Building Students' Motivation and Learning Skills in Online Courses

Welcome! We'll get started in just a moment.

In the meantime, we invite you to comment in the chat on what you've seen as the greatest needs or challenges in postsecondary online learning in STEM.

Be sure to select "Everyone" in the blue drop-down box to share your response with everyone.

Postsecondary Teaching with Technology Collaborative

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Building Students' Motivation and Learning Skills in Online Courses

Insights from the Postsecondary Teaching with Technology Collaborative

November 14, 2024

Webinar

Postsecondary Teaching with Technology Collaborative

An IES-funded research and capacity-building center that aims to study and improve how faculty **teach** and **use technology** to help students apply and strengthen **self-directed learning skills** to increase their success in online STEM courses.

SRI Education™
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CCRC COMMUNITY COLLEGE RESEARCH CENTER
Teachers College, Columbia University

Achieving the Dream

Welcome!

Let's see who is joining us today.

In the poll, please share...

- Your role
- If you're new to the Collaborative
- How familiar you are with self-directed learning

Students face challenges in online learning

Student outcomes are generally worse in online courses and degree programs than in comparable face-to-face ones

In some cases, achievement gaps are wider in online environments

Key factors: greater demands on students' self-directed learning (SDL) capacities; need for belonging and community

(e.g., Altindag et al., 2021; Jaggars & Xu, 2014; Xu & Xu, 2020)

Students face particular challenges in STEM learning

Unwelcoming environment

Individual sink-or-swim culture

Content-heavy courses

Unclear personal relevance

Belonging uncertainty

Stereotype threat

Inequitable opportunities to develop self-directed learning skills

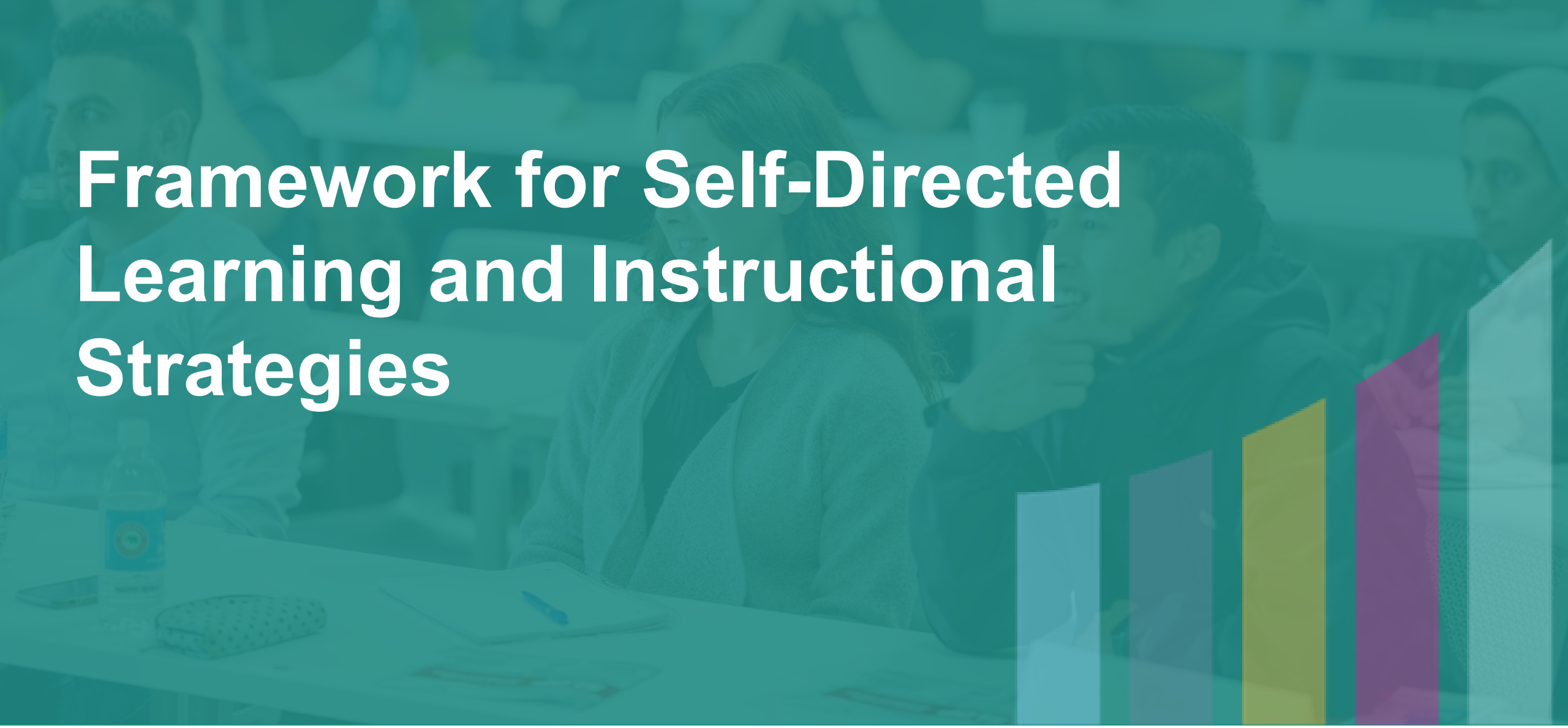
Feelings of isolation exacerbated in online formats

(e.g., Hatfield et al., 2022; Murdock-Perriera, 2019; National Academies of Sciences, Engineering, and Medicine, 2023; Yarnall et al., 2023)

Agenda

Time	Topic
2:10-2:15 pm ET	Framework for SDL and Instructional Strategies
2:15-2:20 pm ET	Rapid-Cycle Experiments (RCEs)
2:20-2:40 pm ET	RCE Findings: Instructor and Student Experiences
2:40-2:45 pm ET	RCE Findings: Survey and Administrative Data
2:45-2:50 pm ET	RCE Findings: Learning Management System Data
2:50-3:00 pm ET	Reflections and Next Steps
3:00-3:15 pm ET	Q&A Discussion

Framework for Self-Directed Learning and Instructional Strategies



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Framework for self-directed learning

Three SDL processes

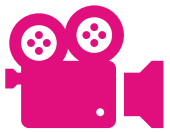
I can: Motivational processes provide the foundational emotions and beliefs that energize students' approach to learning. These are the emotions and beliefs around learning.

I plan: Metacognitive processes translate those emotions and beliefs into an action plan. This includes understanding how to manage learning and actively adjust to the demands of any learning task.

I do: Applied learning processes put that plan into action and adjust it as needed. These are learning techniques and self-discipline strategies that help students take greater ownership of achieving specific learning goals.

Strategies co-developed and tested

Strategies were identified via literature review and systematic database review,[1] and co-developed/adapted for online courses with instructors at four partner institutions.



Assign **videos** to support sense of belonging, time management, and growth mindset

Set up automated **prompts** focused on goal-setting, task-planning, and reflection

Use technology to support student-peer interaction and networking (**SPIN**) and promote help seeking

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[1] To learn more about the Collaborative's research on instructional strategies, read our white paper at https://postseccollab.org/teaching-and-designing-online-stem-courses-to-support-sdl-skills/.

Video series

Sense of belonging

Time management

Growth mindset

Each video follows a consistent structure:

- Overview of what students will learn
- Introduction to the SDL skill/mindset
- 2–3 strategies to develop the SDL skill/mindset
- Where to find additional resources

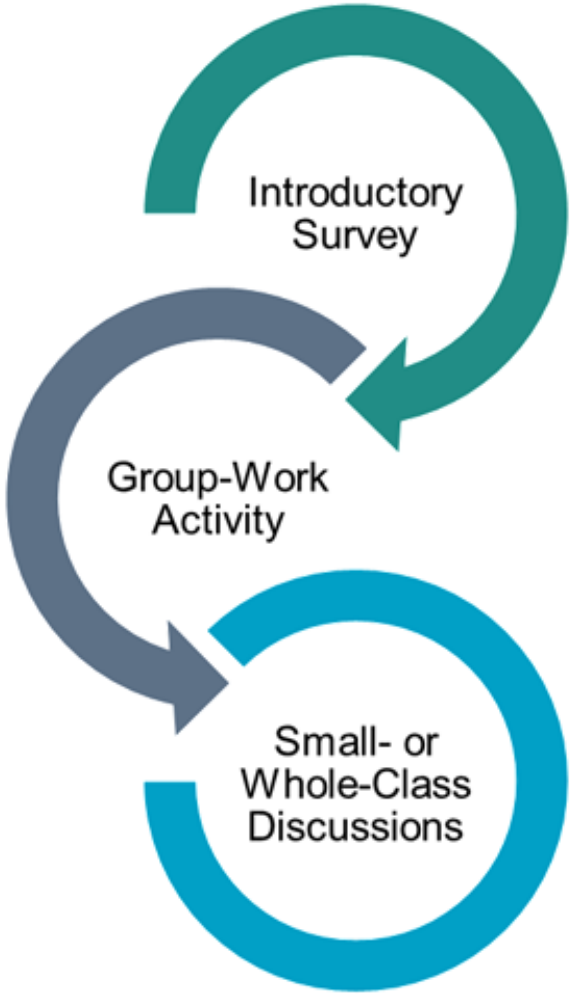
Each video includes a reflection activity:

- Self-rating on the SDL skill/mindset
- Self-reflection on the strategies presented in the video
- Planning for how to apply the strategies

Prompts

	Reflective prompts	Timing
Academic behaviors	• What assignments and other coursework do you need to complete this week for this class? What information, resources, or help do you need to complete this week's coursework?	Starting at 1x/week
	• Have you scheduled a specific time to complete this week's work for this class? [If no] When will you complete this week's work for this class?	Starting at 1x/week
Checking gaps in understanding	• What questions from your last [assessment] did you not understand? What resources and strategies do you need to improve your understanding? – *[Includes customized list of resources for each institution]*	Starting with each major assessment
	• Which concepts from this class do you feel you mastered this week? Which concepts are you still struggling with?	Starting at 1x/week

Student-peer interaction and networking (SPIN)



Introductory survey that instructors use to create an activity around students' shared nonacademic interests

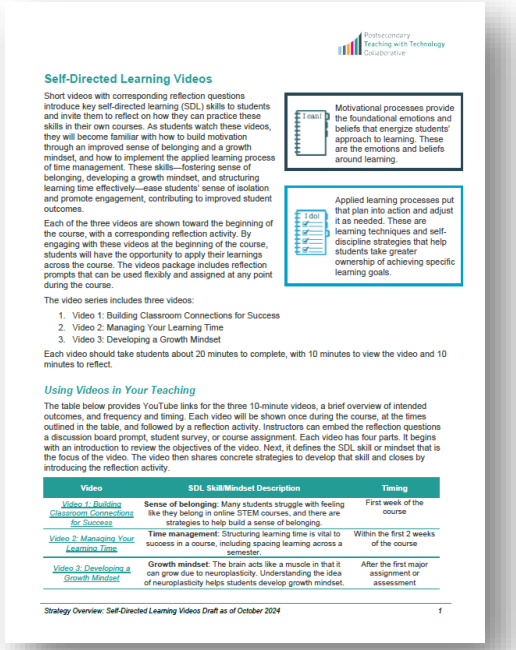
Group-work activity facilitated by instructors

Class discussions for students to share concepts they understood or struggled with and resources

Resources and guidance

Visit the event page for today's webinar at https://postseccollab.org/events/ to access draft versions of the instructional strategies and implementation guidance.

Videos



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Self-Directed Learning Videos

Short videos with corresponding reflection questions introduce key self-directed learning (SDL) skills to students and invite them to reflect on how they can practice these skills in their own courses. As students watch these videos, they will become familiar with how to build motivation through an improved sense of belonging and a growth mindset, and how to implement the applied learning process of time management. These skills—fostering sense of belonging, developing a growth mindset, and structuring learning time effectively—ease students' sense of isolation and promote engagement, contributing to improved student outcomes.

Each of the three videos are shown toward the beginning of the course, with a corresponding reflection activity. By engaging with these videos at the beginning of the course, students will have the opportunity to apply their learnings across the course. The videos package includes reflection prompts that can be used flexibly and assigned at any point during the course.

I can!

Motivational processes provide the foundational emotions and beliefs that energize students' approach to learning. These are the emotions and beliefs around learning.

I do!

Applied learning processes put that plan into action and adjust it as needed. These are learning techniques and self-discipline strategies that help students take greater ownership of achieving specific learning goals.

The video series includes three videos:

1. Video 1: Building Classroom Connections for Success
2. Video 2: Managing Your Learning Time
3. Video 3: Developing a Growth Mindset

Each video should take students about 20 minutes to complete, with 10 minutes to view the video and 10 minutes to reflect.

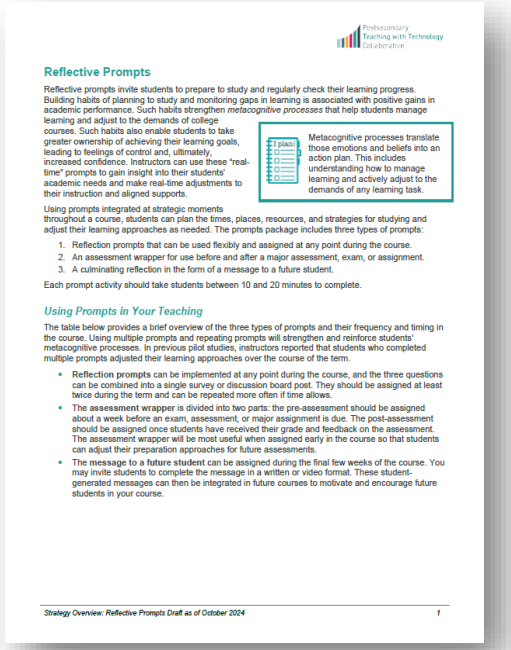
Using Videos in Your Teaching

The table below provides YouTube links for the three 10-minute videos, a brief overview of intended outcomes, and frequency and timing. Each video will be shown once during the course, at the times outlined in the table, and followed by a reflection activity. Instructors can embed the reflection questions a discussion board prompt, student survey, or course assignment. Each video has four parts. It begins with an introduction to review the objectives of the video. Next, it defines the SDL skill or mindset that is the focus of the video. The video then shares concrete strategies to develop that skill and closes by introducing the reflection activity.

Video	SDL Skill/Mindset Description	Timing
Video 1: Building Classroom Connections for Success	**Sense of belonging:** Many students struggle with feeling like they belong in online STEM courses, and there are strategies to help build a sense of belonging.	First week of the course
Video 2: Managing Your Learning Time	**Time management:** Structuring learning time is vital to success in a course, including spacing learning across a semester.	Within the first 2 weeks of the course
Video 3: Developing a Growth Mindset	**Growth mindset:** The brain acts like a muscle in that it can grow due to neuroplasticity. Understanding the idea of neuroplasticity helps students develop growth mindset.	After the first major assignment or assessment

Strategy Overview: Self-Directed Learning Videos Draft as of October 2024 1

Prompts



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Reflective Prompts

Reflective prompts invite students to prepare to study and regularly check their learning progress. Building habits of planning to study and monitoring gaps in learning is associated with positive gains in academic performance. Such habits strengthen *metacognitive processes* that help students manage learning and adjust to the demands of college courses. Such habits also enable students to take greater ownership of achieving their learning goals, leading to feelings of control and, ultimately, increased confidence. Instructors can use these "real-time" prompts to gain insight into their students' academic needs and make real-time adjustments to their instruction and aligned supports.

I plan!

Metacognitive processes translate those emotions and beliefs into an action plan. This includes understanding how to manage learning and actively adjust to the demands of any learning task.

Using prompts integrated at strategic moments throughout a course, students can plan the times, places, resources, and strategies for studying and adjust their learning approaches as needed. The prompts package includes three types of prompts:

1. Reflection prompts that can be used flexibly and assigned at any point during the course.
2. An assessment wrapper for use before and after a major assessment, exam, or assignment.
3. A culminating reflection in the form of a message to a future student.

Each prompt activity should take students between 10 and 20 minutes to complete.

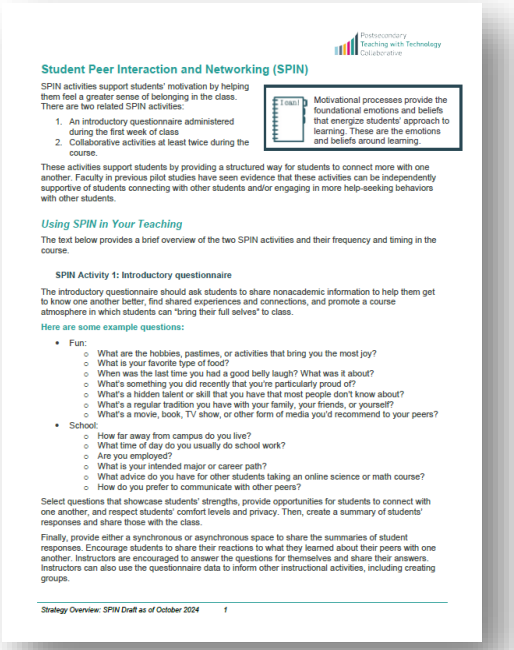
Using Prompts in Your Teaching

The table below provides a brief overview of the three types of prompts and their frequency and timing in the course. Using multiple prompts and repeating prompts will strengthen and reinforce students' metacognitive processes. In previous pilot studies, instructors reported that students who completed multiple prompts adjusted their learning approaches over the course of the term.

- **Reflection prompts** can be implemented at any point during the course, and the three questions can be combined into a single survey or discussion board post. They should be assigned at least twice during the term and can be repeated more often if time allows.
- The **assessment wrapper** is divided into two parts: the pre-assessment should be assigned about a week before an exam, assessment, or major assignment is due. The post-assessment should be assigned once students have received their grade and feedback on the assessment. The assessment wrapper will be most useful when assigned early in the course so that students can adjust their preparation approaches for future assessments.
- The **message to a future student** can be assigned during the final few weeks of the course. You may invite students to complete the message in a written or video format. These student-generated messages can then be integrated in future courses to motivate and encourage future students in your course.

Strategy Overview: Reflective Prompts Draft as of October 2024 1

SPIN



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Student Peer Interaction and Networking (SPIN)

SPIN activities support students' motivation by helping them feel a greater sense of belonging in the class. There are two related SPIN activities:

1. An introductory questionnaire administered during the first week of class
2. Collaborative activities at least twice during the course.

I can!

Motivational processes provide the foundational emotions and beliefs that energize students' approach to learning. These are the emotions and beliefs around learning.

These activities support students by providing a structured way for students to connect more with one another. Faculty in previous pilot studies have seen evidence that these activities can be independently supportive of students connecting with other students and/or engaging in more help-seeking behaviors with other students.

Using SPIN in Your Teaching

The text below provides a brief overview of the two SPIN activities and their frequency and timing in the course.

SPIN Activity 1: Introductory questionnaire

The introductory questionnaire should ask students to share nonacademic information to help them get to know one another better, find shared experiences and connections, and promote a course atmosphere in which students can "bring their full selves" to class.

Here are some example questions:

- Fun:
  - What are the hobbies, pastimes, or activities that bring you the most joy?
  - What is your favorite type of food?
  - When was the last time you had a good belly laugh? What was it about?
  - What's something you did recently that you're particularly proud of?
  - What's a hidden talent or skill that you have that most people don't know about?
  - What's a regular tradition you have with your family, your friends, or yourself?
  - What's a movie, book, TV show, or other form of media you'd recommend to your peers?
- School:
  - How far away from campus do you live?
  - What time of day do you usually do school work?
  - Are you employed?
  - What is your intended major or career path?
  - What advice do you have for other students taking an online science or math course?
  - How do you prefer to communicate with other peers?

Select questions that showcase students' strengths, provide opportunities for students to connect with one another, and respect students' comfort levels and privacy. Then, create a summary of students' responses and share those with the class.

Finally, provide either a synchronous or asynchronous space to share the summaries of student responses. Encourage students to share their reactions to what they learned about their peers with one another. Instructors are encouraged to answer the questions for themselves and share their answers. Instructors can also use the questionnaire data to inform other instructional activities, including creating groups.

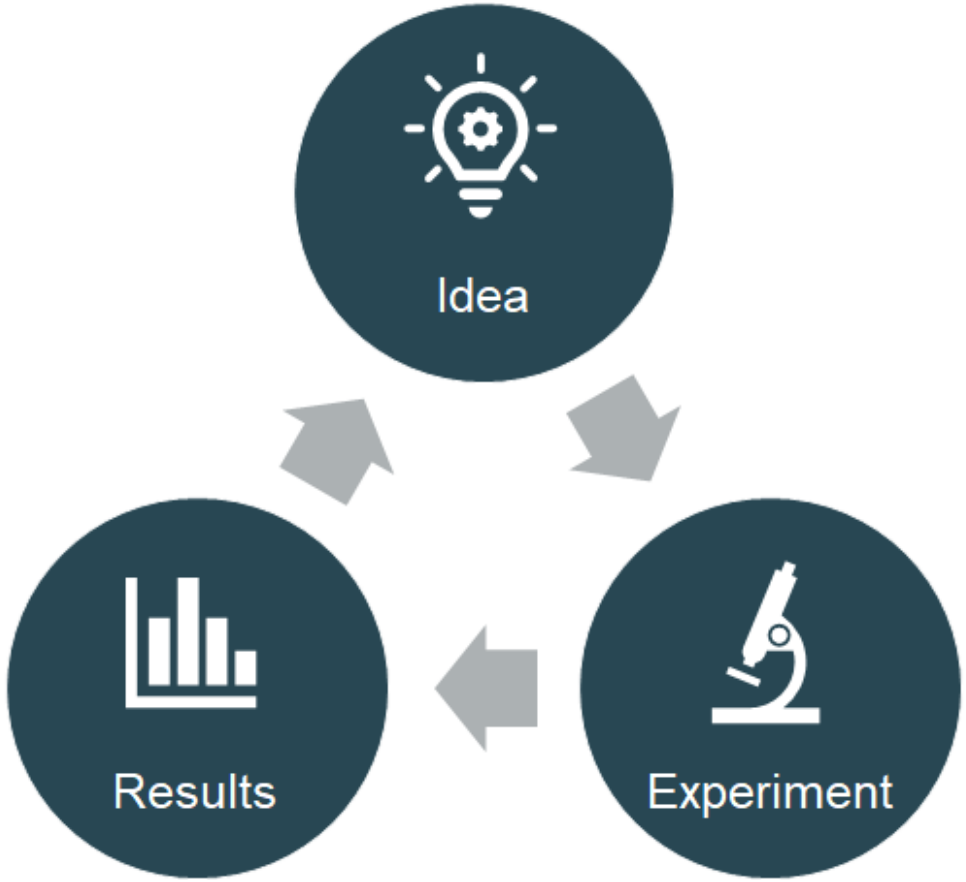
Strategy Overview: SPIN Draft as of October 2024 1

Rapid-Cycle Experiments

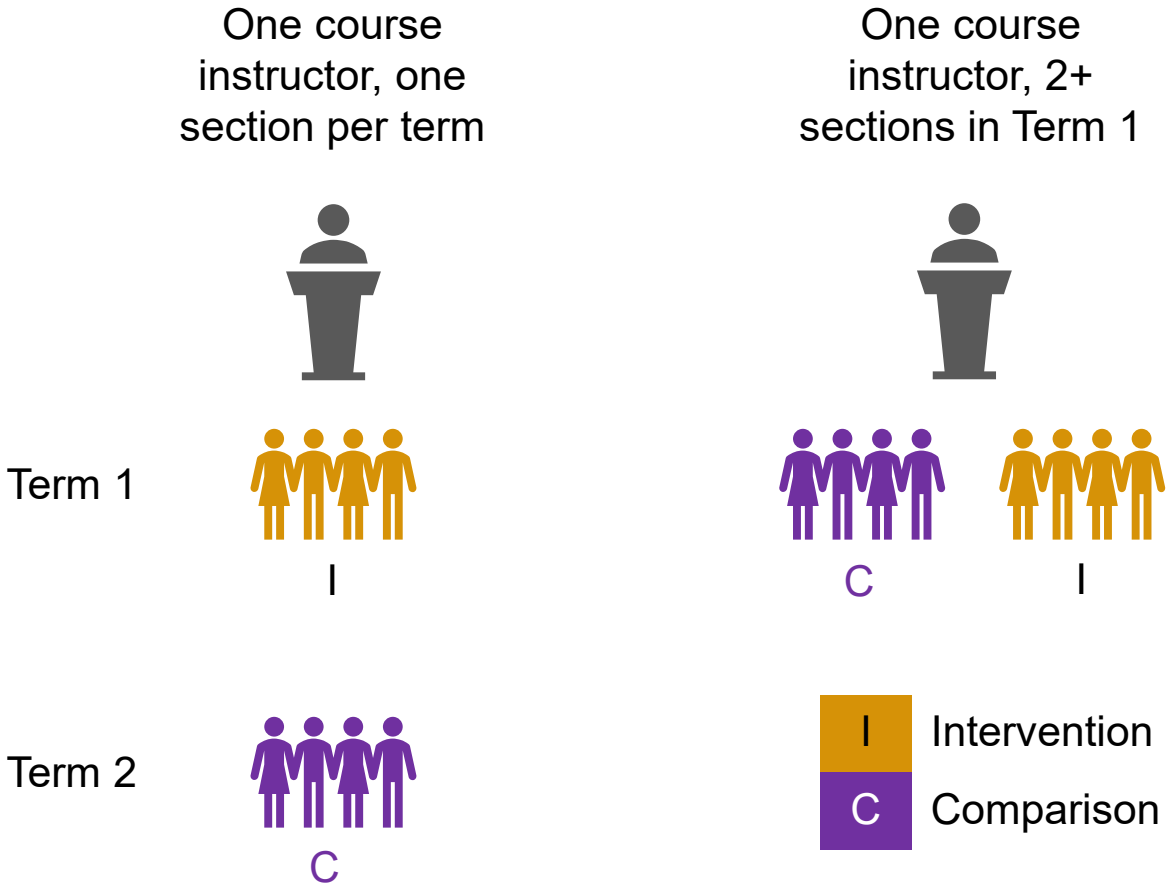
Rapid cycle experiments (RCEs)

RCEs allowed instructors to test a specific strategy (or combination of strategies) in course sections that are designed to help students develop SDL skills.

Findings from these formative studies, triangulated with other sources, are helping to identify and refine promising strategies to include in our culminating resources.



RCE courses and comparison groups



- Eligible courses included fully online or hybrid courses in the STEM disciplines.
- Each participating instructor taught multiple sections of the same course.
- At the start of the term, instructors chose one section for each course to receive the intervention and another to serve as the comparison group.
- Instructors additionally chose which strategy or combination of strategies to implement.

RCEs by the numbers

4 Institutions

3 Instructional strategies

4 Semesters

24 Instructors

105 Course sections

2,000+ Students

Research questions and data collections

Research Question	Pre/Post Surveys	IR Admin. Data	LMS Data	Interviews
1. Compared to a business-as-usual condition, what is the effect of the opportunity to use a technology-based intervention on students' development and application of self-directed learning skills and academic outcomes?	X	X	X	
2. How does this effect vary based on student characteristics?	X	X	X	
3. Is exposure to technology-based instructional strategies associated with students' usage of LMS and courseware features that support self-directed learning?			X	
4. What impedes or assists with the implementation of technology-based instructional strategies to support students' self-directed learning? What are student and staff perspectives on the strategies' strengths and opportunities for improvement?				X

Findings: Instructor and Student Experiences

General insights from instructors

Engagement	Time and Value	Adjustments and Adaptations	Data
• Thoughtful integration into existing activities • Incentives • Variation of pacing	• Worth their time • Informed their insight of student content-related understanding • Less sure if videos had an impact	• Continued participation led to comfort to make adjustments • Adjustments often included change to pacing and focus of reflection questions	• Attuned to course grades, rates of withdrawal and completion • Identified student learning needs

Reflections from an instructor

Paige Roseman
Psychology Instructor
Wake Technical Community College

Videos **Prompts** **SPIN**

SDL interventions: Student experiences

"Learning about other people and what they experience, and like finding myself in that same boat."
-Prompts + Video

"That actually helped me think back on what I learned."

"What didn't you understand so well this week? … When I got asked that question I realized, 'Oh, I really need to study this, because I didn't really understand it, that well this week.'"
-Prompts

"I started a WhatsApp group for the class, only I think [with] 8 or so people. I was inspired by one of the videos to start the group."
-Video

Lessons learned based on student experiences

Student reflections on their experiences with the strategies helped the team to make important iterations to improve instructor implementation guidelines.

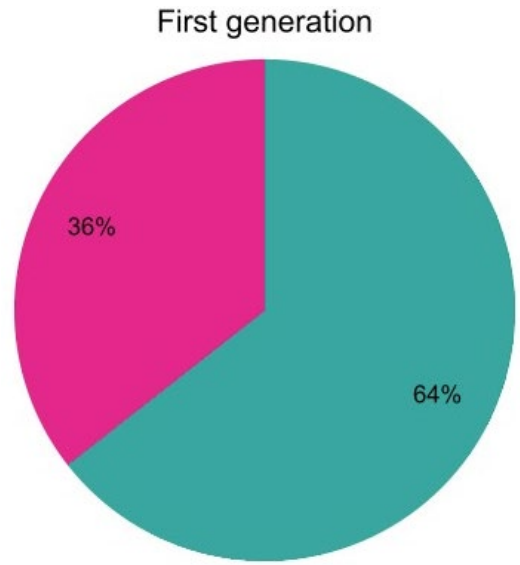
Adaptations to prompts

Feedback from instructors

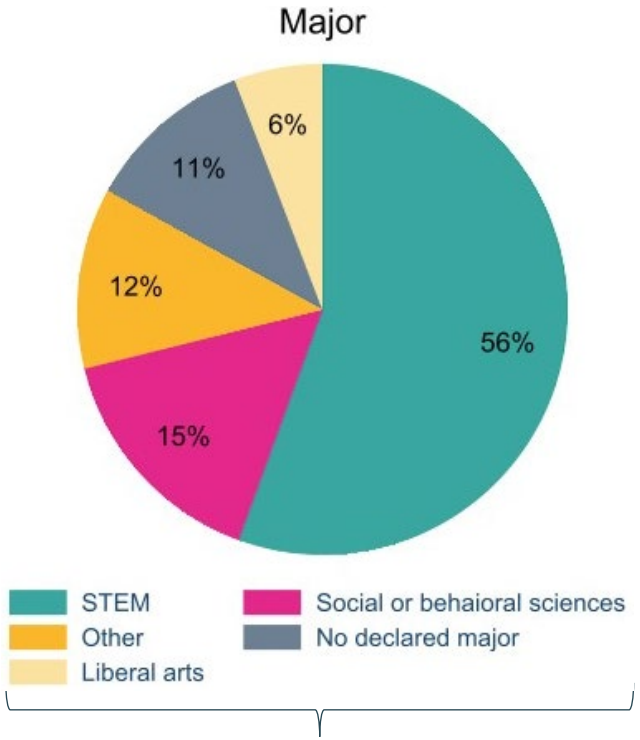
Connections with peers

Findings: Survey and Administrative Data

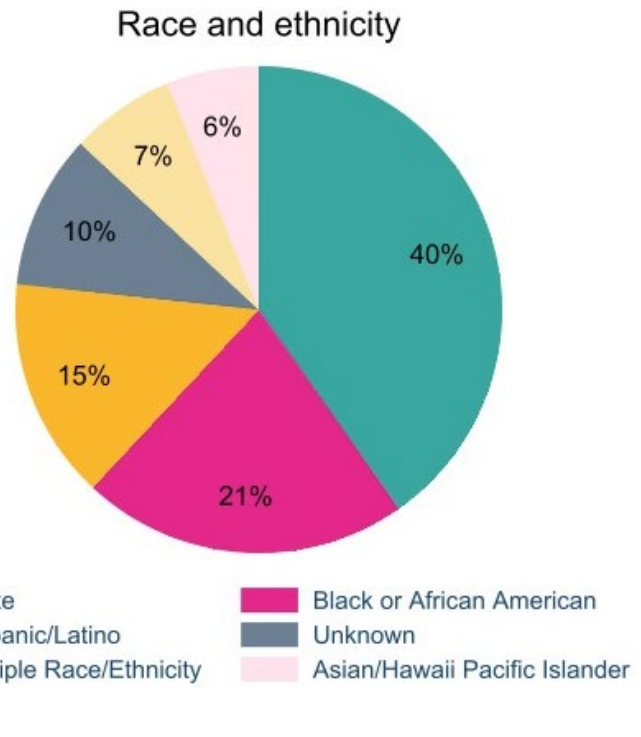
Sample characteristics

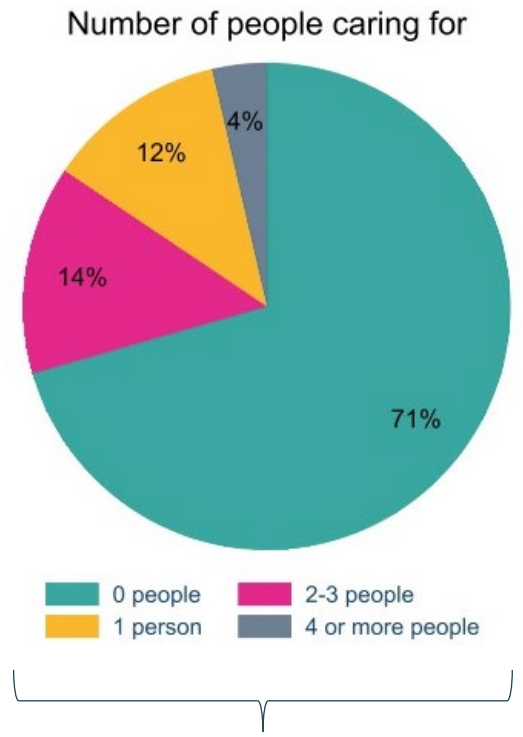


Characteristic missing for one institution



Characteristic only available for survey respondents



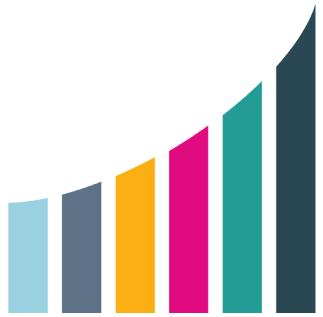


Characteristic only available for survey respondents

Number of students for admin data: 2,224

Number of students for survey data: 1,363

Analysis methods and measures

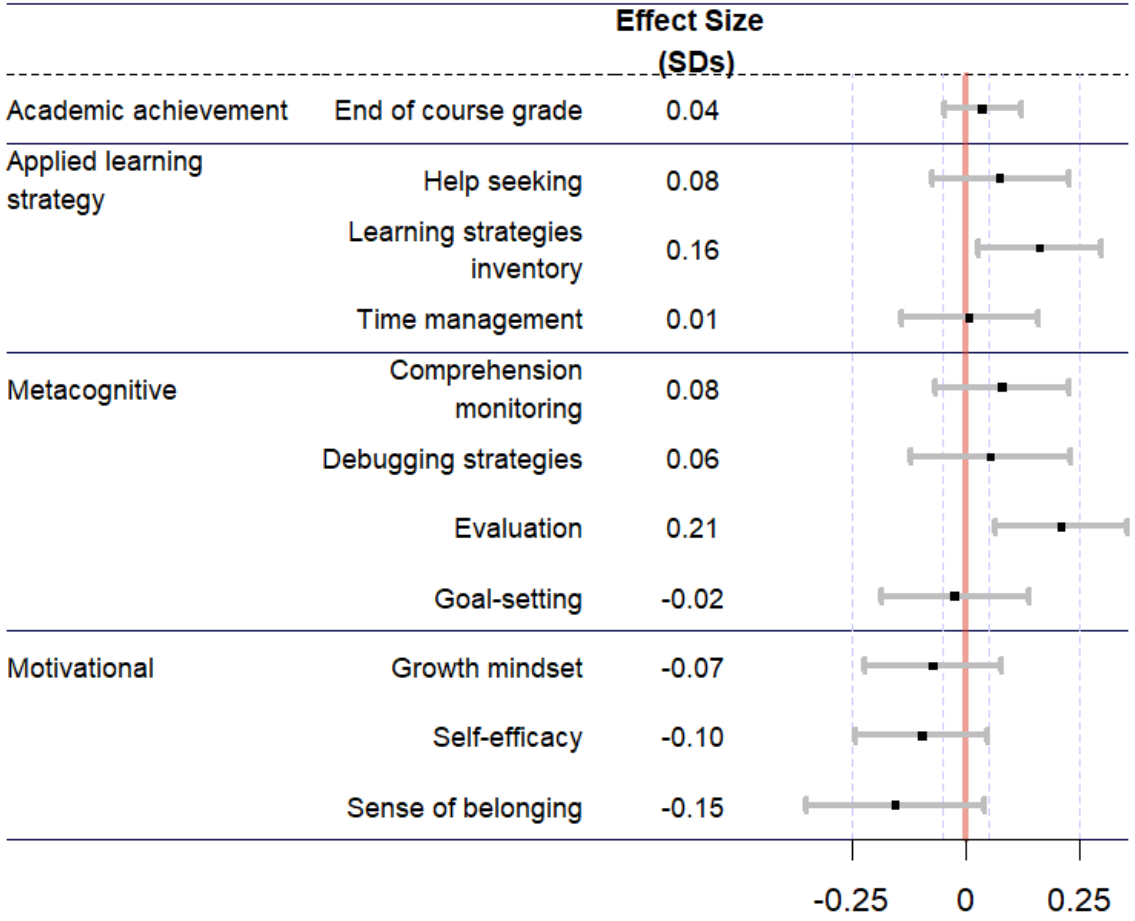


Methods

- Look at whether being in a section using any strategy affected SDL skills and achievement.
- Check students in comparison sections are similar at baseline to students in intervention sections.
- Statistically control for any baseline differences.

Domain	Measure
Applied learning strategy	Help seeking
	Number of learning strategies students used
	Time management
Metacognitive	Comprehension monitoring
	Debugging strategies
	Evaluation
	Goal-setting
Motivational	Self-efficacy
	Sense of belonging
	Growth mindset
Academic Achievement	End of course grades

All survey and administrative impact results, pooled sample



Estimate impacts controlling for courses, baseline measures, and student demographics.

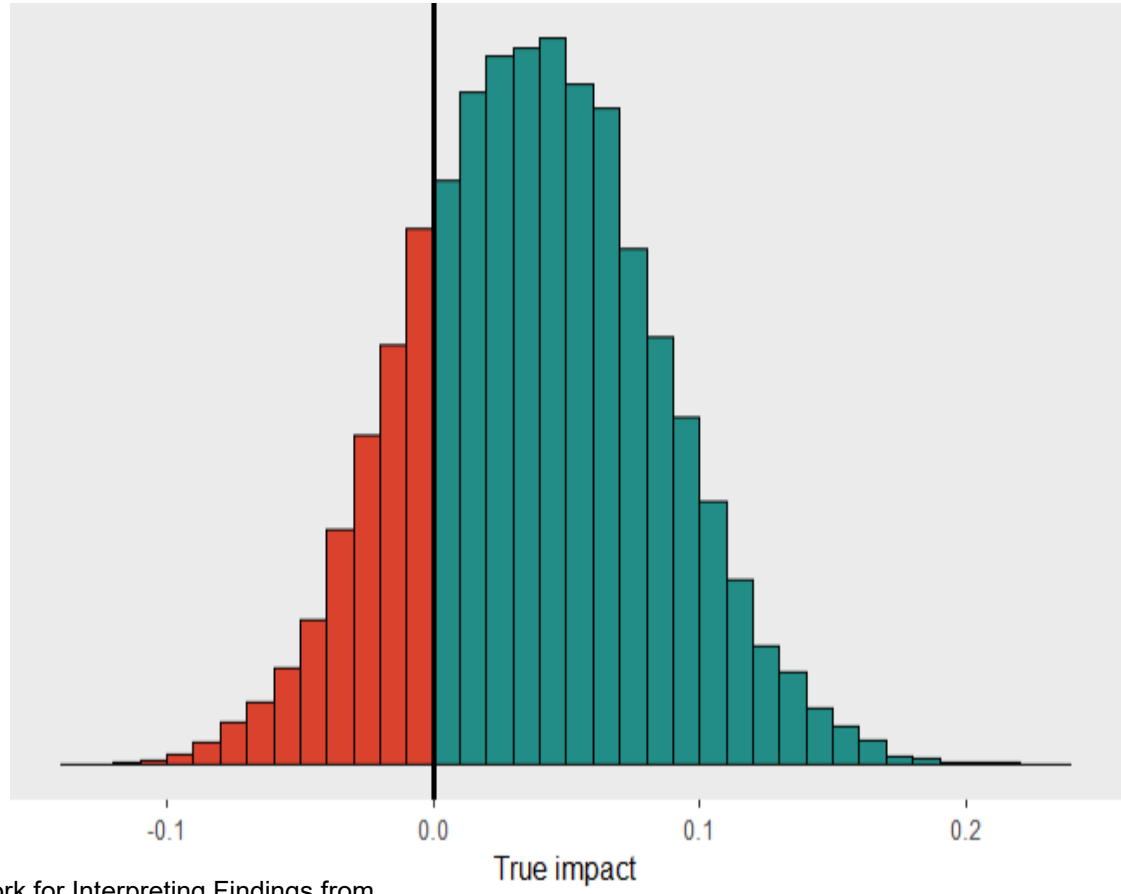
We did not find evidence of differences in effectiveness for different types of students.

Note: Academic achievement is assessed using academic records. All other outcomes are survey measures and are therefore only available for survey respondents.

Probability of positive impact on end-of-course grades

We estimate a 78% probability that the RCE strategies had a positive impact on grades, given our estimates and prior evidence.

- Calculated using Bayesian statistics (Deke et al., 2022). Result is a “posterior distribution,” or full probability distribution for the true impact.
- Incorporates prior evidence on interventions in postsecondary settings.



Deke, J., Finucane, M., & Thal, D. (2022). The BASIE (BAyeSian Interpretation of Estimates) Framework for Interpreting Findings from Impact Evaluations: A Practical Guide for Education Researchers. Toolkit. NCEE 2022-005. National Center for Education Evaluation and Regional Assistance.

Summary of survey and admin impacts

Outcome Domains	Outcome (* = Admin. Data)	Impact Estimate (*SD*)	*p*-Value	Prob Positive Impact
Achievement	End-of-course grade*	0.05	0.450	78
Applied learning strategy outcomes	Learning strategies inventory	0.16	0.019	83
	Help seeking	0.08	0.314	72
	Time management	0.01	0.916	65
Metacognitive outcomes	Comprehension monitoring	0.08	0.283	81
	Debugging strategies	0.06	0.528	81
	Evaluation	0.21	0.006	98
	Goal-setting	-0.02	0.762	65
Motivational outcomes	Self-efficacy	-0.10	0.188	19
	Sense of belonging	-0.15	0.121	15
	Growth mindset	-0.07	0.341	34

Findings: Learning Management System Data

LMS data

- Record of every single action by a student (aka clickstream data)
  - When a student is doing what

Time	User	Course	Description
9/14/2022, 00:29:13	12345	7983	The user with id '12345' viewed the 'page' activity with course module id '704'.
9/14/2022, 00:31:26	12345	7983	The user with id '12345' viewed the 'resource' activity with course module id '704'.
9/14/2022, 00:31:31	12345	7983	The user with id '12345' viewed the course with id '7983'.
9/14/2022, 00:33:01	12345	7983	The user with id '12345' viewed the 'resource' activity with course module id 705'.
9/14/2022, 00:33:04	12345	7983	The user with id '12345' has started the tour with id '3' on the page with URL aoryx.
9/14/2022, 00:33:06	12345	7983	The user with id '12345' viewed the course with id '7983'.

LMS analytical sample

	Comparison	Intervention
# course sections	10	9
# students per section	9 – 34 (average 18.2)	12 – 39 (average 19.3)
# click actions per section	8,528 – 57,268 (average 24,699)	10,348 – 62,636 (average 28,905)

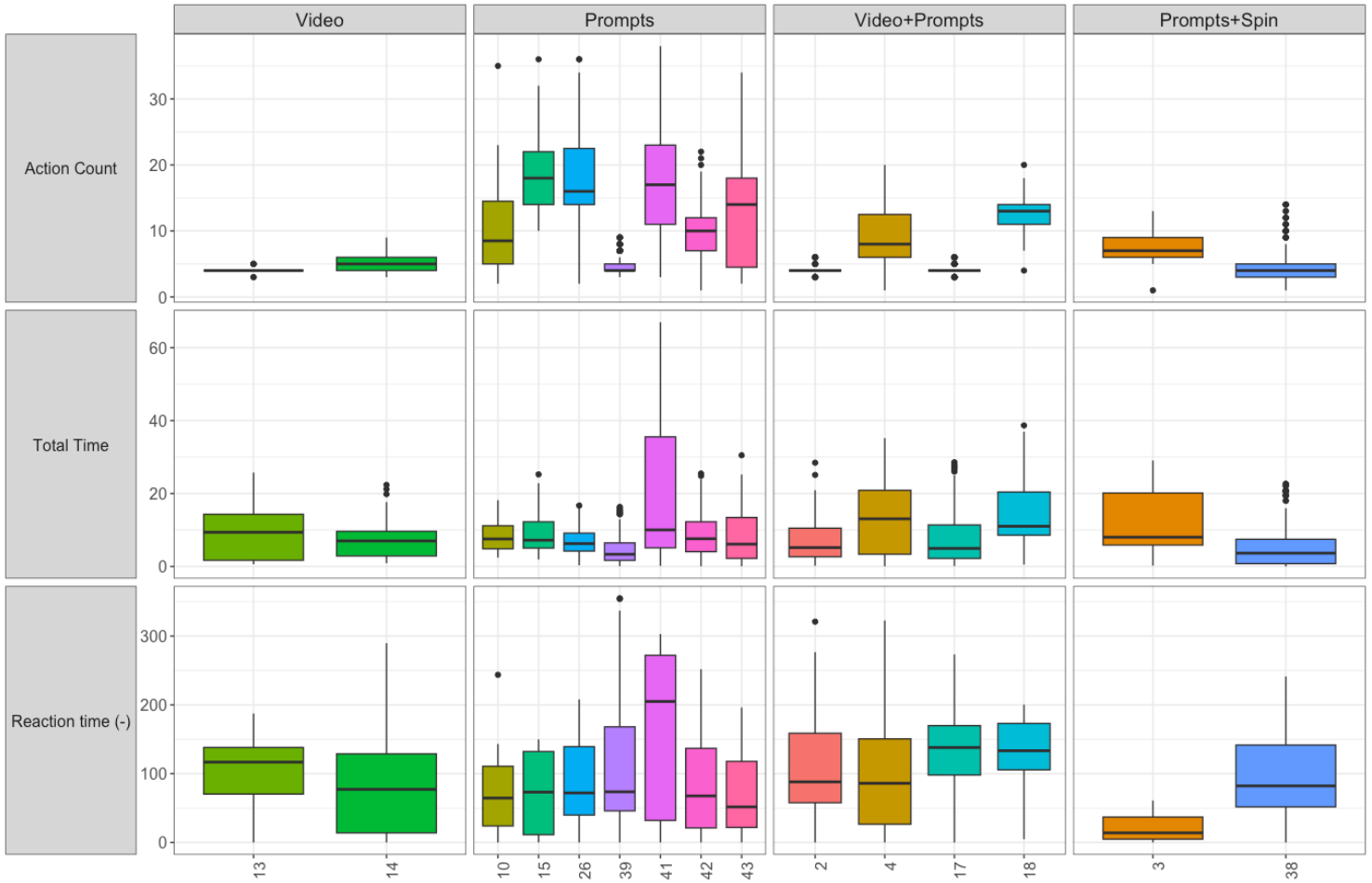
LMS data can help us understand...

- Engagement with tested strategies

For each student with each strategy:

Measure	Definition
Action count	Total number of actions associated with the video/prompt throughout the semester
Total time	Total duration (in minutes) of actions associated with the video/prompt throughout the semester
Reaction time (-)	Time lag (in hours) between the release of the video/prompt and the current student's first action associated with it

Engagement with strategies



- Engagement patterns differ greatly across courses (institutions) and strategies.
- Within the same course, students engage differently with the strategies.

LMS data can help us understand...

- SDL behavioral patterns

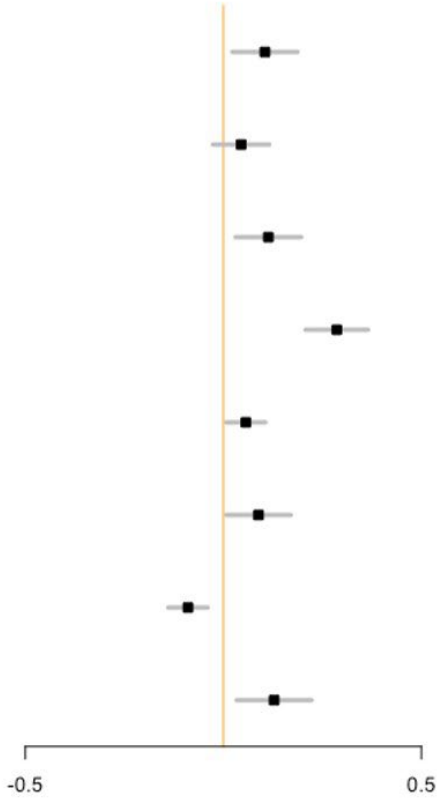
For each student in each course-week:

SDL process	Measure	Definition
Comprehension monitoring	Action count: course info	# actions related to course information
Effort regulation	Action count: learning content	# actions related to learning content
	Study session count	# study sessions
Evaluation	Action count: assessment	# actions related to assessments
Persistence	Average session duration	Average duration (in minutes) of study sessions
Time management	Active day count	# days with actions
	Average session gap **(-)**	Average gap between two consecutive study sessions (in minutes)
Reflection	Action count: feedback	# actions related to feedback

Du, J., Hew, K. F., & Liu, L. (2023). What can online traces tell us about students' self-regulated learning? A systematic review of online trace data analysis. Computers & Education, 201, 104828.

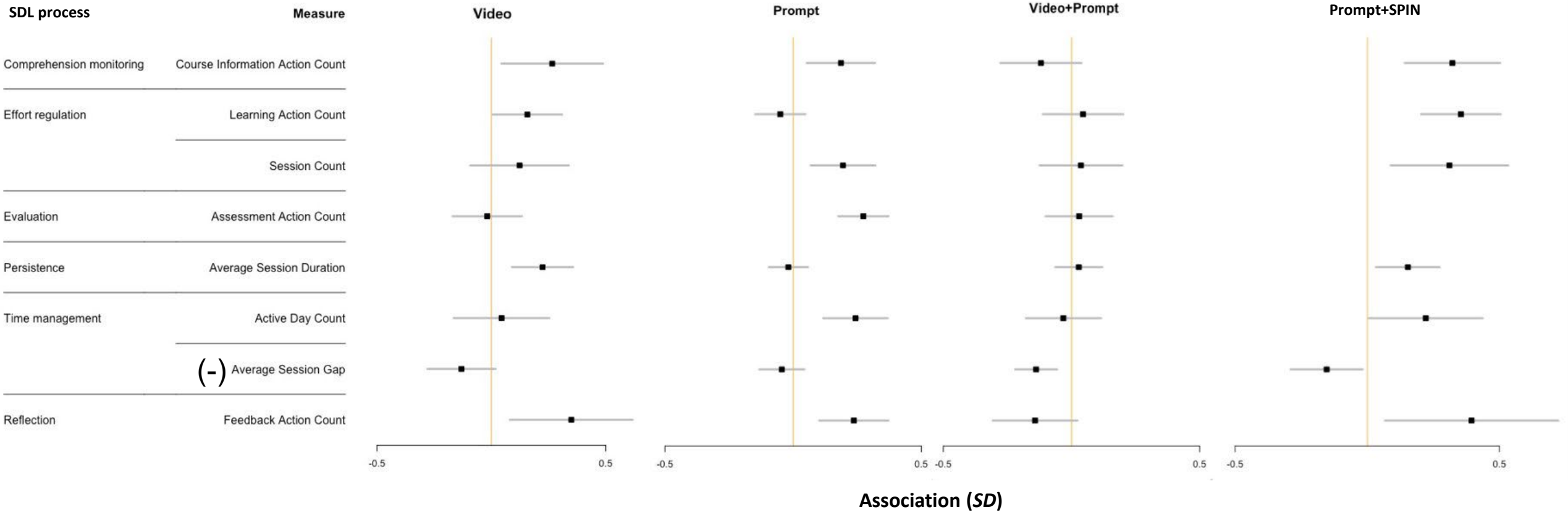
Associations between RCE participation and SDL behavior, full sample

SDL process	Measure	Association (*SD*)
Comprehension monitoring	Course Information Action Count	0.105
Effort regulation	Learning Action Count	0.045
	Session Count	0.114
Evaluation	Assessment Action Count	0.286
Persistence	Average Session Duration	0.057
Time management	Active Day Count	0.089
	(-) Average Session Gap	-0.089
Reflection	Feedback Action Count	0.128

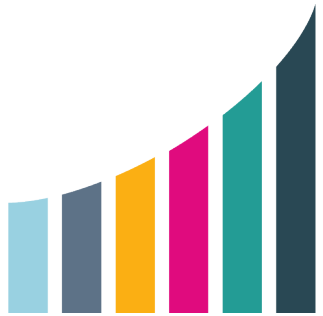


- There is moderate evidence that the RCE strategies are positively associated with SDL behavior in every process.

Associations between RCE participation and SDL behavior, by strategy

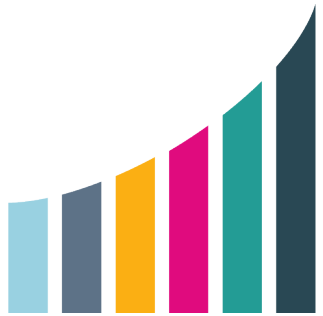


Comparing different student groups



- Compared to their peers, systemically marginalized students of STEM show higher levels of engagement with the tested strategies.
  - Especially women and racial minority students
- The positive associations with SDL behavior:
  - Are somewhat stronger for racial minority students
  - Are somewhat weaker for first-generation students

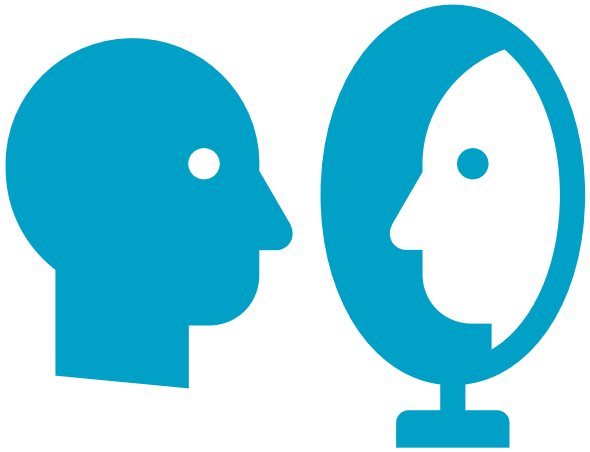
Implications for STEM instructors



- Technology-based strategies may be especially motivating for systemically marginalized students and beneficial for their SDL skill development.
- Student behavior is a good source of information to understand student engagement and SDL.
  - Many LMS products provide dashboards that make it easy to examine student behavior.

Reflections and Next Steps

Reflections



- The goal of the RCEs was to iteratively improve the strategies and inform development of a culminating set of resources.
- As is common with RCEs, relatively small sample sizes limit power to detect significant effects and distinguish between strategies.
- The RCEs drew on a rich variety of data sources, each with its limitations, but generally tell a consistent story of promising effects.

Next steps for the Collaborative

- Refining the instructional strategies and integrating them into a comprehensive set of resources, in collaboration with our institution partners
- Piloting the set of instructional strategies in spring 2025 to test their usability, feasibility, and promise for improving student outcomes

Freely available compilation of resources for instructors, instructional designers, and other administrators to implement and institutionalize an integrated set of evidence-based instructional strategies to support students' development of SDL skills and mindsets in online courses

Questions to consider

- What do you see as key takeaways from the RCEs that may have implications or applications for your work?
- How do these instructional strategies resonate with your work/approaches to support students' online learning?
- How would you implement these strategies in your online courses? How feasible would it be?
- How does your institution support instructors in their efforts to address development of SDL skills and mindsets?

Thank you! Stay tuned for Q&A

Learn more about what we mean by self-directed learning.

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Q&A Discussion

Questions or comments to share?

Please enter any comments you would like to share or questions you have for the presenters in the chat now.

If you have to sign off, or if we don't have time to get through all questions, you can submit your question to postsec-collab@sri.com.