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Americans should have self-sovereign management of their lives. Right now, medical records are yours but not so much your educational records; you don't really control any of that info right now. We're working on envisioning what the future looks like following these guiding principles: to give each person their own destiny, balance on the supply and demand side...and put it into the hands of the ones who want to earn the competencies and credentials. It gives them the power to drive the marketplace. Currently, the providers squarely have the advantage, but we need to make it a new space where learners are empowered.

Jeanne Kitchens

Chair of the Technical Advisory Committee for Credential Engine; Associate Director of the Center for Workforce Development, Southern Illinois University

CHAPTER 15

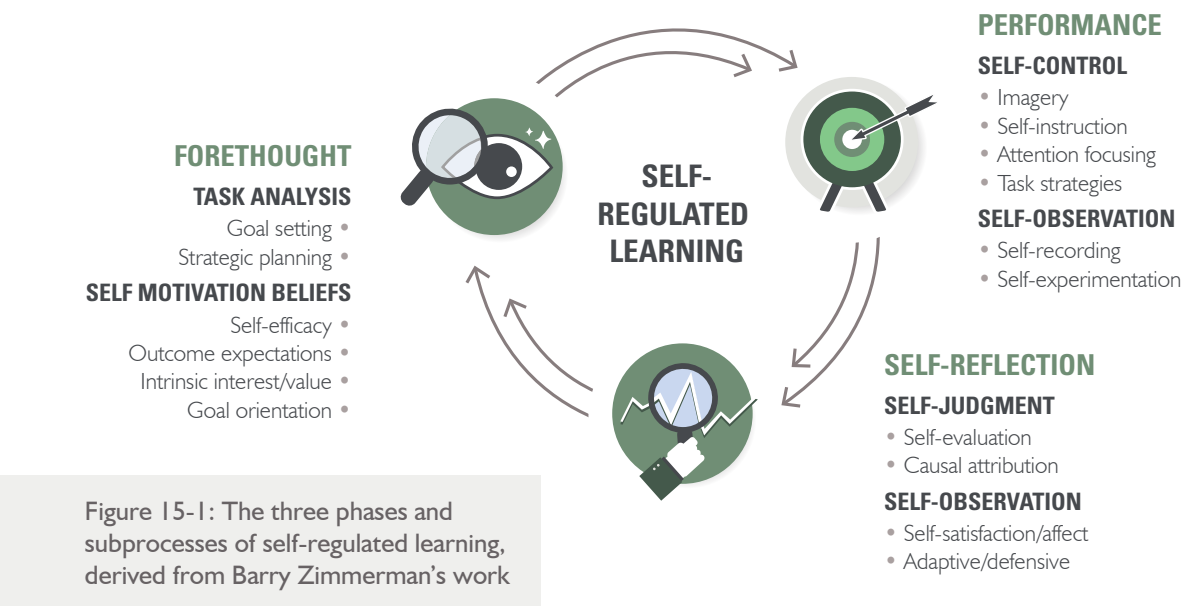
SELF-REGULATED LEARNING

Louise Yarnall, Ph.D., Michael Freed, Ph.D.,
and Naomi Malone, Ph.D.

There's a growing need for continuous modes of lifelong learning to cope with the acceleration of knowledge production and flow aided by new technologies. In response, both schools and workplaces are progressing towards more independent, learner-centered forms of education and development. Potential support for lifelong learning comes from improvements in AI technologies that permit more personalized learning, and greater access to mobile and search

technologies that provide ubiquitous access to information. In the workplace, trainers are increasingly using cloud-based software, augmented reality, and virtual reality to prepare workers, support their lifelong learning needs, and enable diverse collaboration methods.¹ In higher education, institutions are increasingly offering online education options and providing students with information resources and communication tools to aid their independent research and collaboration. However, despite these trends, both educators and employers report challenges with this shift towards greater learner-control. For instance, some learners have difficulty taking responsibility for their own

Self-regulated learning refers to the thoughts, feelings, and actions some learners use to independently attain their learning goals. Self-regulated learners are metacognitively, motivationally, and behaviorally active in their own learning.



learning,² and others may struggle to assimilate their diverse experiences—leading to a situation where they have increased exposure to information but reduced overall comprehension.

Learners need to become skillful at regulating their learning over time and across different settings, especially to acquire thinking, writing, and analysis skills.³ However, individuals often struggle to manage their learning without effective and perceptive external support, such as what a teacher, mentor, or well-structured piece of courseware might provide.⁴ Consequently, developing effective self-regulated learning skills requires educators and trainers to help learners notice knowledge gaps, try new strategies, and adopt more proactive mindsets. Incorporating support for this approach into new technologies can also help learners acquire the meta-level skills needed to manage their own learning across their lifetimes.

Empirical research is beginning to identify effective tools and strategies for aiding self-regulated learning; however, the paradigm originally emerged during the 1980s when education researchers studied why some K–12 students succeeded in traditional classrooms better than others. They found the most

effective students demonstrated a set of learning strategies and mindsets including metacognitive strategies (e.g., goal-setting, self-monitoring, self-evaluation), cognitive strategies (e.g., rehearsal, organization, elaboration), environmental management strategies (e.g., time management, study area management), and self-beliefs (e.g., self-efficacy, intrinsic and extrinsic goal orientation, effort regulation).⁵ Since these behaviors stemmed from learners' personal choices, researchers categorized them as “self-regulated” learning.

By the 1990s, researchers agreed that learners self-regulate during three iterative phases: the *forethought phase*, where a learner plans and initiates action; the *performance phase*, during which learning actions occur; and the *self-reflection phase*, in which a learner reflects on and evaluates performance, adjusting as necessary. Barry Zimmerman, one of the preeminent scholars in the self-regulated learning field, developed a model of these three phases, grounded in social cognitive theory (see Figure 15-1).⁶

More recent evidence has demonstrated that some self-regulation strategies—time management, effort regulation, and critical thinking—have positive impacts on academic outcomes, but that other strategies—rehearsal, elaboration, and organization—have less empirically convincing effects. Further, in both school and workplace settings, a small number of these strategies have the largest impacts, accounting for 17% of the overall variation in learning outcomes.⁷ These include:



1. CONFIDENCE, SELF-EFFICACY, INTERNAL LOCUS-OF-CONTROL –

Effective learners believe they can learn because they're in control and tend to take a more “active” approach to learning. By contrast, less effective learners doubt they can learn (because they think they're not smart enough or not in control) and, consequently, take a more “passive” approach to learning.⁸

2. GOAL SETTING AND PLANNING – Effective learners set appropriate learning goals, anticipate the resources required, and set benchmarks for their progress. By contrast, less effective learners may not set goals or may simply



...it's not going to replace teachers, it shifts the role and nature of a teacher to a master facilitator.

Thomas Deale

Major General, U.S. Air Force (Ret.)
Former Vice Director for Joint Force
Development on the Joint Staff

plunge in, then run out of time or lack access to appropriate learning resources.⁹

3. PRIOR KNOWLEDGE AND STRATEGY

USE – With stronger prior knowledge, effective learners engage in greater instances of planning and monitoring, both independently and in collaboration. With lower prior knowledge, less effective learners use just a few strategies.¹⁰

4. METACOGNITIVE MONITORING

– Effective learners note and address gaps and misunderstandings while they learn. Less effective learners fail to notice or address such difficulties in their learning.¹¹

5. POST-LEARNING REFLECTION

– Effective learners consider what they've learned, taking stock of what remains to be learned.

Less effective learners fail to reflect sufficiently after learning and may rush to the next task.¹²

RECOMMENDATIONS

Helping learners develop better self-regulated learning skills will require new supports, added into the many contexts where people engage in learning. To cultivate awareness of Zimmerman's three phases of self-regulated learning and to develop effective habits at the cognitive, metacognitive, emotional, and behavioral levels, we propose three conceptual levels of self-regulated learning support: micro-, macro-, and meta-interventions. The *micro-level* focuses

on individuals and the tools they use to better navigate a personalized trajectory. The *macro-level* focuses on how to navigate the selection and progression across learning experiences. At the *meta-level*, there's a recognition that building appropriate learning habits requires focused practice in the cognitive, social, emotional, and physical capabilities that contribute to resilience, effective decision-making, and lifelong personal growth. We describe applications of these three levels in the suggested interventions below.

1. Use formative assessments to personalize support for self-regulation skills and mindsets

Although research shows the benefits of supporting learners' self-regulation, these interventions often rely upon the discretion and knowledge of their educators. Hence, better supporting self-regulated learning depends, in part, on enhancing the skills of teachers, workforce trainers, and managers, in addition to learners, themselves. To start, it's useful to help stakeholders identify the specific self-regulation skills and/or mindsets needed in a given learning situation; a first step towards that is to translate self-regulated learning assessment methods from research into practice. For instance, several diagnostic tools can help identify the signs and symptoms of a learner with weak self-regulation mindsets or strategies. These diagnostic tools could be embedded into online courseware or used by teachers, trainers, and learners in both classroom and workplace settings.

Drawing on the three-level support approach to self-regulated learning: Tools can be devised to support individual educators in learning specific diagnostic techniques (*micro-level*), to help them anticipate where self-regulated learning challenges may occur before any extended learning activity (*macro-level*), and to serve as a regular formative assessment to encourage the maintenance of effective mindsets and habits of self-regulated learning (*meta-level*). Below are some self-regulated learning assessments that could be put to use:

SELF-REPORT INSTRUMENTS

Technology can deliver self-report, self-regulated learning assessments; the results from these may be shared with teachers and trainers or fed into adaptive learning algorithms to provide more personalized support to learners. Such assessments may target key elements known to support self-regulated learning, including: level of motivation (e.g., *The Motivated Strategies for Learning Questionnaire*¹³) and the skills of goal-setting, time-management, help-seeking, preparing the study environment for focused work, and self-evaluation (e.g., *The Online Self-Regulated Learning Questionnaire*¹⁴).

ASSESSMENTS IN ACTION: GOVERNMENT WORKFORCE EXAMPLE

In Marcus Buckingham's work, *StandOut*, he designed an assessment...

One of the things that he applied there—that's extremely successful—is a weekly check-in with a supervisor. Once a week, through technology, it sends a request: *These were your goals last week. Were you able to reach these goals? What are your new goals? Did you use your strengths? What did you like? What did you detest?*

Responses help the supervisor know things like, *John keeps disliking this, and I need to get this off his plate and make it less painful for him. This is what he's liking, where he's using his strengths. I need him to do more of this.* It allows for side questions, too, like, *how motivated are you in what you do? How are you as an employee in working with this environment?*

Then there were 5 critical questions provided quarterly asking if the team is growing and learning. It's a huge help for a leader, and it also prompts me to go in and say, "This is what John is working on. This one's important, so can you put it at the top of your list? Thanks for the great idea; I'm glad you're working on it." These learning interventions cause us to have a conversation in a less threatening format and talk back-and-forth. There are lots of benefits and these are the kinds of interventions we intend to apply during the Leadership for a Democratic Society.

Suzanne Logan, Ed.D., SES

Director of the Center for Leadership Development and Federal Executive Institute, U.S. Office of Personnel Management

* applied example

STRUCTURED INTERVIEW PROTOCOLS

Drawing from questions in existing research interview protocols, technology can be adapted to deliver helpful queries to teachers and trainers. These may, for example, help them consider and investigate the potential factors contributing to weak outcomes, either observed among students in school or personnel in a workplace setting. Factors useful for reflection include assessing learners' skills for organizing and transforming information, setting goals and planning to learn, seeking information, keeping records and monitoring learning progress, preparing their study environment for learning activities, engaging in self-evaluation, meting out self-consequences, reviewing texts and notes, help-seeking, and rehearsing and memorizing. (See, for example, the *Self-Regulated Learning Interview Schedule*.¹⁵)

MEASURING SELF-REGULATION PROCESSES AS EVENTS

Education technology researchers working primarily in learning management systems are already moving towards designing more complex, process-oriented measures that can determine individuals' deployment of self-regulated learning strategies over time. Measurement methods include think-aloud protocols and technologies that detect errors in tasks or employ online trace methodologies (e.g., of mood and task steps) that measure individuals as they go about their learning activities.¹⁶ To better support self-regulated learning, researchers will need to study how to adjust these types of detection methods for delivery and use across different learning technology platforms, such as mobile, augmented reality, and virtual reality.

2. Build confidence, self-efficacy, and internal "locus of control" about learning

To realize a vision of self-regulated learning across a lifetime, more needs to be understood about the preconditions for developing habits of lifelong

learning. International studies indicate wide variation in how well both early childhood education and family upbringing sets the stage for lifelong learning;¹⁷ however, it generally begins with establishing confidence and independence as learners. Over the past 35 years, K–12 education researchers have found evidence that open-ended instructional practices, such as guided inquiry activities, foster confidence and independence in learning more than other practices, such as traditional close-ended question-and-answer routines.¹⁸ Introducing open-ended practices in childhood can help set the conditions for lifelong learning, but continued support for self-regulation is needed even in adulthood. For example, some research indicates that those countries with the highest levels of lifelong learning among adults have robust adult education systems.¹⁹

Based on the three-level support approach to self-regulated learning, described at the beginning of this section, individual educators can be tutored in confidence-building techniques (*micro-level*); in methods for identifying likely areas of low confidence in an upcoming lesson (*macro-level*); and in noting, reflecting on, and accepting their own challenges with maintaining confidence during learning (*meta-level*).



The one point I hope every single person can internalize—as the neuroscience evidence shows us—**the brain is learning every single second of every single day**. So, the way every individual learns is the same, but what they’re learning differs and that depends on context—internal and external. Our job is to align our learning goals to what the brain is actually learning. That’s a big paradigm shift for leadership.

Melina Uncapher, Ph.D.

Director of Education Program, Neuroscape; Assistant Professor of Neurology, Weill Institute for Neurosciences and Kavli Institute for Fundamental Neuroscience, University of California San Francisco

3. Develop goal-setting and planning skills

To improve self-regulated learning, goal-setting and planning, strategies should be translated into user-friendly tips to guide individuals while they learn. Such self-regulated learning support should be made available across a range of learning contexts, from face-to-face to online environments. The three-level support approach to self-regulated learning is useful here, too. Individual learners and learning facilitators can be linked to templates and tools to support goal setting and planning (*micro-level*). They can be encouraged to reflect on the pacing and time management required in multiple stages and phases of upcoming lessons and projects (*macro-level*), and they can be encouraged to confront resistance to goal setting and planning by seeing the success stories of those who employ these techniques regularly (*meta-level*).

4. Activate prior knowledge to enrich self-regulated learning strategy use

Past education and experience represent both a potentially rich learning resource and a possible threat, since old habits and misunderstandings can block the grasp of new ideas and procedures. For this reason, educators, trainers, and instructional designers should incorporate activities and tools to elicit learners' prior knowledge and help them reflect on which elements of it are potential building blocks and which are possible barriers.

Based on the three-level support approach to self-regulated learning, ways for activating prior knowledge might include: Linking individual learners and learning facilitators to lessons about how to elicit and document prior knowledge relevant to a particular lesson (*micro-level*). Identifying the useful prerequisite knowledge as well as the naïve concepts that might pose learning hurdles in upcoming lessons or projects (*macro-level*), and supporting individuals' capacity to activate useful prior knowledge and to counter or encapsulate less useful prior knowledge (*meta-level*).

...it's not just what you learned but
rather how much it **changed you**.

Betty Lou Leaver, Ph.D.

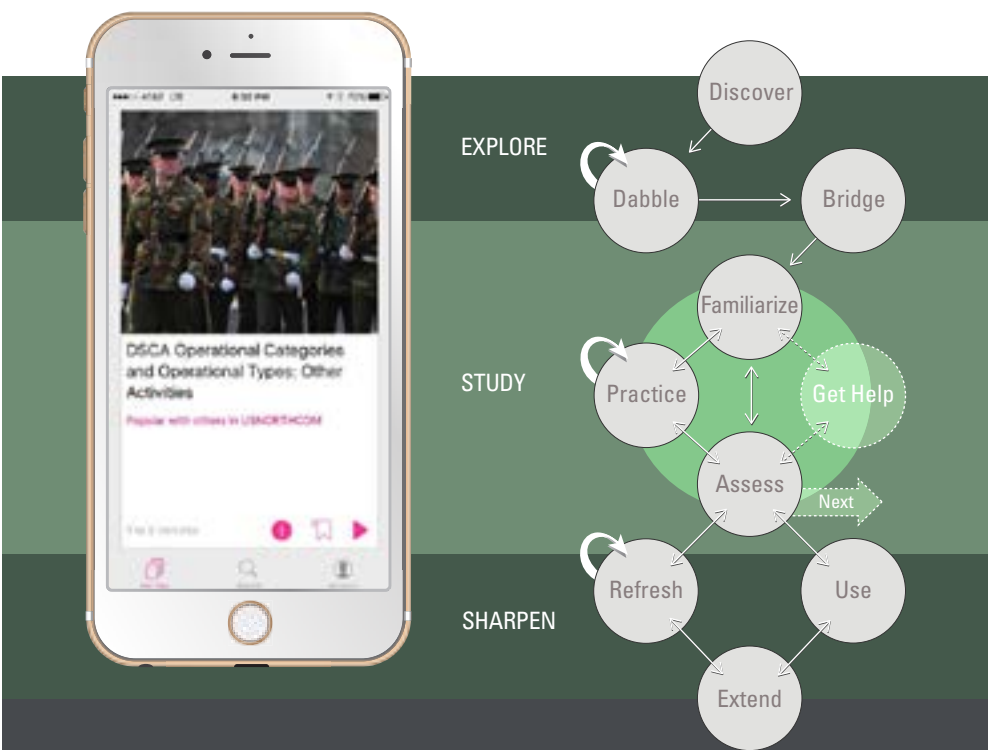
Director, The Literacy Center; Manager, MSI Press; Former Provost,
Defense Language Institute Foreign Language Center

More research is needed in this area, however, to uncover new methods for estimating learners' prior content knowledge and self-assessed self-regulation skill levels. Since traditional testing can negatively impact learners' motivation, finding new assessment methods is a critical step to enhancing personalization models beyond their current level. Currently, traditional testing approaches and curriculum sequences favor comprehensiveness and certification. Work is needed to understand how adjusting the frequency and forms of assessment can inspire rather than hinder self-regulated learning. Methods worth exploring include integration of self-reflective assessments of content knowledge and self-regulated learning skills with validated measures of traditional content knowledge and skills.

5. Support metacognitive monitoring

As learning platforms and media proliferate, the community will need a wider range of ways to gather trace data on how and under what conditions learners use self-regulated learning supports. This line of research is likely to innovate around new approaches to using xAPI to collect student data, usefully aggregate datasets across experiences, and apply learning analytic models to analyze them. Such work need not focus only on individual learners' patterns, but should also consider patterns within content pathways from multiple users. Such data traces can support more personalized and optimal recommendations of what content to review next and can strengthen systems to covert-

PERLS app



U.S. DEFENSE TECHNOLOGY EXAMPLE

By providing fast access to short-form learning materials (“micro-content”), mobile applications can make it easy to use brief windows of available time for learning. Such applications can use AI to identify high-interest topics, select learning activities most likely to benefit the learner, and then recommend micro-content on selected topics and activities. For example, PERLS, a mobile app developed with DoD support, presents recommendations in the form of electronic cards that users flip through to find preferred content, and underlying these recommendation is a dynamic model of self-regulated learning. The app has been evaluated with several DoD organizations, including U.S. Northern Command and Joint Knowledge Online to augment training in areas such as Defense Support of Civil Authorities. Early results show that learners using PERLS reported heightened enjoyment and motivation to learn, and they performed as well as others required to take a full, formal courses.²⁰

If we believe that the exploration of knowledge must continue, then we can't only teach the knowledge we currently have. Truth and facts are constantly unfolding. If we just decide that by 2018 we have all the knowledge we'll ever need then we're making a serious mistake.

Christopher Guymon, Ph.D.
Interim Dean of the Graham
School, University of Chicago,
Office of the President



ly strengthen or fade self-regulated learning support in a continuous fashion.

One aspect of self-regulated learning support that has not been adequately studied concerns understanding both the optimal *frequency* of self-regulated learning support and the optimal *tools* for providing this support. These factors are likely to vary by the content to be learned as well as the learning platform (e.g., LMS, mobile smartphone). R&D developers should be prepared to make the case for which self-regulated learning skills they plan to target, highlighting those skills most important for learners of their content and most amenable to support with their particular learning experience. Such design specifications can improve the field's understanding of how different technologies can support specific self-regulated learning skills.

Supporting metacognitive monitoring across the three levels of abstraction might include: Connecting individual learners and learning facilitators to tips and guidelines for noticing and remedying points of confusion, poor

procedure or technique, and weak understanding (*micro-level*); identifying points for checking on understanding and procedures in upcoming lessons and projects (*macro-level*). Additionally, new methods may be able to track progress over time, measuring the effectiveness of techniques in reducing misunderstandings and, in turn, providing systematic feedback that sharpens procedures over time (*meta-level*).

6. Foster habits of post-learning reflection

Educators, trainers, and instructional designers need to provide extended post-training self-regulated learning support for learners, helping them to reflect, learn how to reinforce, and know when to refresh past learning. Such post-training support could be delivered by mentors and coaches, aided by the parent organization, or take the form of persistent technology-based tools for self-coaching and reference.

To return once again to the three levels of abstraction, ways to foster post-learning reflection might include: Providing lessons to individual learners and learning facilitators about the kinds of useful questions to pose (*micro-level*); scheduling and building-on reflection activities across an extended lesson or project (*macro-level*), and rewarding learners for engaging in reflection activities, such as offering them the chance to unlock a range of new learning opportunities based on their reflective participation (*meta-level*).

Summary

Successful self-learners do more than just study and memorize. They stay alert and are curious to discover new, valuable learning. They skim a lot of content to find the important points. They search informally to nurture motivation for intensive study and periodically review afterwards to fight forgetfulness. *And they find the time to do it all.*

Though more than 70% of work-related learning is self-learning, few technologies help self-learners deal with these challenges. Ideally, technology will reduce the difficulty and friction of all self-learning activities, while making it easier to learn in small slots of available time, whenever and wherever these occur. Targeting and supporting self-regulation skills throughout personalized learning trajectories will aid learners of all ages and promote enhanced learning efficiency across lifetimes.