Lifting the Brick: Encouraging Creativity to Enrich Learning

Angela Jurgensen

Vancouver Island University

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Introduction

My research project was completed at an urban High school in Vancouver Island. In this school, roughly 50% of students come from middle class families. About 30% of students come from lower class, and 20% from upper middle class families. Most students are white, with a smaller population of aboriginal students, a very small percentage (less than 5%) of Asian descent and black students, and a small group of international students from upper class families. The school's mission is one of Intellectual Development, Human and Social development, and Career Development.

The data collected revolves around a grade nine science class set in a lab. The semester started with sixteen boys and fourteen girls, but one of the boys dropped out of class during my first week of practicum. Three students are ESL students; a few students have IEPs, and two of them have severe emotional issues. A Teacher Assistant is permanently present to help control the classroom and help out the students who need it. But at first, it seemed like I was the one who needed help.

"Mrs. J, why do we have to do poetry? That has NOTHING to do with science."

"Mrs. J, what's with the funny questions?

"WHERE is it in the book?"

These questions showed up from the very first day of research, and initially multiplied; this was very difficult considering the nature of my intended research. My project was based upon the premise that focusing so heavily on content is a deterrent to creativity, and thus, to real learning. To expose the students to more creative ways to experience science, I

had originally intended to bring more artistic solutions into the classroom; as it turns out, when I exposed them to my first creative activity, it backfired, and I decided to reassess my idea. My alternative idea came from the principle that what brings creativity is the lack of immediate answers, leaving the result open to the students, and this is what I did instead.

But why do I care so much about including creativity and alternative methods of teaching children? As a child, I had great difficulty understanding concepts through traditional means; this was particularly hard in Brazil, where classes are long, 45 minute lectures, and worksheets are done primarily at home. I tried to sketch while listening to the lectures, but that never went over well.

"Eyes on me! Stop your doodling!"

The dryness of that approach almost lost me completely. If it wasn't for my father - himself an artist, mathematician and educator - working with me from fourth grade onward, I would not have been able to thrive. Surpassing that initial hump would not have been possible were not for his unique way of looking at things from different angles and constantly drawing things out on paper. The use of creativity to connect an abstract concept to our concrete reality proved essential to me. From his initial teachings, I was able to successfully extrapolate, using the same creative methods in science, math, physics and chemistry – and by the time I finished high school, his way of looking at things had become the only way for me.

Today, my interests span a wide variety of areas; although I consider myself an artist first, I believe art to be all-encompassing, and that science is very artistic, creative and exciting. Unlike other subjects such as history and geography, much of scientific concepts require a leap of faith – and a rich imagination - in order to imagine cells working together,

atoms making these cells, organs working in unison. While my degree is in Graphic Arts, I had previously been enrolled in Dentistry. I love the magic of science and its unlimited capacity for raising questions. I have found that children who are given artistic outlets to digest a concept find it much easier to build these concepts up and tie them together. I have been able to teach mathematical and scientific concepts to children with ADD, ADHD and Dyslexia. I have also implemented some of these techniques during my practicum last year, with good results.

I am a visual and kinesthetic learner, and as I have come to understand, we teach who we are. This is an asset when it comes to teaching a classroom, as many of the students need a more creative delivery in order to understand scientific concepts; so, embracing a variety in delivery methods for each concept is one of my goals.

Looking from this standpoint, I found it rather interesting that the class I ended up getting for the research was so active and so defiant; in truth, I saw a little bit of me in many of those students, and I couldn't help but think that perhaps these creative methods would be the best tools to teach them, if only I could get them to play along.

After all, creativity is a crucial portion of learning. It is one of the tools that, if properly developed, can be most useful throughout life; every occupation requires a degree of creativity in order for the person to achieve success. The current methods of teaching focus too much on the textbook, and too little on allowing students to be creative. The question around which my research revolved was, therefore, *how does the inclusion of creativity in my Science class increase student curiosity, courage and engagement?* The answer to that question proved very complex.

Literature/Theoretical Framework

Originally, I started my research from the premise that mixing arts and science would be the perfect way to inspire creativity and curiosity in my students. Since creating something from nothing, which happens when writing a poem, a song lyric, a work of visual art, inherently stimulates creativity, I thought this would be the simplest way to make science more creative. I found a small study done by Amanda Berlinski (2012); she affirmed that "making art helps students make sense of their world. It also helps them learn how to problem solve and think with ingenuity (p.22)." This study had a couple of examples of artistic activities to introduce to students which directly tied arts and science together, and served as inspiration for my own ideas for activities.

I also believe that arts can help students become more creative and see the big picture in their lives. According to Needle et al. (2010), this mixture of different subjects creates "workers of the future (that) can be fluid enough to adapt to changes beyond their individual control" (p.114). Besides reaching different learning styles, integrating different subject matters such as arts and science would also create resilient, adaptable adults, which is so needed in this ever-changing world we live in.

Research by Siler (2011) discussed the idea of truly mixing arts and science as a process that "emphasizes integrative thinking", making "artistic inquiry (...) integral to scientific inquiry and vice versa." This is opposed to simpler "interdisciplinary work, [in which] two things can function together, cooperating, without changing each other (p. 418)." I believe this is something to aim for, bringing a deeper connection between arts and science, as according to the examples given, the depth of knowledge and connections created by students are much

higher. Creating this level of critical thinking otherwise would be more difficult. The ideas generated by the ArtScience program sounds like something for me to explore in depth as I embark in my teaching path. However, the methods were too complex for my research due to time constraints and the fact that the classroom was not mine.

Kaufman and Sternberg (2010) raise the question of creativity being considered good only as far as creative genius is concerned. In fact, creativity is a necessary tool for everybody; "people are creative by virtue of their attitude toward the problems they face (...) Creativity is not something one does once but something to develop through a lifetime"(p. 58). Helping students develop creativity is one of my focuses as a teacher.

My premise for this action-based project was that content has become too heavy in science education. From my experience as a student teacher, grades are the focus, and memorization is still the path in science. The problem is that the weight of this content brick makes it very difficult for connections and deeper learning to occur. This crushes creativity and the courage to try new things, and it does not foster curiosity. As Pafe affirms (2008), "the emphasis upon practical results shackles the truth-finding quality of thought (p. 280-281)."

But as I progressed, the original idea of integrating arts and creative projects onto my science class proved to be too much, too soon. I had to go back to the basic principle of creativity. After all, the inherently creative nature of science is something to consider; according to Hadzigeorgious, Fokialis and Kabouropoulou (2010), "science is a creative endeavour (and) scientific ideas are creations of the mind" (p.603).

According to Garg and Garg (2010), the emphasis we have on content today does not produce creative scientists or thinkers; in India, "the problem of nurturing creativity in

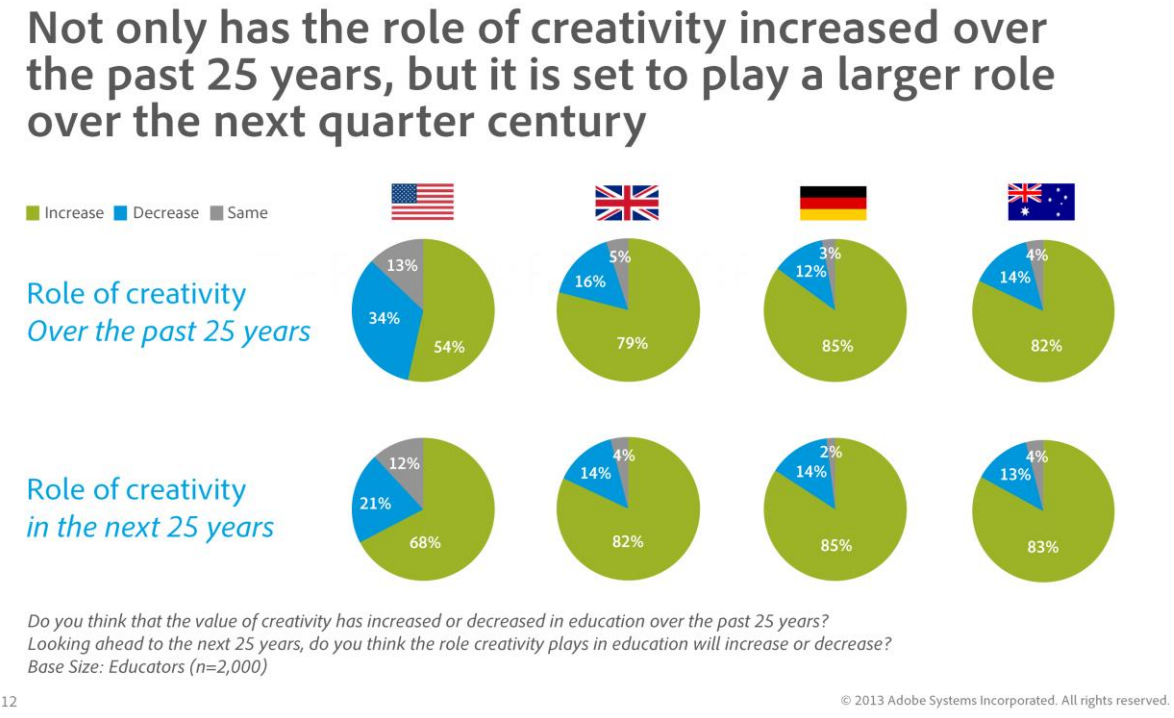
children is further compounded by a lack of trained science teachers at all levels of science education (p. 252).” This reminded me of my hometown in Brazil, where emphasis on content had such a heavy hand, there was simply no space to be creative, and many teachers lack the proper training in actual pedagogy. Countries such as Brazil and India serve to show what can happen if we don’t start focusing more in creative processes and bringing up students with a critical mind. This study proposes several issues with education, such as “undue stress on the right answer (...) emphasis on following the rules (...) fear of being labeled “foolish” (...)” and “making an individual believe that to err is wrong (p. 255)”. Garg and Garg propose methods of “learning by doing” (p. 258) for later grade levels, making science a more interactive and experimental subject. Labs are experimental, but there is a procedure to be followed, and everyone has to do it the same way; I would like to integrate in the future projects that are based on discovery and exploration.

To follow Pafe (2008), I decided to allow freedom of thought to be my guiding light in reaching towards creativity; “the best teacher is not a journalist, but an expositor and an interpreter” (284). Instead of the traditional lecture method, I gave the students food for thought, and left them to their own devices, and only after discussion had been exhausted did I give them an explanation for the phenomenon they had experienced.

Finally, I came upon a study made by Adobe (Appendix A) which truly matched my beliefs regarding the importance of creativity in the world today. In this study done in 2013, parents and educator from the US, Australia, UK and Germany were asked questions regarding their view of creativity and its importance for the future, and their view of how the school system was providing for this need. Key findings show that “parents and educators are strongly

aligned in their concerns and desires for the education system (...) the education system is stifling creativity; a transformative change is needed (..) the demand for creativity is increasing and will fuel economies in the future, yet students are less prepared to become innovative thinkers of tomorrow." (p. 4). This has been my belief all along, and after reading their results, I felt much more energized to continue my path as a science teacher in a more innovative way. The study also gave me more confidence when discussing my choices with others.

I believe that we will need more and more creative people in order to be able to correct serious issues found in the world today. Creativity can find new energy sources, cure disease and fight hunger. According to the Adobe study, others around the world share my concern.



It was interesting to read that one of the main point teachers claim as a detractor to creative teaching is a lack of resources; I believe that should not be a deterrent for creativity sprouting. Necessity is the mother of invention, after all. Perhaps more training on the nature of creativity is needed in order to clarify the idea that to improve creative thinking, money and resources are required. A couple hundred years ago, there were no computers or advanced technology, and resources were limited, and yet the most creative ideas were sprouting left and right. It wasn't the resources, but the willingness to take a chance and the courage to try something new that enabled the most prominent scientists of old to produce their discoveries. I believe if you use what you have with creativity and if you allow for mistakes and errors as a pathway to true learning, your resources will always be enough.

Action-Based Research Outline

This research lasted for seven days of instruction, plus a test day (see Appendix B). It was conducted at an urban school in Vancouver Island, with a class of grade nine science students composed of 14 girls and 16 boys. I was observed by my sponsor teacher and my mentor/supervisor. The class had a teaching assistant at all times.

My research question was *how does the inclusion of creativity in my Science class increase student curiosity, courage and engagement?* To conduct my research, I used a few tools. I implemented a science journal (see Appendix C) in order to open dialogue with the students. I also prepared a website, to ensure that the students who missed class could go there and download materials, read through the PowerPoint presentation and watch missing videos. Finally, I also observed their behavior and how well they responded to the activities, and recorded these observations on my daily reflection log.

I started the first class asking how closely they relate creativity and science. This was written in their journals. On subsequent classes, I also asked students other pertinent questions, such as what they thought of science in general; what they would like to explore in science; and on our final class together, I asked for any suggestions for next practicum.

This study was conducted to explore ways to introduce creativity in the classroom and analyze if this would increase student curiosity, courage and engagement. It is an important and very relevant topic, as creativity is the basis of change.

The study was limited by the size of the sample and methods used. It represents only one result with one particular group of students for this particular amount of time. Seven days was barely enough for students to get to know me, and it certainly is not enough for any

conclusive result for a subject of this magnitude, but it shed glimpses of what direction a bigger study might have taken.

Action-Based Research Project Process/Methodology

During the course of this research, I allowed my natural excitement for science to overflow through everything I did. I acted warmly and excited about learning and teaching, even during the days when the content had a more dry delivery. I did not use one single tool, but a method through which questions and discussions were encouraged. Often, students were given a lab or experiment and then given time to process and try to come up with a scientific explanation. The explanation was only delivered by me the day after.

My original idea was to bring a series of artistically-geared activities to get students creating models, writing and artwork which reflected their learning, but it was too much too soon with the class. As it turns out, simply bringing a series of artistic activities did not encourage students to reflect upon what they had learned, particularly because they had not been exposed to this kind of experience before. The students were uneasy with this shift.

So, I changed my plan and focused instead with the starting point for creativity, which is curiosity and asking questions. My activities included showing them a molecule model; a poetry assignment; a suspension of reality split pea lab; a paper bag lab to explore the expansion of air when heating up; a water evaporation lab; a few interactive paper activities, to paste on their binder; some educational videos; a jigsaw activity; a banana piano to exemplify circuitry. A few things I did not do were radioactivity lab with a Geiger counter, a project to model their own atom with clay, an activity involving electric circuits and a magnet lab, but there wasn't enough time for those with the test going on, and according to my sponsor teacher, it was not a good idea for me to try to do the clay lab this early in the game.

As far as data collection, my data comes from my own notes and observations, my students' responses to prompted questions, my sponsor teacher's comments, and finally my mentor comments. I also took in consideration the test results after the unit was done. Even though tests do not necessarily matter as much as my personal observations, and a higher test mark could have meant simply that the test was too easy, I felt that if they had completely missed the mark in droves, it would have been an indication that my methods were not successful. Thankfully, this did not happen. But then again, this was an easy test, and that could have caused them to do well on it.

I analyzed the data by looking at how many students answered questions positively or negatively, and what was the content of their responses to my prompts. I also watched for general behaviour, classroom participation, and graphed test scores.

My previous intention was to analyze student's engagement with creative projects, but since my project changed, so did my analysis. I had intended on doing more hands-on activities involving arts, clay, poetry and other creativity sparkers, but this got shifted into a more stripped-down idea of what creativity really is and does for us humans. My most valuable measurement was, therefore, the degree in which students became engaged in the classroom, creating hypotheses and volunteering ideas, besides their interaction with the science journal. This shift helped me successfully transition from a content-heavy viewpoint to a more imaginative one.

The Story of My Action-Based Research Project

a. Background

It is important to explain my original premise for this project, thus clarifying the progression of my observations and also my conclusion. Most subjects, such as Math and English, have a system in which the previous unit builds up to the next unit; science, however, often has short, independent units, and there is hardly a simple way for a student to engage with the new subject matter. I believe a good teacher is more worried about teaching the students and less about teaching the textbook, and a more creative, multifaceted approach ensures that all types of learners will have a chance to assimilate these concepts.

I believe that students should learn how to tap into their creativity fountain to draw connections and build upon previous concepts. This is even more important when considering that they can use their abilities in the future not only to help themselves to a fuller life, but to improve the world around them; this is what drives the choices I make as a science teacher. I started this project from the belief that never before in history has humankind needed more the help of creative people, and never has the development of creativity been so overlooked. I have made this conclusion from years of worldwide observation and from hearing different people's perspectives, but found that others share this concern. According to Adobe (2013), "the education system is stifling creativity; a transformative change is needed" (p.4), and teachers have the unique position to truly help bring this change about.

We need to foster questions and wonder again, give creativity room to breathe and a place of importance in the classroom, if we are going to fix some of the issues we have in

the world today. All children are born learners; they absorb everything around them like a sponge, filled with infinite curiosity and a sense of wonder. It is up to us to continue encouraging their curiosity.

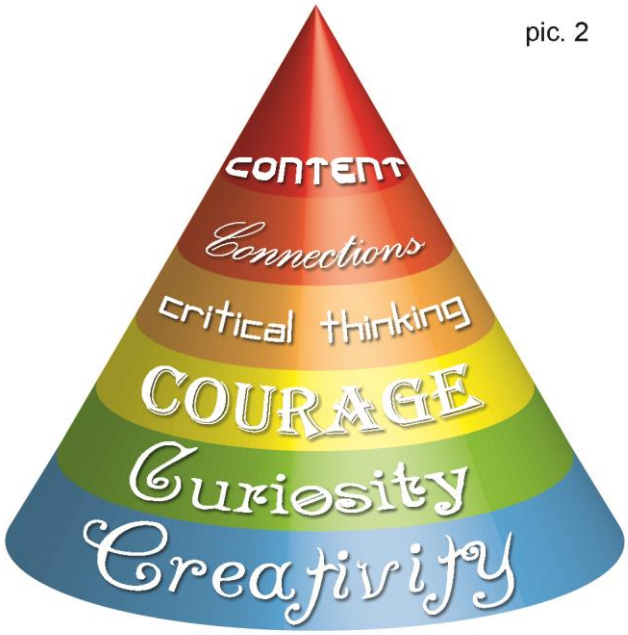
Creativity is a crucial, yet often forgotten portion of learning. It is one of the tools that, if properly developed, can be most useful throughout life; every occupation requires a degree of creativity in order for the person to achieve success. In my experiences as a student teacher, I found that traditional methods of teaching seem to focus too much on the textbook, and not enough on allowing students to actually *discover*. Introducing to students alternative teaching methods not only makes the subject itself easier to understand, but this becomes forever a part of their vocabulary, a concept I call creative literacy.

pic.1

I feel that our current focus on content ultimately squishes away what makes a student excited about learning (pic.1). Students may move from grade to grade, but I believe their learning process and sense of value and purpose is not properly cultivated, particularly considering the different types of learners out there. Students learn that memorization is rewarded; because I believe the system (teachers, school and parents) puts so much emphasis on grades, the students learn grades are the desired outcome instead of learning. After many

years of this indoctrination, how can I expect students to express creativity throughout life? How can I expect curiosity to remain, and genius to flourish?

Looking at life as a snapshot, at this moment, it may seem like getting a job and making ends meet is the most important thing, and that I should be preparing the children for this. However, the world is changing rapidly. I believe part of our responsibility is to prepare a new generation of creative adults who are more connected with nature, so that they may use this creativity to enhance the world. Natural resources are becoming scarcer, and we can no longer sit idly and expect our children to be prepared to face the consequences of our recklessness. Creativity may prove to be our saving grace. We need more efficient, cleaner and cheaper energy sources; we need healthier, more nutritious food to feed our ever-growing world population. Creative solutions and creative scientists are in very high demand.



pic. 2

By making content a less prominent portion of learning, and focusing on teaching the student instead of the curriculum, we can allow for creativity to act as a stronger base in learning, thus increasing chances that the student will be able to use their curiosity and risk-taking abilities to become critical thinkers and to make connections to the world around them.

I created the above diagram to explain where I would like to see education to go. I believe that if creativity acts as a base, and if content is not dispensed so heavily, the middle portions of the pyramid will have a chance to flourish. Bringing a visual or kinesthetic approach to my teaching helps me cultivate younger minds to see what is really important in life (pic.2). By incorporating creative methods to traditional ones and enriching the learning experience, I can not only cultivate curiosity and risk-taking, but also allow for the student to develop a critical mind and the ability to judge if something they see is right or wrong. They also are able to make better connections to what they are learning and their actual lives.

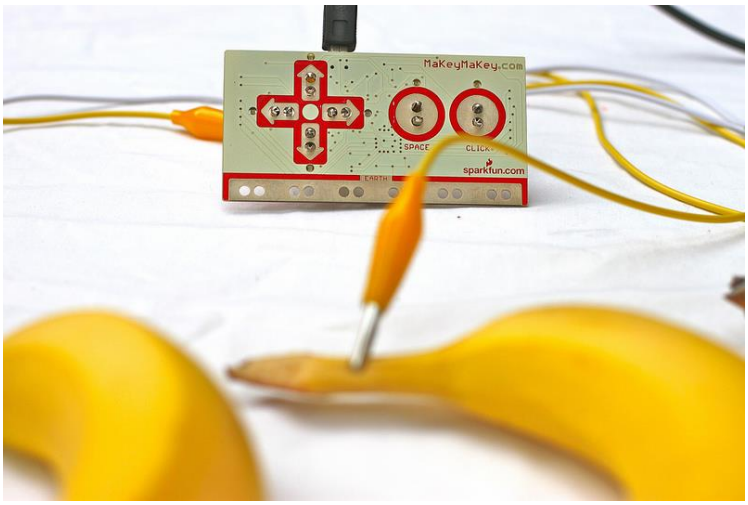
b. Implementation

This research project lasted only seven instruction days and one test day, and overall it developed in unexpected ways. I had started it from the premise that the class would be somewhat similar to the one I had last semester. The majority of those kids was very interested, curious and embraced whatever activity I tried with them. I had only one student who didn't seem to care about the topic, but even that student tried very hard

But this was a very, very different group of students. This particular class was a mishmash of students with very different abilities, very active and energetic, and seemingly not very interested in paying attention. From the whole classroom, only three girls could be considered engaged from the beginning, and this is based on their engagement and behavior alone (which is often not an indicator of what goes on inside). Five of the students had learning disabilities, several had low self-esteem, one had a history of violent behaviour and defiance disorder, three were ESL students and a couple of them had IEPs.

My project was based upon the premise that focusing so heavily on content is a deterrent to creativity, and thus, to deeper learning. My original idea was to bring a series of artistically-geared and creative activities to get students creating models, doing creative writing, artwork and other hands-on projects which reflected their learning. This was to be a fast-paced, activity-filled two weeks practicum, greatly student-driven.

It would culminate on a six-station circuit activity, science fair style, and a guided follow-up discussion to consolidate learning. I was excited about this idea, as it would encourage the students to explore each one of the activities by themselves and be creative.



For this science fair activity, I had planned bringing a special circuit board called Makey Makey, which connects to the computer and subsequently can be connected to other objects to form an electric circuit. When the person holding the gray wire touches the object, it closes the circuit. If connected to software that plays music, for instance, then you can play an instrument with it through your computer. I am always on the lookout for interesting and educational things to bring to the classroom, and this one is always a real hit; everyone loves playing the piano on bananas. It also works when you connect the wires to people, as the current passes over the skin, and so you can slap your friends' hands to produce a song. When connecting to something that does not conduct electricity, however, it does not close the circuit, and so I had planned to have a series of

objects on this one table and let kids discover what produces a noise, what doesn't, and see if they can figure out why.

Table number two would have a strong magnet wand and several different objects and letting the kids figure out what can be attracted by a magnet, and why.

Table three would have a handheld Geiger counter and some samples of rocks with a low radioactivity level (nothing dangerous), and also a plate I found at Superstore which registered quite well. This would introduce them to radioactivity. I bought this Geiger counter last year and find it extremely educational, particularly considering that we are constantly bombarded by a small amount of radiation, something people often don't realize.

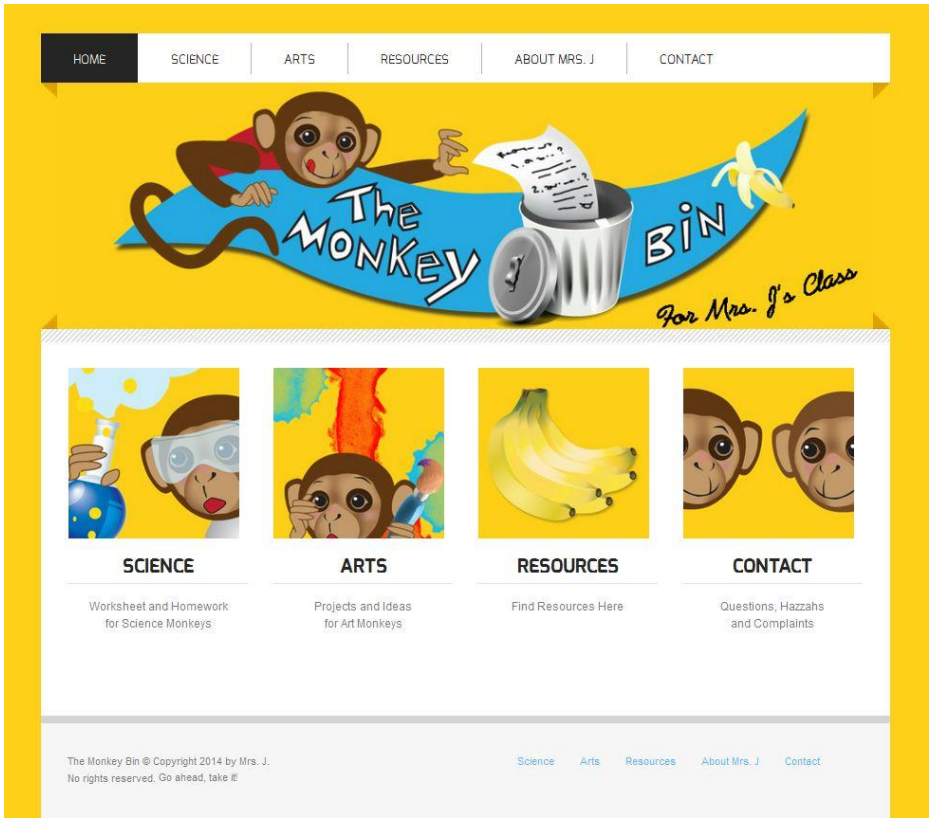
Table four would have a "perpetual motion duckie" which works by evaporation of liquid ether. This is a hard one to figure out, but I thought the kids could come up with their own suppositions and wonder about how the duckie keeps dipping in to drink the water.

For table five, I had planned to bring in a series of circuit pieces and ask students to solve a particular problem. The circuits can be used to spin a fan, light a bulb, make a siren beep and other fun activities; each group would have a chance to solve one of the problems.

The last table was going to be a crafts table, where students would have to build a model or a painting of a particular scientific concept in the time allotted.

This idea seemed like something that the students would never forget, and would make them excited about science; the activities I picked are very hands-on and I was really looking forward to implementing it.

I also prepared a website where students could go and find assignments, extra enriching videos and PowerPoint presentations. I called it “The Monkey Bin”:



But as I started the class, I realized that when given creative tasks, this group had a tendency to get very distracted very quickly. They were extremely energetic and not used to having the freedom to explore a topic by themselves. As it turns out, simply bringing a series of creative activities and open-ended questions from the get-go did not alone encourage students to engage, particularly because they had not been exposed to this kind of experience before.

The students were uneasy with this shift. They did not enjoy the content brick, but lifting it proved harder that I thought.

One more thing I noticed regarding this class was the pace in which the students were able to participate. From the very first day, the students had a difficult time focusing on class when the changed happened too often. My original pacing of dividing the class into six or seven short bursts of activity had to be readjusted. I decided to break the time into three or four longer bursts of activity instead. The switch between activities was too much for them to handle, and caused the class to lose focus. I also modified and simplified some of my activities, while other ideas had to be completely replaced. These changes were greatly encouraged by my mentor, who was very supportive of everything I did.

My originally planned activities also were to be much more artistic in nature, which would have been very difficult to do with this group. My first truly creative activity, a poetry assignment about the states of matter, had to be modified and ultimately cancelled. Over and over, and from different students, I heard that poetry and science should not mix.

"Poetry has NOTHING to do with science, Mrs. J! Science is not creative!"

This proved to be an uphill battle for me because I did not have full support from my sponsor teacher in that respect. Last practicum, I introduced a rap assignment for the students to create a rap about mitosis, and at the last minute, he made the assignment optional, because he said "students should be focusing on actual learning instead." This archaic view of what is learning and what is not learning, what is important in schools and what is not important, is part of the problem we are having today in our education system. This is what the

new BC Education plan is trying to address; a need to shift into a different way of looking at education, as a more comprehensive, multidiscipline approach.

For the sponsor teacher, having the students work for three classes on a poster is learning, but working at home on a rap song is not learning. The same happened this time around when I introduced the poetry assignment. He sided with the students, saying that some of them were not comfortable with poetry, that some were not creative writers, and that they *should not be required to mix science and creative writing*. For a teacher who believes in integration cross-curriculum, this was hard to hear, but it would have been even harder to defend my position due to the need to maintain a healthy relationship with my sponsor teacher. I realized that without his approval, I would not be able to complete my research, and quickly tried to figure out what would be a solution for this bump on the road.

The initial friction slowly dispersed. I had the sense that if there was more time, I could have made a true shift on their perception of what can be done in a science class. Unfortunately, we only had seven days out of the ten we had originally anticipated. I had to cancel the six-table circuit, a hard decision to make, but ultimately the right one.

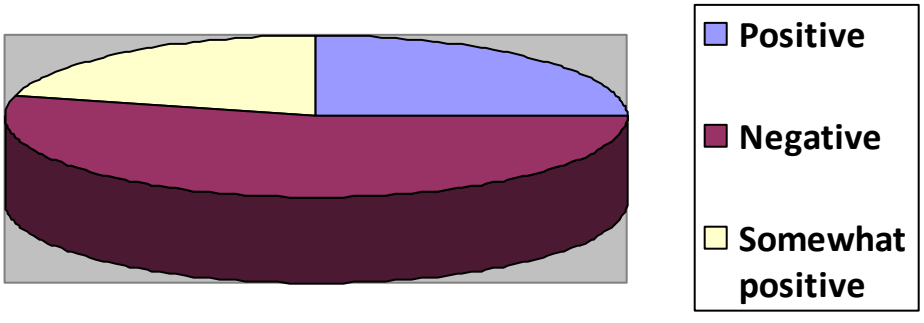
After going through the seven days of instruction, I had to take a few days to digest what had actually happened and to understand what conclusions I could take from the research. At first, I felt divided, as quite a few of my activities had to be cut or simplified, either because the class was not ready or because we did not have enough days do implement them. It is easy to feel like you have not met your goal when the results are so different from your original plan. However, I went back at this point and read my question again: *How does the inclusion of creativity in my Science class increase student curiosity, courage and engagement?*

c. Results

As it turns out, I was able to gather enough information to come up with a hint of an answer to this question, despite the limitations I faced. Even though this study was so short and the environment was somewhat artificial, since it is not my classroom, my observations point to a marked increase of engagement, courage and curiosity.

In the beginning of the first week, there was almost zero engagement; no one answered questions, and there were loud moans of complaint throughout the classroom. On the very first day, I noticed how anxious they were becoming and how they did not want to engage on the different activities I had planned. I did not yet understand why they were misbehaving, but I could see that they were uncomfortable. I developed a semi-daily double entry science journal with the students, and we started working on it from the very first day. This was intended to be a method to get to know them better, but it turned out being a way for them to know me just as much as for me to know them. For this group, it turned out to be extremely valuable. I overheard one of the students commenting on the second week on the amount of work I was doing to respond to every single journal entry individually, and how much effort it must take to keep it up. Showing I cared made them care more, and by the end of the second week, they were much more willing to work with me.

So, on the first day, I gave them their journal with a couple questions: *How creative do you feel during science, and how closely related do you think science and creativity are?* Below, I created a pie chart with the answers.



Most of the class answered negatively; from the ones who answered positively, a great majority associated the creative portions with experiments and labs. I gave each student a unique response based on what they wrote. In a way, this was a risky move, as I contaminated my classroom with my own bias. However, given the state of the classroom and the fact that they seemed to refuse engaging on creative thinking, I decided to connect with them by giving them my thoughts and starting a dialogue.

That first day, my sponsor teacher spoke with me and told me that this group was far different from the group I had last semester. He said they were a “low achieving” group, “weak academically” and just a weak class. He told me to bring my expectations down and simplify my lessons, and forget about doing anything too different with this group.

I felt so overwhelmed by those statements. I could not let my project fail. Deep inside, I started to wonder what would have happened to me, had my father not stepped in on fourth grade and taught me how to use my creativity to overcome the drudgery of traditional education. Was this what would have happened to me? Shut down from my creative process, would I have rebelled against learning? It certainly seemed like a possibility.

I went home after my second day extremely frustrated. I had brought a well-organized split pea lab and had planned the whole sequence of activities so well, my mentor was very impressed. However, as class progressed, I lost their attention and they reverted to walking around, not listening and misbehaving in general. My worksheets for the split pea lab were not well-received, as I wanted them to come up with conclusions and answer questions that were not found in the book. The questions I was asking were labeled “stupid”, “dumb” and

they commented that “there was no point” to the questions, simply because they were not used to having to think outside of the book.

Because of the research and its time constraints, I had to be able to work with the class and achieve a certain result. So, I started thinking, what could I do that would engage students and get them to take chances? I went back to the basics of creativity. According to Garg and Garg (2010), “creativity involves doing something new and different (...) it involves departing from existing facts and methods, finding new ways, inventing answers, and seeing unexpected solutions (p. 256).” This seemed so broad and wide to implement in such a short time, but one thing stuck with me; *inventing answers*.

When you say “creativity”, the first thing that people think about is “arts”. But the creative process is found in many more places than people realize. What my research really wanted to see is the students opening up to the possibility of something more valuable than content and memorizing facts. To achieve that, I decided to spark not only creativity, but curiosity and courage as well, all at the same time.

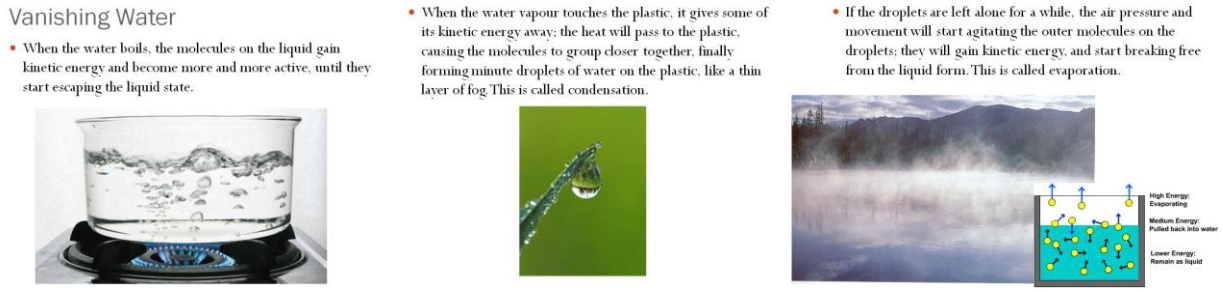
According to my mentor, who observed them on that second day, the group was definitely against engaging, and did not listen to instructions; while some kids were “good workers” and started off the activities well, the majority of the class was not willing to comply. By the end of the lesson, I had lost the class. He told me this was the worst group in terms of classroom management he had seen in all his years as an educator; he said I had to “deal with student conduct” by tightening the grip on my third day, and try to keep the class working on basic, rote memorization activities; he, too, believed that they were not a good class to try creativity integration. I still believed that maybe this was the perfect group to try it on: They

had so much energy, and according to my sponsor and mentor, had given up on academics; was this because their educational needs had not been met for a long time? I had to continue the research and hope to find out.

From the student's perspective, the main complaint I received that day was the fact that the questions I brought to them were too open; "where is it in the book?" was something I heard often, and when they finally figured out that it wasn't there, some of them became truly upset. One kid said "I can't use my imagination!" and another yet said "I can't be creative!" I responded to all those affirmations very positively, and reminded them that all of us are creative, and all of us can use our imaginations; we just sometimes have to remember how.

On the third day, something great happened that made the class start shifting positively towards creative thinking. I initially followed my sponsor's suggestion and tightened my classroom management, bringing some notes for them to copy. After listening for two days how "Mrs. J. always asks weird questions" and "Mrs. J's questions are never in the book" and "What's up with Mrs. J's questions", I decided to introduce the classroom with a slide explaining that science is not about being given answers, but about coming up with the answers by yourself. I explained this to them a little bit, talking about how scientists have to figure things up, and how creative science can be if you use your imagination to solve problems. After this, we did a couple more activities, and I presented them with yet another thought-provoking slide. This time, we had a lively debate, and several students volunteered their opinion and attempted to come up with an answer, while the others listened and interacted. All were on task, and using their minds to solve the problem.

Then, after checking on homework, I proceeded to explain the evaporation lab from the day before (pic. 3), which I had left unanswered.



Pic 3. Water lab slides

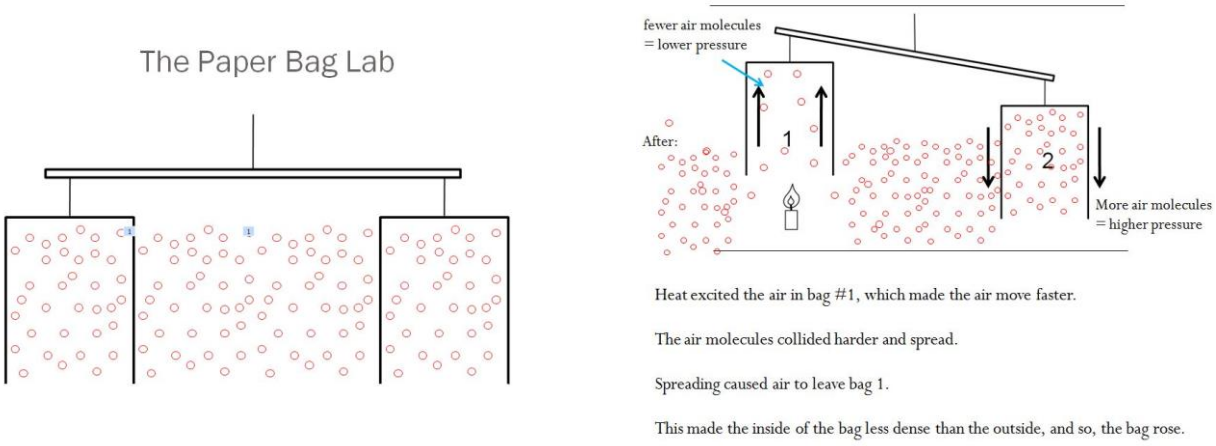
The students were absolutely paying attention to the explanation of the previous day's lab, nodding and providing positive comments. I asked a few follow-up questions, and they actually tried to answer. "Good", I thought, "maybe this is the way!"

Near the end of that day, I introduced a question for them to think about: *why does hot coffee cool when left out?* This time, instead of receiving the question with rude comments like the day before, the students tried to answer the question, coming up with plausible answers, and building on top of each other's ideas. I helped them complete the thought process, and introduced a paper bag demonstration to show them how air rises when it gets hot. My question was, *why?*

Instead of telling them how exactly this happened, I again let them try to come up with the answers. They were much more cooperative, and a debate ensued. One of the kids would say, "Heat goes up!" And the next would say, "Yes, the air inside the bag is heating up!" Some kids mentioned balloons. Instead of giving the answers, I again withheld the complete

molecular explanation, simply probing them more and more with questions. “Look closer,” I would say. I finally told them I would bring the solution the next day; then, when I finally explained the paper bags (pic. 4) and the molecular reason why they teeter-tottered, I was very passionate and excited about the subject, and this truly captured their attention.

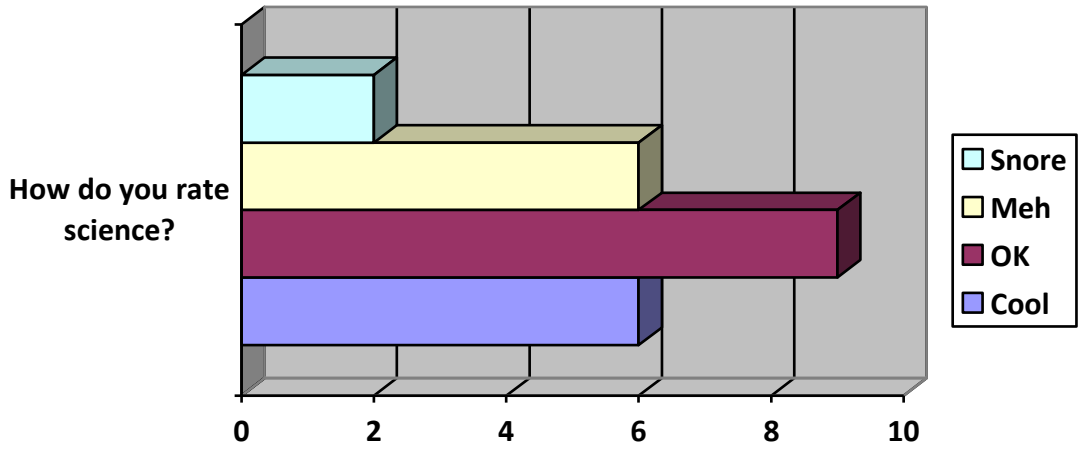
Pic 4. Paper bag lab slides



Despite this victory, at the end of class, my sponsor told me perhaps this group would not be ideal for my five-week practicum. He said he would try to fit me into his other group which would be more compliant. He explained that this is one of the hardest 9-grade groups he has had, and with this particular group, the right approach is to keep things as simple as possible, with rote memorization and following the book, and taking notes.

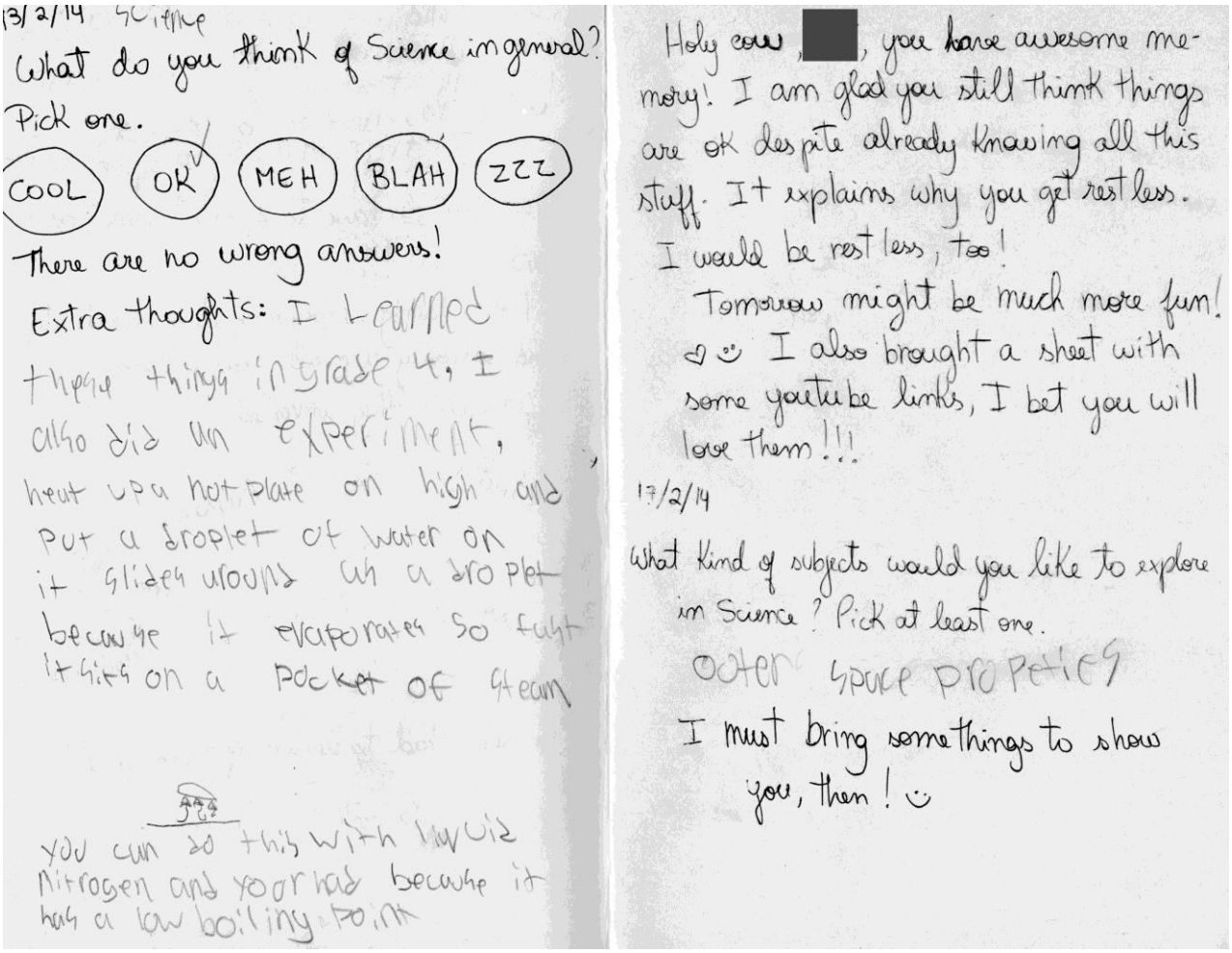
At that point, I was feeling as if I was on a roller-coaster ride, and so half of me felt relief, while the other half felt like I had to get the kids to engage with me, because I could not abandon them for another class. It would be easier, but not fair for this group of kids. Deep down, I had a sense this group would benefit the most from my approach.

That day, I asked them on a scale of “cool” to “snore”, how would they rate science. The following bar chart shows the results.



Only two students responded negatively to science; the majority of students had a positive or indifferent position regarding the subject. Some students were extremely positive, and two of them volunteered on their journals how they were planning to become marine biologists. This goes against my sponsor’s opinion that the students don’t care about the subject. I answered them back in their diaries very positively and with no judgment, which might have helped the kids to open up even more.

One of the best surprises came from one of the students, JJ, who refused to engage in the beginning. I was pretty much told by my sponsor that he simply didn’t care, and was *not worth the effort.* I continued asking him questions, checking on him and encouraging him, but not knowing how well all of it was sinking in, until he did the following entry in his journal (transcribed next page, and on Appendix C).


13/2/14
What do you think of Science in general?
Pick one.
COOL OK MEH BLAH ZZZ
There are no wrong answers!
Extra thoughts: I learned these things in grade 4, I also did an experiment, heat up a hot plate on high and put a droplet of water on it slides around on a droplet because it evaporates so fast it sits on a pocket of steam
you can do this with liquid nitrogen and your hand because it has a low boiling point
Holy cow, [redacted], you have awesome memory! I am glad you still think things are ok despite already knowing all this stuff. It explains why you get restless.
I would be restless, too!
Tomorrow might be much more fun! ☺ I also brought a sheet with some youtube links, I bet you will love them!!!
17/2/14
What kind of subjects would you like to explore in Science? Pick at least one.
outer space properties
I must bring some things to show you, then! ☺

What do you think of science in general?

OK. I learned these things already in grade 4. I also did an experiment: heat up a hot plate on high, and put a droplet of water on it, the droplet slides around because it evaporates so fast, it sits on a pocket of steam (little drawing of a droplet with steam pocket). You can do this with liquid nitrogen and your hand, because it has such a low boiling point.

After he had a chance to read my response, I stopped by his desk and we had a conversation about his ideas in chemistry, and it was just amazing to hear him become so

engaged. I continued to encourage him and engage him, and in the final test, his grade was a very high B plus -- the second highest in the class.

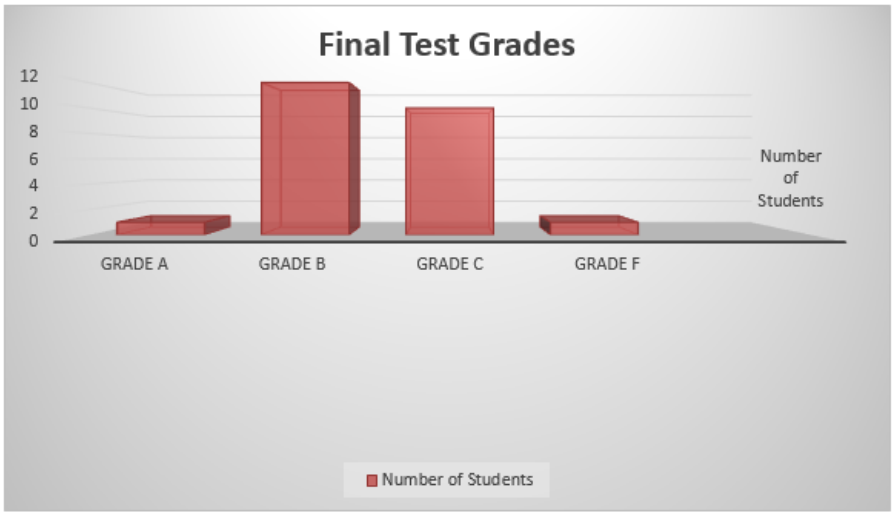
After that third day of class, things really started to turn, and I knew I had found my way into creativity. Student engagement went up, and all students remained largely on task. I continued to bring experiments and fun activities and let them explore the answers, often bringing an explanation only on the next day. Some of the activities required a leap of faith; others required the suspension of belief. As days progressed, my slides got more and more simplified, with answers revealing themselves only after debate was exhausted. I encouraged these very active students to get up and get close to me whenever I was doing a demonstration. I asked them to interact and try things themselves. In between the creative techniques and activities, I inserted some rote learning techniques, such as note-taking and worksheets, to give them a sense of familiarity.

During my second week, I brought the banana piano electric circuit activity, and the kids were very excited about trying it; it was my favourite experience. They were around me, interacting, asking relevant questions such as “Am I closing a circuit?” and “Is this like flipping a light switch?” They also asked if the bananas were becoming radioactive, which was an interesting question, since bananas have a natural low amount of radioactivity, and this generated more debate.

On the last day, we had a unit test, which had to be moved up due to an assembly. The results of the test were pretty good, considering this. My sponsor had asked me to make the test easy; I opted to do a test that had no trick questions, was simple but touched

upon all major points we have seen during the practicum. Results show that even with the diversion of a different, more creative approach, the students overall understood the subject.

*** Below, the test results; considering the kids were surprised by the test being moved a day ahead, basically being told "the test is tomorrow", I consider this a good result.*



By the end of the two weeks, my sponsor told me that "things had changed", and that he feels it would be fine for me to come back to the same class. I think the improvement and engagement were partly due to the fact that they finally understood what I was trying to accomplish and were willing to answer questions and take risks, but also because I created an environment where their opinions and comments were valued and positively reinforced. I believe that it was not creativity alone that brought forth engagement and curiosity, but the fact that the students started to like me more. A few students wanted to know exactly when I would be back, and one of them made me an origami flower.

Further Reflection and Continuing Questions

This process was very educational. I grew greatly as a science teacher, and understand much more about how to implement creative solutions into a classroom. The most important thing I have learned is that introducing something new takes time; I can't expect to "lift the brick" immediately and have the students thank me for it, and embrace the creative process. For many students, grades and memorization is synonym to school, and all that they have been exposed to. Making the shift from focusing on grades to focusing on taking risks and creative exploration, and deeper learning, can't be done overnight.

As I continue my practice, I will repeat this process many times. Next time, however, I will introduce things slowly. Perhaps I will start the first week showing them all the amazing, talented scientists who had to be so creative in order to come up with solutions for so many things we take for granted today, such as electricity and running water. Leonardo Da Vinci, for instance, is one of the most well-known artists from the Renaissance period, but very few remember what an incredible scientist he was.

I still wonder if the introduction of creativity needs to be done by a teacher who is not abrasive and encourages students to succeed. My sponsor teacher is very sarcastic and gives little positive reinforcement. He also cuts off the most creative sections in the book, such as space exploration, because he feels chemistry is much more important. I plan on reintroducing space when I come back to my next practicum, and also bringing some information about underwater exploration, and tie these to relevant facts happening today. I wonder if creativity in the teacher is a requirement for teaching creativity, and if so, can this be trained into our teaching professionals?

I have learned some valuable techniques to start implementing creativity in the classroom, and they are as follows:

- Bring make-believe into the classroom
- Start a journal with each of your students, and answer them promptly with positivity and encouragement, to increase trust and dialogue
- Use no words (or very little words) on your slideshows, and encourage dialogue, before revealing the words
- Get them out of their seats and around you when doing an experiment
- If possible, bring things they can build, experience or create in an open-ended way, such as models, crafts, building sets, posters, plays, music, creative writing, etc.
- Implement no right or wrong for creative activities
- Bring some of the answers next day. Let the kids spend the night thinking about your proposed question. No hurry!

As it turns out, my initial idea regarding creativity was far too simplistic. I have learned so much more about the creative process – which is so interesting, as I have been an artist all my life. Perhaps because I don't really think about how I make art, I had not thought about what makes the creative spark, and what is truly important to bring to a science class, and that is the power of *questioning and supposing*. Curiosity should be inspired just as much as creativity. Only when you have questions can you start opening your mind to come up with answers, and that proved a far better path for me in this research. This short period of time was probably not enough to truly spark the creative process, but it proved to be a very good beginning.

From a class labeled “non-compliant,” “weak” and “low achieving”, I reaped rewards that were far greater than I expected. Once they figured out what I was trying to achieve, they were an incredible class to work with, energetic, debating, coming up with creative answers, and most of the times, on task. The change from the beginning of the research to the end of the research was truly remarkable. While behavioral problems still exist within the group, they were by the end much more willing to try new things, and less negative when it comes to their own abilities. I confirmed my original suspicions: that everyone wants to do good, and they will try, when given a chance. Having high expectations for these students raised the bar to what they were capable or willing to do; I believed in them, and so, they believed in themselves.

I believe a teacher should expose the students to different experiences, and allow them to swim in them freely. I felt much happier as a teacher when the students were excitedly coming up with answers themselves; they are never this alive when listening to a lecture. I must provide a balance between content and activities, but certainly embracing the creative process within each student seems like the most rewarding path for me.

As far as action-based research, I will continue doing this during my practice, as I learned so much from it. I want to research and learn about different groups, and how the interaction between people in the group changes their interaction with me. I also want to implement processes such as this with my students, so they can explore a topic they love, and present it to their peers in the end.

Conclusion

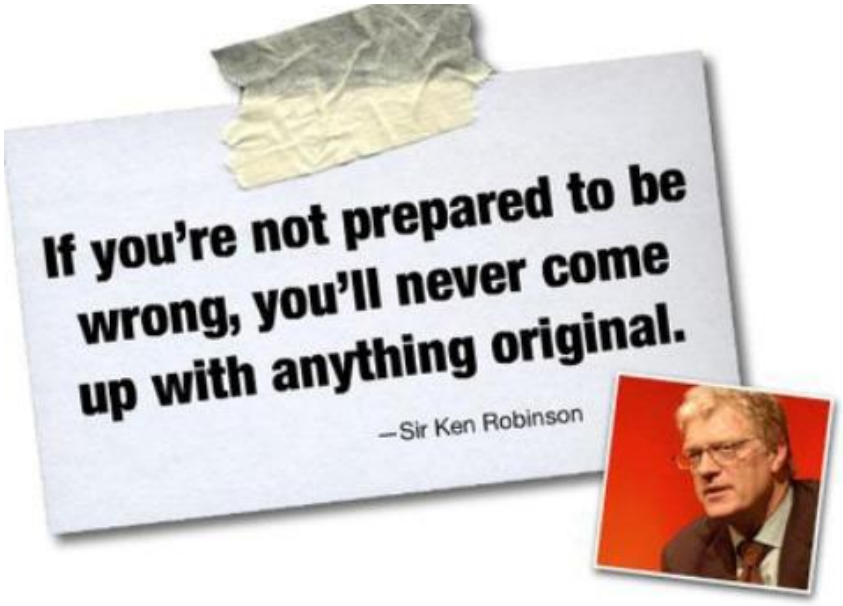
One of the main things I have learned from this process is that appearances and other's opinions regarding a particular class or students should be taken with caution. It would have been easy for me to assume the students were not able to rise to the occasion. However, due to my belief that every person should be given the benefit of doubt, and every student's past history should not influence what I believe they can achieve, I had a much more positive experience. The power of encouragement and allowing students to explore and make mistakes is an amazing tool.

source for paper and tape: quoteswave.com, quote by Lorii Myers

When content has a lighter footprint, and the children are allowed to explore their creativity and come up with answers themselves, real learning can occur. This not only sparks curiosity and the courage to try new approaches, but also gives the students the

breathing room to make connections to their own lives and enables them to become true critical thinkers – which is needed in any area they wish to explore.

However, the implementation of fast-paced creativity needs buy-in from students, families and even other teachers, and it is a process that should be done carefully and slowly. You can't simply change things around and start immediately bringing creative activities to do with the kids, and expect them to embrace the new style of learning. Thinking of the brick metaphor, when you lift the content brick, the students are left with a flat head and very cold on top; it is uncomfortable and different. The introduction of creativity-inducing activities should be done gradually, and the brick should be put back often, until the students are ready to embrace a less content-driven pursuit.



source: quoteswave.com

Still, my action-based research was, in my opinion, very inconclusive. Was creativity and curiosity enabling them to be more engaged and more willing to take risks, or

was it me and my personality that encouraged them to try? Perhaps a creative approach to teaching science requires a teacher that is also creative, or at least not worried about right and wrong answers.

Maybe the students were engaging with the subject because they came to like me more. I am unsure of the reason, but I can at least affirm that engagement, curiosity and courage were greatly enhanced after my practicum, even though I can't fully correlate this increase to the addition of creativity.

As a last word, the path of creativity is, for the teacher, a harder road. Bringing different and thought-provoking activities constantly made my best friend compare me to "Bill Nye the Science Guy"; it is a bit of a circus, and you have to keep your enthusiasm up no matter what happens. But for me, however, as I grow into my teacher shoes, this approach will become more and more prevalent. This is what I do; I mix things up. I choose the crazy road. I bring experiments and opportunities for learning that children would not have otherwise. I raise questions, so that they in turn learn how to question other things around them that may not make sense. Most of all, I encourage them to be their best, each one unique and individual.

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Appendices

Appendix A – Adobe Study

Barriers to Creativity in Education: Educators and Parents Grade the System

June 2013

Methodology

- Online survey among a total of 4,000 adults including 2,000 educators of students in K through Higher Education and 2,000 parents of children in K through Higher Education including 1,000 each in the US, UK, Germany and Australia.
- The survey was fielded between Tuesday, February 12, 2013 and Friday, March 8, 2013.

Key findings

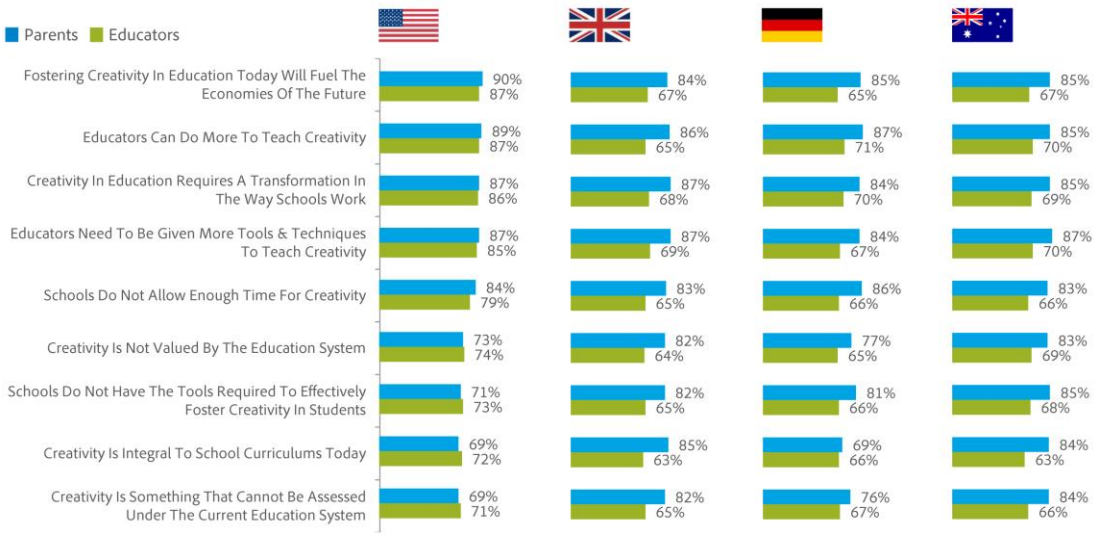
1. Parents and educators are strongly aligned in their concerns and desires for the education system

2. The education system is stifling creativity; a transformative change is needed

3. The demand for creativity and creative thinking is increasing and will fuel economies in the future, yet students are less prepared to become innovative thinkers of tomorrow

5

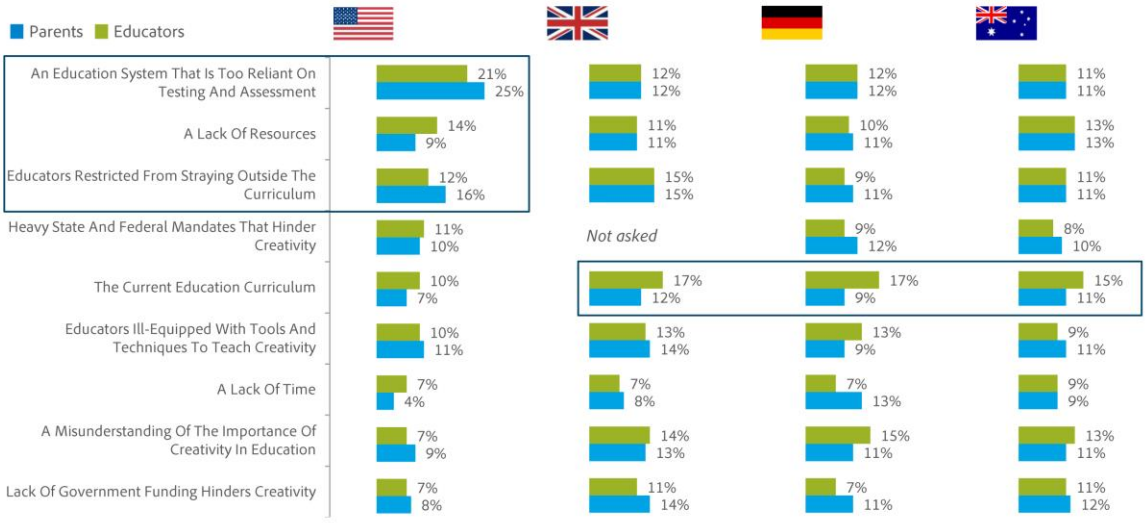
U.S. parents and educators are strongly aligned around the importance of creativity



Indicate how much you agree or disagree with each of the statements. Shown: Top 2 Boxes (Agree strongly/Agree somewhat)

6

The greatest barriers to teaching creativity

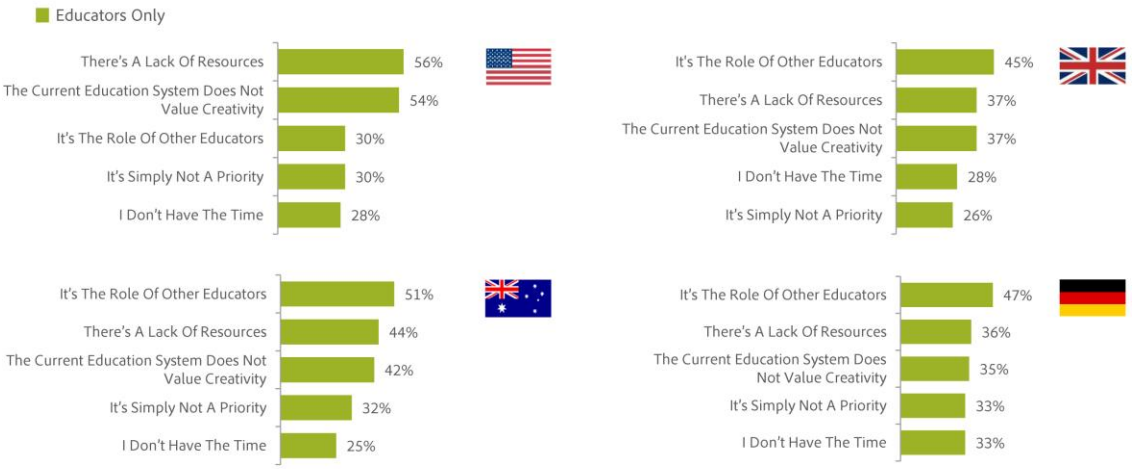


What do you believe is the greatest barrier to teaching creativity in education?

7

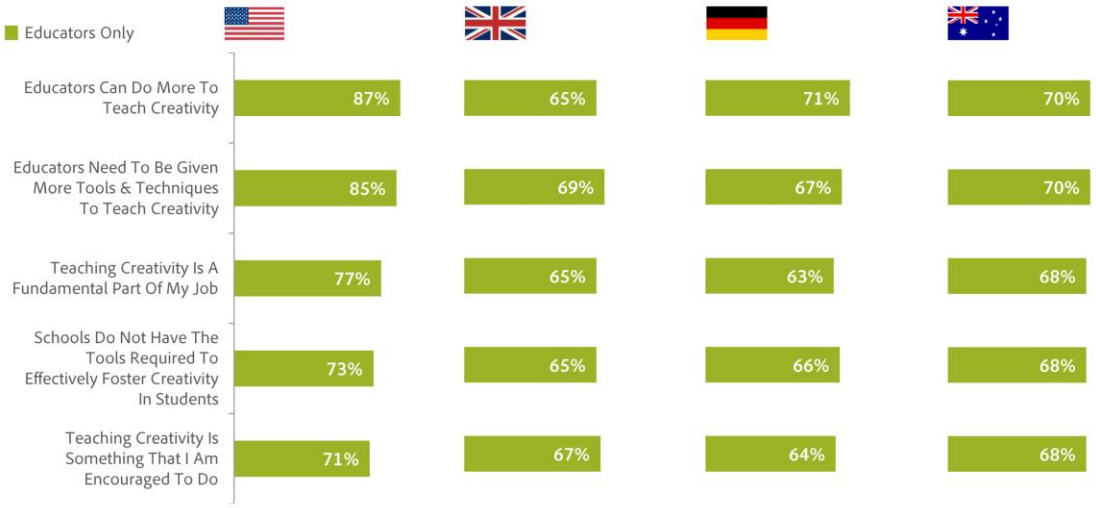
Top reasons educators struggle to incorporate creativity

"I would love to have the ability to integrate creativity more into my classroom but..."



8

Educators agree: they can do more to teach creativity

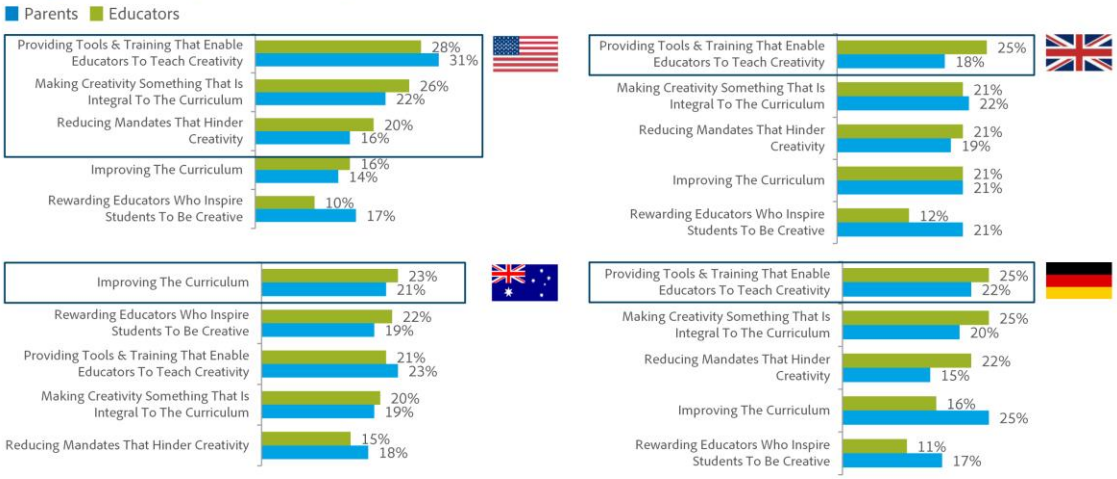


Indicate how much you agree or disagree with each of the statements. Shown: Top 2 Boxes (Agree strongly/Agree somewhat)

9

U.S. wants tools & training to promote & foster creativity

Single most important step

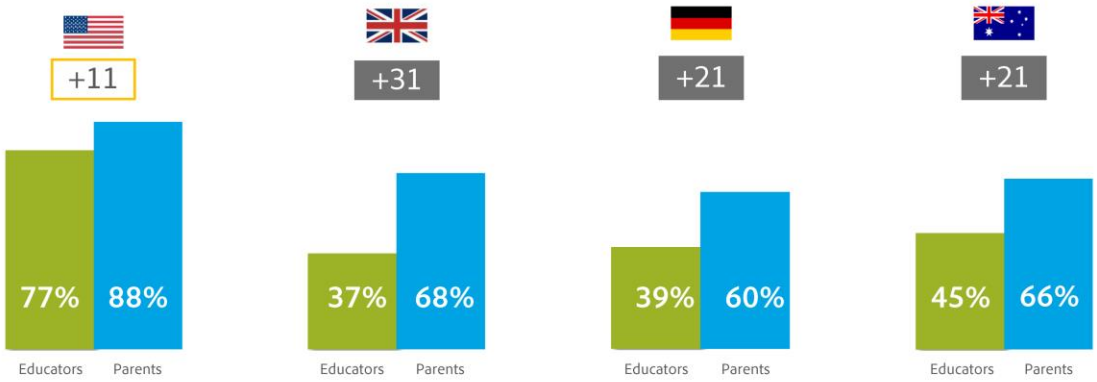


What do you believe would be the single most important step to promote and foster creativity in education?

10

Infusing creativity in education is not as important in UK, Germany or Australia as it is in the U.S.

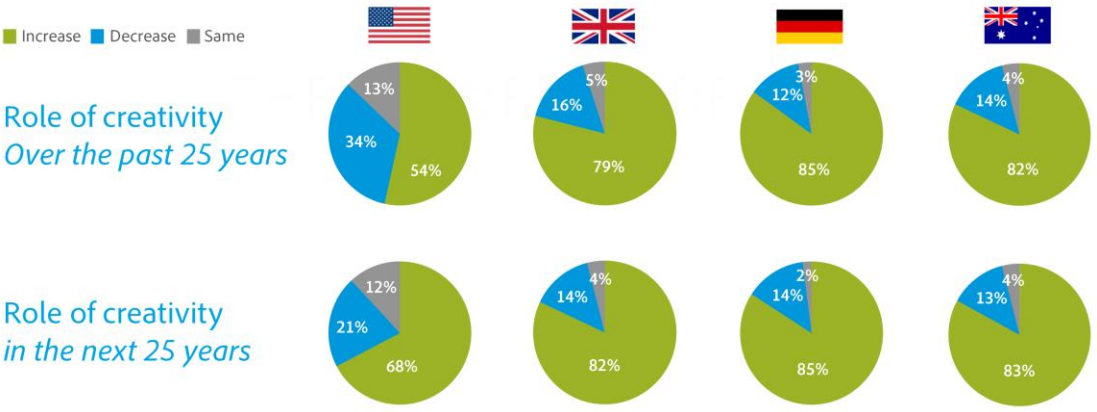
Importance of infusing creativity in education



How important is infusing creativity in education to long-term success?

11

Not only has the role of creativity increased over the past 25 years, but it is set to play a larger role over the next quarter century



Do you think that the value of creativity has increased or decreased in education over the past 25 years?
Looking ahead to the next 25 years, do you think the role creativity plays in education will increase or decrease?
Base Size: Educators (n=2,000)

12

Research summary

- Globally, parents believe creativity in education will fuel the economies of the future (86%) vs. non-U.S. educators (66%) and U.S. educators (87%)
- Top 3 most significant barriers to teaching creativity (Parents & Educators combined)

  U.S.

  1) System too reliant on testing
  2) Educators restricted from straying outside the curriculum
  3) A lack of resources

  International Combined (UK+Germany+Australia)

  1) The current education curriculum
  2) A misunderstanding of the importance of creativity in education
  3) A lack of resources AND educators restricted from straying outside the curriculum (tied)
- Creativity in education requires a transformation in the way schools work (87% parents, 86% educators)
- Top two reasons educators struggle to incorporate creativity into the classroom
  - U.S: lack of resources 56%; the current education system doesn't value creativity 54%
  - UK: the role of other educators 45%, lack of resources 37%
  - Germany: the role of other educators 47%, lack of resources 36%
  - Australia: the role of other educators 51%, lack of resources 44%

13

Research summary Continued

- Educators agree that they can do more to teach creativity (U.S: 87%; UK: 65%; Germany: 71%; Australia: 70%)
- U.S. educators need to be given more tools and techniques to teach creativity (87% parents, 85% educators)
- Top 3 most important steps to promote and foster creativity in education

  U.S.

  1) Provide tools and training that enable educators to teach creativity
  2) Make creativity something that is integral to the curriculum
  3) Reduce mandates that hinder creativity

  International Combined (UK+Germany+Australia)

  1) Improving the curriculum
  2) Providing tools and training that enable educators to teach creativity more effectively
  3) Making creativity something that is integral to the curriculum AND Rewarding educators who inspire students to be creative (tied)

14

15

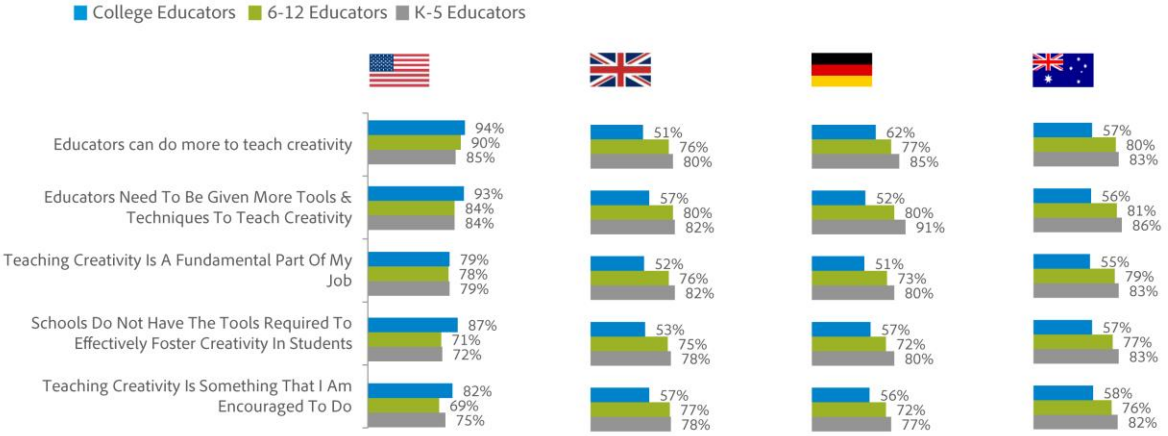
Barriers to creativity in education: Educators and parents grade the system

Parents and educators are in agreement that testing and government mandates are stifling creativity in the classroom.

There is a growing concern that the education system itself is a barrier to the creativity that drives innovation.

17

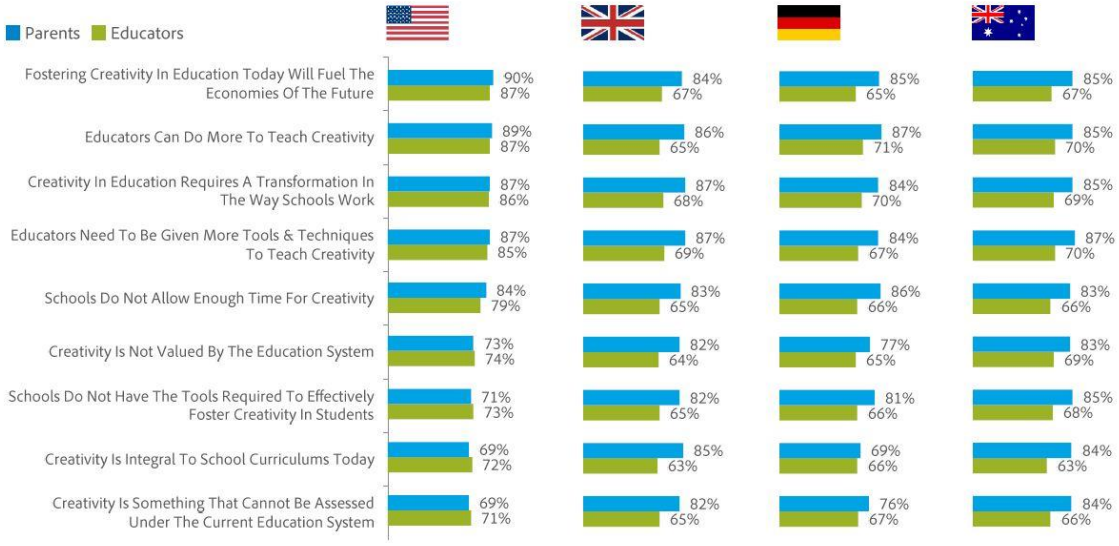
K-12 educators globally believe they can do more to teach creativity and looking for tools to do that



Indicate how much you agree or disagree with each of the statements. Shown: Top 2 Box (Agree strongly/Agree somewhat)

18

U.S. parents and educators are strongly aligned around the importance of creativity



Indicate how much you agree or disagree with each of the statements. Shown: Top 2 Boxes (Agree strongly/Agree somewhat)

6

Appendix B – Final Test

Student: _____

1) Regarding lab safety, choose the student who practiced lab safety.

a) Jesse mixed some chemicals; he used protective equipment and was very careful. He had some leftover chemicals after his procedure, and decided to put it back in the original container. He thinks glasses are geeky, so he decided to just skip using protective goggles.
b) Sierra turned on her microscope, and examined a sample under the light as she finished her sandwich. Thank goodness she has two hands!
c) Diana mixed some chemicals and started smelling a strange scent: doughnuts. She held her container at arm's length and wafted fumes from the container towards her nose. Turns out her mixture did smell like doughnuts after all.
d) Alex arrived at the school after coming back from Jamaica. He still had his flip flops on. He decided to work on the lab anyway.

2) Near each one of the following, write a **C for chemical** change or a **P for physical** change.

a) Digestion of a sandwich in the stomach _____
b) Breaking the lead of a pencil _____
c) Freezing some juice into a popsicle _____
d) Fireworks! _____
e) Evaporating milk _____
f) A rotting banana _____
g) A broken glass _____
h) Making beer _____
i) cooking an egg _____
j) Ripping some paper _____

3) Choose the correct answer.

a) Chemical change is a change that transforms the appearance of a substance; an example of this is when you break glass.
b) When a substance changes its appearance, but no other substances form, this is called physical change. An example of this is a ripped piece of paper.
c) If a substance is transformed into another substance, or two substances combine to form a third substance, this is called kinetic energy.
d) When a substance changes its appearance, but no other substances form, we call this sublimation.

4) Fill in the blanks with SOLID, LIQUID or GAS (there are repeats!!!)

A _____ substance has molecules which slide between each other, but still, have a steady volume.
When we have a substance without set shape, form or volume, we call it _____.
_____ substances have molecules which are quite close together, but still vibrate.
A _____ substance has very, very large spaces between its particles. The particles can move freely in all directions, and increase in volume if allowed.
When you pour a _____ inside a container, it takes the shape of the container, but the volume remains the same.

5) According to the kinetic molecular theory, what makes particles move? Pick one.

a) Time
b) Money
c) Heat
d) Energy
e) Electrons

6) Kinetic energy can be defined as:

a) The motion of energy between two bodies
b) A particle in motion
c) The energy of motion
d) The space between particles in motion
e) A solid, a liquid and a gas moving together

7) Match the columns.

a) Condensation	( )	change from liquid to solid
b) melting	( )	change from solid to gas
c) solidification	( )	change from gas to solid
d) deposition	( )	change from solid to liquid
e) sublimation	( )	change from liquid to gas
f) evaporation	( )	change from gas to liquid

8) Pick the wrong answer.

a) Qualitative properties of matter can be observed, but not measured.
b) Quantitative properties of matter are the ones which count matter particles.
c) Crystallinity is a qualitative property of matter.
d) Density is a quantitative property of matter.

9) Regarding physical properties of matter, classify the following as **qualitative and quantitative**.

a) Magnetism is a _____ property of matter

b) Melting or freezing point is a _____ property of matter

c) Colour is a _____ property of matter

d) Ductility is a _____ property of matter

10) Connect the scientist to his main idea.

a) John Dalton	( ) He proposed the "raisin bun" model of the atom, and was the first to find negative particles, later called electrons.
b) Niels Bohr	( ) He believed the particles that made matter were small, solid spheres, unique for every different element. He defined an atom as the smallest particle of an element.
c) J.J. Thomson	( ) He proposed that electrons were organized in "shells", which meant each electron has a particular amount of energy.
d) Ernest Rutherford	( ) This scientist discovered the nucleus of the atom by bombarding a thin sheet of gold with positive alpha particles. He also figured out that to keep stability, there must be a neutral particle between protons.

11) What is the main function of the neutron?

a) Neutrons add mass to the atom.
b) Neutrons balance out the atom because they have a charge that balances out the proton.
c) Nuclear stability – neutrons stop the positive particles (protons) from exploding apart; they are the glue of our universe.
d) Neutrons help attract the electrons and keep them spinning.

12) If the nucleus of an atom was an orange, how far away would you say the outer electron shell would be?

a) About a meter away
b) About three meters away
c) Down the street somewhere

13) Pick the correct statement.

a) Electrons have no mass.
b) Neutrons have no electric charge.
c) When I pick up a large rock from the ground, the weight I am lifting is mainly protons and electrons.
d) There are three types of electric charge: positive, negative and indecisive.

14) Knowing that an atom is balanced and stable, and knowing that this atom has 17 protons, how many electrons and neutrons would this atom have?

a) 16 electrons, as electrons are -1; and as many neutrons as needed to keep the atom stable
b) 17 electrons and 17 neutrons
c) 16 electrons and 17 neutrons
d) 17 electrons and as many neutrons as needed to keep the atom stable

15) The charge of the atom's nucleus:

a) is always positive
b) is always negative
c) is always neutral
d) depends on what it had for breakfast

16) The charge of the atom's outer shell:

a) is always positive
b) is always negative
c) is always neutral
d) depends on how many shells it has

17) Fill in the blanks.

gas molecules		**mass**	**energy**	**protons**	
protons	**electrons**	**electrons**	**electrons**	**neutrons**	**neutrons**
subatomic particles			**positive**	**negative**	

Atoms are made up of _____ which are called _____, _____ and _____. All three particles have _____, but only two have electrical charges. For instance, an electron has a _____ charge and a proton has a _____ charge. Because opposites attract, _____ and _____ are attracted together, while _____ exist to keep the atom stable. The only particles that can actually leave the atom are _____, and that only happens when it receives enough _____ -- it is then freed from the atom, just like _____ get freed from liquid.

18) Alchemists were researchers looking for:

a) fame and fortune
b) kidney stones
c) a way to make gold out of any other metal
d) Chemistry

19) If an atom has a measurable mass of 20, and we know that it has 10 protons, how many neutrons would you say it has?

a) 5 neutrons
b) 10 neutrons
c) 20 neutrons
d) Impossible to say

20) A substance melts at -20 degrees Celsius, and it boils at 400 degrees Celsius. What would be the state of this substance at 200 degrees Celsius?

a) liquid
b) solid
c) gaseous

HURRAH !!!!

You did it !!!!

Appendix C - Journal Entries By Student, Including Mrs. J.'s Responses

1) TC

11-02 - "How close or far are science and creativity? How creative do you feel during science?"

I think that art is close to science because you can be creative in the way that you can experiment in labs like you do with your artwork, that's why I think science is close to art.

Yes! When you are a true adult bona-fide scientist, then you can be even more creative. You can also come up with cool inventions! The process for making something new, like an invention or a painting, is one and the same… - Mrs. J.

13-02 - "What do you think of science in general? Pick one. Extra thoughts:"

I think science is ok because some things you do can be cool, but some things can be boring. Sometimes, but for the most part it can be cool so that's why I think science is ok.

Fair enough! I bet you like labs and experiments, right? I sure do! Some things can be so repetitive, though, right? – Mrs. J.

17-02 - "What would you like to explore in Science?"

More labs, they're fun and you can learn some things.

Yes! Labs are fun! Let's try to do more of those. ☺- Mrs. J.

I like your teaching. The only complaint was how much writing they have.

2) EG

11-02 - "How close or far are science and creativity? How creative do you feel during science?"

Science is a very interesting and creative subject. During science, I feel like I have to be precise in the things that happen in a lab.

It is important to be precise and not mix dangerous things. But… the reason we know some things are dangerous is because some poor, creative, curious scientist tried them out first… what a scary thought! – Mrs. J.

13-02 - "What do you think of science in general? Pick one. Extra thoughts:"

OK.

3) SD

"How close or far are science and creativity? How creative do you feel during science?"

I feel like science brings me closer to creativity by experimenting.

Yes! Experimenting is good. School can be very structured, but keep in mind that real science is much more free. You have to record procedures, BUT you come up with them yourself. How cool, huh? – Mrs. J.

"What do you think of science in general? Pick one. Extra thoughts:"

Cool. I really like doing science. It's quite fun (ish) doing Biology and doing labs/ experiments. Science in general can be a cool subject, it sometimes gives you a different perspective on things.

I agree. We go through life taking so much for granted… but if we stop to think, we are really dependent on the forces that keep our energy particles together! The whole universe is made of three little things… protons, electrons, neutrons… amazing, right? Mrs. J.

4) ED

"How close or far are science and creativity? How creative do you feel during science?"

I find (science) brings me closer I guess, because you get to try out new stuff.

Trying out new stuff is one of the most fun things in science. Most of the true discoveries were made by coming up with the idea by yourself! – Mrs. J

"What do you think of science in general? Pick one. Extra thoughts:"

Cool. I like science a lot. It's one of my favourite subjects. ☺

Mine too, E! I really like how varied it is. I always felt that even when I didn't like one subject, the next one would make everything worthwhile. It's like a sequence of fun facts about the Universe! Sure makes me feel small (drawing of Earth)! ☺- Mrs. J

17-02 - "What would you like to explore in Science?"

I don't know. Anything, I guess.

Ahh ok! Easy, then! ☺- Mrs. J.

5) JP

"How close or far are science and creativity? How creative do you feel during science?"

You can do things independently and create stuff; I feel about a good 7/10 creative.

"Creating stuff" is both creative and scientific! ☺Many great scientists were creative artists – I have even read that all greatest scientists were artistic somehow. Painters, sculptors, musicians… funny, huh? Keeping their minds working creatively must have helped them become better scientists somehow. – Mrs. J.

"What do you think of science in general? Pick one. Extra thoughts:"

Cool. I like doing labs.

Me too, J! And experiments. My favourite is the good old paper bag experiment, but mainly because I love balloons! ☺- Mrs. J.

17-02 - "What would you like to explore in Science?"

Dissection *→ Eww! - Mrs. J*

Fire *→ YAY! – Mrs. J*

Experiments *→ Yahoo! – Mrs. J.*

Let's get some cool things for next practicum, then! – Mrs. J.

OK.

6) SH

"How close or far are science and creativity? How creative do you feel during science?"

Science brings me close to creativity because I have to think a lot and get creative.

It is interesting how you connected thinking with creativity! Many scientific discoveries were done by using creativity to solve a problem, and that requires quite a bit of thinking. – Mrs. J.

"What do you think of science in general? Pick one. Extra thoughts:"

I think science is cool! I really like doing all the labs and learning how to mix chemicals and make experiments.

Yay! That is super cool. I hope you enjoy tomorrow! There will be a few things to explore! I love experiments too, and imagining things from really up close. It's very neat to think we're a bunch of energy! (atoms are energy) – Mrs. J.

17-02 - "What would you like to explore in Science?"

I would like to explore any labs or I would like to learn more about the solar system or anything! I really like science so I am open to learning anything!

Ah! Many of you like astronomy! I will make sure to bring some activities when I get back. I love science too. And the solar system is neat, and the whole universe. The Milky Way is gorgeous! (drawing of Milky Way with sign saying "we're here") – Mrs. J.

You're doing a great job! Don't change!

7) AD

"How close or far are science and creativity? How creative do you feel during science?"

Yes and no. I feel creative in science because we get to do labs and cool stuff and learn new things so I can use my imagination. But sometimes I don't because when we do classwork I have to know what I am doing, so I can't be creative.

This is true, A! A science classroom is a little different than actual science, where you can invent things and come up with your own conclusions. I am trying to bring projects that allow you to think for yourselves, and hopefully you will enjoy them! – Mrs. J

"What do you think of science in general? Pick one. Extra thoughts:"

Meh. I don't like homework, but who does, ha ha! *(Not me! :v – Mrs. J.)*

I like doing labs with my friends, that way we share thoughts and have more fun.

I am with you, A! Homework can get overwhelming, especially when all teachers think they are the only ones giving homework! (Help!) Sharing thoughts is awesome to do in science. I find that it really helps me clear my thoughts! And real scientists work together all the time! – Mrs. J.

17-02 - "What would you like to explore in Science?"

I like Chemistry, because I love to experiment and use acids and stuff like that!

Chemistry is fun; experiments are so awesome. I hope I get to do some experiments with you guys when I get back!

8) JJ

"How close or far are science and creativity? How creative do you feel during science?"

Science and Art can be close or far in many ways; for example, in both there are times when you have to be exact, and other times you have room to experiment.

Yes! You do have to be exact sometimes in art. Great! And certainly, experimentation, creativity and curiosity are all basis of science. It's how they invented… (graphic) (electricity – cars – airplanes – computers – modern medicine – microscope – internet) Someone had to dream of them first! Scientist = Dreamer – Mrs. J

"What do you think of science in general? Pick one. Extra thoughts:"

OK. I learned these things already in grade 4. I also did an experiment: heat up a hot plate on high, and put a droplet of water on it, the droplet slides around because it evaporates so fast, it sits on a pocket of steam (little drawing of a droplet with steam pocket). You can do this with liquid nitrogen and your hand, because it has such a low boiling point.

Holy cow, JJ, you have awesome memory! I am glad you still think things are ok despite already knowing all this stuff. It explains why you get so restless. I would be restless, too! Tomorrow might be much more fun! I also brought a sheet with some youtube links, I bet you will love them! – Mrs. J.

17-02 - "What would you like to explore in Science?"

Outer space properties

I must bring some cool things to show you, then!

9) S

"How close or far are science and creativity? How creative do you feel during science?"

I think science is somewhat creative because you have to think of stuff to put together to make something else.

Yes! You also often have to solve problems, like curing disease, or building airplanes; and sometimes the inventions happen by mistake, which can be awesome. – Mrs. J

"What do you think of science in general? Pick one. Extra thoughts:"

Cool.

10) CA

"How close or far are science and creativity? How creative do you feel during science?"

I think science and creativity are close in some reasons but not in others. It really depends on the chapter of science. Ex.: electricity and art don't mix, but cells and art might mix.

I really like your thinking! The image of a cell and organelles working in unison is very inspirational to me. But as far as electricity, I have to disagree a little… Look closer! What is electricity, really? (picture – jumping electrons -- Magic!) Also, electricity makes for amazing lightshows… (lightning) Kaboom! They are beautiful! – Mrs. J

"What do you think of science in general? Pick one. Extra thoughts:"

I think science is ok. It could be better if we did a few more lab activities. But other than that science is pretty good*.*

I agree! Hopefully tomorrow works out fine. I am planning a few explorations! – Mrs. J.

17-02 - "What would you like to explore in Science?"

I would like to explore electricity because it's the most useful invention of science.

And that is why I brought the banana experiment, ha ha ☺- Mrs. J.

Suggestion: Read from the textbook instead of taking notes. Everything else was pretty good.

11) SP

"How close or far are science and creativity? How creative do you feel during science?"

I feel a little bit creative but not entirely during science.

That is understandable, S. I myself find that the magic and fun of science gets squished out by school rules. Science is so much more… The atom, the solar system, the Milky Way, all these spinning, marvellous things! Makes me feel like drawing spirals ☺ (drawings of atoms, solar system and spirals) – Mrs. J

"What do you think of science in general? Pick one. Extra thoughts:"

It's OK.

12) PP

"How close or far are science and creativity? How creative do you feel during science?"

I don't think it is very close, as they are very different subjects. I feel normal creative, not very much.

Hi P! It is interesting that they are considered different subjects when in reality they have so much in common. The reason why you don't feel real creative is because of the way content is organized in school… imagine, if it was this dry, the early scientists wouldn't have been that interested in it… ☺ I sure wouldn't be! – Mrs. J

"What do you think of science in general? Pick one. Extra thoughts:"

17-02 - "What would you like to explore in Science?"

Kinetic Energy and K.E.R.S. system and D.R.S. system.

Boy, I had to look that up. But ok, you're on! – Mrs. J.

13) KG

"How close or far are science and creativity? How creative do you feel during science?"

Art is nothing like science. In science, you have no artistic freedom and need to follow strict procedures in order to stay safe. I feel like science has no creative spark, exactly why it is an academic instead of an elective.

That is a very good point, K! To counter that, there is a whole lot of procedure in some art forms. Also, scientists who actually do anything important – did you know that all of them are artists? Check out Leonardo da Vinci – my favourite scientist! Isn't it sad that we forget the "spark" in this search for academic growth? Can we change this? – Mrs. J

"What do you think of science in general? Pick one. Extra thoughts:"

Snore. This subject isn't one of interest.

Aw! Well, at least you do well in it! And maybe here and there, you will find some fun things… - Mrs. J.

17-02 - "What would you like to explore in Science?"

I would like to explore astronomy.

I love astronomy too! I will FOR SURE bring some activities for you guys on my next practicum. – Mrs. J.

14) CT

"How close or far are science and creativity? How creative do you feel during science?"

Science isn't very creative considering it can be dangerous. I feel a distance between science when it becomes creative.

Yes, science can be dangerous; but science is more than mixing chemicals. Check out "inventions" and "robotics" and other things on Google! It really shows how you have to have a degree of creativity in order to make a difference in the science world. – Mrs. J

"What do you think of science in general? Pick one. Extra thoughts:"

Ok. My career is based on science; I want to be a dental hygienist.

Really? I almost was a dentist! I did 2 years of dental school, but I ended up getting bored of teeth ☹ So I did arts and now I am teaching! Teaching is SO FUN! – Mrs. J.

15) A

"How close or far are science and creativity? How creative do you feel during science?"

Science and art are not very similar to each other; science is more of a follow instructions class, while art is a "do what you want".

That is true! Do you feel that if you were allowed to be more independent in science – discovering instead of simply following instructions – you would think differently? I wonder, if Benjamin Franklin had been more structured, if he would have had so much fun with his electricity experiments. Old science was so creative! ☺- Mrs. J

"What do you think of science in general? Pick one. Extra thoughts:"

Cool.

16) RS

"How close or far are science and creativity? How creative do you feel during science?"

I don't feel very creative during science class.

Let's see if we can change your perspective! –Mrs. J

"What do you think of science in general? Pick one. Extra thoughts:"

Ok. I like to do labs with friends.

Science is fun with friends, isn't it? For me, I find it very boring doing science by myself. I love teaching it, though! ☺- Mrs. J.

17-02 - "What would you like to explore in Science?"

Chemistry and Biology.

Ah! I love Biology best… but the atom is very cool too! – Mrs. J.

17) KHW

"How close or far are science and creativity? How creative do you feel during science?"

(In)science I think you don't have to be creative because, say, if you mix two chemicals that you don't know if they won't explode; it is dangerous. During science I don't feel creative.

Well, science is more than that, but I get where you are coming from. In class, the content is often a constraint to your creative process… but real scientists are very creative! They invent things, build awesome machines, cure diseases… and even mix dangerous chemicals and find out which ones explode, so we don't have to! ☺- Mrs J.

"What do you think of science in general? Pick one. Extra thoughts:"

Ok. I like science but I find that we get a lot of work and in the other classes they give us the same amount so it is really hard to do the homework.

I agree, that makes it very difficult. In my opinion, it seems like teachers always believe they are the only ones giving homework! I will try to make it so we do our work mostly in class, ok? ☺- Mrs. J.

17-02 - "What would you like to explore in Science?"

I would like to learn about different types of acids and learn about different elements.

Oh! You will! Mr. Orton is starting a whole unit on Chemistry and it will be pretty intense. ☺ -- Mrs. J.

Suggestion: Less notes to copy down, read from text book more.

18) DB

"How close or far are science and creativity? How creative do you feel during science?"

I feel like science is a 60 meter from creativity, only because I am an artist myself. Science is a form of mixing particles together, in the eye of a scientist maybe this is art. But… all depends on the person.

Good to hear you are an artist! In defense of science, however, let me suggest you look at Leonardo da Vinci (you know, Mona Lisa's daddy) and check out his SICK inventions. He was an amazing scientist! Problem is, while he could just have all this freedom to invent, sometimes modern science gets squished out of all sense of wonder in the school system/academics. I am an artist too! ☺ → better than this! – Mrs. J

"What do you think of science in general? Pick one. Extra thoughts:"

Meh. Science is okay, I'm not really a big fan though it is one of my best subjects. – DB

Oh, that is interesting! You probably like the labs and experiments, right? For me, what really made me love science were the animal studies, cells and…robots (drawing of a robot)! – Mrs. J.

17-02 - "What would you like to explore in Science?"

The main thing is animal studies due to me wanting to be a marine biologist.

I love animal studies! There is a project coming up that you will love. It is all about reproduction and you can pick your own animal to explore! – Mrs. J.

19) JE

"How close or far are science and creativity? How creative do you feel during science?"

Science doesn't bring me closer to creativity. I don't feel creative.

I understand your feelings, J. You probably have had some unfun experiences with science before. I will try to make it more fun for you these next few weeks – can you try to play along? You may like it…

Also, I had a sense that you would perhaps like to play a musical instrument! You move like a musician. I am thinking guitar (electric) or drums! And remember, just because you haven't tried, doesn't mean you won't be GREAT at it. – Mrs. J

"What do you think of science in general? Pick one. Extra thoughts:"

~~Meh~~ ZZZZ is what I think of science.

Tsk Tsk! Too late! I saw "Meh"! ☺ I like "Meh" better than "zzzz"… Anyway! I hope you are enjoying class so far. I am bringing some neat things on Tuesday!!! ☺ - Mrs. J.

17-02 - "What would you like to explore in Science?" (at least one, please → see, I said please, with a cherry on top)

How to make fireworks!

Ahh! My husband worked on the Expo 86 making fireworks! He was in charge of the firework team, and had to put out a show every day for 30 days. On the 29th day, one of the fireworks exploded on him and he caught on fire… he had to jump in the water and spent 2 weeks in ICU! But maybe we could do something on a smaller scale when I get back. ☺ -- Mrs. J.

20) S

"How close or far are science and creativity? How creative do you feel during science?"

Science and art are pretty far apart. In science, there isn't a lot of room for creativity, you have lots of rules and planned labs in science, where in art it's a lot more about how you feel and being able to express creativity.

That is so true! The way school is organized makes it hard on creativity… it makes me sad to think of all the people who are creative and get turned off by the way science is usually presented! Think of all the great discoveries in science; they were made possible due to the immense creativity, curiosity and love for experimentation of those scientists. Artists make the best scientists! ☹ Check out Leonardo da Vinci… he blows my mind! – Mrs. J

"What do you think of science in general? Pick one. Extra thoughts:"

Ok. Science is actually pretty cool. (YAY! – Mrs. J.) I love doing experiments and labs. Biology really interests me too; so I love doing experiments outdoors.

Oh!!! This sounds awesome. What kind of experiments outdoors? ☺ I am curious! Please tell me more!!! – Mrs. J.

17-02 - "What would you like to explore in Science?"

I like Marine Biology, so maybe marine science would be cool. I love marine wildlife, like whales and fish.

Oh! So does D (student)! It is a beautiful profession. My cousin really wanted to go into it! I love diving! (drawing of diver) – Mrs. J.

I don't think you are annoying, and I like that you always do experiments. You're a good teacher.

21) RP

"How close or far are science and creativity? How creative do you feel during science?"

Science doesn't bring me to creativity. I do not feel creative during science.

That is understandable! Many of the lessons are heavily built around the curriculum and there is little room for experimentation. But science in the traditional sense can be very creative! It's how inventions are made… - Mrs. J

"What do you think of science in general? Pick one. Extra thoughts:"

It's ok. I think science is fun.

I think so too. And it helps us think about the world and life! ☺- Mrs. J.

17-02 - "What would you like to explore in Science?"

Chemistry and/or Biology. In Chemistry, I'd like to learn how chemical reach boiling point.

Oh! Every chemical is different… and because of their different densities, some elements take longer to gain enough energy to boil. But next unit will help you understand the concepts! ☺- Mrs. J.

22) LM

"How close or far are science and creativity? How creative do you feel during science?"

Science is very creative…but sadly I'm not. I try to be creative but I'm really bad at it… sorry. :O

What!? No way! I bet you are creative in at least one aspect! There is visual arts, musical instruments, singing, dancing, poetry, writing fiction, oh! So much to try! Just the fact that you try to be creative is huge. You know how many years it took me to be good at drawing? A good 10 years! But it was worth it. It's like a muscle! Keep flexing! – Mrs. J

"What do you think of science in general? Pick one. Extra thoughts:"

I like science somewhat, it's between ok and meh. Science is hard for me because of learning disability.

Ah! That does make it harder, doesn't it? But learning disabilities can be overcome, many times… it takes a lot of work but it is worth it. One of my friends has a few different disabilities and she is going to be a science teacher, and my husband has really bad dyslexia – and he is an electromedical engineer! It was very hard for him, but he loves science! You can do it!!! ☺-- Mrs. J.

23) IA

"How close or far are science and creativity? How creative do you feel during science?"

It's Far.

Good answer – you went straight to the point. But I believe your perception is due to the way school must present the subject… there is very little leeway and actual experimentation. Check out Leonardo da Vinci, for instance. (graphic) Mona Lisa X First Scuba Diving Suit (and many other inventions…) See… because he was so creative, he was able to invent something no one had considered possible. He also came up with the helicopter, the parachute, the machine gun, and much more! ☺- Mrs. J

"What do you think of science in general? Pick one. Extra thoughts:"

Meh. Science is ok.

Yay! Happy you think so! - Mrs. J.

17-02 - "What would you like to explore in Science?"

Space.

Yes! Tons of you want space! I will make sure to bring some cool space things for us. - Mrs. J.

24) TM

"How close or far are science and creativity? How creative do you feel during science?"

Science and art are not close in work, but maybe in creativity. I don't feel creative in science because we haven't done anything yet.

Good point! Let's see if we can get a little creative. Meanwhile, check out Leonardo da Vinci's inventions online… he is my favourite artist-scientist! :D – Mrs. J

"What do you think of science in general? Pick one. Extra thoughts:"

Snore.

17-02 - "What would you like to explore in Science?"

Not flames. Penguins! ☺

Penguins, huh!? Mr. Orton has a project coming up and it will be all about reproduction of animals. Maybe you could do penguins! – Mrs. J.

25) ND

*This cheeky student missed the first journal assignment, and decided to copy the answers I gave some of his friends into his journal as a lark, instead of coming up with his own answers. I noticed how it sounded familiar and had a bit of fun with it.

"How close or far are science and creativity? How creative do you feel during science?"

Science brings me close to creativity because I have to think a lot and get creative. It is interesting how you connected thinking with creativity! Many scientific discoveries were done by using creativity to solve a problem, and that requires quite a bit of thinking.

Hi N! The interesting thing is that you see the connection too. T is hard sometimes to keep this connection in mind during a science class! I find science so fascinating. My favourite thing is to

imagine things from the inside, or really up close. The Universe is so amazing! (See what I did there? I pretended you actually wrote that! Creative, huh?) – Mrs. J.

"What do you think of science in general? Pick one. Extra thoughts:"

Meh.** (Meh is fine! I can work with Meh! – Mrs. J)* ***I don't like the homework; I'd rather do all my work in class. And I like doing lots of labs, it keeps it interesting.

I like lots of labs too! :D And videos! Homework can be such a drag. I will try hard to get everything done in class from now on. And if it doesn't get done today, there is always tomorrow, right? – Mrs. J.

17-02 - "What would you like to explore in Science?"

I'd like to explore chemistry. I'd like to do that because you get to do fun experiments.

I love chemistry too! I will try to bring experiments when I get back! – Mrs. J.

26) TS

Refused to write on journal; also was the only student who failed the final test, with a mark that was far below average – 47 points out of 100, even after everyone got 10 points due to a couple of confusing questions.

27) JO

Refused to write on journal, and only showed up once in eight days; I believe he may have left this class.

28) AL

17-02 - "Hi A! Hope you enjoy this week! How do you feel about science? What subjects would you most like to explore?

Anyone that is the most fun to do.

Ok, that should be easy! ☺- Mrs. J.

29) PL

I like doing labs in science because you get to be creative.

Oh, good! I hope you also like observing experiments! ☺

What subjects would you like to explore in science?

Atoms, elements and compounds.

Good! It's what's coming next! ☺

No (suggestions), you are doing a good job! <3