Canadian Psychology/Psychologie canadienne

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Online First Publication, June 17, 2021. http://dx.doi.org/10.1037/cap0000290

CANADIAN PSYCHOLOGICAL ASSOCIATION
SOCIÉTÉ CANADIENNE DE PSYCHOLOGIE

Canadian Psychology / Psychologie canadienne

ISSN: 0708-5591

https://doi.org/10.1037/cap0000290

An Advance Organizer for Student Learning: Choke Points and Pitfalls in Studying

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Both teachers and students benefit from an accurate understanding of how people learn, yet research shows that both groups often hold mistaken beliefs that undermine student learning. This article describes an advance organizer that can be used to help teachers understand how people learn and that teachers can use in turn to train students how to study more effectively. The advance organizer is a graphical representation of a simplified information-processing framework. It focuses on the choke points and pitfalls of learning based on cognitive research. Choke points are constraints in the human cognitive system, such as the selective nature of attention and the limited capacity of working memory, that impede learning. Pitfalls are common traps students fall in that undermines their learning, such as multitasking and overconfidence. The organizer describes each choke point and pitfall and provides a way of addressing each of them.

Public Significance Statement
This article describes a graphical diagram which summarizes the factors that cognitive research indicates are critical for effective learning. The diagram is intended to be an accessible guide for helping people to improve their learning. The diagram outlines the challenges of learning and provides possible solutions to each.

Keywords: teaching, pedagogy, student learning

Cognitive research has clearly delineated the superiority of some learning strategies over others (Dunlosky et al., 2013), yet students often use suboptimal strategies when they study (Blasiman et al., 2017). Students can benefit from instruction in empirically supported study skills (e.g., Biwer et al., 2020; Brown-Kramer, 2021). Therefore, teachers should not only teach the subject matter of a course, but also effective learning strategies for retaining that information (Chew, 2014; Rodriguez et al., 2018), especially in introductory courses.

Teachers of psychology likely studied learning as part of their training, which gives them an advantage over teachers in other fields. That knowledge, however, will still vary in depth and applicability to student learning. Furthermore, they may not have received much training in how to teach in graduate school (Chew et al., 2018). Teachers outside of psychology may not have any knowledge of learning or pedagogical research. In fact, studies find that teachers often lack an understanding of effective learning strategies, and that belief in myths and misconceptions about learning are common (Betts et al., 2019; Morehead et al., 2016; Nuthall, 2007; Rodriguez et al., 2018). Teachers, then, often lack the knowledge to teach students how to learn effectively.

The problem of improving student learning strategies is twofold. First, students need to be instructed in effective study skills, either as part of a course or as a general set of skills independent of a particular course context (Chew, 2014, 2020a). Ideally, students should receive instruction on study strategies in both ways. Second, teachers need to be instructed in effective learning strategies so they can pass on and reinforce those skills in their students as well as use the knowledge to teach more effectively. It would be counterproductive to teach students effective learning strategies who are then taught by teachers who endorse learning myths, such as learning styles. Even when students know about effective study strategies, they may not employ them for a variety of reasons (Blasiman et al., 2017; Karpicke et al., 2009). Teachers can help by modeling the use of effective learning techniques, such as utilizing feedback effectively and self-assessment, as part of teaching.

Academic learning is both complex and counterintuitive. There is no universal best method of learning. Rather the best approach depends on the interaction of a myriad of factors including cognitive processes such as attention, working memory, and executive function; the prior knowledge of the student; the concept to be learned and how it is being presented; the learning strategies employed by the student; and the method used to assess the level of learning (Chew & Cerbin, 2021). Learning can go awry in multiple places and in multiple ways. Explaining how people learn to teachers and students in such a way that both

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groups can use the knowledge to improve study habits is a challenging undertaking.

Despite the research showing the complexity of learning, students and teachers often hold simplistic, flawed understandings of how students learn. Students often select the easiest method of study, generally mindless re-reading, and focus on the amount of study rather than quality of study (Blasiman et al., 2017; Chew, 2014). Many teachers assume that their responsibility for student learning ends at presenting accurate, up-to-date information in a clear, organized fashion, when research clearly shows that they can have a great deal of influence, both positive and negative, on whether students learn and what they learn (Chew et al., 2018). When students struggle, teachers rely on their own understanding of how people learn to try to help. If their understanding is flawed, they may give the students incorrect advice or vague, unhelpful advice such as "study harder."

Cognitive researchers and educators have written books to help students and teachers understand the nature of learning. Some recent examples are Agarwal and Bain (2019), Benassi et al. (2014), Cavanagh (2016), Penn (2019), Weinstein et al. (2019), and Willingham, (2009). One book was intentionally written by cognitive scientists in collaboration with a novelist to minimize technical jargon and enhance readability (Brown et al., 2014). Hattie (2009) wrote an extensive review of factors associated with student achievement and then wrote a book covering the same factors specifically for teachers (Hattie, 2012). Faculty in various fields who study teaching have also contributed books, such as McGuire (2015) and Eyler (2018). A lot of the books focus primarily on one aspect of the student learning context, such as learning strategies (Agarwal & Bain, 2019; Brown et al., 2014) or metacognition (McGuire, 2015). Resources that provide a comprehensive overview of all the factors in the learning situation (e.g., Weinstein et al., 2019; Willingham, 2009) contain a lot of information, and they tend to present it as a sequence of factors instead of as a coherent framework.

Cognitive scientists and education researchers have also written articles on how to study effectively based on cognitive principles at various levels of technical complexity. For example, Dunlosky et al. (2013) conducted an extensive review of learning research and specified the effectiveness of popular study strategies. Dunlosky then wrote a more accessible version of that review for K-12 teachers for the *American Educator* (Dunlosky, 2013). Putnam et al. (2016) and Miyatsu et al. (2018) wrote articles whose specific purpose was to translate research into an accessible form for teachers and students. One issue with these written resources is that they do not provide the student with a coherent framework that encompasses the key aspects of learning to help students understand and apply the information to help them study.

There are websites maintained by cognitive researchers and educators, such as the Learning Scientists (www.learningscientists.org), Learning Sciences in Canada (https://www.canadianlearningsciences.ca/home), Taking Learning Seriously (www.takinglearningseriously.com) and The K. Patricia Cross Academy (www.kpcrossacademy.org). Many universities maintain teaching and learning centers to provide evidence-based information to help teachers, such as the University of British Columbia Centre for Teaching, Learning, and Technology (https://ctlt.ubc.ca/). Mount Royal University houses the Institute for Scholarship in Teaching and Learning, dedicated to pedagogical research. (https://www.mtroyal.ca/ProgramsCourses/FacultiesSchoolsCentres/InstituteforScholarshipofTeachingLearning/index.htm). There are numerous teaching focused blogs (e.g., *Online Learning and Distance Education Resources*, found at https://www.tonybates.ca/) as well as podcasts (e.g., *Teaching Strides*, found at http://www.teachingstrides.ca/). Finally, many organizations, researchers, and teachers are active on various social media platforms.

Several psychologists have created videos by on how to study effectively based on cognitive principles. Chew (2011, 2015), for example, offers a series of five relatively brief videos for students that cover the cognitive basis of effective learning strategies, and another series of videos for teachers explaining the cognitive principles of effective teaching.

None of the materials developed thus far provide the reader with a single, comprehensive framework or diagram that clearly and accurately illustrates how students learn in a way that will help students learn more effectively. There are tables and lists of effective practices, but not a comprehensive graphical representation. Ideally, such a graphical framework would provide students and teachers with a schema for learning that would help teachers design and implement effective pedagogy and students to develop effective study strategies.

A Schema for How People Learn

A schema is an organized framework of long-term knowledge that, when activated, facilitates the encoding and learning of new, related concepts; promotes inference, reasoning, and problem solving within that domain; and guides recall of relevant information (Alba & Hasher, 1983; Bransford & Johnson, 1972; Chen & Mo, 2004; Mannies et al., 1989). Taking individual facts and creating a coherent schema, a process called schematization, has profound effects on the long-term recall and utility of the information (Alba & Hasher, 1983; Herbert & Burt, 2004). Teachers who have developed an accurate schema of learning can design and implement pedagogy to fit a particular educational context, diagnose problems and make any needed adjustments, and design meaningful assessments (Willingham, 2017). Students with an accurate schema of learning can develop effective learning strategies for any course context, identify and avoid bad study strategies, and regulate their learning (Chew, 2020a, Pan & Bjork, 2020). Clearly, both teachers and students benefit when they possess a valid schema of how people learn, and helping both groups develop such a schema should be a priority. Unfortunately, much of the advice offered to these groups comes in the form of decontextualized, stand alone "tips" that often focus more on behavior than cognitive principle (Chew, 2020a; Chew & Cerbin, 2021) Teachers get teaching tips such as "provide feedback to students" without being told how to formulate feedback to help student learning. Students get study tips such as "don't cram" without knowing why that is bad for long-term learning.

What is the fastest, easiest way for a novice to create an accurate schema of new information? Schema formation can be rapid in areas where students have rich background knowledge. One good example is enough to create a functional schema (Ahn et al., 1992). By the time they get to college, students have a lot of experience with studying, even if they may not do it well. Certainly, teachers have relevant background knowledge. Thus, we can expect that one good example or illustration may be sufficient for students and teachers to create a schema for learning.

The goal of this article is to create a graphical advance organizer based on cognitive research that will help both students and teachers

develop a schematic understanding of the complex nature of learning. The organizer should assist teachers in creating supportive learning environments. It should provide a coherent schematic framework to help students understand how people learn and help them plan and carry out effective study strategies. This diagram would also help teachers understand how people learn and be a tool for them to explain this information to students. The challenge is summarizing and translating the research into an understandable and useful form for teachers and students.

Advance or Graphic Organizers

Ausubel (1960) introduced the idea of using *advance organizers* to help students learn. Advance organizers present a coherent overview of the relationships among the concepts to be learned. It should provide a schematic framework with proximally superordinate categories that subsume the concepts. The advance organizer is shown to students before the concepts are presented.

A well-designed advance organizer should be inclusive of all concepts needed to achieve the learning goal, showing both the necessary depth and breadth of the material. An advance organizer can take multiple forms, but it should be easy to understand, both in terms of the concepts and the relationships among the concepts. Advance organizers can be composed of written text (Corkill, 1992), but graphic diagrams or concept maps are a commonly used format, and there is evidence that they are superior to text-based advance organizers for learning (Robinson & Kiewra, 1995).

The use of a well-designed advance organizer can significantly enhance learning (Mayer, 1979; Stone, 1983). Stull and Mayer (2007) found that providing students with advance organizers was more effective than having students generate their own. They tested the impact of advance organizers on learning low, medium, or high complexity information. They found no difference in recall of information with the use of advance organizers, but they found significantly better transfer of information with the use of advance organizers at all levels of information complexity.

An Advance Organizer for Student Learning: Choke Points and Pitfalls in Learning

In this section, I discuss the development of a comprehensive, graphical advance organizer based on the Information Processing Model that includes components of the model relevant for academic learning, but translated into a form that is accessible and usable by teachers and students. Slate and Charlesworth (1988) first suggested using the information processing model as the basis of as an advance organizer for improving teaching and learning but their organizer was text-based, and it omitted several processes relevant to learning.

To design a graphical advance organizer, I started with an updated information processing model that included Working Memory (WM) instead of short-term memory. I also included learning strategies for transferring information to long-term memory such as self-testing and deep processing. I chose to omit cognitive concepts that are not directly relevant to academic learning, such as sensory memory, pattern recognition, and implicit forms of memory. To include these concepts would make the advance organizer harder for students to understand and obscure the relevant information (Mayer, 2014). Next, I decided on a level of granularity for the advance organizer that would convey the essential properties of a cognitive process for learning without going into unneeded detail. For example, I discuss Working Memory in terms of its function, but I do not discuss the episodic buffer, phonological loop, and visual-spatial sketchpad. I did include chunking because it is directly relevant to student learning.

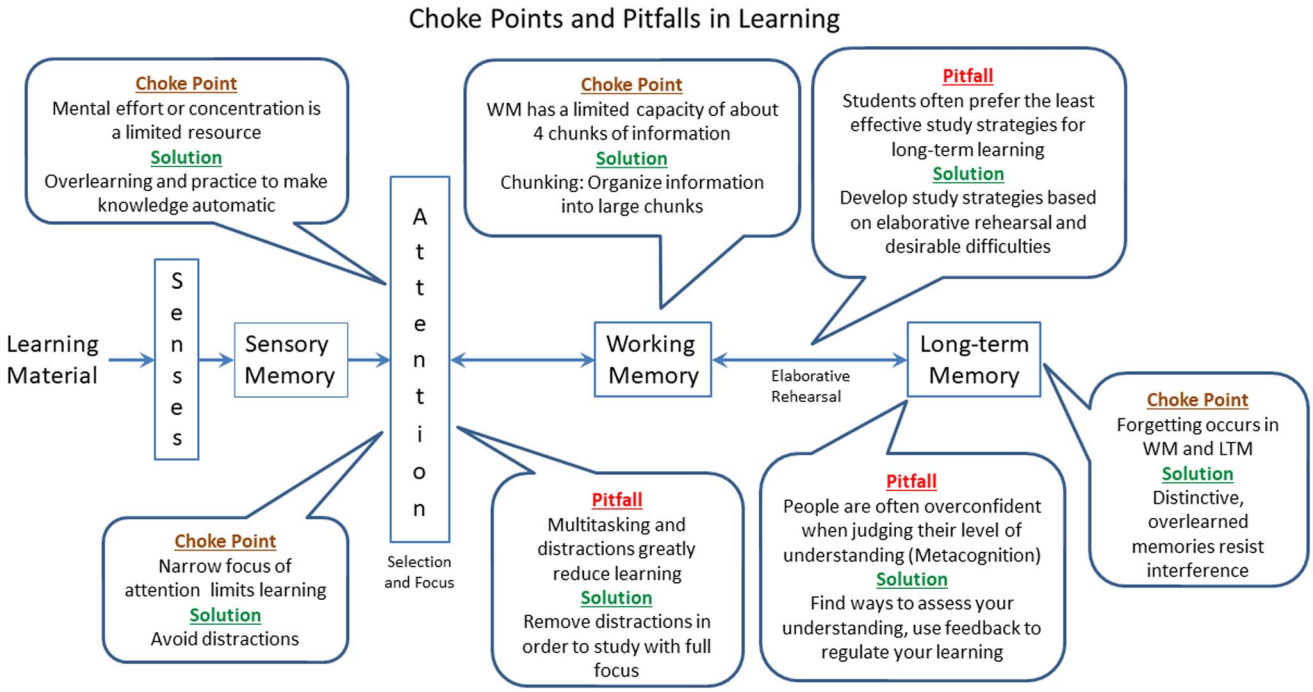
A critical factor for the effectiveness of the advance organizer was to translate cognitive research and theory into a form that is both accessible and useable by students and teachers (Daniel & Chew, 2013; Willingham, 2017). Neither teachers nor students need to have a detailed understanding of psychological theories or a technical grasp of research findings. They simply need a general, functional understanding, supported by research, that can help them teach and learn more effectively. For example, it isn't necessary for students and teachers to understand the *new theory of disuse* (Bjork & Bjork, 2006) and the research that supports it. In most circumstances, teachers and students only need to understand a general principle that is supported by the theory (Willingham, 2017). If they know that forgetting and then relearning information strengthens long-term recall, then they can utilize strategies such as spaced practice, interleaving, and delayed feedback. To make the advance organizer accessible, I introduced the categories of chokepoints and pitfalls, to capture cognitive constraints that limit learning and common student missteps in learning, respectively.

The final challenge in designing the advance organizer was creating a graphical illustration using the principles of effective multimedia learning. Following the guidelines of Mayer (2014), I minimized extraneous material that did not bear on the learning goal (coherence), highlighted important relationships within the diagram (signaling), and embedded captions in the relevant parts of the diagram (spatial contiguity).

The resulting advance organizer for student learning is shown in Figure 1. It is based on a simplified information-processing model with three stages of memory: sensory memory, working memory, and long-term memory. It also depicts attention and elaborative rehearsal. The linear progression of stages is intentional as a visual metaphor. Sherrington (2020) has proposed an alternative, nonlinear graphical framework of learning, also based on information processing.

In bottom-up processing, information flows into the system through the senses on the left and arrives at sensory memory. Sensory memory holds incoming sensory information for a brief time. Information then goes through attention, which serves two functions. It selects information for further processing, essentially filtering out any non-attended information, and it allows students to concentrate on important stimuli such as an exam. At this point, information can flow either way in the system. Information that makes it through attention then arrives at working memory (WM). Working memory is conscious and has a limited capacity. In WM, if information is not rehearsed, it is forgotten in seconds. Information in working memory can be rehearsed in different ways, and elaborative rehearsal is the most efficient way of making information permanent by transferring it to long-term memory (LTM). Elaborative rehearsal can be achieved in multiple ways, such as semantic processing, spaced rehearsal, or retrieval practice. LTM is the permanent storehouse of knowledge. It is unlimited in capacity; but in order to recall information, students have to have an effective retrieval strategy. Information can still be forgotten through retrieval failure. Students who lack an effective retrieval strategy cannot recall information even though it is in LTM.

Figure 1
The Choke Points and Pitfalls in Learning, With Possible Solutions



Note. An advance organizer illustrating the choke points and pitfalls of student learning within an information processing model. See the online article for the color version of this figure.

Choke Points and Pitfalls

The advance organizer points out the common choke points and pitfalls that undermine the effectiveness of their studying. A choke point is a limitation or constraint in the cognitive system that students must cope with in order to learn, such as the limited ability of WM to hold information. A pitfall is a common error students make when studying. These pitfalls are often due to faulty assumptions and intuitions about how people learn.

Choke Points

Here are the common choke points for learning that students and teachers need to know. Each choke point is labeled on the advance organizer along with a means of obviating the constraint.

In attention, *mental effort or concentration* is a limited resource, and thus a major constraint on learning. Students have a limited amount of concentration that they can use at any given time (Chandler & Sweller, 1991; Sweller et al., 2019). A task requires a certain amount of mental effort to complete, which is called its cognitive load. Students can easily be overwhelmed when the cognitive load of a task or the combined cognitive load of a set of tasks they are trying to complete exceeds their available mental effort. If the cognitive load exceeds available mental effort, then students will be overwhelmed and their learning performance will decline. Cognitive load is high when students are trying to learn new, complex information (e.g., Piolat et al., 2005). Distractions that take up mental effort are harmful to learning because learning new information has a high cognitive load (Forster, 2013). Students can solve the mental effort choke point through deliberate practice and automaticity. The more students practice and use information, the less mental effort is needed to recall and use the information (Feldon, 2007). Students should aim to make new knowledge automatic, which means overlearning the information, studying it well beyond an initial ability to recall the information. Short of automaticity, students can try to structure their study environment to reduce distraction and avoid becoming overwhelmed.

In attention, the *narrow focus of attention* forms another choke point. Selective attention allows a person to focus their awareness on a specific stimulus. By doing so, they lose the ability to perceive stimuli outside their focus (Kreitz et al., 2015). This fact makes students vulnerable to distraction, especially by stimuli that are more eye-catching and potentially interesting that what is going on in class or during a study session. Blasiman et al. (2018) documented the negative impact of different kinds of distraction during online learning. When we try to divide attention between different sources, commonly called multitasking, our ability to perceive either source falters. Multitasking is one of the pitfalls I will discuss later. The simplest way to address selective attention is to reduce or eliminate distractions (Ent et al., 2015). Students should reduce the number of distractions in their study environment. The mere presence of a smartphone might reduce the ability to concentrate and learn (Thornton et al., 2014). Furthermore, they should develop study habits that involve the reduction and avoidance of distractions (Neal et al., 2013). The human cognitive system is designed to focus on one stimulus at a time.

Working memory, which has a limited capacity to hold information, is another major choke point. WM is the only memory with a capacity limit, making it and attention the two main constraints on learning. The capacity limit of WM is severe, roughly four chunks of information (Cowan, 2010). Because WM is conscious, it is the cause of frustration of many students as the try to repeatedly rehearse information in an attempt to get it through WM to long-term memory. Students try to overcome the WM capacity limit through concentration and repetition, but this is the wrong way to overcome this bottleneck. We measure WM capacity in terms of chunks. A chunk is composed of organized, coherent information so that it acts as a single unit in WM. The solution to the capacity limit in WM is to organize information into large chunks, a process called chunking (Gobet, 2005). For example, memorizing a random string of letters, such as "P-T-M-A-O-P-I-H-O-S-U-P" would be difficult because each letter acts as a chunk and 12 chunks far exceed WM capacity. However, memorizing the same string of letters arranged to spell a familiar word, such as "H-I-P-P-O-P-O-T-A-M-U-S is easy because now all the letters are organized by long-term knowledge into something familiar and meaningful. To overcome the WM capacity limit, students need to study to organize information into meaningful chunks. This is most difficult for novice learners in introductory classes because they lack the expertise to build big chunks. As a result many students find introductory courses to be much more challenging that advanced ones.

The rapidity of *forgetting* forms the last choke point. In WM, forgetting occurs in a matter of seconds without rehearsal. Forgetting in LTM occurs at different rates depending on conditions. Forgetting generally occurs due to interference from other memories (Weinstein et al., 2019). Forgetting in general is more rapid than learning, which is why it is so frustrating. To slow down forgetting, students can overlearn information, which leads to stronger initial learning (Rose, 1992). Forgetting still occurs, but the stronger initial learning means that the memory lasts longer. Overlearning through the use of retrieval practice may help reduce the effects of interference (Kliegl & Bäuml, 2016), which makes practicing recall under test conditions a good way to learn. Another way to reduce interference is to create a highly distinctive memory that stands out against other memories (Mäntylä & Nilsson, 1988).

Pitfalls

Here are common pitfalls, or missteps, that students often make that undermine their learning. For each pitfall, the advance organizer indicates a way for students to avoid it.

Students try to study while *multitasking* or in the presence of *distractions*, which greatly reduces learning (Weinstein et al., 2019). The human cognitive system is not built to multitask, but to focus on one stimulus at a time. Multitasking, also called task switching, involves trying to attend to more than one activity at the same time. It is a huge problem with the plethora of digital distractions that surround us, especially for students trying to concentrate and learn (Wammes et al., 2019). The clear conclusion from a large body of research is that multitasking reduces learning and hurts academic achievement (e.g., Bellur et al., 2015). Students may feel like they are good at multitasking because they do it often, but the belief is mistaken. The human cognitive system is not built to multitask, but to focus on one stimulus at a time. People probably can carry out two automatic tasks at once, but studying generally involves an effortful attempt to learn complex unfamiliar information. Avoiding the problem of multitasking is not a matter of willpower, but of removing the distractions from the environment (Ent et al., 2015). Students should reduce the number of distractions in their study environment. Furthermore, they should develop study habits that involve the reduction and avoidance of distractions (Neal et al., 2013).

Another pitfall is that *students often prefer the least effective study strategies for long-term learning*. Students can employ different rehearsal or learning strategies on information in WM. Some of the rehearsal strategies only keep information current in WM. Once this kind of rehearsal stops, forgetting is rapid. To make information permanent, students have to use a study strategy that will transfer information from WM to LTM. Students need to use the proper kind of rehearsal to match their study goal. Students however, strongly prefer to use the least effective learning strategies for long-term learning (Blasiman et al., 2017; Yue, 2020), such as mindless rereading, massed practice, and highlighting. These methods tend to be easy to do. Learning strategies that are effective at creating enduring memories are more effortful and usually involve some kind of meaningful elaboration or manipulation (Weinstein et al., 2019). On the advance organizer, I have used the category label elaborative rehearsal (Craik & Watkins, 1973) but there are a wide range of effective study strategies, such as chunking, spaced practice, retrieval practice, interleaving, and self-testing among others (Weinstein et al., 2019).

Another pitfall is that students are often *overconfident when judging their level of understanding*. Students tend to be overconfident in judging their own level of understanding, especially weaker students (Ehrlinger & Shain, 2014; Yue, 2020). Overconfidence causes students to stop studying prematurely, believing they have deep understanding when in fact their knowledge is shallow, incomplete, and has misconceptions. Poor study strategies can lead to overconfidence because the student has put in long hours of study with little actual learning. Overconfidence is most likely to occur in introductory courses in which students have less knowledge about a field and thus are poor judges of their level of understanding (Guillory & Blankson, 2017). Yue (2020) makes several suggestions about how to reduce overconfidence and improve metacognition. These include providing multiple opportunities for students to gain feedback about their level of understanding and having students reflect on that feedback, modeling metacognitive strategies for students, use retrieval practice in the classroom, and teaching students how to use self-testing appropriately.

Assessing the Advance Organizer

Even though the advance organizer may accurately reflect cognitive research, it is useless unless teachers and students can understand it and use it. I tested the utility, accuracy, and appeal of the advance organizer by getting feedback about it from teachers across many disciplines I posted a draft version of the organizer on different social media sites that are frequented by educators and educational researchers, and asked for honest, critical feedback. Although I could have created a formal survey, this method provides unfettered feedback from the group for which the advance organizer was designed. Their feedback was in the form of likes, shares or retweets, and comments.

I posted the advance organizer on my Twitter and Facebook accounts and asked for feedback. My Twitter account is primarily

dedicated to teaching, pedagogy, and the scholarship of teaching and learning. It has about 3100 followers, most of whom are educators and education researchers in a variety of fields, roles, and levels. I also posted the advance organizer on the Facebook group of the Society for the Teaching of Psychology (STP). The STP group has over 16,000 members. Presumably, the vast majority of these members are teachers or prospective teachers of psychology at various stages of their careers and in a wide variety of settings. Finally, I created a video on how people learn which used the advance organizer as a centerpiece, and posted it on YouTube (Chew, 2020b). I publicized the video on Twitter and Facebook.

According to analytics, the Twitter post was seen by over 40,000 people, of which 3117 opened the tweet. Overall, the post received 335 likes and 101 retweets, 12 of which were positive quote retweets. The tweet received 22 comments, which were overwhelmingly positive and supportive. Several people made suggestions that resulted in modifications to the advance organizer, such as enclosing "attention" in a rectangle, adding the caption "elaborative rehearsal" between WM and LTM, and changing *forgetting* from a pitfall to a choke point. There is not a comparison group for evaluating these results, but compared to other tweets about pedagogy, the advance organizer was well received both in terms of positive responses and sharing.

The Facebook post containing the advance organizer received 130 likes and 16 shares. It received nine unique comments, all of which were strongly positive. Compared to other posts in the group, the advance organizer received a great deal of attention and positive feedback.

The YouTube video using the advance organizer was posted in July, 2020. In 6 months, it has been viewed over 12,000 times. The comments from teachers have been uniformly positive. The video has been used by high school and college teachers to show students how to study. I posted notices about the video on both Twitter and the STP Facebook group, welcoming critical feedback. The Facebook post received 124 likes and was shared 30 times. There were 18 comments which were strongly positive.

Summary and Conclusion

Effective teaching involves more than just instructing students in course content. It also involves teaching students how to learn, think about, and use the information (Chew, 2014). Furthermore, teachers of psychology have the unique opportunity to teach students effective study skills as part of a class. In this article, I have described the development of a graphic advance organizer to help with this goal. The purpose of this advance organizer is to help teachers understand learning, and to enable them to design better pedagogy and instruct students in how to study effectively. For students, the organizer is intended to help them avoid common pitfalls in learning and develop flexible, effective study skills that they can use in any learning situation. The organizer graphically represents the course of learning, pointing out the choke points and pitfalls that might undermine learning. Not only does it point out these potential problems, but it also supplies solutions.

To test the accuracy and usefulness of the advance organizer, I posted it on several social media sites where it would be seen by teachers of psychology specifically and teachers in general, as well as other educational professionals. While not a controlled study, the hypothesis that the advance organizer was a valid and useful learning tool could have been falsified by critical comments or teacher indifference. The results show that the advance organizer was viewed positively and enthusiastically. Obviously, the lack of controlled testing is a limitation, although the fact that teachers were free to choose to criticize, ignore, or respond positively, and the majority did the latter.

More extensive research should be done with the advance organizer and, if warranted by the results, modifications made. For example, three groups of first-year college students could be given the same presentation on how to study effectively, with one group being given the advance organizer beforehand, another group getting the same information as the advance organizer but in list form rather than graphical form, and a control group not given any form of organizer. The students could be assessed on how much they learned from the presentation, how they planned to incorporate the information into their study strategies, and how useful the advance organizer that the first two groups received. Another way to assess the impact of the advance organizer would be to follow the paradigm used by Bransford and Johnson (1972) for testing schema activation. Three groups of first-year students could be given the same presentation on how to study, but one group would be provided with the advance organizer before the presentation, a second group would be provided with the advance organizer only after the presentation, and the third group would not be provided with the advance organizer at all. This study would use the same dependent measures as the previous one. In either study, it would be useful to follow up with the students after a time period to see how well students retained and used the information, and to see if either advance organizer could act as a reminder of the information.

Previous attempts to instruct teachers and students in how people learn have taken the form of books, articles, and video presentations. This advance organizer is unique in that it contains highly relevant information in one instructive diagram that can be used by both teachers and students. It has the potential to help teachers and students to develop a schema of how people learn.

Résumé

Les enseignants et les élèves ont tout à gagner d'une compréhension précise de la façon dont les gens apprennent. Pourtant, les recherches montrent que les deux groupes ont souvent des croyances erronées qui nuisent à l'apprentissage des élèves. Cet article décrit un organisateur avancé qui peut être utilisé pour aider les enseignants à comprendre comment les gens apprennent et que les enseignants peuvent utiliser à leur tour pour former les élèves à étudier plus efficacement. L'organisateur avancé est une représentation graphique d'un cadre simplifié de traitement de l'information. Il se concentre sur les goulots d'étranglement et les écueils de l'apprentissage, sur la base de la recherche cognitive. Les goulots d'étranglement sont des contraintes du système cognitif humain, comme la nature sélective de l'attention et la capacité limitée de la mémoire de travail, qui entravent l'apprentissage. Les écueils sont des pièges courants dans lesquels les élèves tombent et qui nuisent à leur apprentissage, comme le multitâche et l'excès de confiance. L'organisateur décrit chaque goulot d'étranglement et chaque écueil et propose une façon d'aborder chacun d'entre eux.

Mots-clés : enseignement, pédagogie, apprentissage des élèves

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Received July 2, 2020
Revision received March 20, 2021
Accepted March 28, 2021 ■