Effective teaching strategies to develop students' self-regulated learning in online learning environments

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Background

- Online learning has become the trend
  - The unprecedented COVID-19 global pandemic has accelerated the transition of teaching and learning from face-to-face to online mode (Mishra et al., 2020)
  - MOOCs see exponential growth (Impey, 2020)

Background

- Challenges of online learning (Jansen et al., 2017)
  - Increased student autonomy
    - Learners solely responsible for their time and environment management
    - Increased responsibility demanded of learners to effectively engage in learning tasks
  - Physical absence of the instructor and the peers
    - Lack of motivation
    - Lack of peer support

Background

- To succeed in online learning
  - Students need to be self-regulated learners (Lai & Hwang, 2016; Park, Park, & Chae, 2018; Wang, Shannon, & Ross, 2013)

Self-regulated learning (SRL)

- "The degree to which students are able to become metacognitively, motivationally, and behaviorally active participants of their own learning process"(Zimmerman, 2000).

Framework

- SRL framework: Zimmerman, 2002

Barry J. Zimmerman (2002) Becoming a Self-Regulated Learner: An Overview, Theory Into Practice, 41:2, 64-70, DOI: 10.1207/s15430421tip4102_2

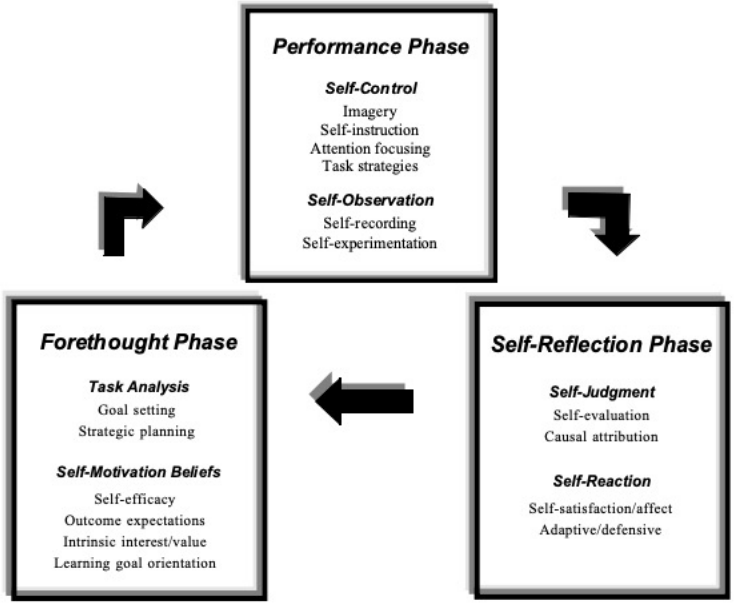


Figure 1. Phases and Subprocesses of Self-Regulation. From B.J. Zimmerman and M. Campillo (in press), "Motivating Self-Regulated Problem Solvers." In J.E. Davidson and Robert Sternberg (Eds.), *The Nature of Problem Solving*. New York: Cambridge University Press. Adapted with permission.

A meta-analysis (Broadbent & Poon, 2015)

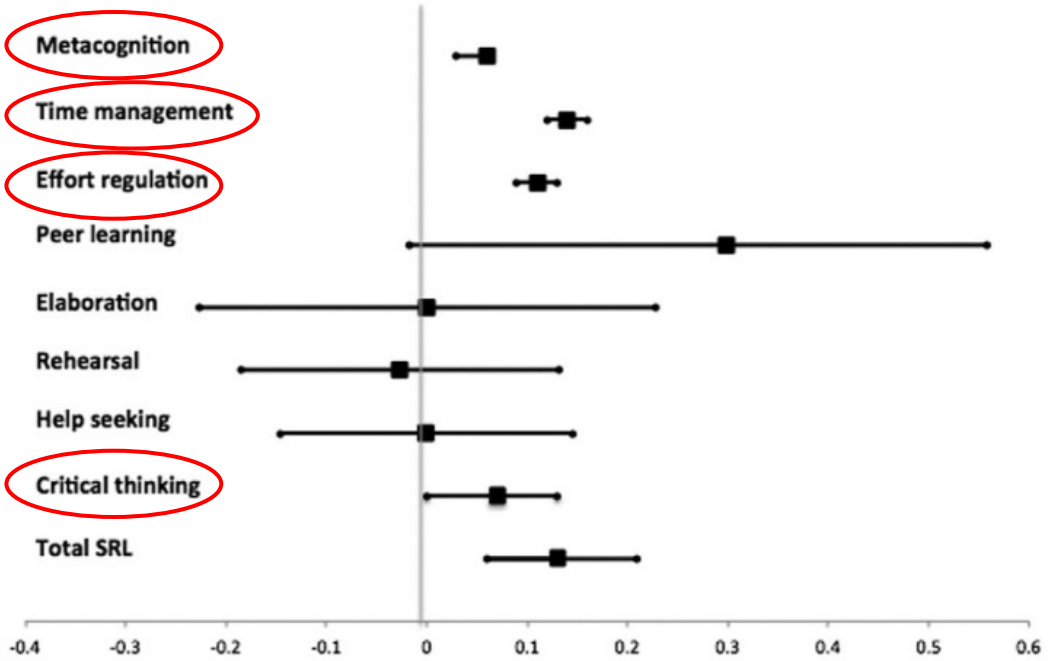


Fig. 2. Forest plot of each individual SRL strategy and the combined SRL strategies.

A meta-analysis (Broadbent & Poon, 2015)

- Online learners who
  - make good use of their time (time management)
  - are conscious of their learning behavior (metacognition)
  - are critical in their examination of content (critical thinking)
  - persevere in understanding the learning material despite challenges faced (effort regulation)
- are more likely to achieve higher academic grades in online settings

A meta-analysis (Broadbent & Poon, 2015)

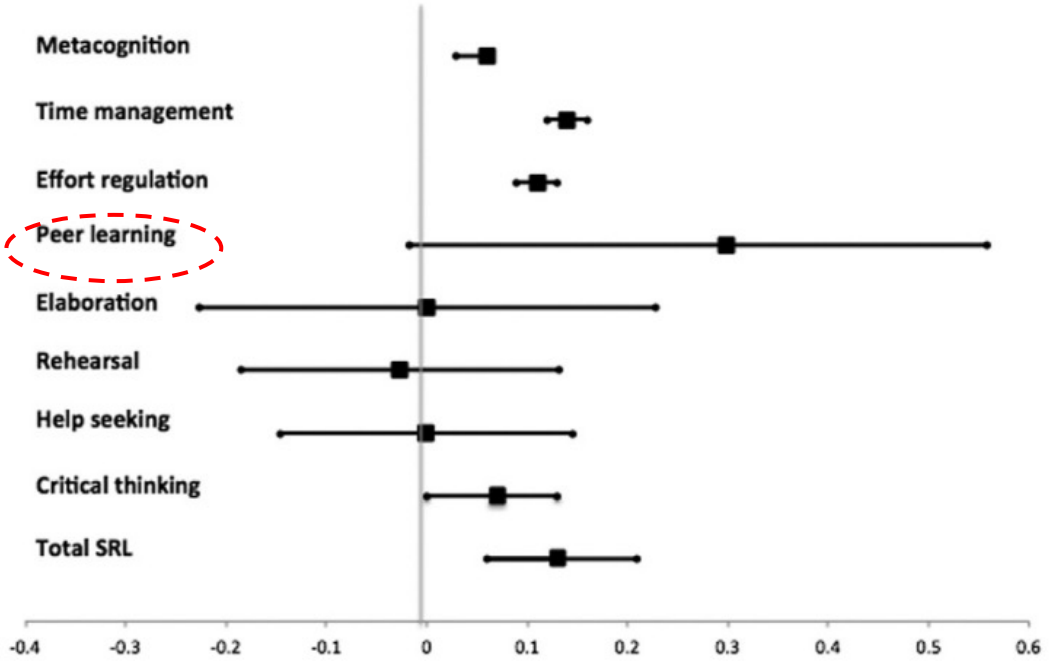
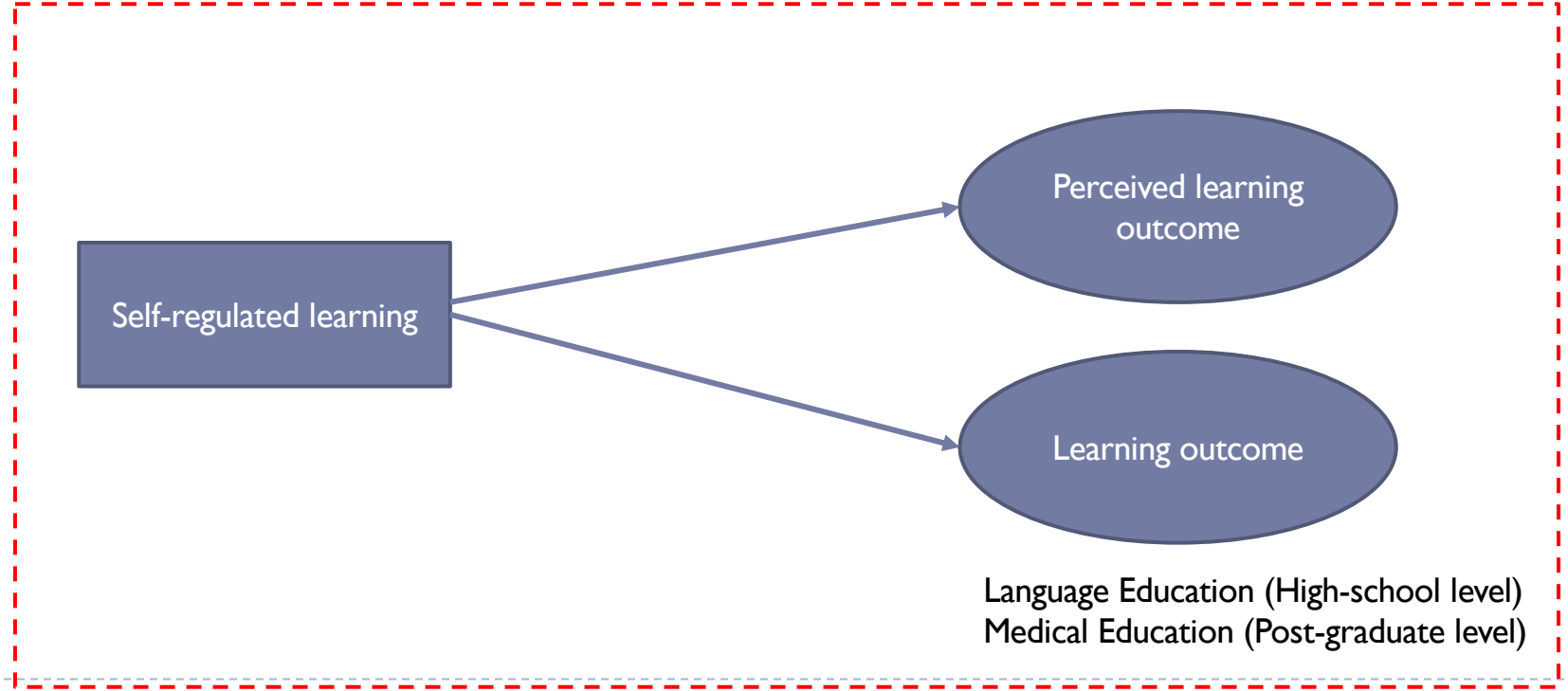


Fig. 2. Forest plot of each individual SRL strategy and the combined SRL strategies.

Peer learning

- largest effect size despite the overall non-significant effect
  - Stronger effect than in traditional face-to-face settings (Richardson et al., 2012)
  - For online learning when interaction with teachers may be reduced, students may seek to use alternatives that are more available (i.e., peers) to get assistance

My research


Perceived learning outcome
Self-regulated learning
Learning outcome
Language Education (High-school level)
Medical Education (Post-graduate level)

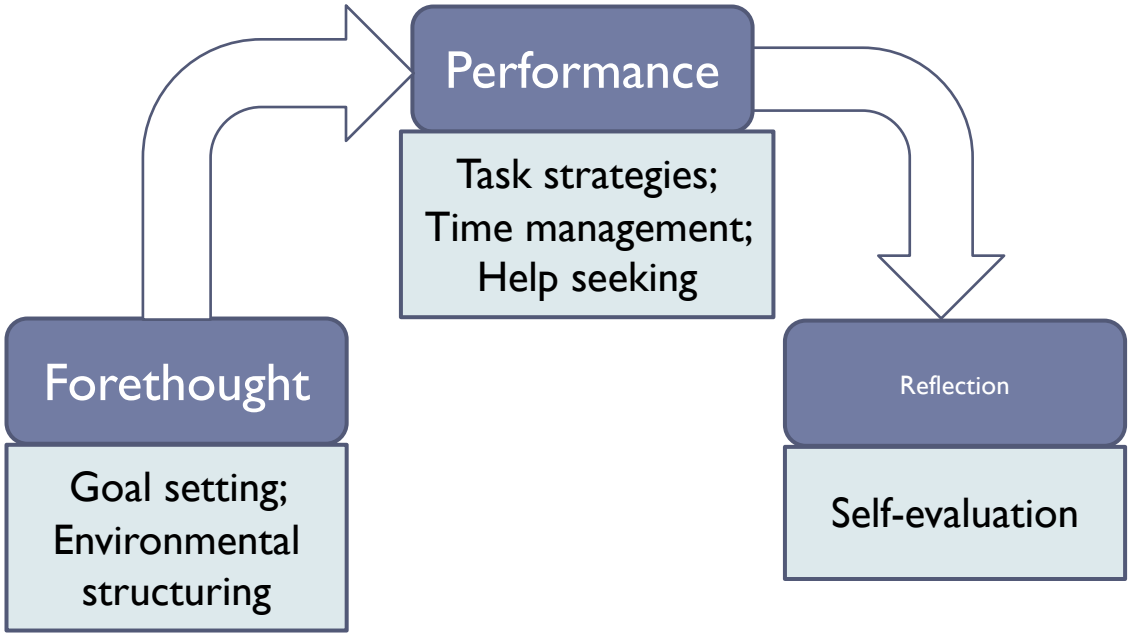
Study 1

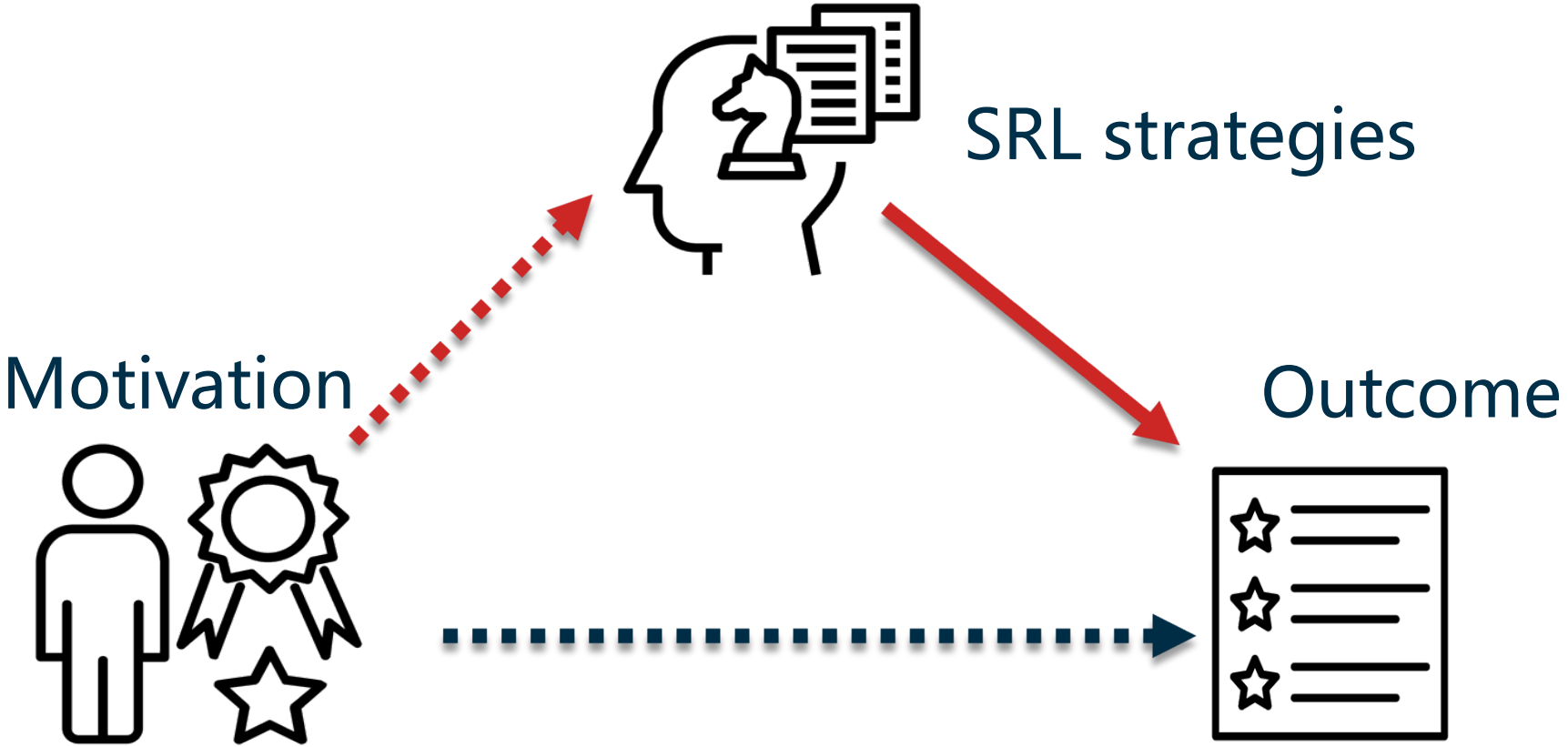
- SRL strategies, motivation and online language learning (Lin, Zhang, & Zheng, 2017)
  - a Midwestern Virtual School
  - 466 high-school online language-learning students who take online courses

Lin, C.-H., Zhang, Y., & Zheng, B. (2017). The role of learning strategies and motivation in online language learning: A structural equation modeling analysis. *Computers & Education*, *113*, 75-85. doi: 10.1016/j.compedu.2017.05.014

Framework

- Online SRL, Barnard et al., 2009





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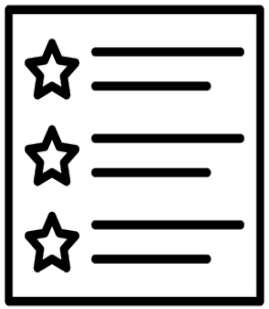
SRL strategies

Outcome

42.5% Satisfaction

11.9% Test scores

55.3% Perceived progress



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Discussion

- In online language learning, SRL strategies are important predictors of students' learning outcome

- Students in online language learning exhibited low motivation and SRL strategies in general

Study 2: specific SRL strategies in flipped classrooms

- Undergraduate medical education

- Flipped classroom, where students are required to independently learn about 15 hours of online reading and videos before class, while class time is focused on small group discussions centered around patients' chief complaints and concerns

Zheng, B., Zhang, Y. Self-regulated learning: the effect on medical student learning outcomes in a flipped classroom environment. *BMC Med Educ* **20,** 100 (2020). https://doi.org/10.1186/s12909-020-02023-6

Study 2: specific SRL strategies in flipped classrooms

Categories	Sub-categories	Sample questions
Cognitive strategies	Rehearsal	"When I study for this class, I practice saying the material to myself over and over."
	Elaboration	"I try to understand the material in this course by making connections between the readings and the concepts from the class activities."
	Organization	"I make simple charts, diagrams, or tables to help me organize course material."
	Critical thinking	"When a theory, interpretation, or conclusion is presented in class or in the readings, I try to decide if there is good supporting evidence."
Meta-cognitive strategies		"I ask myself questions to make sure I understand the material I have been studying in this class."
Resources management	Time and study environment	"I make good use of my study time for this course."
	Effort regulation	"Even when course materials are dull and uninteresting, I manage to keep working until I finish."
	Peer learning	"When studying for this course, I often set aside time to discuss the course materials with a group of students from the class."
	Help seeking	"I try to identify students in this class whom I can ask for help if necessary."
Self-efficacy		"I am confident I can do an excellent job on the assignments and tests in this course"

Motivated strategies for learning questionnaire (MSLQ, 1993)

Zheng, B., Zhang, Y. Self-regulated learning: the effect on medical student learning outcomes in a flipped classroom environment. *BMC Med Educ* **20,** 100 (2020). https://doi.org/10.1186/s12909-020-02023-6

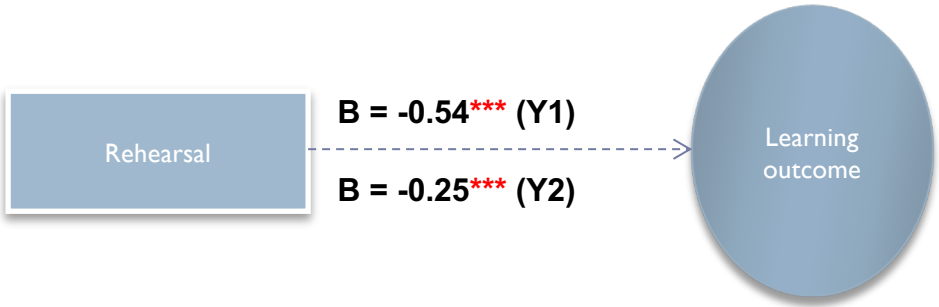
Study 2: specific SRL strategies in flipped classrooms

	Total/Mean (SD)	Y-1	Y-2
Pre-test	46.25 (10.93)	37.11 (5.09)	54.66 (7.60)
Post-test	58.33 (13.93)	49.81 (10.00)	66.17 (12.37)
Cognitive strategies	4.07 (1.36)	4.20 (.83)	4.14 (.84)
- Rehearsal	3.64 (1.12)	3.54 (1.10)	3.74 (1.13)
- Elaboration	4.78 (1.00)	4.92 (.95)	4.64 (1.04)
- Organization	4.07 (1.36)	4.21 (1.32)	3.94 (1.40)
- Critical thinking	4.18 (1.04)	4.12 (1.05)	4.23 (1.04)
Meta-Cognition	4.46 (.75)	4.43 (.77)	4.49 (.74)
Resource management	4.48 (.78)	4.71 (.79)	4.27 (.72)
- Time management	4.91 (.84)	4.96 (.84)	4.87 (.84)
- Effort regulation	4.93 (1.06)	4.90 (1.07)	4.96 (1.05)
- Peer learning	3.75 (1.47)	4.20 (1.42)	3.33 (1.39)
- Help seeking	4.33 (1.28)	4.78 (1.09)	3.91 (1.31)

19 Zheng, B., Zhang, Y. Self-regulated learning: the effect on medical student learning outcomes in a flipped classroom environment. *BMC Med Educ* **20,** 100 (2020). https://doi.org/10.1186/s12909-020-02023-6

Study 2: specific SRL strategies in flipped classrooms

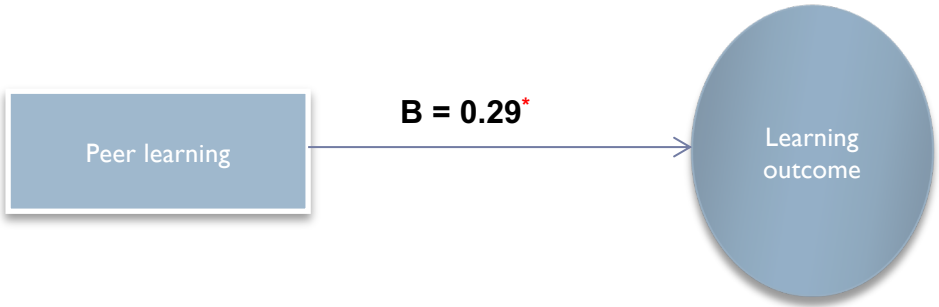
- Rehearsal



* p < 0.05, ** p < 0.01, *** p < 0.001

Study 2: specific SRL strategies in flipped classrooms

- Peer learning (Y1)



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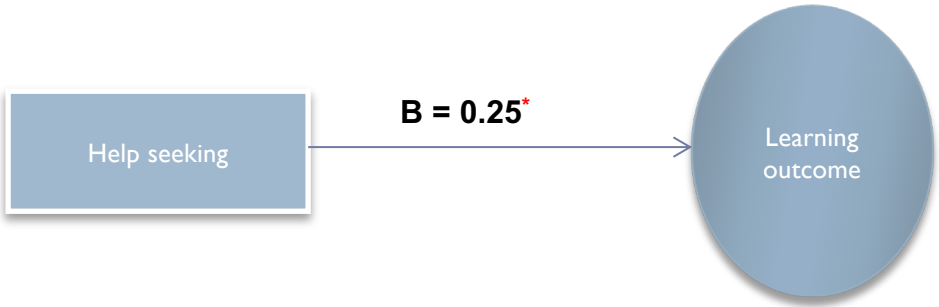
Study 2: specific SRL strategies in flipped classrooms

- Help seeking (Y2)



* p < 0.05, ** p < 0.01, *** p < 0.001

Study 2: specific SRL strategies in flipped classrooms

- Discussion
  - Rehearsal as a cognitive strategy
    - Might be helpful for lower-level learning such as remembering and memorization of information
    - The competency-based curriculum focuses on the integration of basic science and clinical experiences, and heavily emphasized students' knowledge connection and applications.

Study 2: specific SRL strategies in flipped classrooms

- Resources management strategies
  - Peer learning: potentially help students decrease their learning anxiety, increase their learning engagement, and improve their understanding of the learning materials (Owens and Walden, 2001)
    - Learning societies: a group of eight students, clinical faculty, basic scientists, and social scientists.
    - *"I enjoy being able to work with my small group since everyone has a different way of thinking of things and explaining them. There will be three different analogies/explanations thrown out so that it'll click for everyone."*

Study 2: specific SRL strategies in flipped classrooms

- Resources management strategies
  - Help seeking: important for medical educators to provide better support for students' help-seeking behavior.
    - Peer tutoring: upper-cohort students volunteer to tutor first-year students on a one-on-one basis
    - Learning specialists help address students' learning challenges
    - Social media platform: Facebook page and GroupMe to provide academic and emotional support for each other

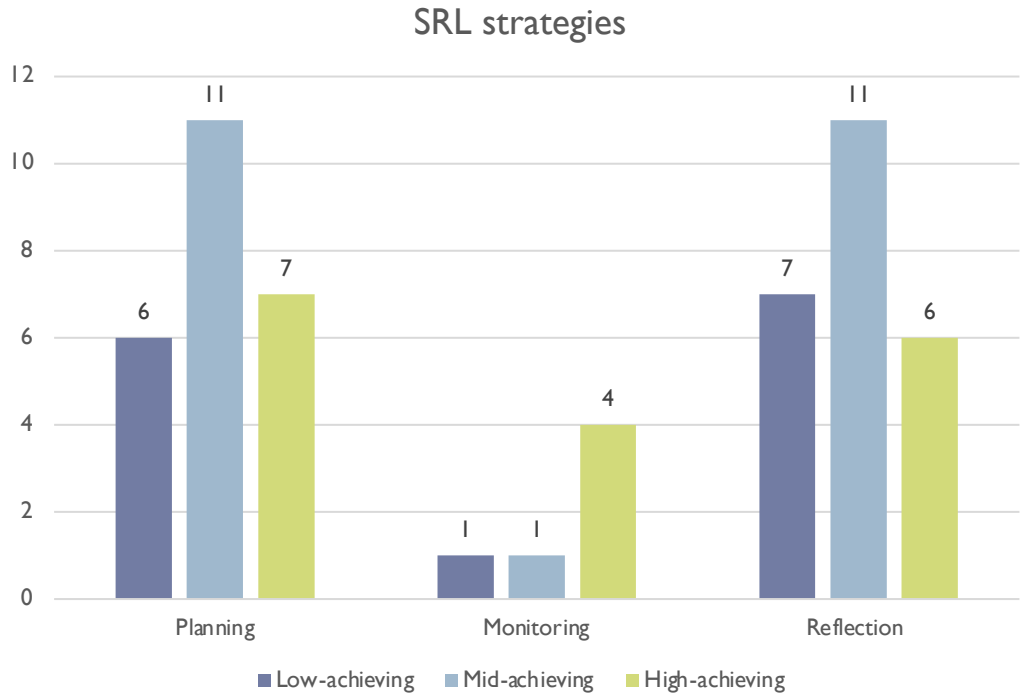
Study 3: SRL strategies across achievement levels

- Undergraduate medical education

- Qualitative study of 26 students, across achievement levels and study years, to describe their learning process,

Zheng B, Ward A, Stanulis R. Self-regulated learning in a competency-based and flipped learning environment: learning strategies across achievement levels and years. Med Educ Online. 2020 Dec;25(1):1686949. doi: 10.1080/10872981.2019.1686949.

Study 3: SRL strategies across achievement levels



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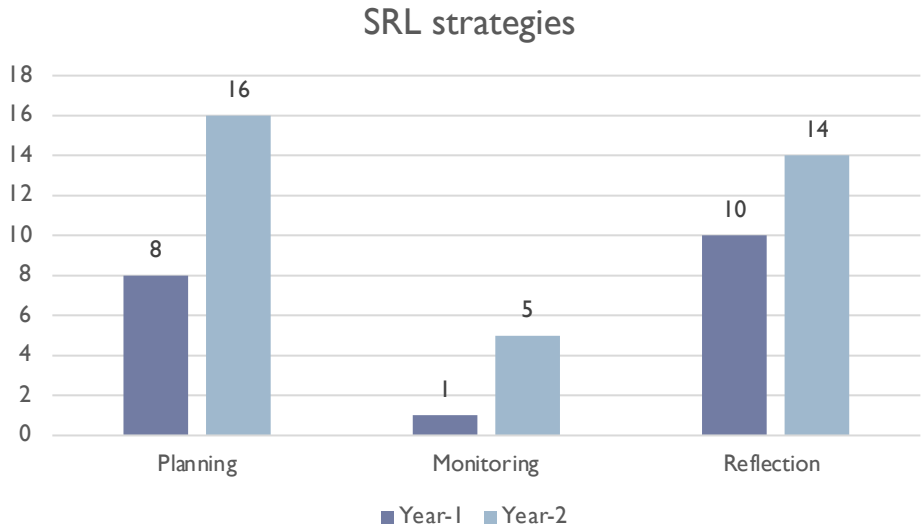
Study 3: SRL strategies across achievement levels



Discussion

- Planning
  - Goal setting: students mentioned that they would now "use learning objectives to guide learning", "get a picture/snapshot of what to learn" and keep the "big core objectives" in mind.
  - Strategic planning: some students mentioned that they now "look for learning objectives to decide which resources to watch and read", "skim to estimate the workload", or "space out reading based on class schedule instead of preparing everything on weekends".

Discussion

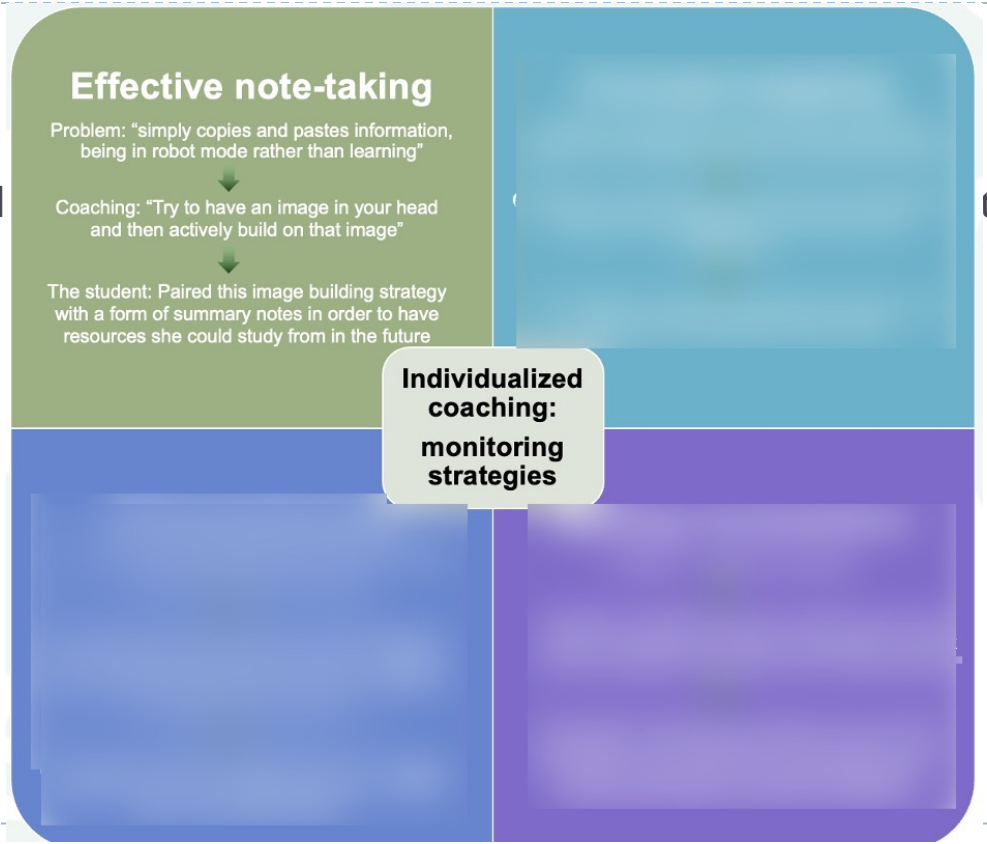
- Self-reflection
  - Use flashcards from outside resources (e.g., Anki, Osmosis) to quiz themselves or go back to learning objectives to make sure they were able to "recall the information".
  - Delayed multiple testing to make sure she could still retain information a while after her learning.
    - One student noted, "at the end of the week I like to review…And then the following week, (as well as) after the following week, I'd go back with the USMLE rx…so that'd be like my third pass…It does give you an idea of how much you know. You might think you know but you don't really know it…But if you are testing yourself, you can actually see how much you know."

Discussion

- Monitoring
  - Traditional learning does not require as much monitoring as in online environments, as the instructor/peers will help monitor student learning
  - Strategies to support students' self-monitoring

Study 3: SRL strategies across achievement levels

- Intervention
  - Individualized



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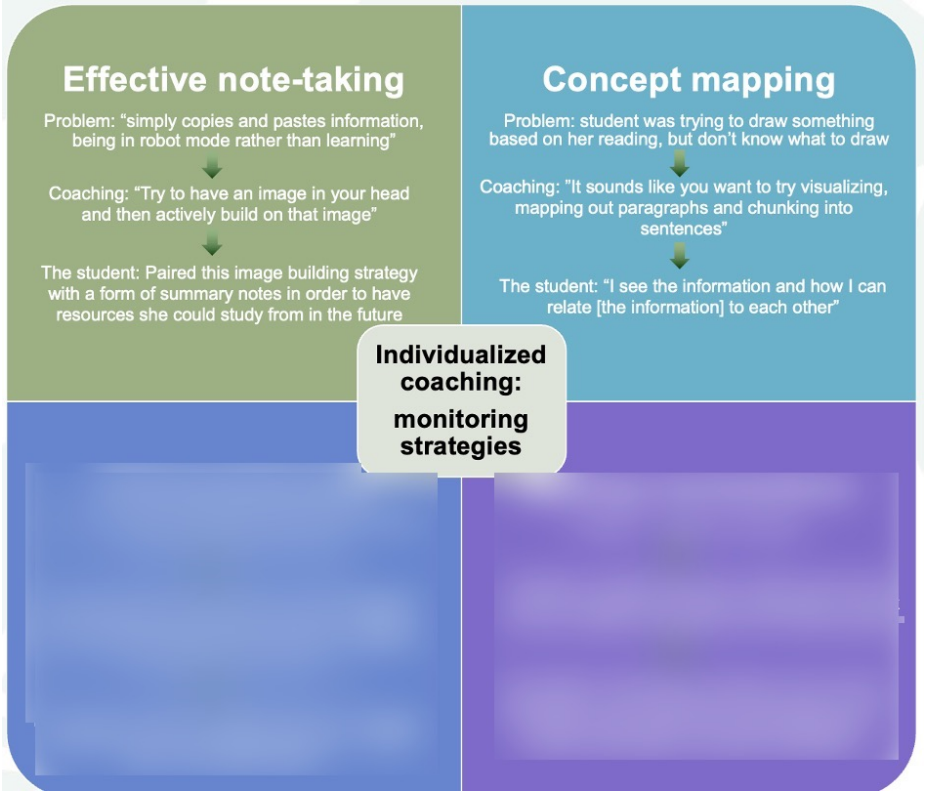
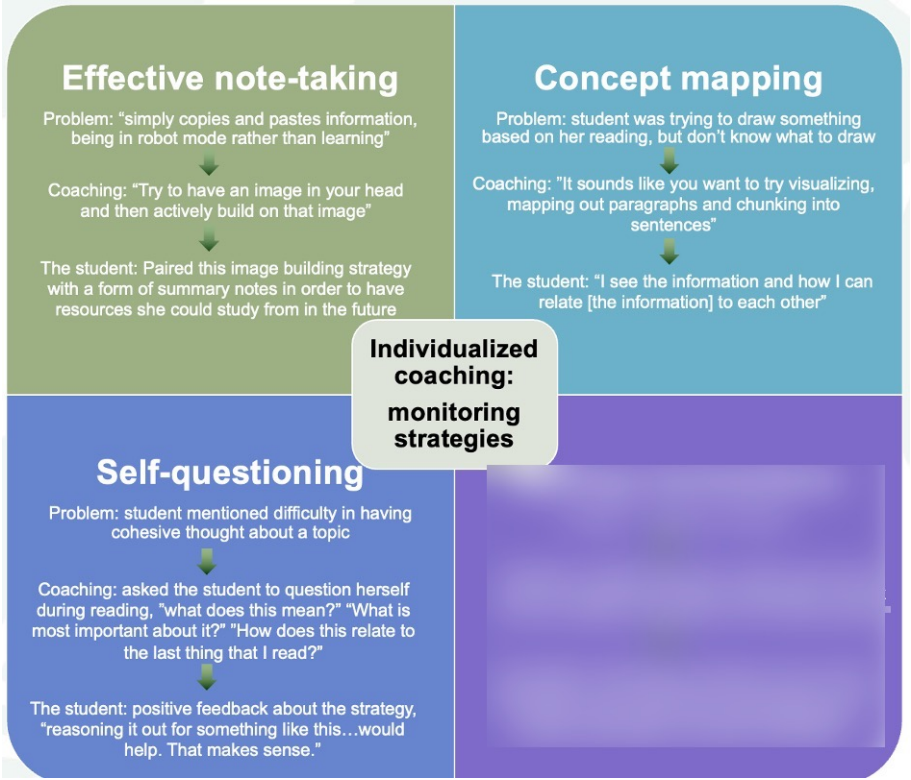
Study 3: SRL strategies across achievement levels



Study 3: SRL strategies across achievement levels



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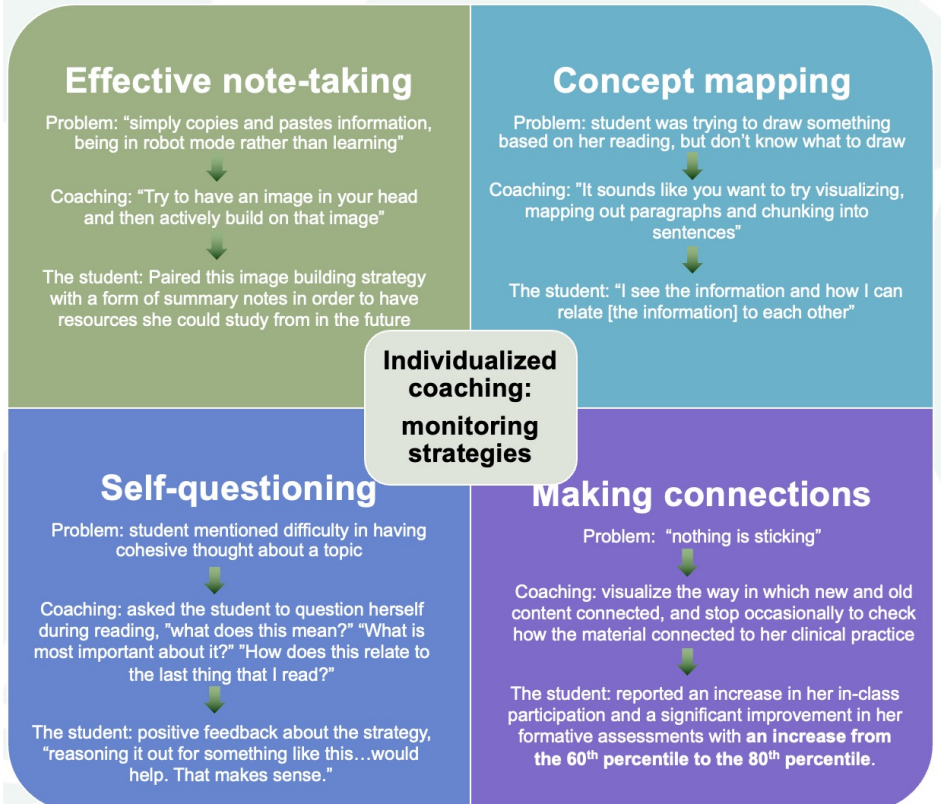


Summary

- SRL strategies
  - As students transition from traditional classroom to online learning environments, we cannot expect students to be equipped with those SRL strategies all by themselves.
    - We are too reliant on the assumption that students know how to self-direct their learning (Brydges et al., 2009).
    - These strategies can be explicitly taught with opportunities for repeated practice
    - Educators and instructional designers have a role to play in scaffolding students' development of such skills (White et al., 2013; Durning et al., 2011)

Pedagogical support

- Explicit instruction of SRL strategies
  - Develop online modules, sections, or content folders specifically dedicated to SRL strategies to increase students' awareness (Hu & Driscoll, 2013)

Pedagogical support

- Embed into the curriculum
  - Self-assessment questionnaire at the beginning, end, and regular intervals (Stizmann and Ely, 2010)
    - Am I concentrating on learning the material?
    - Do I understand all the key points of the material?
    - Are the study strategies I am using helping me learn the material?
    - Am I setting goals to help me remember the material after I finish the course?
    - Would I do better on the next quiz if I studied more?
    - Am I setting goals to ensure I have a thorough understanding of the training material?
    - Do I know enough about the material?

Pedagogical support

- Embed into the curriculum
  - Self-monitoring online recording form (Chang, 2007)
    - Beginning of study: when, where and with whom, prediction of test results
    - End of study: study time, actual outcome, any distractions

Pedagogical support

- Timely reminder (LMS, email, text message)
  - Regular reminder to all students (encourage them to watch learning materials, boost morale and motivation) (Goh, Seet, and Chen, 2012)
  - Automatic detection of high-risk students using learning analytics

Pedagogical support

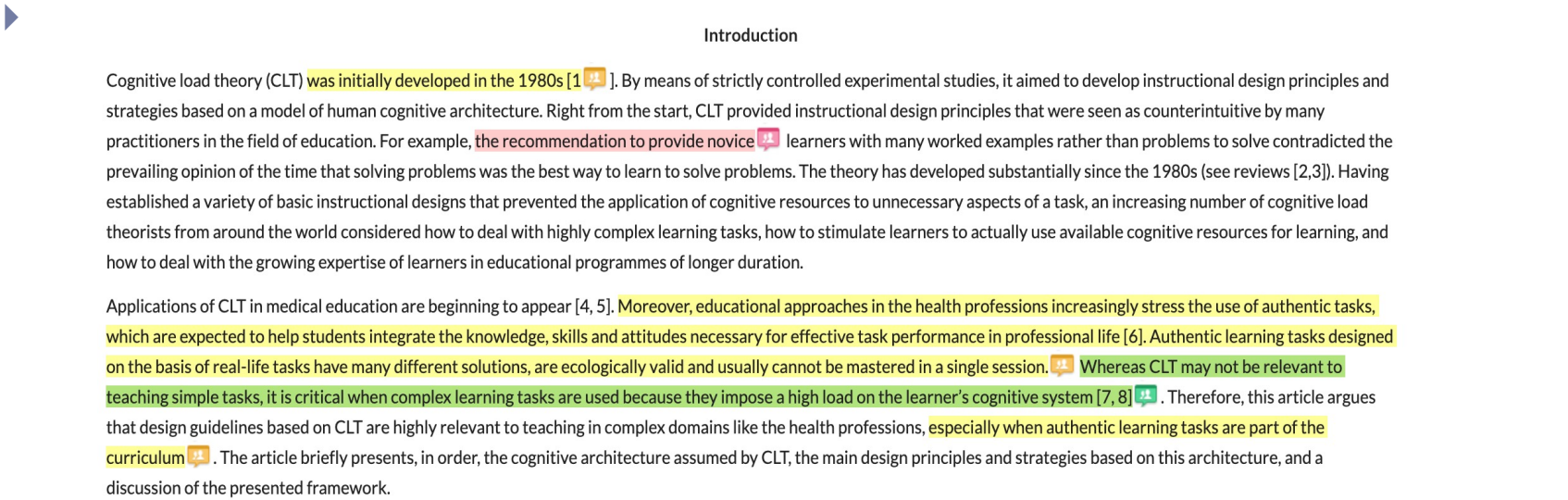
- Break large project into smaller steps
  - To overcome procrastination (Michinov et al., 2011)
  - Final project → break down to outline, different sections, drafts, and final paper, and set due dates with time intervals
  - Clear rubric and sample work for goal setting and self-evaluation

Pedagogical support

- Peer learning
  - Collaborative annotation

Collaborative annotation

- Diigo



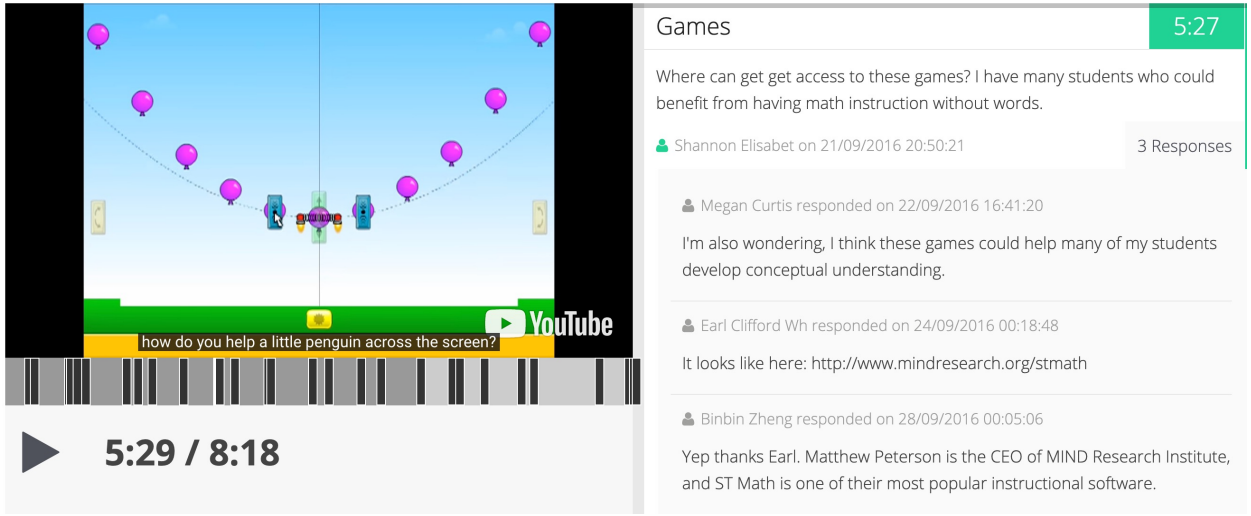
Introduction

Cognitive load theory (CLT) was initially developed in the 1980s [1]. By means of strictly controlled experimental studies, it aimed to develop instructional design principles and strategies based on a model of human cognitive architecture. Right from the start, CLT provided instructional design principles that were seen as counterintuitive by many practitioners in the field of education. For example, the recommendation to provide novice learners with many worked examples rather than problems to solve contradicted the prevailing opinion of the time that solving problems was the best way to learn to solve problems. The theory has developed substantially since the 1980s (see reviews [2,3]). Having established a variety of basic instructional designs that prevented the application of cognitive resources to unnecessary aspects of a task, an increasing number of cognitive load theorists from around the world considered how to deal with highly complex learning tasks, how to stimulate learners to actually use available cognitive resources for learning, and how to deal with the growing expertise of learners in educational programmes of longer duration.

Applications of CLT in medical education are beginning to appear [4, 5]. Moreover, educational approaches in the health professions increasingly stress the use of authentic tasks, which are expected to help students integrate the knowledge, skills and attitudes necessary for effective task performance in professional life [6]. Authentic learning tasks designed on the basis of real-life tasks have many different solutions, are ecologically valid and usually cannot be mastered in a single session. Whereas CLT may not be relevant to teaching simple tasks, it is critical when complex learning tasks are used because they impose a high load on the learner's cognitive system [7, 8] . Therefore, this article argues that design guidelines based on CLT are highly relevant to teaching in complex domains like the health professions, especially when authentic learning tasks are part of the curriculum . The article briefly presents, in order, the cognitive architecture assumed by CLT, the main design principles and strategies based on this architecture, and a discussion of the presented framework.

Collaborative annotation

- Video annotation (e.g., VideoANT) https://ant.umn.edu/atdompdkhw/view



Pedagogical support

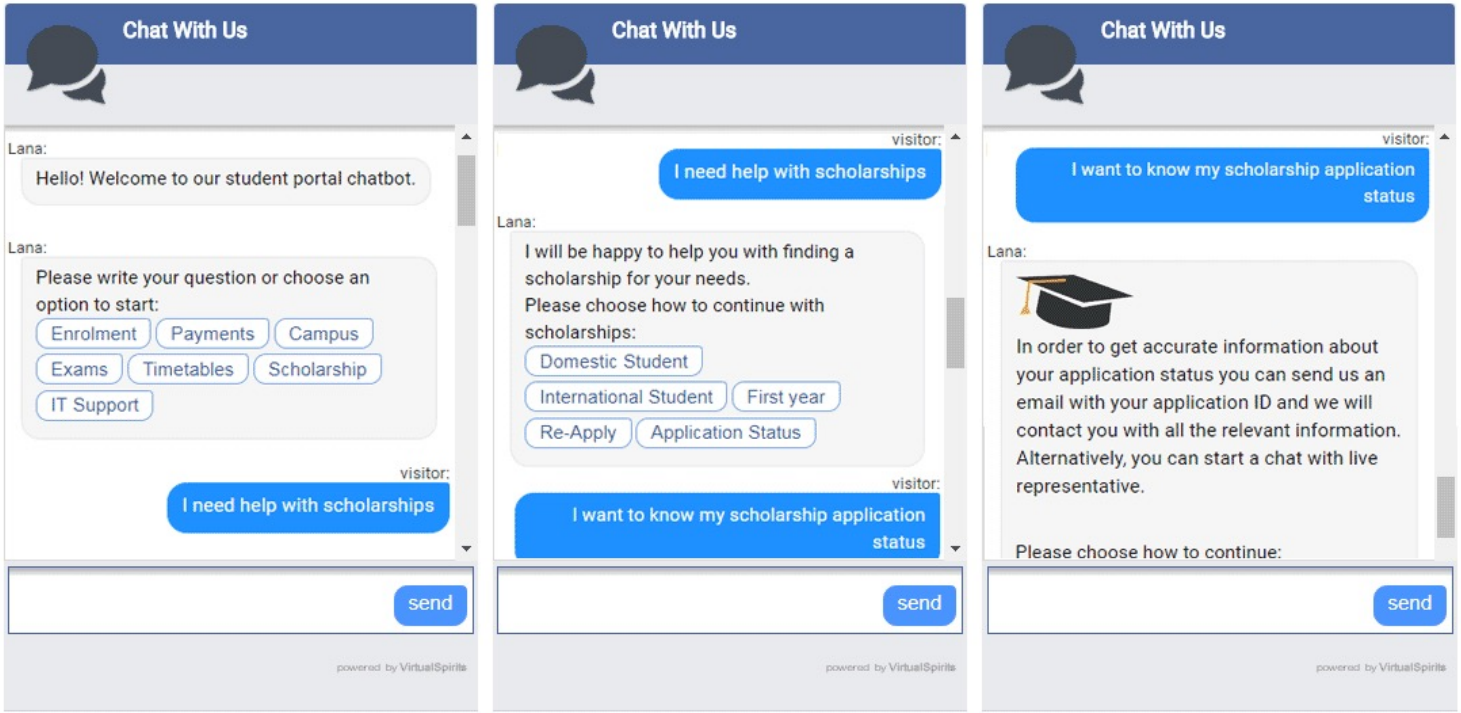
- Help seeking
  - High-performing students were more likely to engage in online help seeking (Hao et al., 2016)

Pedagogical support

- Fostering help seeking (Cheng & Tsai, 2011)
  - Information searching (repository of reliable resources; students share links among themselves)
  - Prompt feedback, clear expectations
  - Encourage peer support (e.g., WhatsApp group)

Help seeking

- Chatbot



https://www.virtualspirits.com/chatbot-for-university-top-challenges-and-solutions.aspx

Gradual release of scaffolding

- Scaffolding can fade off over time
- Students will internalize those strategies and become self-regulated learners gradually
- Beneficial for students to become lifelong learners

Thank you!

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