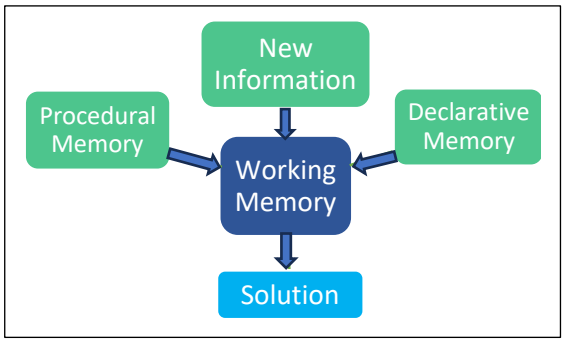
ISSUE 15 NOVEMBER 2023

QUARTERLY JOURNAL OF WAY TO SUCCEED: MINDFUL INSIGHTS FOR LEARNING

Learning Insights

In this issue:

Mathematics involves memory resources and processes: working with numbers, combining, dividing, factoring, etc. Mathematics is not just a process course however. It must come with a knowledge base in order to be able to properly and easily manipulate symbols that represent quantities (known or unknown) during procedural tasks. Mathematics depends more heavily on working memory especially as problems increase in complexity, whereas subjects such as history depend on more of a declarative type of memory for learning.



The diagram displays the idea of a three-part foundation to the components of working memory. We can discover insights into the difficulties some students have with mathematics using this model. Strengthening any of the contributors to Working Memory can help your students with problem-solving in your class. See the side bar to the right for some ideas for each component.

Three types of memory are discussed in this article.

1. Declarative memory is the information that is already known. This includes facts, formulas, basic numeracy ideas and visualizations.
2. Procedural memory is associated with processes, typically physical, such as tying a shoe or riding a bike, but can also be connected to physical or symbolic mathematical processes and procedures.
3. Working memory is the mental space dedicated by one's mind to holding information on a short-term basis while working on solving a problem. Working memory includes retrieval of both Declarative and Procedural memory and holds the new information presented in a novel problem. Visually, working memory can be illustrated in the diagram to the right as three parts contributing to a smoothly functioning process. New information, existing memories of knowledge, both factual and experiential, and learned procedures all feed into Working memory. There, the student manipulates, sorts, decides relevance and strategies in order to arrive at a solution.

Improving the Interpretation of New Information

- Emphasize to the students that understanding the process is entirely different from working through the same type of problem on their own.
- Give students time to try out a problem on their own while in class if possible.
- Discuss with your student how to make decisions when approaching a new problem.
- Point out relevant and irrelevant information in the problem. Highlight key words that suggest certain operations. Communicate ways to simplify or rearrange complex expressions.
- Help students visualize application problems. Minimizing the language element is also helpful for some learners.

Improving Declarative Memory

- Memory retrieval is not taxing on working memory unless basic math facts must be re-calculated or looked up continually. Encourage your students to become more fluent with basic facts through practice and deliberate learning.
- If your class requires the use of formulas, formula cards are a way to more easily commit the formulas to memory.
- Practice. Repeated use of facts and formulas will help with fluency, freeing Working Memory for more procedural tasks and decreasing anxiety and frustration.

Improving Procedural Memory

- Again, practice! Repetition is a foundational way to learn new things like learning an instrument, athletics, and new languages. The same principles apply to learning math.
- Break solutions down into smaller components to limit the possible procedures necessary to solve one step of a problem.
- Discuss step-by-step *thinking and reasoning*, and not only the step-by-step algorithms.
- Students confronted with a problem with a wide variety of possible procedures, such as on an exam, need to know in advance about procedure choice and how to make wise decisions about what procedure to use.

The Importance of Vertical Alignment

"Some … schools … are taking drastic steps to simplify content to accommodate the less-prepared student. This may benefit the school image but may give students a false sense of achievement and preparation for future classes."

Professors are seeing an increase in under-prepared college students. The causes of this current trend are many. Primary and secondary school policies, cultural changes, and online learning due to the pandemic all contribute to the pervasive lack of college readiness. Under-preparedness is present in three major areas, according to McMahon (2017).

- Students need remediation before taking on college-level work
- They lack the study habits and other habits of mind necessary for college success
- Students do not have ability to use critical thinking skills to apply appropriate strategies to learning situations

When students are not prepared adequately for college-level learning, especially in basic math concepts, one must look to the previous schooling of the students. Teachers at the high school level are required to adopt school policies and curricula that either do not prepare students academically or they must struggle with teaching underprepared students themselves or both. In either case, the alignment of curricula vertically, that is, from grade to grade, may not be consistent or does not take into consideration the pre-requisite skills for the next level of coursework. Vertical alignment is especially critical in mathematics, where curricular content follows a logical and sequential flow of concepts and ideas. Any gap or lack of prerequisite knowledge hinders learning at the next level.

Within the K-12 system, vertical alignment planning is fairly commonplace, but these typically occur within the individual schools, such as elementary, middle, or high schools. Vertical alignment meetings between schools of different levels happen infrequently. Rarer still are these meetings with collegiate faculty and high school faculty. Even though community colleges, colleges, and universities differ in rigor and entrance requirements, all most likely have a basic standard for prerequisite skills for entry level mathematics courses.

The need for between-school vertical alignment has never been greater. Some high schools and colleges are taking drastic steps to simplify content to accommodate the less-prepared student. Others are removing content and reducing rigor so that more students pass courses. This may benefit the school image but may give students a false sense of achievement and preparation for future classes.

Perhaps it is time to initiate a vertical alignment plan with local high schools. This should be a session for a gathering of sharing information to improve learning. Vertical alignment is all about communication with a common goal of improving student learning and success in math or other STEM courses.

Things to keep in mind:

1. Begin with the end in mind, as with any goal. Then work backwards to create appropriate steps in curricula that would result in the desired mathematical knowledge and numeracy. Many elementary teachers don't have a background in mathematics, and therefore are less aware of what students need to know before moving to the next grade.
2. Keep the range of levels to a minimum. Then create the schedule of meetings where communication of minimal prerequisite requirements for students to know are passed down to the previous level of instructor.
3. Include the development of metacognition, self-regulation skills, and other learning-related proficiencies. Students should gradually move beyond the need for learning supports and developing independent learning skills as they progress through primary and secondary school. School policies that encourage independent learning should be developed or protected.

References

Brewer, D. S. & Becker, K. (2010). Online homework effectiveness for under-prepared and repeating college algebra students. *Journal of Computers in Mathematics & Science Teaching, 29*(4), 353 – 371.

McMahon, Maureen. "Underprepared College Students." Underprepared College Students – Research Starters Education, 4/1/2017, pp. 1 – 6. EBSCOhost, lrcproxy.iccms.edu:2048/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=e0h&AN=45827557&site=eds-live.

Way to Succeed Can Help!

We designed Way to Succeed to accompany first-year math and other STEM classes. Our goal is to help your students become aware of and develop their learning skills and strategies in a personal way while freeing you to focus on your math or other STEM content. The online program works outside of class, providing personal learning profiles and targeted actions for improvement, short, thought-provoking readings, videos, and short quizzes that that highlight the skills, attitudes, cognitions, and learning strategies in which successful students engage. Student can quickly make changes to become better learners and improve their academic achievement.

No-Fail Policies

Dealing with the consequences in your class

No-Fail grading policies are popping up across the country in our K-12 public school systems. Generally, no-fail policies mean that no student can be given a grade below a 50% on any assignment or test, regardless of the quality, although this minimum grade varies from district to district. Zeros for assignments not turned in are not allowed. In some districts, students are also allowed to retake tests and quizzes when a poor grade is earned.

The reasoning behind such a change in grading over more traditional methods is threefold. First, many believe students should not be punished for having weak skills or for being slow learners. Teachers should encourage lower achievers. Secondly, students with too many zeros may find it mathematically impossible to overcome such low grades to pass a class, and therefore become discouraged and lose motivation to continue trying to learn. A third reason for no-fail policies is that one bad test grade may be extremely damaging to a student's ability to pass a class, and that retaking tests improves knowledge and achievement. What we are finding is that while no-fail grading sometimes helps students achieve in the short term, it is having a deleterious effect on long-term student learning, especially for those who progress to post-secondary schooling. One of the predominant effects is weak habits of mind for learning such as initiative, industry, and persistence, leaving many students lacking learning independence and a more passive approach to learning. Students seldom make the extra effort to achieve if they believe they will receive a passing grade. Motivation to learn and academic achievement decline.

The recent pandemic exacerbated this effect. School districts in the throes of switching to online school with little preparation gave blanket passing grades to students regardless of attendance or achievement. This practice left students woefully behind academically and did not prepare them for the rigors of college-level learning.

Many college professors are seeing the aftermath of these policies and want to know what can be done to help students regain the ability to learn at the college level, despite content gaps and skills. Four recommendations, based on research, come to mind.

1. **Include a homework grade category**. Effort and time spent on practicing content is the primary method through which students learn. They often avoid what they don't know. Credit for completing assignments with the intent of learning the content increases motivation and helps them to experience *how* to learn for themselves.
2. **Use online homework software**. Quality software helps students practice current content while identifying and correcting weak areas and learning gaps. Students receive immediate feedback, and short tutorials on correct completion of algorithms. Brewer and Becker (2010) found that marginal students scored significantly better in a College Algebra course when using online homework vs. the students who completed homework from a traditional textbook.
3. **Limit, phase out, or eliminate chances to retake assessments** so that student take their learning tasks and studying seriously. Pressure to perform well the first time is not a bad thing, as students will face these demands in their careers and in life.
4. **Consider adding a learning skills component to your class**. Learning math and other STEM subjects is different from learning history or literature. If you are not sure, or don't have time, find an outside resource to help you.

Q&A About Way to Succeed

Q: How does Way to Succeed help students with improving self-regulation?

A: This is a great question! We reach your students in two ways:

1. We offer seven chapters in our eBook covering common difficulties first-year and at-risk students have when taking a STEM class. Learning math and other STEM content is different than learning for other subjects. We address those differences so that students know what to do to be successful in math.
2. Students take three Personalized Diagnostic Learning Assessments which focus on personal learning beliefs and practices. We help them identify strengths and weaknesses and offer solutions to correct areas of weakness. The goals of these chapters and Learning Assessments are to provide students with the means to identify and make changes in their study habits and goals to become more academically successful while they progress through your math or other STEM course. Students learn to take on the responsibility for their own education to become self-sufficient learners.

QUOTE OF THE MONTH

Don't handicap your children by making their lives easy.

Robert A. Heinlein

Visit our Website

We offer a unique research-supported approach to helping students become more independent and successful in your classes.

Visit Way to Succeed for more information about our product, pricing, and how to order.

You can be ready for Spring Semester 2024 classes!

First-year, at-risk, and probationary students typically need more support than most other returning students, especially when these students enroll in online classes. Way to Succeed can help you to assist your students with a personalized, stand-alone success program designed for mathematics and other STEM courses. Way to Succeed helps them develop their own self-regulating and metacognitive skills so they can become more independent and effective learners.

- Students learn how to learn, especially in their math or STEM class
- Our focus is on improving self-regulation, time-management skills, metacognition in your students, and how to access extra help resources
- Nothing to grade; No essays for your students
- Personalized learning diagnostics for each student
- Companion eBook for better student accountability
- Research-based process with significant improvement in grades
- Low department and per-student costs
- Compatible with any STEM text or curriculum, online or face-to-face
- Easy-to-access instructor reports
- **Quick student set-up for your school or by class**

Upcoming Articles in the next issue of ***Learning*** *Insights*

1. The Connection between Working Memory and Math Anxiety
2. The Truth about Student Success and Failure
3. Student Procrastination: How to Reduce it in Your Students

….and more!

Way to Succeed
Mindful Insights for Learning

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