The Art and Science of Learning: How New Mexico School for the Arts Uses Research

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At New Mexico School for the Arts (NMSA), Head of School Eric Crites says, "We figure out who each student is, what their strengths are, what their talents are, and what their needs are. And we meet those needs." While this is a lofty goal for any school, NMSA has the added challenge of supporting students' success in both academics and their chosen art specialty.

NMSA, a public/private partnership comprised of an accredited New Mexico state charter high school and a non-profit arts educational institution, opened its doors in 2010 to students from throughout the state of New Mexico. NMSA administrators and teachers take pride in the fact that their ninth through twelfth graders experience rigorous arts and academic curricula. After their daily academic classes, students participate in an applied arts block of their specialty (either music, theater, dance, or visual arts) for 2 hours and 45 minutes. All of these artistic disciplines are taught by working artists who bring the vibrant Santa Fe arts scene directly into the school.

Though NMSA collected six consecutive "A" grades from the New Mexico Public Education Department, and school leadership felt proud of their accomplishments, NMSA Founder and President Cindy Montoya shared that staff had been operating primarily on intuition. Their instructional strategies seemed to be working overall, but staff couldn't be sure which strategies were most effective, or why. NMSA was looking for a way to ensure their strategies were evidence-based.

With this goal, they invited Dr. Melina Uncapher, Assistant Professor in the Department of Neurology at the University of California, San Francisco, and CEO and Director of Research at the Institute for Applied Neuroscience, to lead full staff trainings on the science of learning, starting in 2016.

Learning Sciences Training

In these training sessions, Uncapher introduced NMSA educators to research-based learning strategies, which helped the NMSA team put into words what they had been doing and why. The NMSA team learned about concepts including *intrinsic motivation*, *growth mindset*, and *metacognition*, and instructional strategies like *retrieval practice*.

NMSA's staff found it natural to incorporate these research concepts into their practice due to the school's focus on the arts, and its culture of experimentation and creativity. For instance, Crites shared that intrinsic motivation, or internal drive for success, that NMSA students feel for their chosen artforms keeps them naturally motivated to work hard and to continually improve. This motivation to achieve and grow as learners can carry over into academic disciplines, including subjects like math and science that, according to visual arts department chair Karina Hean, have often been "siloed as uncreative."

Another research concept that was new to NMSA staff was growth mindset, the understanding that failure is part of learning, and that improvement is possible with hard work. Montoya believes growth mindset already helped connect the art and academic aims of the school: "Each thing that we do is just one step towards getting better at something. This really resonates in the arts and it crosses over to the academics." She added that since the staff has realized growth mindset helps students build confidence as artists and confidence as learners, they've begun to introduce the concept explicitly in the classroom.

Uncapher also provided the NMSA team with language about metacognition, the awareness and understanding of one's thinking and learning processes, as well as evidence behind embedding metacognition into an instructional approach. NMSA educators like Hean had already strived to make students aware of the process of learning alongside the artistic process, helping them recognize that effective learners and artists practice externalizing their thoughts – whether through writing, speaking, or artistic media. Metacognition provided NMSA with a framework for understanding this process of making thinking visible, which can help students continually reflect and improve.

This new shared research language gave educators the confidence to extend many of their existing practices and to be more intentional in their approach. Below we share examples of how administrators, teachers, and students applied their new understanding of learning science in their daily work.

How NMSA Administrators Use the Science of Learning

NMSA administration and faculty see themselves as learners alongside their students. They are committed to leveraging research on learning and have begun to structure the school based on this commitment, in order to ensure that both students and teachers understand research-backed learning strategies.

The NMSA administrative team recently modified its required 9th Grade Academy course using learning sciences research that Dr. Uncapher had introduced. In this course students learn skills for success – including study habits, close reading skills, and public speaking – that are meant to carry them through their high school careers. While the seminar has been mandatory since 2014, in the past two years the curriculum has been enhanced to reflect the school's commitment to research. Teacher Kim Martinez recently introduced her students to several research-based strategies – *spaced practice*, *retrieval practice*, and *elaboration* – and helped them use these to prepare for a test. By explicitly teaching learning strategies and metacognition, Martinez ensures her freshmen become aware of, and begin to shape, their own learning processes.

Starting in fall 2016, NMSA also aligned its professional development (PD) policy with learning sciences research findings. Each teacher is required to select one research-based strategy from the training with Dr. Uncapher to focus on for the full school year. Teachers create a plan to implement the learning strategy, and to monitor their implementation approach and any modifications they make based on data. They share their learnings informally throughout the school year, and in a formal presentation to the school community in the spring.

Within these PD requirements NMSA teachers have the freedom to select their own strategy of interest, and are invited to be creative about how they implement the strategy and track outcomes, which leaders say improves buy-in. Many teachers are excited about their work in this area, and discuss ideas for improvement with colleagues. Montoya was proud that through this requirement, teachers were able to improve student test scores (NMSA scored three times the state average on their recent state math assessment) while focusing on student learning rather than "drill and kill." She said, "We met the demands of the state, but in a way that was authentic" to NMSA and "not just checking a box."

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Crites added to that thought, describing how NMSA creates "the structure that encourages teachers to try or practice something and to actually see that it works, so then it becomes this intrinsic motivation to do it in your classroom. Of course, every teacher wants to use practices that are effective, and this [school-wide focus on using strategies based on the learning sciences] builds the incentive right there to keep doing it and to deepen the practice."

How NMSA Teachers Use Learning Sciences Research in the Classroom

Both the initial trainings and ongoing PD on evidence-based strategies have cemented research into the teacher culture at NMSA. Hean remarked that the school has "gotten to a point where [the learning sciences] is so integrated into the way we teach now that it's almost hard to distinguish where it is in our teaching." She added that the trainings have influenced the way she and her colleagues set up learning environments, pace instruction, and communicate with their students.

NMSA teachers said that this research affirms what their "gut" tells them to try in the classroom, increases their understanding of students' experiences, and empowers them with tactical information that can improve their effectiveness. An inspiring example of learning science research implementation comes from former NMSA math teacher Dan Newell.

Newell's interest was piqued when Uncapher presented research on retrieval practices, which are strategies for bringing information to mind that have been shown to improve retention of that material. He had been looking for a way to help students recall information when they need it most, such as when taking a routine quiz or test, or facing the high-stakes assessments that can determine whether or not they will graduate. His students had typically prepared for tests by "reading and rereading" their notes, but research has shown that this strategy is *not* effective for remembering information over the long term. Newell decided to implement retrieval practice with his classes using three strategies.

1. **"Everything-you-know":** This strategy involved a student telling either a peer or teacher everything they knew about a particular area that would be assessed. According to Newell, "We affectionately called it the 'barf methodology.' Get it all out, and then see what you forgot or what you missed." A key strength of this strategy was that it could help identify gaps in knowledge. After sharing what they knew, students could take a targeted approach to reviewing any concepts they did not automatically retrieve from their memory.

2. **Flashcards:** Newell also helped students create and use flashcards for retrieval. He advised them to include multiple representations on a flashcard (e.g., a definition and an image of a concept) in order to "broaden their ability to access those different parts of the information." His goal for this strategy was for students to use retrieval both in the process of making their flashcards, and again while using them over and over as a tool to practice retrieving the information that would be assessed.

3. **Practice Test Questions:** Newell distributed packets of practice test questions at his office hours in the days and weeks prior to tests. His students would take the packets home and practice solving the problems. These practice questions were structured in a similar way to each upcoming test, but not exactly the same. He explained, "I didn't ever want them to be exactly the same, because a student still needed to be able to apply the knowledge in different types of situations." Newell shared that a related strategy would involve students creating their own practice test questions, or questions for their classmates to practice answering.

During the first several months of the school year, Newell tried all three strategies with his students. He later started collecting data to determine which strategies his students found most useful. In addition to informally discussing each strategy with his students and observing them in action throughout the year, Newell decided to conduct a more formal research project as part of his PD requirement. He created a short survey that asked students which of the three strategies they had used and how well prepared they felt for a test after using it. It also had students rate each retrieval strategy overall and share how likely they were to use it again in the future.

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The data confirmed his hypothesis that students most preferred the practice testing strategy. He also found that without using retrieval practice strategies, only about a quarter of the students responded that they felt well prepared for a test, compared to about three-quarters of respondents who reported feeling well prepared after using the strategies. Outside of the survey, Newell noticed that some students were using retrieval practice strategies more frequently as the school year progressed, and he was persuaded that formally integrating these strategies into the classroom was an effective way to get his students "prepared for the tests and quizzes that will be coming their way."

While he wished for a way to more rigorously measure whether these strategies were effective, Newell believed the benefits of implementing retrieval practices and conducting research outweighed any challenges. Montoya explained that when teachers run small research projects in their classrooms they "feel very empowered" and

"can deal with some [state level] reforms and mandates because [they] know that the classroom is [theirs]." NMSA educators have the freedom to collect, analyze, and learn from their own data, and NMSA administrators show genuine enthusiasm and unwavering support of these research projects and the considerable time required to carry them out. Newell shared what he sees as the key ingredient for making changes at the classroom level: "What it does take is support from the administration. And in this case, we had that."

Head of School Eric Crites said that Newell and the rest of the NMSA staff members are open to having conversations and analyzing problems together. They are willing to trying new approaches, based on the learning sciences, to keep getting better as educators. Montoya shared that since the trainings, when discussing a problem together faculty will ask, "Have you looked at the research around neuroscience and considered what can we do [based on what research says works]?"

Educators enjoy using student data in combination with this learning sciences research to make decisions about their practice. They reflect on what has worked and what hasn't, continually striving toward improvement. Melanie McKinley, a former science and math teacher at NMSA who is now using data to measure student growth and mastery, shared that by diving into research she "realized how much more of an effective teacher I could be, with knowing how the brain actually absorbs information, and what the best way to learn is."

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How NMSA Students Use the Science of Learning

While each student we interviewed stressed that implementing the strategies took hard work, they agreed the experience was worthwhile as it gave them confidence going into tests and quizzes, and universal study skills that they could keep using across disciplines.

Like 80 percent of the students Newell surveyed, sophomore musician Ahmad shared that he preferred the practice test questions to the other strategies. He made a point to pick up packets of practice questions at Newell's office hours in advance of each quiz and test, so that he'd feel prepared for different types of questions. Working through a variety of questions involved rounds of retrieving the information that would be assessed. Ahmad said, "When I finished them and I got it all understood, then I was ready for the test."

Fellow sophomore, and dancer, Than Povi agreed. "The practice tests are more hands-on and you can actually use your brain muscles to go over the problem and use it." While neither student had yet received practice test questions from their other teachers, Than Povi has been writing her own questions to practice retrieving key information. She said, "I use this technique in other classes because it helps with accessing information more easily for quizzes and tests."

Junior visual artist Simona preferred to use flashcards when she was struggling with math as a sophomore in Mr. Newell's class. She put a creative spin on her flashcards, adding visuals to make geometry concepts, like types of triangles or symmetry, make sense to her. For Simona, the repetitive process of

studying with flashcards became a helpful part of her daily routine. She described, "I'd just have a little stack of them in my backpack and I would just be able to take them out and just flip through them, which was very easy and convenient for me." She has since used this strategy for studying vocabulary in English class and when learning about new artists. She said, "You just have to make [these strategies] known to teachers so they have a better understanding of how we learn."

According to Newell, the greatest challenge of implementing research-based strategies with his students was their reluctance to engage in the "desirable difficulties," a form of learning that involves a considerable amount of effort from students and ultimately improves their long-term performance (Dunlosky & Metcalfe, 2008). He said the lack of incentive to do so may have been an issue (some of his students wanted extra credit for participating), but he believed the real incentive was how these strategies helped his students learn. Montoya said, "We're confident that, if [they] follow those strategies, the students will, in fact, be able to retain [and] recall information. They'll be able to apply it outside of that classroom, take it to other classrooms. For our students, we're hoping that when they leave us, as graduates, they'll be able to apply it to the college they go to, to their next step."

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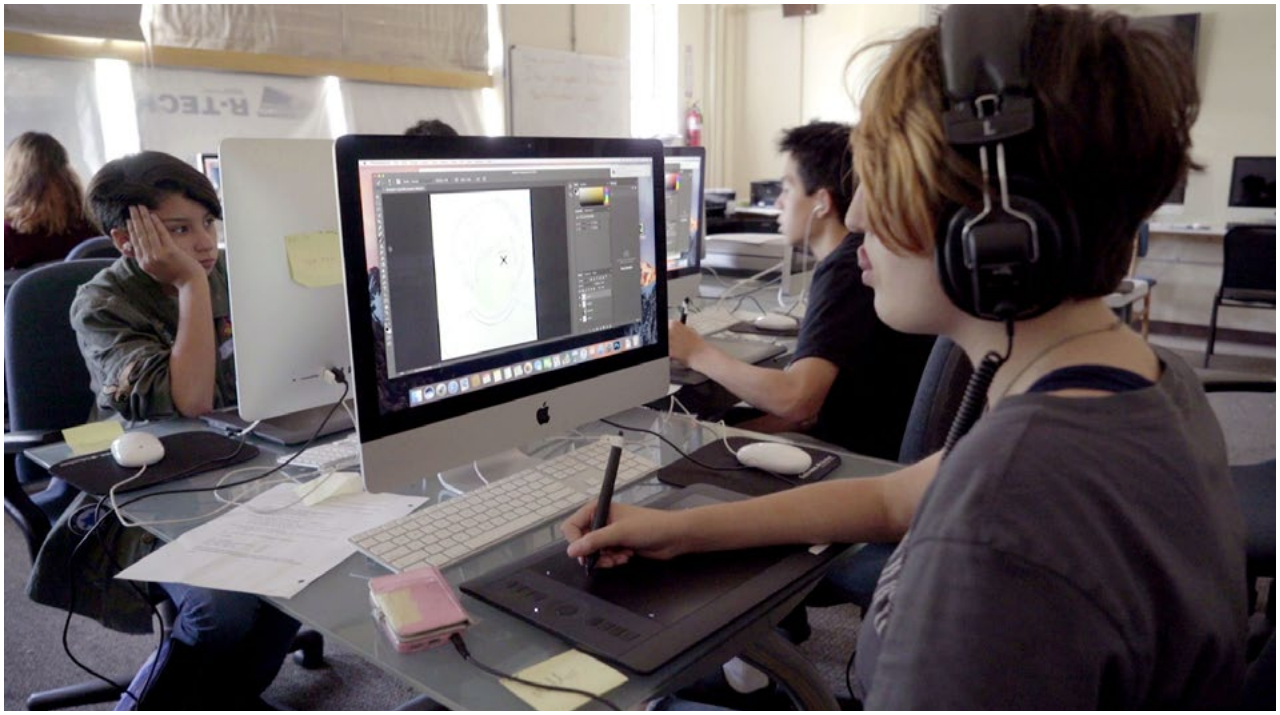

Implementing the Science of Learning: Recommendations from NMSA

Since 2016, NMSA has embedded learning sciences research at all levels: administrators are now explicit with teachers, and in turn teachers are explicit with students, about why and how they use research-based approaches to improve learning. Crites shared proudly that when he walks through classrooms, "students can explain what they're doing and why they're doing it." They might describe how and why they're using a particular study strategy, why they chose paint over charcoal, or why they need to take a quick snack break. The science of learning has helped NMSA support students to learn how to learn, while remaining true to the quality arts experience that attracts students in the first place.

The following recommendations can help other schools as they experiment with implementing new research-based practices:

1. **Understand how the science of learning is related to your school's mission:** Research gave NMSA staff a shared language around many of their existing arts education practices, and the school's culture of creativity and experimentation fit nicely with the iterative component of applying research in practice. Staying true to your school's own mission and practices by thoughtfully selecting relevant research strategies to apply.

2. **Start small:** You don't have to overhaul your entire curriculum to incorporate the science of learning. Like the teachers at NMSA, you can start by selecting a single strategy or piece of research that resonates with you, and using it in the classroom. Dan Newell started using retrieval practice with a small group of students before introducing the strategies to full classes.

3. **Be explicit:** NMSA administrators and staff share information about the brain, and the benefits of learning sciences research, with students. When students understand what their teachers are trying and why, they are part of the learning conversation and can begin to use these strategies themselves.

4. **Track your progress:** Dan Newell and other NMSA teachers have collected ongoing data in their classrooms to find out which strategies are already working, and to continuously improve. From informal conversations and observations, to more formal student surveys and assessment data, NMSA teachers are empowered to conduct small-scale research projects to help them make evidence-based decisions.

5. **Collaborate and share:** Once NMSA staff have done the work implementing research in their classrooms, they make a point to share their learings with both colleagues and the greater community. While formal presentations of data may seem out of reach to some educators, one-on-one conversations between colleagues are a great way to start sharing learings and spreading best-practices.

Learn More

This case is part of our series on implementing research in practice: a collection of stories and videos that highlight examples of learning sciences research use in districts, schools, and classrooms, as well as meaningful collaborations between researchers and education practitioners.

Check out the **video** to learn more about how NMSA incorporated retrieval practice.

Visit the Digital Promise Research Map for videos, summaries, and resources to help you start using research today!

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