

As we come to the last remaining chapters of *Sparks of Genius* it is clear that we use many different tools for thinking in this class, which is typical of creative work. Our creative thinking requires many tools found in the 16 chapters by Root-Bernstein, and transforming is one of the two thinking skills that encompass all of the previously learned. Transformational thinking is the “serial or simultaneous use of multiple imaginative tools in such a way that one set of tools acts upon another’s set.” (p. 263). It requires us in the real world to identify a problem, investigate, and communicate the solution all using a variety of sets of thinking tools. Transformational thinking seems to be very complex and sophisticated, but most people perform some small type of transforming everyday.

Great examples of transformations used everyday are by students in my classroom during which I provide them with mnemonic devices. You may recall learning the order of the planets in such a way: “My Very Eager Mother Just Served Us Nine Pizzas.” With this mnemonic device, the first letter from each word represents the planets in order: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and what was formally known as Pluto. Sometimes these mnemonic devices can even create abstractions using their body, like the 9’s finger trick in multiplication. With this transformation you place both hands in front of you with all fingers up and put down the number finger that represents the other multiplier. For example, in 9×6 you would count from left to right on your fingers until you reached your sixth finger (thumb) and fold it under. The abstraction you see before you is five fingers up a space where the folded finger is and then four fingers up on the remaining hand equaling the answer of 54! I feel this works great with my students, because these mnemonic devices allow them to experience playful transformations that contain a great deal of information and are able to remember it due to patterns. Another transformation used in the classroom the way we display data from standardized tests in my classroom. I do not have the power to remove such assessments from my classroom, but I can use it as an opportunity to graph anonymous results as visual images. The transforming comes from the various thinking skills the students applied to their method of answering/solving a question, which creates numerical data for the scores, and then finally is transformed into various pictographs, line graphs, and bar graphs for our students to see.

The important thing to remember from transformations as teacher is that, “different transformations of an idea or set of data will have different characteristics and uses. The more unexpected the transformation, the greater likelihood that a surprising insight will result.” (p. 285). Therefore I can teach more creatively in the all designated subjects I am required to teach, because transformations can be used in any area and yield discoveries in any field as well. What does this mean I have to do? Well, for starters I need to continue to give more than one method for solving and approaching questions or situations, nor can I expect one specific answer for them. I need to be able to expect different ways of understanding in my students thinking and truly realize that their understanding comes from being able to link as many ways of knowing to multiple forms of communicating their understanding. I have always been taught that I need to teach in multimodal ways to reach my entire class of learners, but I can now truly see why it is so important. Without transformational thinking, I am teaching my students the different

parts of thinking creatively, but I am not allowing them to converge those tools in way that could produce a variety of outcomes and ultimately lead to true understanding.

My students are sometimes my greatest teachers, because they will be honest with me and about what they understand. They also can provide ways of thinking and producing outcomes that I wouldn't have thought of. I used to pretend that I knew how to do a math problem the way they have done it or that I knew many possible answer all along, but the truth is, I was lying. I thought by showing my students I didn't know all the answers, it would be a sign of weakness and I would lose the respect I had worked so hard to gain. Yet, as the year has progressed I am letting go of my fears and having my students teach me their ways of transformational thinking. This has yielded some of the greatest "aha" moments for me as a teacher, because I better understand their thinking.

Though transforming seems like there could be nothing more comprehensive in a thinking skill, we need to take one step further and synthesize our understanding. Synthesizing occurs as a result of transforming when, "sensory impressions, feelings, knowledge, and memories come together in a multimodal, unified way." (p. 296). As described by Nabokov and Lighthill in a much simpler way, we simply, "feel what we know and know what we feel." (p. 297). Like transformational thinking, we typically synthesize as normal brains function, but only some are conscious of it, which is why it seems like such a skill for only a genius. If we practice and train ourselves to recognize synthesizing in our own thinking than we will be experiencing and understanding creativity on a much deeper level.

Consider the Disney classic *Fantasia* and all of the synthetic thinking that occurred by those who created it and those who watch it. This film contains different combinations of abstracting, imaging, patterns, empathizing, transforming, and then it ultimately synthesizes the combinations of sensations, feelings, memories and thoughts that arise from truly understanding it. The use of music to instill emotion can bring to the body a variety of emotions that are again stimulated by color. The use of Mickey Mouse in this film also stirs your memories as a child and the beloved character from your past. Watching the movie as a child, I was bored and uninterested in the seemingly empty "plot" and lack of dialogue. Yet, now as an adult I can appreciate its creative value in a way I never thought possible. My growth of personal creativity has allowed me to take a film I once hated and want to share it with my students to help them appreciate what it has to offer to their thinking skills. I can now even relate the smoke from candles as synthesizing, because I refer to it as "birthday smell." When I smell the smoldering of any sort of candle, that's not even related to a birthday, I am instantly reminded of the memories of my past 25 years. Instantly I can feel a warmth inside of me that recalls family gathered around a small table as my face is warmed by the flames on the cake. I can for an instant close my eyes and see the flickering light from cameras that are attempting to capture the joy expressed on my face. There is a moment with the smell of a blown out candle, when I feel appreciated for who I am as a person and thankful that I have love in my life.

My previous examples are a bit more complicated for my students to understand, but I have begun a project with them in order to teach them creative synthesis. With the holidays approaching, my students are to collect prices and pictures of food, create a budget for a holiday dinner, and purchase them in a "classroom store" set up for the

project. They will then have to find trends in the market advertisements, choose the best deals, compare prices, display their final decisions on a chart or graph of their choosing, serve their “dinner” to the class, compile a report and/or culminating visual aid that best displays their conclusion, and then reflect on their work in a discussion session. This may seem fairly heavy for a 3rd grade class, but we have been practicing these ways of thinking throughout the last two quarters and I feel that they are becoming more confident in their recognizing patterns/trends, modeling, play, transforming, and eventually synthesizing. They of course still need continued practice in their thinking skills, but we are off to a good start.

From start to finish, I am thankful that I read chapter 16 again, because it made me realize that my “Swiss Cheese Quandary” from synthesis 1, is becoming more solid as both student and teacher learning are continued. I have realized that as a teacher, I need to change how I teach. My purpose is to teach students how to understand, not to simply *know*. Root-Bernstein comments that from early on, “every student should study the arts as thoroughly as the sciences, the humanities, and mathematics.” (p. 317). Which is why I feel fortunate enough that my students have the opportunities for specialty classes everyday in music, art, and physical education. Even if they had not had the opportunity their whole life, part of my job and the school is to help continue or even start this creative process for our students.

Our subjects in school are not always interconnected through the curricula given to use, but in our own classrooms we have the opportunity to teach terms and skills in a cross curricular way. We can teach the how-to follow steps in modeling the scientific process, as well as modeling how to tie a shoe, writing expository models such as recipes, and modeling the steps of an algebraic problem using manipulatives. When we link our disciplines, understanding will come easier, and then is transferable to other areas. This transferable understanding throughout the disciplines reminds me everyday that I must resist narrowing my students’ abilities into an area they are successful in. Instead, I need to open a broader range of fields of interests where they can use their skills in a multitude of ways. Those who are successful in mathematics do not need to become engineers or accountants; they should be able to apply their understanding in a variety of ways that may challenge society’s norms. If I am able to create a true synthesis of education eventually in my career I will have been successful, because “Education is meant to open many doors, leading to many rooms.” (p. 325).