

A Beautiful Mindset: Creative Teaching Practices in Mathematics

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Creativity is essential to effective thinking and learning across disciplines. It is increasingly viewed as a vital skill for working, thinking, and living in the 21st century. Yet, there remains little understanding of effective applications of creative teaching in mathematics classrooms. This is reflected in the lack of a consistent understanding of what creativity means or looks like in successful math teaching. In this piece, we explore creativity as a construct of effective mathematics teaching, sharing ideas and examples from an award-winning math teacher. In a previous study, Henriksen and Mishra (2015) investigated creative teaching practices through in-depth interviews with award-winning teachers. The study explored themes central to the practices of successful, creative teachers, in their beliefs and practical teaching approaches. Here, we examine these ideas with a focus on mathematics education. This article synthesizes core creative teaching themes, through examples, ideas, and comments shared during an interview the first author conducted with noted mathematics educator Alex Kajitani (a California Teacher of the Year, and a National Teacher of the Year finalist).

Key Words: *Creativity, creative teaching, mathematics, culturally relevant pedagogy, transdisciplinary thinking, mindset.*

Creativity has increasingly become one of the most important and desirable qualities of thinking for success in the 21st century (Pink, 2005). Creative thinking, inventiveness, and collaboration are necessary tools for real-world mathematical contexts (Leikin & Pitta-Pantazi, 2013). In our technology-centered global society, fluency in mathematical thinking, creative problem solving, and inquiry are vital skills (Alexs & Hamm, 2010). Yet, in mathematics, teachers often struggle to creatively engage students, make learning compelling, and help students build efficacy with content (Clements & Sarama, 2014). Many students find mathematics to be uninspiring, dry, and boring—even difficult to the point of being fear-inducing (Eden, Heine & Jacobs, 2013; Pekrun, Hall, Goetz, & Perry, 2014).

Creative teaching and learning practices make content learning more effective and compelling (Sawyer, 2011). In creative teachers' classrooms, students tend to be collaborative, cooperative, motivated, and engaged (Hickey, 1999; Kiely, 1998; Lilly & Bramwell-Rejskind, 2004; Sawyer,

2015). Such teachers inspire innovative learners that can produce, create, or think in real-world terms—rather than merely summarizing or repeating information (Piaget, 1973).

In this article, we share some overarching themes drawn from previous research about creative teaching (Henriksen & Mishra, 2015). We illustrate these with tangible examples, using a nationally award-winning math teacher, Alex Kajitani, as an illustrative case that provides a model for what creative teaching can look like in a math classroom.

Thematic Connections for Creative Teaching

The themes covered in this article are drawn and synthesized from a previous, larger-scale study of creative teachers (Henriksen & Mishra, 2015). Our ideas here were initially identified in that qualitative study, through in-depth interviews with accomplished, creative teachers (all National Teacher of the Year winners/finalists). The selected themes include: (a) *engaging personal creative hobbies with the content*, (b) *applying culturally-relevant pedagogies*, (c) *designing transdisciplinary lessons*, and (d) *having a mindset for creativity*. To better understand creative teaching in a mathematics classroom, we share ideas from a creative math teacher, Alex Kajitani (a National Teacher of the Year finalist, a California Teacher of the Year, and a highly-recognized educator for his work connecting rap music to math).

Alex Kajitani: Creativity in Unpredictable Situations

We share Alex’s work as an illustrative case of creative teaching. This is based on the acknowledgement of his creative pedagogies by his peers, and educational departments at state and national levels, and is validated in the criteria and accomplishments in his National Teacher of the Year finalist award. During the first author’s interview with him in the original study, he shared his experiences as an accomplished, effective, creative mathematics teacher. Alex is nationally and widely known as “The Rappin’ Mathematician,” and has been noted for his innovation in the classroom and as a teacher-trainer nationwide. Alex has been honored at The White House and on The CBS Evening News for his innovative teaching (Tracy, 2008). Yet, he has related how he began as a struggling mathematics teacher in an urban district, and inspired students by connecting learning with what they love, through the incorporation of rap and hip-hop in math teaching.

Before considering more of Alex’s ideas on teaching, we provide some illustrative background on Alex, his context and challenges, and how he implemented creative pedagogical approaches to face these challenges.

Intelligence helps us deal with predictable situations; but, creativity helps us deal with unpredictable, often challenging contexts (Mehta, Mishra & The Deep-Play Research Group, 2016). Alex teaches middle school mathematics in northern San Diego, in a neighborhood facing overwhelming

increases in poverty. Two-thirds of the parents of the students in his school have never finished high school. Ninety percent of the school's population are Latino and/or Hispanic. Alex's biggest challenge has been a lack of equitable education and resources for his students and, therefore, a risk of them dropping out. He has had to meet requirements of standards, as well as facing increasing class-sizes that challenge what we know of ideal learning environments. Yet, Alex described how he thrives on challenges and finds solving problems his biggest reward. Here, we witness the mathematician within him—the creative problem solver. We attempt to share and learn from his pedagogies, which have resulted in increased student engagement, improved test scores, and multiple accolades for him as a teacher.

Engaging Teaching Passions: Using What You Love

A theme for all of the award-winning, creative teachers in the original Henriksen and Mishra (2015) study was that they engage in personal hobbies and interests outside of the classroom, and actively interweave these into their teaching. For a science teacher who loves art, this might mean having the students engage in more arts-based science activities, and for a math teacher who loves music it might mean having the students explore connections between math and music. In Alex's case, he discussed how he has had success in teaching math concepts through his interest in rap music. It all began quite simply, with his own personal interest in rap. He noted:

I've always been a fan of rap music. I listen to a song a few times and can sing it back, and I think in rhythms fairly quickly, so I could make them up. I don't have any formal music background, so it's very important for me to make a distinction that *I'm a teacher who raps, I'm not a rapper who teaches* [emphasis added]. (Alex, interview)

As a first year teacher, he encountered classroom discipline problems and struggled to motivate or engage the students in math. Yet, he noticed that students could easily memorize the lyrics to a new rap song as soon as it was released. In order to capture this interest, he wrote a rap for his students called "The Itty Bitty Dot" ("just line up the dot and give it all you got") about adding and subtracting decimals. It was one of the first instances he had seen of real student engagement with mathematical content. As he put it:

I walked by the lunch tables on my way to the teacher's lounge. All the kids were singing this song I'd created for the math lesson. One kid said, "Are you going to quit teaching now and be on MTV full-time?" For the first time, by the end of the week, they understood how to add and subtract decimals, and their test scores were better. From there, whenever I taught a concept, I would make up a rap to reinforce it. (Alex, interview)

Trying to write rap songs about math might seem daunting to anyone unfamiliar with the genre. Alex, however, was careful to note that what is important is not the rap itself, but the fact that he applied something that

interested him and made relevant connections for his students. In fact, all the teachers in the Henriksen and Mishra (2015) study had their own personal passions and interests, which they applied to their teaching in different ways. The key point was to find something that tapped their personal interests and abilities and could be brought into the subject matter. For instance, Alex stated:

Other teachers come up to me and say, “Wow! My students want to know why I don't rap like you.” And I tell them it's not about rapping, it's just about connecting in their language, on a level that's both fun and focused on the academics. (Alex, interview)

The key takeaway. Creative teachers bring their passions from outside the mathematics realm into the classroom. And through it, they make real connections with their students, engaging them as fellow creative human beings who can do math and still have fun. Rap music may be a specific and contemporary example, but the larger notion of connecting with students in a purposeful or artful way that relates to their lives and interests is vital.

Culturally-Relevant Teaching: Using What Students Love

The Henriksen and Mishra (2015) study found that accomplished, creative teachers aim to design lessons with a focus on relevant applications, examples or scenarios, to make connections to what students care about. When the award-winning teachers in this study were asked about their “most creative lessons,” they placed a focus on lessons or classroom examples using ideas that were personal and relevant to their students and to their cultural, lived experiences (Leander, 2008). Their view of culturally-relevant teaching (Aronson & Laughter, 2016; Ladson-Billings, 1995) as “creative” may suggest that this approach often gives learning and classroom activities a fresh and unique feel. Such approaches are also sometimes lacking in some of the more standards-based or “teach-to-the-test” approaches which prevail in U.S. education policy today (Giroux & Schmidt, 2004).

In approaching the design of his classroom lessons, Alex sought to build in connections to students' lived experiences. He worked with a primarily Latino population, so in learning about graphs, he had his students graph lifetime earnings of various ethnicities, college versus non-college graduates, and college attendance rate, to see how it breaks down by ethnicity. He noted that students become more curious and attentive when they see how math impacts their culture and world:

Latinos have very low rates of college entrance and high rates of poverty and teenage pregnancy and high school dropouts. I'll further separate it by gender and show them why Latina females have the highest dropout rates in the country. These are the ones that really tie in their ethnicity, tie in their gender, and tie in their own socioeconomics and demographics. (Alex, interview)

Alex sought relevant connections to the students' world in any approach he took to contextualizing problems and in his students' interactions with mathematics principles. For example, he described a lesson where he used math concepts to explain a basic situation that his students could all relate to:

I try to relate the math that I'm teaching to my students and to the wider world. I was at a Chinese food buffet last month...As I'm staring at all these different combinations, I realized, "This is a great math lesson on combinations and possibilities and data and statistics." The next day I had my students grab a paper and a pencil and we went to the cafeteria line. We calculated the possibilities if they grabbed a different drink, a different main dish, and a different bag of chips every day. We calculated and realized that they could go through the entire school year never eating the exact same meal twice. It blew their minds and it all started with me trying to decide in a buffet line. (Alex, interview)

Alex aimed for lesson designs that make the most of places where mathematics naturally and easily relates to and intersects with the lives of his students. He described how identifying areas that students can connect to in popular culture is also a way to develop a real-world lesson. For example, he used the example of how Justin Bieber began his career with viral videos, when teaching exponential growth (i.e. "how someone puts something on YouTube...then three people show three people, who show three people who show three people"). Alex discussed how culturally-relevant significance is usually the most fun and memorable for students.

The key takeaway. Creative teachers give students a culturally-relevant context for learning and ideas that connects to their lived experiences—to things they care about. Taking knowledge out of a vacuum into a more relevant experience is critical to authenticity in creative teaching.

Transdisciplinary Connections

Another theme of creative teaching (Henriksen & Mishra, 2015) was in how teachers described their most "creative" lessons, as those which purposely connected across disciplines, in some cases using one main discipline to teach and strengthen understanding in another. This crisscrossing of the disciplines is a transdisciplinary approach, and a common theme of creative thinking in multiple contexts (Mishra, Henriksen & the Deep-Play Group, 2012; Root-Bernstein, 2003).

Alex incorporated different disciplines into his math teaching practices. For example, he sometimes taught his students about the topics of advertising and psychology to use examples that make a math concepts more vivid. He used examples from sales to teach mathematical concepts like percentages, but also engage students in how advertisers try to target them as

young adults. Alex sought out opportunities to tell students about different ways that math connects to other subject matters and areas:

I've got special guests that visit my classroom. It's really just me, but I've got a bunch of different outfits. One of the special guests that comes from time to time is "the Math Professor." His tagline is "there is nothing that does not have something to do with math." If you can stump the Math Professor, you can win a prize. The kids bring up language arts or science. They bring up things from different subjects, and the Math Professor takes the opportunity to explain how these things can relate to math. (Alex, interview)

This is one example, of a larger point in which Alex felt strongly about these transdisciplinary connections, for building creative minds that understand how ideas intersect.

The key takeaway. Creative teaching requires thinking about and looking for how different disciplines can relate to each other, and building out those connections in teaching. Successful and effective teaching is not only creative in its nature, but is inherently transdisciplinary as well (Mishra, Koehler, & Henriksen, 2011).

Maintaining a Creative Mindset

Finally, a theme for all of the creative teachers, including Alex, was the importance of maintaining an ongoing mindset for creativity. The teachers in their study described creativity not as a discrete process separate from the rest of their thinking, but as an integrated aspect of how they work and operate. Alex, too, talked about his own creative processes as something he practices as an ongoing mindset. His creative teaching practices and ideas for lessons are things that he is constantly thinking about and open to. As he phrased it:

I'll often be in the middle of something else or see something happen, and I'm always thinking, "How can I relate that to teaching?" ... I've trained my mind to look at something and think about how it applies to teaching. After a while you start to see ideas everywhere, and it just makes sense and comes into your head. (Alex, interview)

Alex has managed to remain open to creative inspiration for math teaching, by actively cultivating this creative mindset. For example, he noted that he would sometimes get ideas for teaching while reading a book on a different subject (e.g. getting classroom management ideas, while reading Malcolm Gladwell's "The Tipping Point").

During this interview, Alex described how he originated his creative ideas, by engaging a willingness for trying new things:

I absolutely love solving problems, any kinds of problems and coming up with solutions—especially solutions that are common sense things, but creative at the same time. For me, teaching has always been an opportunity to really try out new things—to see how they go, and see

what the effect is ... I would bet that many good teachers are not rule followers. I follow the guidelines, but I've never been fearful of bending the rules for the sake of the bigger picture of learning. (Alex, interview)

The key takeaway. Creative inspiration often arises when a person has a relaxed mind (Mehta et al., in press), and is engaged in a different subject or activity. Therefore, it requires a mindset that tries to stay open to new ideas wherever they may come from, and to practice looking for connections from the surrounding world.

Conclusion

Creativity is a multifaceted and complex area, and teaching itself is an ill-structured domain (Spiro, Feltovich, Jacobson, & Coulson, 1995). Therefore, details and variables of context will affect how a teacher engages creativity within teaching practices. We have summarized a few core themes of creative teaching, drawn from a research study on the practices of a group of highly accomplished and creative teachers (Henriksen & Mishra, 2015), through an illustrative case of mathematics teacher Alex Kajitani. Many teachers in today's educational climate struggle to balance the demands of high stakes testing and accountability, with the capacity for flexible, independent and creative approaches in their classrooms. In the race to meet standards, the aforementioned creative themes may be lost (Berry, 2003). Even in working with the most recognized and lauded teachers in the U.S., it was clear that they faced this challenge, too.

Nevertheless, creative teachers find ways to successfully integrate culturally relevant approaches they are personally passionate about, and which connect with their students. They make transdisciplinary connections, and connect with their own and their students' personal interests. To do this, they engage with an open mindset to model ways to think about math all around them, which helps them engage students in new ways of exploring math in their worlds. This is what we call *a beautiful mindset*.

In looking across the practices of a group of award-winning and creative teachers, and sharing some examples and experiences from Alex Kajitani, we hope to connect ideas that inform creative teaching practices for mathematics. Mathematicians in practice see their work as beautiful and exciting (Raman-Sundström, Öhman, & Sinclair, 2016). And mathematics as a discipline has been described as a language that describes the universe (Carroll, 2015). It is important that education find ways to share these inherent connections, and to share with students that which is compelling and creative in mathematics.

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