Using Self-Directed Learning to Improve Online Learning



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USING SELF-DIRECTED LEARNING TO IMPROVE ONLINE LEARNING

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Researchers and college practitioners co-developed and tested three online course strategies to develop students' self-directed learning skills. Researchers describe adapting the self-directed learning framework to the college online context and share preliminary responses from instructors and students to the usability and value of the strategies.

Post-COVID, college students continue to sign up for online courses, but they also pass them at lower rates than face-to-face courses (Altindag et al., 2021; Jaggars & Xu, 2016). To support better outcomes, this paper describes how the Postsecondary Teaching with Technology Collaborative research team leveraged self-directed learning (SDL) concepts to design, develop, and test three instructional strategies for online learning. The team designed the strategies so college instructors of gateway science, technology, engineering, and math (STEM) courses could help their students manage online learning.

STEM college courses demand much from learners and sometimes trigger self-doubt, particularly among historically underrepresented students (Fry et al., 2021; Hatfield et al., 2022; Morton, 2021; Newsome, 2021; Thompson, 2021). The online delivery of STEM courses worsens such challenges (Altindag et al., 2021; Berry, 2018; Jaggars & Xu, 2016; Xu & Jaggars, 2014). To improve results, the research team adapted concepts from self-directed learning (Merriam, 2001; Merriam & Caffarella, 1999; Morris, 2023), self-regulated learning (Boekaerts et al., 2000; Pintrich & Schunk, 1996; Zimmerman, 2002; Winne, 2010), and self-determination theory (Ryan & Deci, 2000) to develop an SDL framework that organized strategies toward three competencies: positive motivational attitudes, metacognitive routines, and applied learning skills (Yarnall et al., 2023). Through this new framework, we aimed to develop an integrated theory to meet the specific support needs of college-level adult learners. Unlike other SDL frameworks, this approach brought together intrinsically driven adult motivational concepts with psychological strategies for managing learning and developing social connection in college and STEM courses.

The research team further characterized the three competencies as a self-reinforcing cycle. The cycle begins with students' initial *motivational* mindsets that shape their commitment to learning, which then drives their *metacognitive* processes to plan, monitor, adjust, and

reflect on their learning. Together, these processes provide structure and support for a series of *applied learning* activities students can use to actively manage their learning. Students' resulting experiences of learning success feed positive emotions and refuel motivation, starting the cycle anew. In effect, the SDL framework can help instructors understand the processes that undergird students' learning and use instructional strategies to support those processes in a way that enhances the online classroom environment (Boekaerts & Corno, 2005).

The research team used the SDL framework to develop three instructional that instructors could integrate into online courses:

- assigning researcher-produced videos to support students' *motivational* attitudes around a sense of belonging and cultivating a growth mindset and their *applied learning* habit of time management;
- setting up a series of reflective prompts, exam wrappers, and a letter to a future student to support *metacognitive* habits, such as goal-setting, task-planning, and reflection; and
- using technology to promote both a sense of belonging (*motivation*) and help-seeking (*applied learning*) through three types of student-peer interaction and networking (SPIN) activities.

The SPIN activities include an initial "get to know you" questionnaire and subsequent activities focused on either group work or discussion threads in the learning management system (LMS). The instructional strategies are freely available on the project website.

After conducting several rounds of rapid cycle evaluations (Burkander et al., 2024; Mislevy et al., 2024) to refine the individual strategies and confirm the probability of improved student outcomes, the research team conducted a pilot study engaging instructors and students in using all three strategies. This paper describes initial findings regarding four research questions:

- What life factors shape and motivate student online learning?
- To what extent did instructors find the SDL strategies usable?
- To what extent did instructors and students find the SDL strategies consistent with typical classroom practice, and how did that consistency affect their perceptions of each strategy's value?
- To what extent did instructors and students find the SDL strategies effective and valuable?

Method

During summer 2024, the research team engaged nine instructors and their students in three colleges to use all three instructional strategies. The nine participating instructors taught 10 course sections ranging from 4 to 10 weeks. Before the summer term, the team trained instructors in the strategies. Table 1 shows the strategies implemented and describes the purpose of each strategy, the SDL skills it supports, and the recommended schedule for implementation. All strategies are delivered through the course LMS.

Table 1

Self-Directed Learning Strategies List

SDL strategy	Purpose	SDL skills supported	Recommended schedule
SPIN Activity 1: Questionnaire	Survey for students to share their interests and schedules	Sense of belonging, help-seeking	Week 1
Video 1: Sense of belonging	How to develop a sense of belonging, reduce "imposter syndrome"; prompt students to plan approach	Sense of belonging, self-reflection	Week 1
Video 2: Time management	How to manage time and space practice; prompt students to plan approach	Plan for learning, self-reflection	Week 2
Reflective prompts: Time 1	Prompt students to plan or reflect on learning	Self-reflection, plan for learning, help-seeking	Mid-course
Reflective prompts: Time 2	Prompt students to plan and/or reflect on learning	Self-reflection, plan for learning, help-seeking	Mid-course
Video 3: Growth mindset	How intelligence increases with practice and challenges; prompt students to rate growth mindset and reflect	Confidence and self-efficacy, self-reflection	After first major exam
Exam wrapper (pre-exam)	Prompt students to plan for exam	Self-reflection, plan for learning	One week before first major exam
Exam wrapper (post-exam)	Prompt students to reflect on exam and adjust learning strategies	Self-reflection, confidence and self-efficacy, help-seeking	After major exam is returned to students
SPIN Activity 2: Collaborative Activity 1	Group activity for students to learn together	Sense of belonging, help-seeking	Mid-course
SPIN Activity 2: Collaborative Activity 2	Threaded discussion in which students can ask questions	Sense of belonging, help-seeking	Mid-course
Reflective prompts: Time 3	Letter to a future student about how to use SDL skills to succeed in class	Confidence and self-efficacy, self-reflection, sense of belonging	Final week

During the term, the research team invited instructors to participate in 60-minute Zoom pre- and post-interviews. In the pre-interview, instructors showed onscreen how they planned to carry out the strategies; in the post-interview, they described implementation. The research team also recruited a subset of students to discuss their experiences. Questions focused on strategy effectiveness, value, consistency with typical classroom practice, and ease of use, and on recommended changes. Students were also asked to describe what motivated their college attendance and course goals. Figure 2 depicts institution types, number of participating instructors per institution, number of interviewees, STEM subjects, course durations, and online modality of the pilot courses.

Table 2

Sample Description

Descriptor	Institution A	Institution B	Institution C
Institution type	2-year college	4-year historically black university	2-year college
Number of instructors	3	2	4
Number of interviewees*	2 instructors; 3 students	2 instructors; 1 student	3 instructors; 1 student
Course length	8 weeks	8 weeks	5 weeks
Course disciplines represented	Statistics, psychology, calculus	Biology	Anatomy & physiology, biology
Course modalities included	Asynchronous, hybrid	Asynchronous	Asynchronous

* *Three students were in classes of an instructor who was not interviewed.*

Findings

Most instructors and students reported the strategies seemed usable, effective, and valuable, with few changes needed.

Student Learning Factors. In interviews, students described the often busy, time-constrained conditions of their college experience (e.g., raising children, working, traveling). Some could work only a few hours a day, usually early in the morning or later in the evening. Some described struggling to adjust to the higher discipline of college. Students described a wide range of motivations for attending college (e.g., providing a better life for their children, seeking to attend law school). Most wanted to deepen their knowledge of a topic or maintain their grade point average to pursue longer-term goals.

Usability and Consistency With Typical Classroom Practice. Most instructors described the SDL strategies as easy to use. Noted exceptions were due to time constraints and the limitations of group activities in online contexts. For example, the instructors teaching 4-week courses found it challenging to use every strategy and omitted one of them, and several instructors combined the exam wrapper and the reflective prompts because of time constraints. Several instructors and students reported challenges around fostering rich engagement in the SPIN group activities. Instructors reported integrating the strategies into the LMS in varied ways: sometimes as a "form" (ungraded assignment), sometimes as a discussion board post, and sometimes as a link to a Google form (survey). They sometimes incentivized students to use the strategies by providing grade points or credits for completion. One instructor took about 2 hours to load the strategies into the LMS. Both instructors and students described the reflective prompts and initial SPIN questionnaire as novel strategies, and the videos and SPIN activities as being consistent with typical classroom practice. Analysis of the instructor and student feedback suggests the more novel

the strategy seemed, the more salient its value appeared for offering additional targeted support for SDL skill development.

Efficacy and Value. Few students had experienced SDL supports in their previous college classes, and most appreciated them, saying they reminded them of useful coping strategies, helped them connect with other students, and enabled them to better track their learning. Some instructors reported consulting students' video and prompt reflections to gain insight into student needs or identify content students found difficult. One instructor said a student who failed an early test appeared to improve by using the reflective prompts, completing more homework and earning As on subsequent tests.

Instructors developed group activities related to their content. For instance, biology students considered evolutionary adaptations of fish, math students solved a problem with a graphing calculator, and another group created an "interactive study guide." Students used group work and discussion threads to gauge their progress and reinforce learning. Both instructors and students praised the videos, but some students found the content not particularly novel or universally useful. One student suggested the videos might have lower utility for experienced, working students but higher utility for first-time online students. A student who expressed doubts about her confidence found the videos helpful. Table 3 shows the perceived value of the SDL strategies.

Table 3

Perceived Value of SDL Strategies

SDL strategies	Instructor perceptions	Student perceptions
SPIN Activity 1 (questionnaire)	Useful for grouping students based on common schedules. Inspired student interest in group work, which tapered off and needed reinforcement.	Potentially a good way to meet peers, but some instructors did not share results to support that.
Videos	Useful insights gleaned from student reflections.	Useful coping strategies and chance to reflect; less useful when student felt pressed for time or was familiar with content.
Reflective prompts	Useful insights gleaned from student reflections.	Helpful for tracking progress, identifying areas for more study and practice. One student felt uncomfortable revealing he was behind to instructor.
Exam wrappers	Important to use around first exam to support future success in course.	Helpful for focusing on learning needs; less useful to students already preparing for exam. Post-exam wrapper might be more useful if it asked students to correct mistakes or if instructors responded to student questions.
SPIN Activity 2 (group activities)	All emphasized group activities, and few changes were noted; one instructor noted students seemed more likely to meet in groups.	Reinforces learning, with harder assignments stimulating more help-seeking; occasional concerns about procrastination by other group members.

SDL strategies	Instructor perceptions	Student perceptions
Reflective prompts (letter)	One instructor was concerned students would not want to do this.	No comments.

Discussion

The pilot study indicated all three SDL strategies were usable and offered valued insight to instructors and students in an online STEM course. The small sample of online students described familiar challenges that college students face, from adjusting after high school to juggling work and family responsibilities. The students displayed common adult motivations for attending college and enrolling in STEM courses, usually situating these courses within a longer-term vision of career success. Instructors described efforts to incentivize usage of the strategies, sometimes by offering participation credits or grades.

Instructors and students perceived the SDL strategies as useful overall. Instructors reported spending minimal time—maybe a couple hours per course—to integrate the strategies. They leveraged SDL surveys and reflections to serve their needs to organize students into groups and identify areas where students needed more help; some gleaned insights into how individual students were managing specific course challenges. Students appreciated how the SDL strategies supported their connections with other students and helped them identify areas where they needed to study more, track their learning, and gauge how they were progressing compared to their peers.

Thus, the SDL strategies appear to help instructors monitor and manage lessons and respond in timely ways to student needs. The strategies helped some students take a more active role in managing their learning, from tracking learning needs and progress to supporting academically beneficial social interactions. Suggestions for improvement included condensing the materials, adding more questions to the prompts, and providing implementation tips and examples.

Drawing from this feedback and other research (Brown et al., 2024), the research team collaborated with educators from four partner institutions to develop an instructional model that instructors could follow to implement the strategies (Wasserman & Bickerstaff, 2024). This is a small-scale design study with limited generalizability. In the future, the team will conduct an efficacy study on the impacts of strategy use on students' course grades and their self-reported use of SDL strategies.

Conclusions

This study offers insights into ways to design and deliver technology-based supports for students' use of SDL skills in online college STEM courses. The study confirms the value of instructors supporting SDL skills by using online strategies that can be implemented within the time constraints of challenging and content-heavy academic courses. Given the social isolation observed in online courses, these findings provide a promising indication that incorporating such SDL strategies into online courses can activate both instructors' and students' use of productive cognitive and social strategies to support teaching and learning.

The study reinforces past research on the value of broadening learning supports beyond strictly instructional or academic interventions to strategies that support motivational beliefs

and relationships (Patrick et al., 2007). The findings resonate with past research that students' social identities (e.g., high or low confidence) limit instructors' control over students' decisions about engaging in SDL activities (Cleary & Chen, 2009; Montalvo & Torres, 2008). While some research has called for substantial schoolwide change to support instructors' SDL strategy implementation (Zumbrunn et al., 2011), our study showed a positive level of adoption and reception with minimal professional development and only a couple hours of course integration.

References

Altindag, D. T., Filiz, E. S., & Tekin, E. (2021). *Is online education working?* (NBER Working Paper No. 29113). National Bureau of Economic Research. https://www.nber.org/papers/w29113

Berry, G. R. (2018). Learning from the learners: Student perception of the online classroom. *Quarterly Review of Distance Education*, *19*(3), 39–56. https://www.infoagepub.com/quarterly-review-of-distance-education.html

Boekaerts, M., & Corno, L. (2005). Self-regulation in the classroom: A perspective on assessment and intervention. *Applied Psychology*, *54*(2), 199–231. https://doi.org/10.1111/j.1464-0597.2005.00205.x

Boekaerts, M., Pintrich, P. R., & Zeidner, M. (2000). Self-regulation: An introductory overview. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 1–9). Academic Press. https://doi.org/10.1016/B978-012109890-2/50030-5

Brown, A. E., Bickerstaff, S., & Edgecombe, N. (2024). *Supporting learning online: Perspectives of faculty and staff at broad-access institutions during COVID-19*. Postsecondary Teaching with Technology Collaborative. https://postseccollab.org/wp-content/uploads/2024/04/Supporting-Learning-Online_postsec-collaborative-report_508c_acc.pdf

Burkander, P., Yu, R., Yang, H., Cao, Q., Lin, X., & Yao, C. (2024, September 18–21). *Improving student success in online postsecondary STEM courses through technology-based interventions* [Paper presentation]. Society for Research on Educational Effectiveness Conference, Baltimore, MD, United States. https://sree.confex.com/sree/2024/meetingapp.cgi/Paper/5838

Cleary, T. J., & Chen, P. P. (2009). Self-regulation, motivation, and math achievement in middle school: Variations across grade level and math context. *Journal of School Psychology*, *47* (5), 291–314. https://doi.org/10.1016/j.jsp.2009.04.002

Fry, R., Kennedy, B., & Funk, C. (2021). *STEM jobs see uneven progress in increasing gender, racial and ethnic diversity*. Pew Research Center. https://www.pewresearch.org/science/2021/04/01/stem-jobs-see-uneven-progress-in-increasing-gender-racial-and-ethnic-diversity/

Hatfield, N., Brown, N., & Topaz, C. M. (2022). Do introductory courses disproportionately drive minoritized students out of STEM pathways? *PNAS Nexus*, *1*(4), 1–10. https://doi.org/10.1093/pnasnexus/pgac167

Jaggars, S. S., & Xu, D. (2016). How do online course design features influence student performance? *Computers & Education*, *95*, 270–284. https://doi.org/10.1016/j.compedu.2016.01.014

Merriam, S. B. (2001). Andragogy and self-directed learning: Pillars of adult learning theory. *New Directions for Adult and Continuing Education*, *2001*(89), 3–14. https://doi.org/10.1002/ace.3

Merriam, S. B., & Caffarella, R. S. (1999). *Learning in adulthood* (2nd ed.). Jossey-Bass.

Mislevy, J., Thomas, K., Bickerstaff, S., & Cheever, H. (2024). *Building students' motivation and learning skills in online courses* [Webinar]. Postsecondary Teaching with Technology Collaborative. https://postseccollab.org/practical-strategies-to-support-online-stem-students/

Montalvo, F. T., & Torres, M. C. (2008). Self-regulated learning: Current and future directions. *Electronic Journal of Research in Educational Psychology*, *2*(1), 1–34. https://ojs.ual.es/ojs/index.php/EJREP/index

Morris. T. H. (2023). Four dimensions of self-directed learning: A fundamental meta-competence in a changing world. *Adult Education Quarterly*, 1–19. https://doi.org/10.1177/07417136231217453

Morton, T. R. (2021). A phenomenological and ecological perspective on the influence of undergraduate research experiences on Black women's persistence in STEM at an HBCU. *Journal of Diversity in Education*, *14*(4), 530–543. https://doi.org/10.1037/dhe0000183

Newsome, M. (2021, April 12). Even as colleges pledge to improve, share of engineering and math graduates who are Black declines. *The Hechinger Report*. https://hechingerreport.org/even-as-colleges-pledge-to-improve-share-of-engineering-graduates-who-are-black-declines/).

Patrick, H., Ryan, A. M., & Kaplan, A. (2007). Early adolescents' perceptions of the classroom social environment, motivational beliefs, and engagement. *Journal of Educational Psychology*, *99*(1), 83–98. https://psycnet.apa.org/doi/10.1037/0022-0663.99.1.83

Pintrich, P. R. & Schunk, D. H. (1996). *Motivation in education: Theory, research, and applications*. Prentice Hall.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*(1), 68–78. https://doi.org/10.1037//0003-066x.55.1.68

Thompson, M. E. (2021, July 26). Who's getting pulled in weed-out courses for STEM majors? *Brown Center Chalkboard*. https://www.brookings.edu/blog/brown-center-chalkboard/2021/07/26/whos-getting-pulled-in-weed-out-courses-for-stem-majors/

Wasserman, E., & Bickerstaff, S. (2024, December 23). Practitioners leading the way: Developing a model for self-directed learning in online courses. *Postsecondary Teaching with Technology Collaborative Blog*. https://postseccollab.org/practitioners-leading-the-way/

Winne, P. H. (2010). Bootstrapping learner's self-regulated learning. *Psychological Test and Assessment Modeling*, *52*(4), 472–490. https://www.psychologie-aktuell.com/journale/psychological-test-and-assessment-modeling.html

Xu, D., & Jaggars, S. S. (2014). Performance gaps between online and face-to-face courses: Differences across types of students and academic subject areas. *Journal of Higher Education*, *85*(5), 633–659. https://doi.org/10.1080/00221546.2014.11777343

Yarnall, L., Griffiths, R., & Cheever, H. (2023). *Teaching and designing online STEM courses to support self-directed learning skills*. SRI International. https://postseccollab.org/wp-content/uploads/2023/06/Teaching-and-Designing-Online-STEM-Courses-to-Support-Self-Directed-Learning-Skills_postsec-collaborative-whitepaper_05192023_Acc.pdf

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory Into Practice*, *41*(2), 64–70. https://doi.org/10.1207/s15430421tip4102_2

Zumbrunn, S., Tadlock, J., & Roberts, E. D. (2011). Encourage self-regulated learning in the classroom. Metropolitan Educational Research Consortium, Virginia Commonwealth University. https://scholarscompass.vcu.edu/cgi/viewcontent.cgi?article=1017&context=merc_pubs

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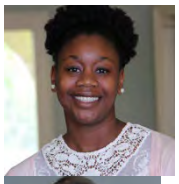

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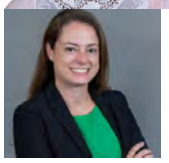

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