

# Self-Regulated Learning:

## Using Educational Psychology to Enhance the Learning Experience for Undergraduate Students

by Allison Palmer, Scott Strong



### Introduction: Individual, Conceptual, and Self-Regulatory Learning

Bloom's Taxonomy is a framework often utilized to describe student learning outcomes and behaviors and to organize the cognitive aspects of learning in a hierarchical fashion [1]. According to educational psychologist Bloom, people's cognitive domain focuses on "intellectual skills, cognitive strategy, and verbal information" [2]. Although Bloom's is a popular model, we will note that there are several alternatives that include additional aspects of learning, e.g. the notion of self, that all work to gradate the various outcomes of learning, helping students and educators contextualize learning so they can assess and improve educational experiences [3].

Looking at Bloom's Taxonomy specifically, shortly after the original work was published, others sought to include and formulate two related domains, affective (Krathwohl *et al.*) and psychomotor (Harrow), which are not as heavily emphasized or discussed in post-secondary education [4, 5]. Schools' curricula, expectations, and teaching styles tend to emphasize students' capabilities to solve technical problems and think critically, making the cognitive domain the most stressed of the three. Thus, educators and students alike must pause and pose the inquiry: what are the intellectual as well as personal consequences of over-emphasizing the cognitive domain in students' learning and lives?

By further framing instruction and learning with non-cognitive domains, such as those discussed here, educators and students can establish a more holistic sense of self. The affective domain focuses on "skills and disposition for appropriate emotions

and responses" [2]. Learning is enhanced when the amygdala, prefrontal cortex, and hippocampus interact harmoniously, and one's emotional state is intimately connected to these brain activities [6]. The psychomotor domain focuses on "physical actions, reflexes, interpretive movements and hand-eye coordination," and there is a growing body of literature seeking to reconcile the divorce between the mind and body [2, 7, 8]. Clearly, both of these domains are significant components to effective learning.

Students, like all humans, carry within them more than just their intellectual capacities and technical abilities. In order to reach students' minds, help them learn, and help them develop as people, education systems must strive to view learners in a more holistic manner. Seeing through this lens and engaging in learning activities that incorporate all three domains (cognitive, affective, and psychomotor) are seemingly suitable and significant steps toward doing so [2]. That being said, how might we characterize students' experiences when the practice of learning is discordant?

For example, we will look at *cognitive load theory*, which assumes that humans have two main types of memory: *working memory* and *long-term memory* [9]. Long-term memory can hold a great deal of information; in contrast, working memory can only hold a small amount and for a much shorter period [9]. When a learner's working memory is overwhelmed, their high intrinsic and extraneous loads are likely negatively altering their ability to concentrate on the task at hand [9]. This may cause them to experience inefficiencies, become frustrated, or lose motivation altogether. If this leads to overwhelming exhaustion, cynicism, and task-dissociation, then one might characterize the learner as "burnt-out." Prior to this negative

$\sigma$  $V \propto T$ 

$$\begin{aligned} \sin^2\theta + \cos^2\theta &= 1 \\ 1 + \tan^2\theta &= \sec^2\theta \\ 1 + \cot^2\theta &= \csc^2\theta \end{aligned}$$

$$P = \frac{\Delta E}{\Delta t}$$

$$a_c = \frac{v^2}{r}$$

$$F = \frac{Gm_1m_2}{d^2}$$

$$v = \frac{\left(\frac{V_p}{V_s}\right)^2 - 2}{2\left[\left(\frac{V_p}{V_s}\right)^2 - 1\right]}$$

$$K = \frac{1}{2}I\omega^2$$

 $j$  $\omega$ 

$$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$$

 $\mathcal{T}$ 

$$\int e^x = e^x + C$$

 $\kappa$ 

$$n = \frac{c}{v}$$

$$\nabla \cdot \vec{E} = \frac{\rho}{\epsilon_0} = 4\pi k\rho$$

$$\nabla \cdot \vec{B} = 0$$

$$\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$$

$$e^{i\pi} + 1 = 0$$

outcome, educators and students might benefit from asking the question of what exactly one is trying to motivate and how can we support that motivation?

**Self-regulated learning (SRL)** is a broad term in educational psychology that encompasses many parameters affecting learning, e.g. cognitive, metacognitive, behavioral, motivational, and emotional. After the following section, we outline a mindful learning activity informed by this framework. While the activity we prescribe is a simple and relatable one, we ask the participant to be mindful about aspects of their learning practice in order to highlight how the actions of their everyday life fit within the construct of SRL. We hope that this might cause them to be more intentional and self-aware when selecting their learning strategies.

Self-regulated learning refers to a framework originating with the cognitive modeling of educational psychology researcher Zimmerman that focused on how learners develop cognitive models and attain task mastery [10]. There are now several models of SRL and, while all of the noteworthy models define SRL as a cyclic process, each emphasizes different aspects of cognition, motivation, and self-affect. For example, the “burn-out” state described before is a more natural entity in education researcher Boekaerts’ perspective [11], where emotion is emphasized and cited as two-thirds of their defined purposes of regulatory aspects seeking to protect the ego from damage. In an article from educational psychology researcher Panadero [12], all six of their reviewed models break SRL into distinct phases with defined subprocesses seeking to explore three main areas: (meta)cognition, motivation, and emotion. However, they tend to contrast with one another in regards to how they address the concepts of growth/mastery versus protection of the self-concept, the role of downregulation of metacognitive processes in favor of automaticity of process, and contextual variables pertinent to the setting in which the learning occurs. That said, for our purposes, it is most important to bring awareness of Zimmerman’s cycle to undergraduate STEM students so that they may benefit from its inclusion into their own mental models of learning.

To help convey the concept of SRL cycling, we connect SRL to the three-fold concept of learning domains from the previously discussed taxonomies and pose the following rhetorical questions, which will be expanded upon later in this article.

**1. Forethought, Planning, and Activation.** Where are you doing this work? Can you think of how this environment might affect your emotional and physical self? What will you be doing? If you made a task list, is it consistent with intrinsic/extrinsic goals? Are the tasks actionable and reasonable in scope?

**2. Monitoring and Control.** During the task, do you reflect on your emotional and physical self? What support could you envision assisting you here (e.g. TA’s, peers, food, calming techniques, etc.)? Could this support help your focus persevere and self-instruction grow, and how might you record this?

**3. Reaction and Reflection.** Looking back on the work session, what things went well/poorly, and why did they go well/poorly? Was it a productive session? What are the necessary ingredients for your next steps and future sessions?

While SRL defines a framework for research, it is also useful as a means to teach learners how they can be more strategic and successful in their personal learning practices, especially in circumstances in which motivation can be difficult to form and sustain. When students do not actively counteract this decrease in motivation and focus, major consequences can occur, including exhaustion, anxiety, or academic failure. As psychologist McGonigal said, “if there is a secret for greater self-control, the science points to one thing: the power of paying attention” [13]. SRL may just be the tool that students are needing to become active in their learning experiences and to begin really paying attention.

According to educational psychology professor Bembenuity, “self-regulation of learning’ refers to learners’ beliefs about their capacity to engage in appropriate actions, thoughts, feelings, and behaviors in order to pursue valuable academic goals while self-monitoring and self-reflecting on their progress toward goal completion” [14]. If the first piece of the question is “what exactly is one trying to motivate?”, then our response would be learning performances, no matter how big or small, that are supported by planning and reflective components, the answer to the second piece of the question of “how can we support that motivation?”

Before we outline our mindful learning activity, which is prescribed for a typical work session where the learner intentionally engages with the phases of SRL, we first consider the larger context in which this activity applies.

## SEP and Lifelong Learning

To better understand the context of our activity, we treat the college curriculum and class structure as a system and apply the Systems Evaluation Protocol (SEP) of Cornell University’s Office of Research on Evaluation [15]. The SEP is a procedural process that seeks to establish consistency between a program’s activities and their proposed outcomes. Additionally, the SEP emphasizes a holistic understanding of stakeholder needs prior to defining the scope of a program’s proposed outcomes and activities [15]. For our SEP work, we defined an interest in **lifelong learning** to be an important long-term outcome of a college education.

Professors Dunlap and Grabinger’s article describes a lifelong learner as an individual with the drive to set goals, use resources, be aware of their actions and strategy use, and adjust according to their needs determined by their post-session reflection [16]. These characteristics are reflected in the three-phase SRL model. If student lifelong learning is our goal and its driving elements are reflected in SRL, then it makes sense to begin with activities supporting awareness of the cognitive framework of SRL.

We hypothesize that, if a student practices our mindful activity, then, in the *short-term*, they will become more aware of specific concepts from educational psychology and how they can positively correlate to attitudes, behaviors, and course outcomes.

After the student begins developing this awareness and knowledge of educational psychology principles and how they relate to their own life, we expect the student to continue applying these principles and practices to their other courses. We also expect that some will continue adding to their knowledge base and developing their personal skills. Consequently, our *medium-term* outcomes focus on the continued application and development of personal learning strategies and how they may be positively correlated to self-regulated learning.

It is then plausible that, in the *long-term*, if the individual continues the practice of learning with intentionality, then we can expect further strengthening of their self-regulatory capabilities, leading to a predilection to lifelong learning, improved performance, increased efficiency, and enhanced self-efficacy.

## Discussion on Proposed Self-Regulated Learning & Goal-Setting Activity

According to Zimmerman, self-regulated learning has three phases: *forethought*, *performance*, and *self-reflection* [14] [10]. Assuming this construct, each of these is imperative to strengthening one's overall self-regulatory abilities. One method that can help students better understand these phases includes practicing an activity that touches on each phase. For our example mindful activity, we ask students to intentionally design an effective work environment and session, affirm reasonable goals and intentions, participate in a task of their choosing, and finally reflect on their experience [17].

### *Forethought (& Goal-Setting) Phase*

Two stages of this activity embody the *forethought phase* of learning [14, 10]. The first stage concerns setting up their workspace [17].

To start, the student should set up and adjust their work environment to suit their needs. Space, time, and emotion are three aspects of the learner's environment that can be altered [17]. This can be done, for example, by adjusting their chair to be more comfortable or limiting distracting ambient sounds and lights [17]. All of these actions assist in removing distractions that may interfere with the session [17]. Learners should also be mindful of what time of day they are sitting down to work, as some people are more productive in the morning, others are more productive at night [17], and for some it may depend on daily events. Adjusting the setting also reminds us of all three of the student's domains' abilities to work effectively and efficiently [2]. Finally, a more unconventional, yet equally important, aspect of a student's environment is their

emotional state [17]. Emotions heavily affect one's memory and ability to focus [6]. By understanding these ideas, learners are acknowledging the presence of the three domains, preparing them to monitor and work with their attitudes, behaviors, and actions throughout the work session [2].

After changing the environment to their liking, the student can continue moving through the phase by setting learning goals and intentions for their session [14, 10, 17, 18]. This can be done by visualizing the activity, setting "implementation intentions" for specific situations, and understanding the reasons for their actions [18]. One way to do this is to actively write these goals and intentions down on paper that can then be set within their area of sight, such as on their desk. This way, the learner can be reminded of their goals and intentions during the session, possibly inspiring them to sustain their motivation. Doing this activity can help clarify goals, leave little slack in achieving them, and allow students to later reflect on their progress toward them [19]. Additionally, neuroscience states that people better follow their *own* ideas than those they have seen or read elsewhere [19]. So, by writing their goals down themselves, students are 1.4 times more likely to achieve success [19]. When setting these goals, students should initially set small, challenging-yet-achievable goals that can later lead to larger goals [17]. The student should "set goals that give some room for error" [17]. Giving themselves compassion and permission to both succeed and make mistakes along the way can enable the learner to feel capable and motivated to continue doing the work at hand. For instance, the student could write a goal of "doing five challenging calculus problems" instead of "doing the entire homework set," especially when they are struggling either in the subject itself or with staying focused or motivated. Utilizing prospective planning strategies, such as those discussed above, can help learners better understand their specific situations as well as their own abilities. From there, they can set their goals and intentions so that they push for growth rather than unrealistic expectations [18].

### *Performance Phase*

Next, when the learner sits down to begin their work session, they transition from the first to the second phase. As such, students will be in the process of doing the task at hand, implementing strategies, and monitoring themselves when they are in the *performance phase* of learning [14, 10, 20]. Self-monitoring includes "tak[ing] ownership of [the] learning process" by checking in with oneself as well as adjusting strategies as needed [20]. In this particular activity, the student can do this during the work session and while implementing strategies [14]. By monitoring their own "attention control" capabilities and needs, students can "manipulate [their] environment" to refocus themselves [14, 20]. For example, if a learner finds a specific type of music to be distracting, they can change it or turn it off to see how it changes their ability to focus and work. This action can be described as practicing metacognition and "flexibl[y] us[ing]...strategies" [20]. The monitoring tasks practiced during this phase can increase the learner's sense of self-awareness, thus showcasing activation and awareness of all three domains [2].

### *Self-Reflection Phase*

After completing their work session and monitoring their performance, the learner enters the *self-reflection phase*, where they can “evaluate [their] strategies and performance,” their “personal reactions,” and their progress toward their initial goals [14, 10, 20]. Also, the student can use this reflection to “see what needs to be changed for [the] future” [14]. Regarding their work session, learners can note what distracted them, how they felt during the session, how effectively and productively they worked, and what their strengths/weaknesses are with respect to the course material. This way, for the future, the learner can further change their environment to test if it makes a positive difference in their work capabilities. They can also see what they did well or what they need to do more of during their work session in order to improve their self-regulation as well as achieve their personal and academic goals. This self-reflection phase allows the student the opportunity to practice having a growth mindset, as well as truly become aware of each domain and how each of them were accessed in their work session.

The reflection can be done in a multitude of ways. The learner can go as far as taking some time after to journal and answer self-posed questions about their session, or they can simply update, annotate, and/or check items off of their task/goal list and reflect on which goals they met during their session. Although the first is likely a more effective and engaging manner of reflecting, as it includes writing thoughts down, increasing the likelihood that it is retained in long-term memory, and making them reminders for the future [17], revisiting the tasks/goals list also constitutes a reflection upon the session. Post-session reflection is an important component of effective learning and productivity. Although it can require

more commitment, focus, and time, it is ultimately necessary to complete a self-regulated learning cycle and, consequently, beneficial to the student’s short-, medium-, and long-term success and learning [14, 10]. After completing their reflection, the student has completed the three phases of SRL [14, 10]. Since learning can be proportional to practice, each time the student begins a new work session, the cycle starts again.

### *Activity Summary*

In summary, we suggest that learners begin the practice through the intentional design of an effective work environment and setting learning goals and intentions. When they begin working, they should monitor their performance, attitudes, and behaviors throughout the session. Finally, once the session has finished, they should reflect on their experience. Performing this activity can both improve the learner’s self-regulatory capabilities and assist them in acknowledging the three domains of learning [2]. The work itself can allow for the already commonly-emphasized cognitive domain to be strengthened and used [2]. However, by setting personal goals as well as reflecting on personal reactions to the work session, the student is ensuring that the affective domain is not neglected [2, 14]. In addition, by paying attention to their physical being and their surroundings as well as reflecting on their performance and strategies used, students are acknowledging the role that the psychomotor domain plays in their own practice [2, 14]. People are multifaceted, as shown by the domains, and partaking in the SRL cycle is a way to access that multifaceted self instead of only focusing on the cognitive domain.

## Self-Regulated Learning Checklist



**Emotions**



**Space**



**Time**



**Reflections**



**Goals**

## Assessment Plans & Future Work

To measure the short-term outcomes, we propose a mixed-method assessment that asks students to take a pre-activity survey that seeks to understand their current motivation and attitudes as well as their capacity for metacognition and self-regulation [21]. To assess this, we will use several standard measures:

- Academic Self-Regulation Scale will be used to measure memory strategy, goal setting, self-evaluation, seeking assistance, environmental structuring, learning responsibility, and organizing [22]
- Motivated Strategies for Learning Questionnaire will be used to measure self-efficacy, intrinsic value, test anxiety, self-regulation, and use of learning strategies [23]
- Attitudes Toward Mathematics Inventory will be used to measure engagement, attitudes, and behavior [24]
- Metacognitive Experience Questionnaire will be used to measure feelings about cognitive processing [25]

Then, the students will be instructed to practice the prescribed activity. After this, the same survey will be administered, in addition to a free-response self-assessment of their experiences. The *quantitative* data will show us whether there was change in the student's motivation, attitudes, and capacities during the activity practice period. The *qualitative* data will be analyzed using the Linguistic Inquiry and Word Count of Tausczik and Pennbaker [26]. With this program, we can characterize student-written responses to assess analytical thinking, authenticity, and emotional tone, which should give us a better understanding of the student's perception of their participation in the activity.

We hope that participation will encourage students to become more aware of the three phases of SRL (forethought, performance, self-reflection) and to have them in mind when they continue moving forward in their education [14, 10]. Regarding the long-term outcomes, current students will need to be tracked longitudinally. This is outside of the scope of our current study, but we plan to utilize responses to the post-activity survey to create focus groups of students from the current cohort. We hope to track these students' progress in applying the discussed concepts and practices in their other courses, the development of their related skills, and the changes in their attitudes and behaviors toward the content. Finally, we will also continue applying the activity, survey, and related assignments to new cohorts each semester, adjusting them as needed with the goal of providing the most helpful and easily-adoptable dose of educational psychology to interested members of our community.

## Conclusion

Higher-education tends to focus on student learning outcomes in the cognitive domain by emphasizing problem-solving, critical thinking, and intelligence [2]. However, the practice of learning involves affective and psychomotor domains as well.

Thus, the cognitive focus of STEM education may benefit from formalized guidance in more areas than just their "hard skills." We suggest that work sessions be constructed so that the non-cognitive domains of learning are acknowledged and, more importantly, that this intentionality is used to cue engagement with the three phases of self-regulated learning.

Practicing and strengthening self-regulation may improve students' learning experiences and, in the long-term, their predilection to lifelong learning. In the short-term, we must assess the effect of this activity on student motivation and attitudes, as well as their metacognitive and regulatory capacities. Assuming that the results are positive, we will seek to apply this activity in other educational environments and curate a community around its usage, all aiming to continue our investigation into the role that educational psychology concepts can have in undergraduate STEM courses and student learning experiences.

## References

- [1] Bloom, Benjamin S., *Taxonomy of educational objectives. Vol. 1: Cognitive domain*. New York: McKay, 1956.
- [2] University at Buffalo. "Domains of Learning." University at Buffalo Center for Educational Innovation (CEI). <https://www.buffalo.edu/ubcei/enhance/designing/learning-outcomes/domains-of-learning.html> (accessed: Dec. 2020).
- [3] Fallahi, Carolyn R.; LaMonaca, Frank H., Jr., "The Evolution of Educational Objectives: Bloom's Taxonomy and beyond," *Journal on Excellence in College Teaching*, v20 n1 p71-86, 2009
- [4] Harrow, A.J., *A taxonomy of the psychomotor domain*. New York: McKay, 1972
- [5] Morshead, Richard W., *Taxonomy of educational objectives Handbook II: Affective domain*. Studies in Philosophy and Education 4, no. 1, 1965
- [6] [6] C. M. Tyng, H. U. Amin, M. N. M. Saad, and A. S. Malik, "The Influences of Emotion on Learning and Memory," *Frontiers in Psychology*, vol. 8, Aug. 24, 2017. [Online]. Available: <https://doi.org/10.3389/fpsyg.2017.01454>. [Accessed: Jan. 2021].
- [7] McNerney, Samuel. "A Brief Guide to Embodied Cognition: Why You Are Not Your Brain." November 4, 2011 [Scientific American Blog] Accessed on: April 2021
- [8] Macedonia Manuela, "Embodied Learning: Why at School the Mind Needs the Body," *Frontiers in Psychology*, October 2019
- [9] F. Paas and J. J. G. van Merriënboer, "Cognitive-Load Theory: Methods to Manage Working Memory Load in the Learning of Complex Tasks," *Current Directions in Psychological Science*, vol. 29, no. 4, pp. 394-398, Aug. 1,

2020. Accessed: Dec. 2020. [Online]. Available: <https://doi.org/10.1177%2F0963721420922183>.
- [10] B. J. Zimmerman, "Motivational Sources and Outcomes of Self-Regulated Learning and Performance," in *Handbook of Self-Regulation of Learning and Performance*, ed. B. J. Zimmerman and D. H. Schunk, Abington, Oxfordshire: Routledge/Taylor & Francis Group, 2011, pp. 49-64.
- [11] Boekaerts, M. *Emotions, emotion regulation, and self-regulation of learning*," in *Handbook of Self-Regulation of Learning and Performance*, eds B. J. Zimmerman and D. H. Schunk. New York: Routledge, 2011
- [12] Panadero, Ernesto, "A Review of Self-regulated Learning: Six Models and Four Directions for Research," *Frontiers in Psychology*, April 2017
- [13] McGonigal, Kelly, *The Willpower Instinct: How Self-Control Works, Why It Matters, and What You Can Do to Get More of It*. New York: Avery Publishing Group, 2011
- [14] H. Bembenutty, "Introduction: Self-Regulation of Learning in Postsecondary Education," in *Self-Regulated Learning: New Directions for Teaching and Learning*, ed. H. Bembenutty, San Francisco, CA, U.S.: Jossey-Bass, A Wiley Imprint, 2011, ch. 1, pp. 3-8.
- [15] W. Trochim et al., *The Guide to the Systems Evaluation Protocol*, V3.1 (2016). Accessed: Nov. 2020. [Online]. Available: <https://core.human.cornell.edu/research/systems/protocol/index.cfm>
- [16] Dunlap, Joanna C. and Grabinger, S. "Preparing Students for Lifelong Learning: A Review of Instructional Features and Teaching Methodologies." *Performance Improvement Quarterly*, 2008
- [17] TEDx Talks. *Motivation, self-regulation and learning how to learn | Heidi Ashton | TEDxYouth@LBIS*. (Dec. 20, 2017). Accessed: 2019. [Online Video]. Available: <https://www.youtube.com/watch?v=A64J2eEZ4Os>
- [18] T. Mann, D. de Ridder, and K. Fujita, "Self-Regulation of Health Behavior: Social Psychological Approaches to Goal Setting and Goal Striving," *Health Psychology*, vol. 32, no. 5, pp. 487-498, May, 2013.
- [19] "Why Writing Down Your Goals Can Help You Achieve Them." Self Development Secrets. <https://www.selfdevelopmentsecrets.com/writing-down-your-goals/> (accessed Dec. 2020).
- [20] L. Edwards. *Self-Regulated Learning*. (Oct. 2, 2013). Accessed: 2019. [Online Video]. Available: <https://www.youtube.com/watch?v=3OQsT7w6MBM>
- [21] Johri, A. and Olds, B.M. Eds., *The Cambridge Handbook of Engineering Education Research*, Cambridge University Press, 2014
- [22] Magno, C., "The role of metacognitive skills in developing critical thinking." *Metacognition Learning*, July 2010.
- [23] Pintrich, P. R., & de Groot, E. V., "Motivational and self-regulated learning components of classroom academic performance," *Journal of Educational Psychology*, 82(1), 33-40, 1990
- [24] Tapia, M., "The Attitudes toward Mathematics Instrument" *Paper presented at the Annual Meeting of the Mid-South Educational Research Association*, Tuscaloosa, AL, November 6-8, 1996
- [25] Efklides A., "Metacognitive Experiences in Problem Solving." In: *Trends and Prospects in Motivation Research*, Efklides A., Kuhl J., Sorrentino R.M. Eds., Dordrecht: Springer, 2001, pp 297-323.
- [26] Y. R. Tausczik and J. W. Pennebaker, "The Psychological Meaning of Words: LIWC and Computerized Text Analysis Methods," *Journal of Language and Social Psychology*, December 2009

## About the Author

Allison Palmer is studying engineering with a focus in community development within the Engineering, Design, & Society department. She is also minoring in Public Affairs within the McBride Honors Program. Allison has been doing research on educational psychology and its place in classrooms for multiple semesters, and the experiences have helped her develop a deep passion for the subject. In the future, Allison hopes to continue exploring this topic through research, personal experiences, and potentially post-graduation opportunities.

