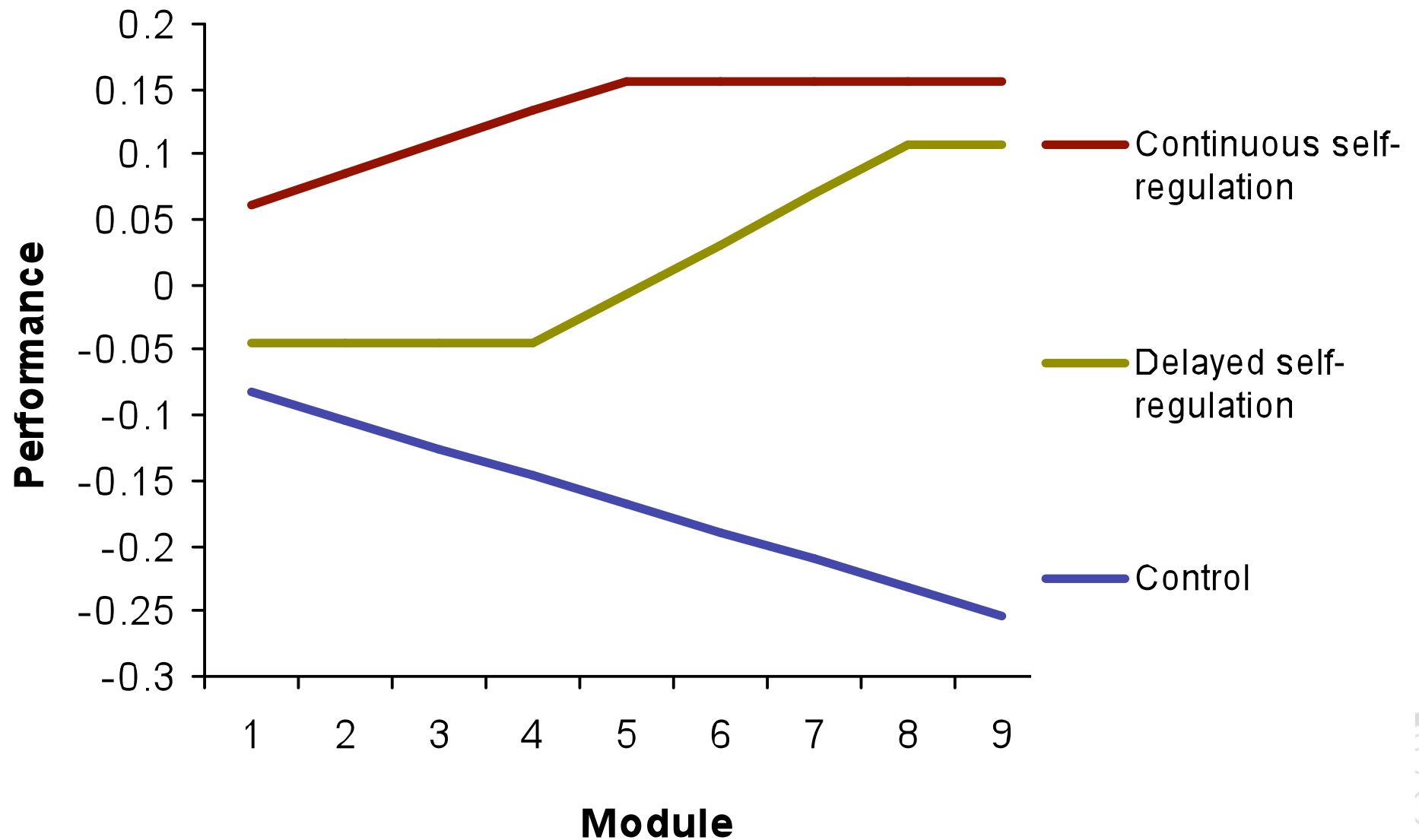


Learning Results





Learning Results





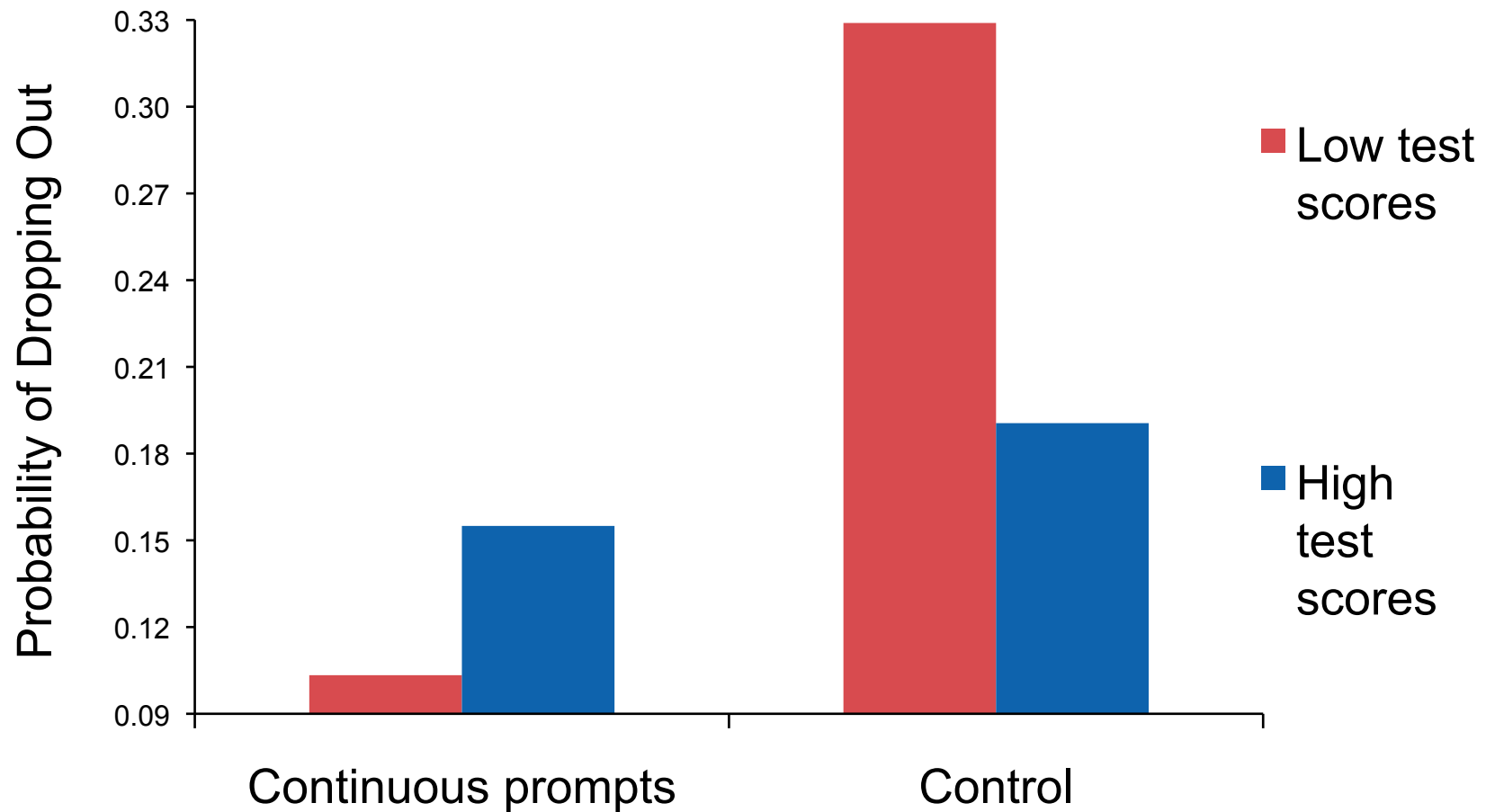
Predicting Attrition

- Prompting self-regulation resulted in a 17 percentage point reduction in attrition
- Trainees were less likely to drop out following poor performance when they were prompted to self-regulate





Predicting Attrition





Conclusions

- Adults are capable of managing their own learning when they receive reminders to self-regulate
- Prompting self-regulation is a no-cost intervention that enhances learning and reduces attrition
- Can be incorporated in any Web-based training course





- I'll have that for you right away



Interruptions in Training

- Interruptions are an externally generated, randomly occurring, discrete event that breaks continuity of cognitive focus on a primary task
- Interruptions may be problematic in Web-based training



Technology

is a queer thing.

It brings you great gifts
with one hand...

...and **stabs** you in
the back with the
other!



C.P. Snow, *New York Times*, March 15, 1971



Technical Difficulties in Training

- Technical difficulties refer to interruptions individuals encounter when interfacing with technology
 - Low bandwidth
 - Incorrect configurations
 - Error messages
- Current study examines the effect of technical difficulties on:
 - Learning
 - Attrition





Participants

- 530 adult trainees
- 75% were employed full or part-time
- 52% had a bachelor's or more advanced degree
- 69% female
- Average age = 41 years

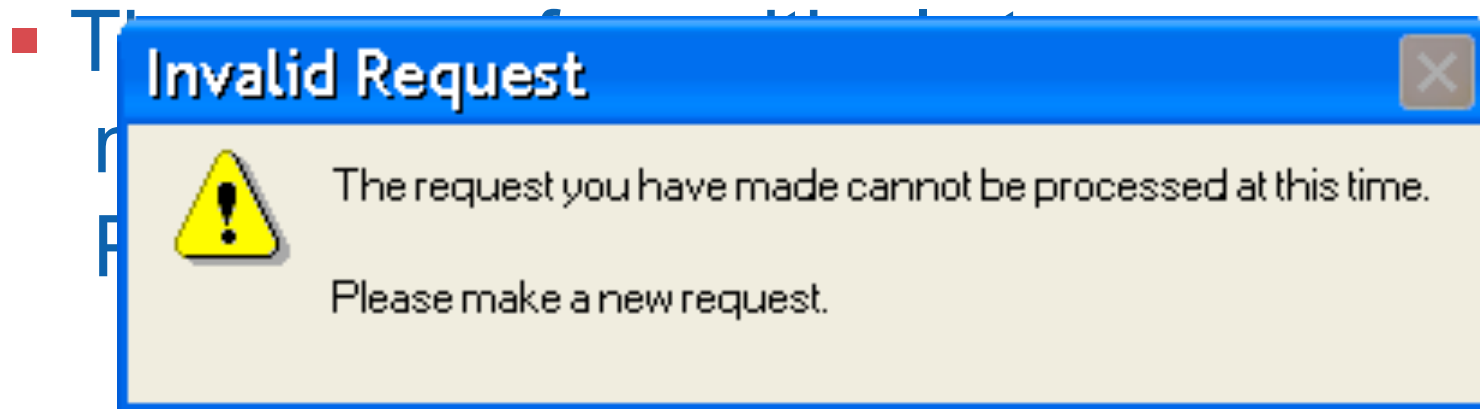




Research Methodology

- Training
 - 5 hour course on Microsoft Excel
 - 4 online modules
 - Measured learning at the end of each module
- Randomly assigned trainees to experimental conditions
 - Conditions differed in terms of the number of modules and the pattern of which of the 4 modules contained error messages







Authorization Error



You currently are not authorized to access this information.





Attrition

- Only 19% of trainees who started the training completed the course
- Results are consistent with previous research indicating attrition is problematic in Web-based training





Predicting Attrition

- Technical difficulties
 - Resulted in a 10 percentage point increase in the attrition rate in the first training module
 - Did not predict attrition in later modules
- Test scores
 - Predicted attrition in modules 2-4
 - Attrition was 18 percentage points higher for trainees with low test scores in the previous module





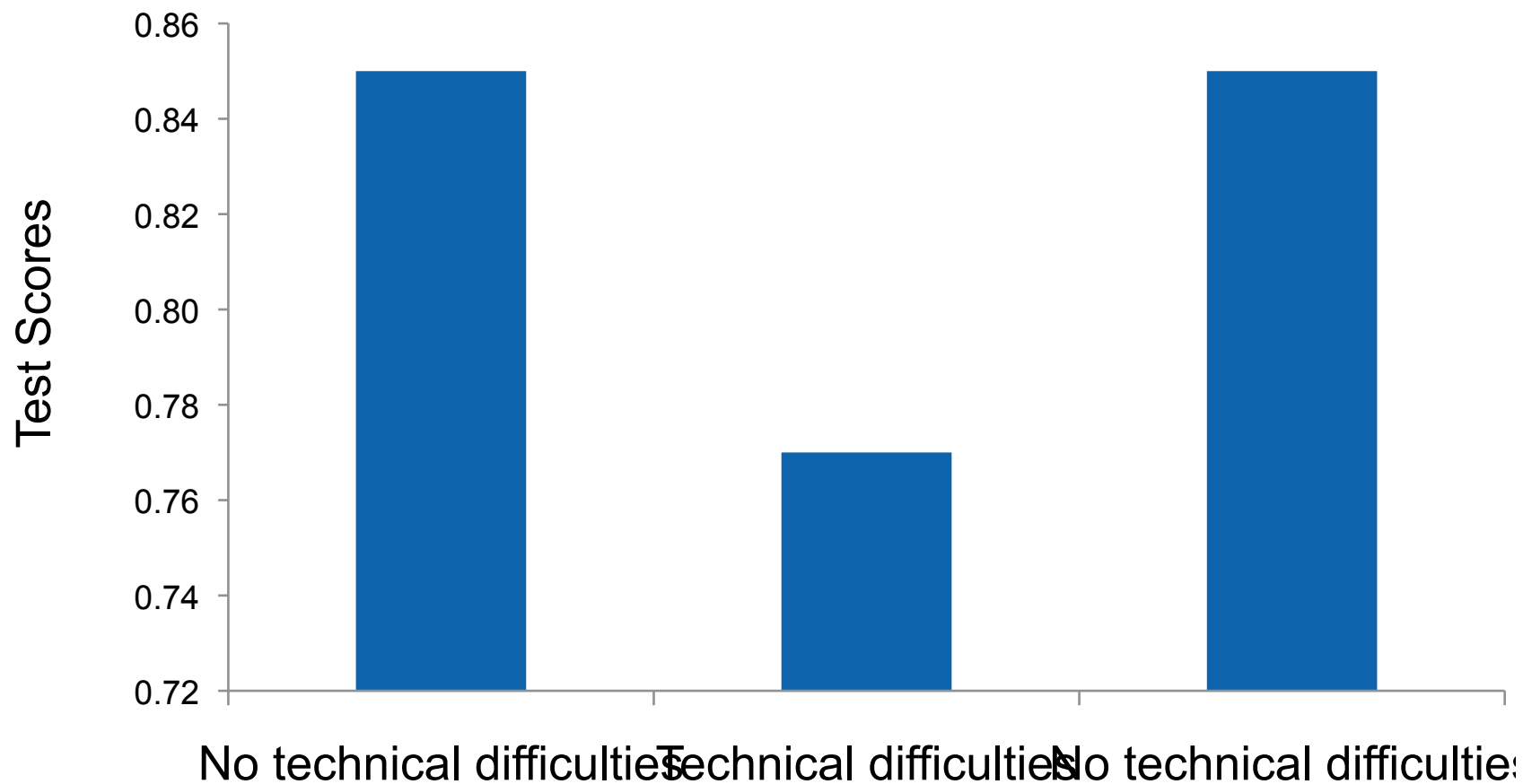
Predicting Learning

- Test scores were 7 percentage points lower in modules with technical difficulties



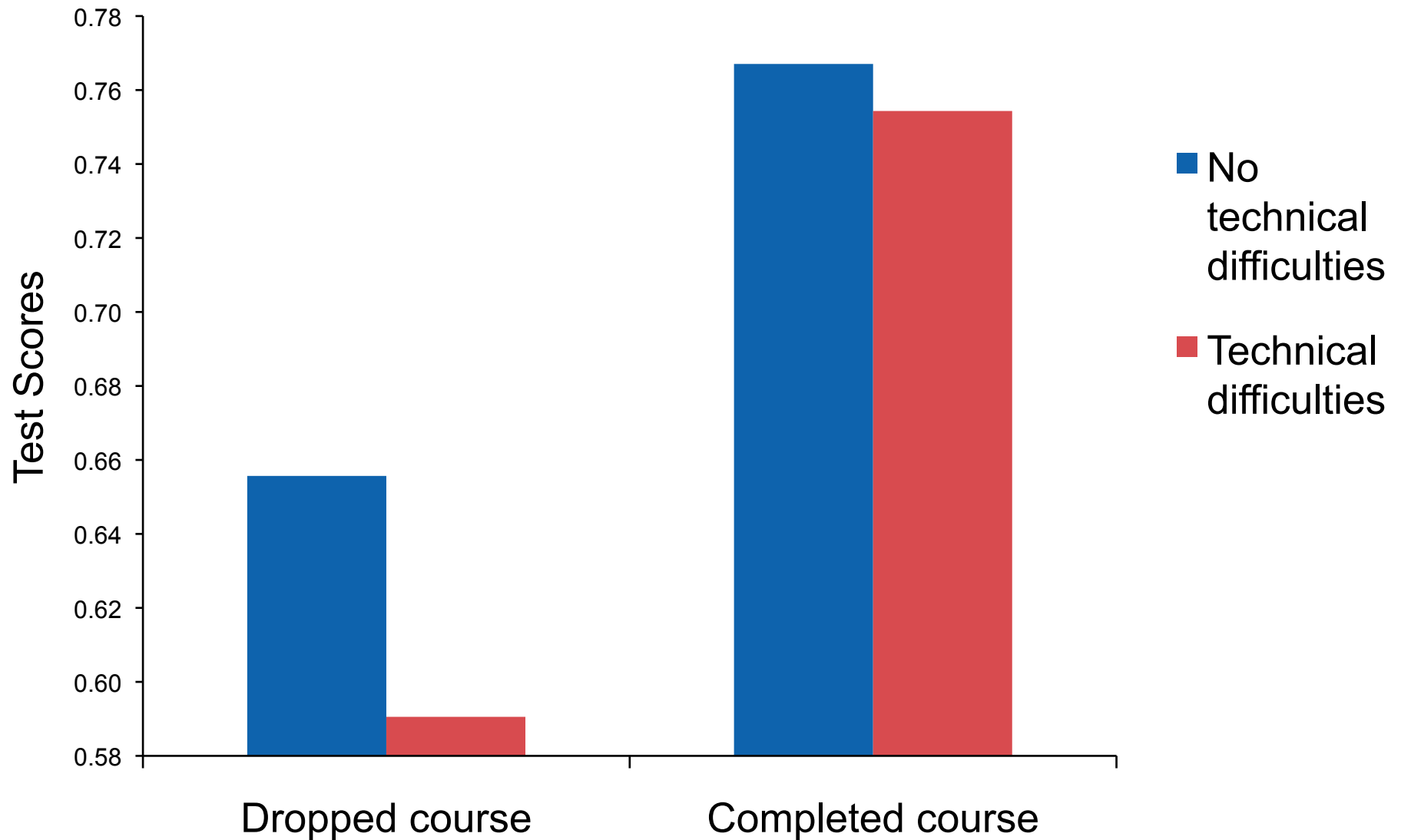


Lois Lane's Performance





Predicting Learning





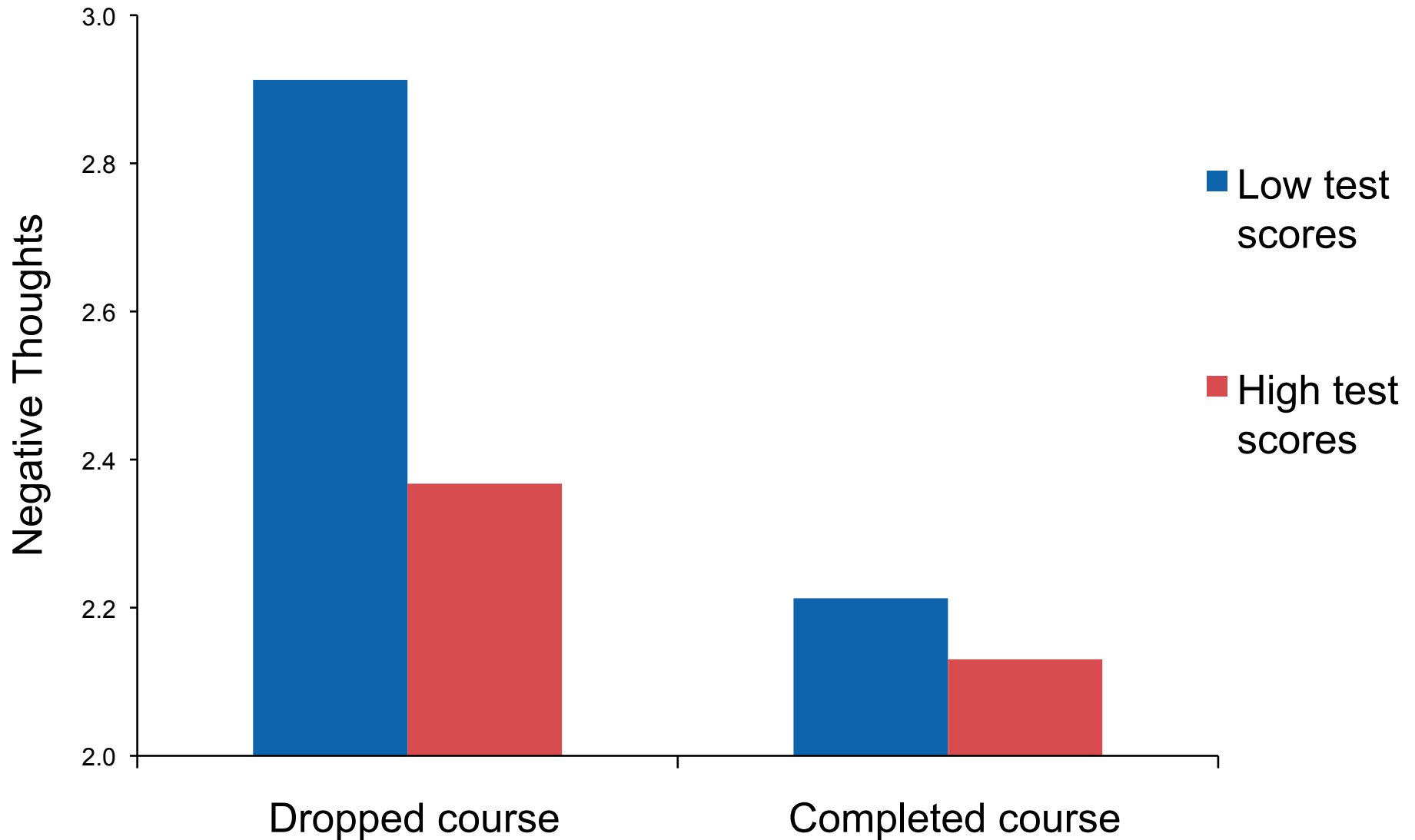
Negative Thoughts and Learning

- Cyclical relationship
- Negative thoughts impaired learning
 - For every one-point increase in negative thoughts, test scores were 7 percentage points lower
- Test scores predicted negative thoughts in the subsequent module
 - Negative thoughts were 1.70 points higher (on a 5 point scale) for trainees with low test scores





Predicting Negative Thoughts





Summary

- Technical difficulties impaired learning and increased negative thoughts
- Cyclical relationship between test scores and negative thoughts
 - Low test scores → Higher negative thoughts
 - High negative thoughts → Lower test scores
- Predicting attrition
 - Module 1 → Technical difficulties
 - Modules 2-4 → Test scores





Recommendations

- Provide access to Internet skills courses and technical support
- Trainees must have a reliable Internet connection
- Complete training in a quiet environment, free from distractions





Questions or Comments?

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