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Sea Lions and Honors Students: More in Common than You May Think

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The ability to transfer knowledge across contexts, as from course to course or from school to the "real-world," is important to both students and educators. Without this transfer, students cannot apply information learned in the classroom. Even though we all know the importance of transfer of knowledge, we can do more to ensure that it takes place. While transfer of information between contexts is a requirement in animal training, we do not always hold ourselves and our students to this same standard. We tend to assume that students, especially honors students, come into our classroom with the metacognitive skills that are critical for transfer, but research does not support this assumption. We must teach our students the skills of metacognition and self-regulation to ensure that they receive a well-rounded education, not only learning the course material but also learning how to learn.

Although historical arguments have posited only a modest intellectual connection between "man and beast" (Kant; Müller), more recently the field of comparative cognition has explored the similarities and differences among the various species of our planet ranging from the simple sea slug to the highly complex human. Researchers within the field have continually demonstrated a common thread binding animal species and linking together both our biological and psychological components. Despite many differences in the cognitive abilities among animal species, Darwin put it best when he stated, "There can be no doubt that the difference between the mind of the lowest man and that of the highest animal is immense. Nevertheless the difference, great as it is, certainly is one of degree and not of kind" (445).

That being said, one can easily find a link between the general principles of learning in relation to both nonhuman and human animals. What may be a more difficult but equally important parallel is how these learning principles are applied to the training of animals and the teaching of honors students. I am not suggesting that honors students should simply be trained; however, in comparison to the process by which an animal such as a sea lion is trained for aquarium and/or behavioral research purposes, we do not always hold ourselves, an arguably more complex and intelligent species, to the same quality of learning. When one is teaching a sea lion a new behavior, such as vocalizing on

cue, the animal first works with one specific trainer in one specific area of the habitat in order to keep the environmental context consistent. This procedure has been shown to facilitate learning of novel behaviors (Pryor; Ramirez). Once the sea lions consistently perform this behavior correctly, the training does not stop whereas for many students the training does stop—after an experience in the same classroom with the same professor—on the day of the final exam. We teach our students information in the context of a course and a classroom, and then we typically ask them to demonstrate their grasp of that knowledge in exactly the same context.

For the sea lion, knowing to perform a specific behavior in a specific location with a specific person is not very useful. The same can be said for our students. Being able to discuss the material that a professor teaches in the context of the classroom is an important accomplishment, one that should not be discounted, but the teaching and learning process should not be considered complete at this stage; it is often just the beginning. The sea lion is not considered to have completed learning a behavior until it can be performed in any context, e.g., required by any trainer, in any location, with a verbal or gestural cue, alone or with other animals. Then, even when the behavior has been solidly established, the trainer understands that the animal must continue to work on the skill, at least occasionally, in order to maintain its ability to perform at a high level. If sea lions are held to this high standard of learning, we should consider ways of consistently using the same rigor in an academic setting with our students.

Knowledge gained, whether through formal academic study or general life experience, is not useful if one cannot apply it across various contexts. "Very often, in instructional settings (and in everyday life) we do not get the transfer we want. Learners acquire skills and knowledge in one situation and fail to make connections to other situations where those skills and knowledge would prove valuable" (Perkins & Salomon 1). In academia, we typically teach students in a specific classroom context, and we then test them on the retention of that knowledge in a similar fashion to that in which they were originally taught. In some ways this consistency is good as it can increase a student's comfort level during testing and can increase performance on exams. In fact, research has shown that simply changing the room that an individual studies in from that in which they are tested decreases test scores (Aslan, Samenieh, Staudigl, & Bäuml; Bilodeau, & Schlosberg; Greenspoon & Ranyard). This fact implies problems in the students' knowledge base and ability to use information outside the classroom.

Research on memory has repeatedly provided support for context-dependent, or state-dependent, memory in which one has significantly higher recall for information when tested under the same environmental circumstances in which the information was acquired (Kelemen, & Creeley; Lang, Craske, Brown, & Ghaneian; Peters, & McGee; Smith, "Environmental"). This kind of memory research has been a growing field since Carr, in 1925, studied context cues in mice running a maze. How we remember is influenced not only by the focus of attention on a specific topic but also by the details of the environment in which we are learning, e.g., room color, room temperature, time of day, and

by the emotional or physiological state of the individual (Smith, "Mood"). The higher the match between information in a retrieval cue and information stored in the memory that was there during encoding, the higher the chance of successful recall (Aslan et al.; Godden & Baddeley; Greenspoon & Ranyard; Isarida & Isarida).

Based on these types of investigations, students are often instructed to study in the same context in which they will be tested, especially for high-stakes exams such as the SAT and GRE. Studying in one's pajamas on a bed with papers spread all around and music playing in the background is not the context in which the exam will take place, and the above research has demonstrated that simply matching the study context to the testing context will statistically improve test scores for many students. While maintaining a similar context is both important and helpful in test-taking, we should be going further to ensure that the knowledge we have and teach is strong enough to endure a context change. As Smith and Vela suggest, "If environmental changes lead to poorer test scores, it is not only of concern to the student, but it should also worry educators, who would likely prefer classroom learning to be independent of learning or training environments" (204).

A common experience of students and professors alike is that a student learns information, and perhaps excels, in one course but at the next level is unable to make connections between the material taught in the first and second courses. We should be challenging ourselves and our students to use information across situations and in a variety of ways. Being able to transfer knowledge from class to class throughout one's academic career is critical since courses typically build upon each other. Ultimately students need to make a larger contextual change and transfer knowledge completely out of the academic environment to their professional lives. If students have not been successful within the course-to-course transfer, we should not be surprised to see them struggle to apply this academic knowledge beyond their degree. Some evidence indicates that GPA is not strongly correlated with professional success (Scager et al.). Researchers are currently investigating the best predictors of success, but perhaps transfer of knowledge from the classroom to the boardroom may be what is lacking for those students who excel academically but falter in the workforce. Understanding the information in a meaningful way should allow students to break free of context and succeed under a variety of circumstances.

Luckily, just as psychological research has shown us the important relationship between study environments (memory encoding) and testing environments (memory retrieval), it can also show us how to reduce environmental effects and improve transfer of knowledge across contexts. Metacognition (the awareness of one's own thought process) and self-regulation (strategic learning guided by metacognition) have been correlated with increased test scores and better overall understanding of learned material across contexts (Schunk & Zimmerman; Zimmerman, "Investigating"). Even though humans naturally possess metacognition, we often do not fully understand how to use it to self-regulate during learning (de Bruin & van Gog). As educators, we owe it to our students to ensure

that we teach them not only our course material but also the larger, overarching, and cross-disciplinary process of learning to learn (see Ovens, Wells, Wallis, & Hawkins)

Metacognitive abilities enable successful transfer of knowledge from one context to another, and a student who is struggling academically may need help in improving these skills. Since honors students by definition are not supposed to be struggling academically, their instructors may erroneously assume that these skills are already in place when students enter the classroom. Researchers have found that students who succeed in high school honors programs can often struggle in college (Barber) and that early grades are not a strong predictor of long-term academic success (Scager et al.). One reason might be that college professors take these students' self-regulatory skills for granted rather than teaching them explicitly in college-level honors courses. Honors students may also provide special challenges to professors in teaching the skills necessary for metacognition: like all students, they have many academic and non-academic distractions, but they also may resist being instructed about how to learn since their study habits and skills have worked well thus far. The change from high school to college-level course material and assignments, however, often requires a change in study habits and cognitive skills.

Research indicates that one of the best methods for educating students about how to best educate themselves is formal instruction on the three main phases of metacognition and self-regulation. The first phase, planning, has been shown to promote learning (Pintrick; Scheid). Students must use forethought to determine, for instance, how much time to spend on a given task, which learning strategies to use, and what material to focus on the most. Students need to spend time thinking about their current knowledge base and their goals for expanding on it (what they want to learn). In the second phase, monitoring, learners must be aware of their attention/focus as well as the effectiveness of strategies they are actively employing (Shunck & Swartz; Zimmerman, "Self-Efficacy"). For example, thinking about what to cook for dinner while reading your biology textbook is not going to help the learning process, but being aware of not focusing on the task does help. This awareness allows students to refocus and take in information properly. Also, students need to monitor the effectiveness of their learning techniques, such as using flash cards; otherwise, they will not be aware of potential strategic problems and may waste their time. Awareness that a strategy is not working leads to adopting more effective strategies (Shunck & Swartz; Zimmerman, "Self-Efficacy"). Evaluation is the third phase and encompasses assessment of learning strategies and making judgments about the outcomes of the thinking and learning process (Shunck & Swartz; Zimmerman, "Self-Efficacy"). This third phase cycles back to the first, planning, as it informs decisions about which techniques to use for similar tasks in the future.

While studies have shown the effectiveness of self-regulation (for a review, see Zumbrunn, Tadlock, & Roberts), the application of this research has not generally crossed into the curriculum, especially at the college level, perhaps

because we assume that students, especially in an honors program, have already mastered this skill. Professors should consider explicitly teaching self-regulation skills to students at all levels, thus enabling them to transfer their knowledge from one context to another and use it appropriately throughout their lives, both in and out of the classroom. Consider a student trying to learn the material in a chapter of a biology textbook: the chapter is most likely already set up to aid students in self-regulatory learning by including bold-typed vocabulary words, bold-typed headings, and end-of-chapter review questions, but the student must know how to use these aids effectively. Students can benefit by being taught the three phases of self-regulation and how to apply them. First, planning will allow the student to think about how much time to dedicate to a particular learning task and to prioritize the topics to be covered during the study period. Also, prior to reading a chapter, the student should explicitly consider such questions as "What do I already know about this topic?" and "What do I want to know about this topic?" The student should also look over the chapter headings and vocabulary words prior to reading each section. The next phase, monitoring, should be carried out while the study session is in progress. The student should mentally check his or her understanding of the material and decide whether to read it again or seek another way to clarify the topic. Finally, the student needs to evaluate what he or she has learned after reading the chapter by, for instance, completing review questions.

A professor's use of direct instruction and modeling of these metacognitive skills (Boekaerts & Corno; Levy) as well as instructor-guided, independent practice (Lee, McInerney, Liem, & Ortiga; Schunk & Zimmerman) has proven useful within the classroom (see Zumbrunn et al.). Four specific techniques have proven especially effective in aiding students in self-monitoring.

One technique that is both helpful and simple is for students to summarize text material (Thiede & Anderson, 2003). As the first part of this process, students should rate their confidence in their understanding after reading the material. After that level is sufficiently high, students should attempt to summarize what was read without looking at the text. If they correctly summarize the information, they can be confident in their knowledge level.

Research has shown that a second technique—general review of key terms—is helpful, especially if students are aware of their confidence level and accuracy while studying (Dunlosky & Rawson). For example, students should be instructed not only to look over the keywords of a chapter or lecture material but to define the terms on their own, without looking at the book or notes, until they are confident in the correct answer. This process is time-consuming but can lead to higher vocabulary attainment and better overall retention of information, which should be a goal for us all.

A third technique, creation of concept maps, has repeatedly proven to be a highly effective self-monitoring strategy (Jo; Redford, Thiede, Wiley, & Griffin). Creating a concept map requires students to diagram the interconnections between information learned and their already existing knowledge base.

Drawing a diagram of information to be learned requires organization of the material and helps in visualization of what needs further study in order to completely understand it.

The final technique is a quick but effective activity that a teacher can use in the classroom. The instructor should follow four steps:

1. discuss the importance of paying attention to key terms during a lecture;
2. at the end of class, ask the students to write down three main points they felt were conveyed in the lecture;
3. state the three main points that the instructor hoped the students would take away from that class; and
4. ask students to compare their points to the instructor's and check for accuracy.

Researchers have shown that students improved from 48% to 75% accuracy after only three classes that included this exercise (Lovett).

Given the research on learning strategies, the assumption that college students, and in particular honors students, understand and therefore employ self-regulation may be a fatal flaw on the part of educators. We need to ensure that we explicitly instruct our students and teach them not only our course material but also to learn how to learn. Thinking back to the humble sea lion that has learned to produce its new behavior in a variety of contexts, we need to ensure that we hold ourselves and our students to these same standards. While our first goal is to have our students grasp the basic material of a course, our second goal should be to provide them with the tools to use this knowledge beyond our classroom.

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