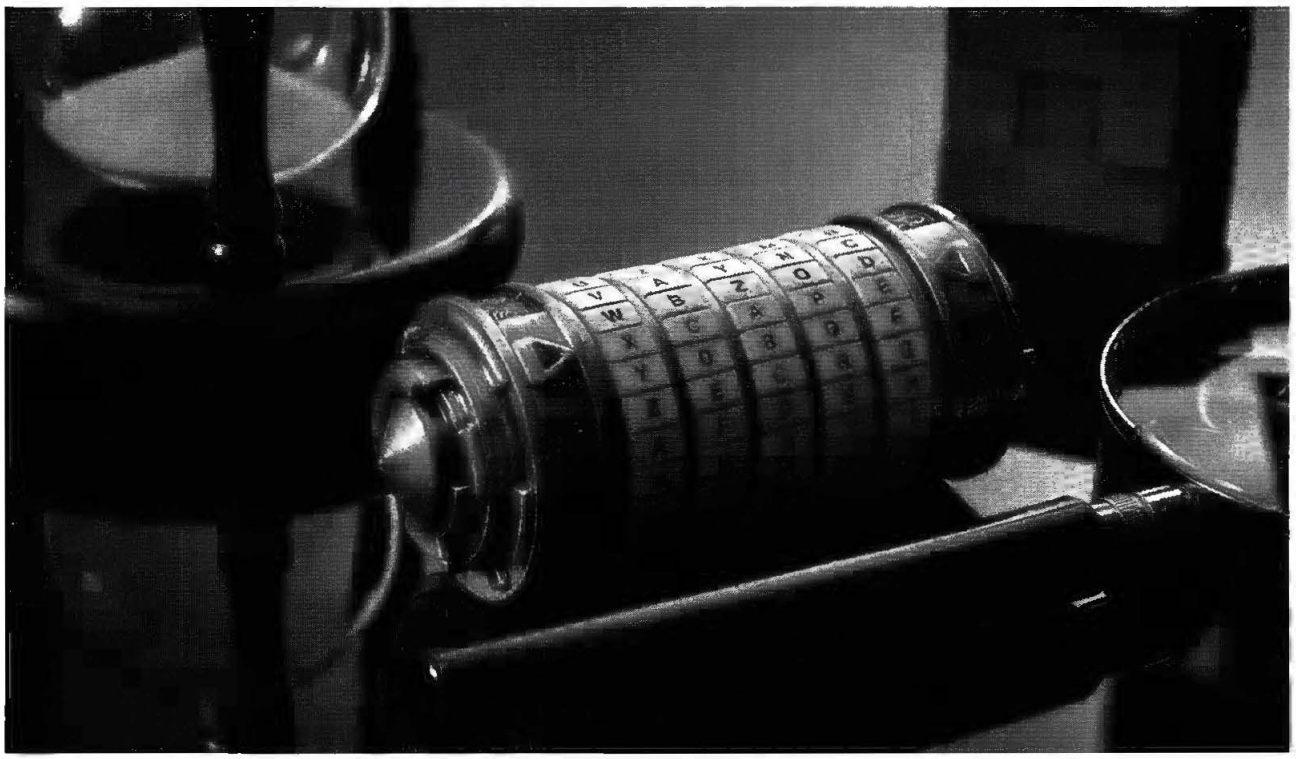
Developing a Passion for Mathematics Through History

Armand Doucet and Jata MacCabe



This article highlights an interdisciplinary collaboration from secondary school that begins in a history classroom. The teacher Armand Doucet invites students to delve into areas that they are passionate about. Jata MacCabe, a student, is passionate about mathematics. Upon hearing of this initiative, an invitation was extended to share their story with the readership. The coauthorship enriches the value. Armand's writing (in italics below) will introduce the context and the background with regards to Passion Projects. Jata will then share her experience with the project and what it meant to discover that she wanted to continue pursuing mathematics as a career path.

My goal as a teacher in the classroom is to develop skills intertwined with curriculum content. Social and Emotional Learning (SEL) and 21st-century skills need to be developed not haphazardly, but purposefully. For this to happen, the culture and design of my classroom and how I approach curriculum outcomes and standards, as well as skills development, is with a combination growth mindset (Carol Dweck) and design thinking process (IDEO-Tim Brown). I try to foster and develop divergent thinking (Sir Ken Robinson) in students who will embrace the problems of the world instead of fearing them because in reality: "The world doesn't care

what you know. What the world cares about is what do you do with it" (Tony Wagner).

So, I believe that connecting the curriculum to what the students are passionate about is a great way to develop my classroom. With Passion Projects students realize the joys of learning again by following their own path. As you can see in Jata's statement below, when allowed to pursue their own goals in education, students struggle at first. I try to let them explore before giving them stricter guidelines for their creative piece. We conference in order for them to discover what it is they would really like to pursue. As they embrace the core problem of their Passion Projects, resiliency precedes enthusiasm and then enthusiasm leads to pride as students create and subsequently showcase their projects. History comes alive as students gather information and collaborate with the international community. The experience is unique to each student. Tony Wagner (Creating Innovators) states, "the most important thing is allowing students to ask questions and then give them the space to find the answers."

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With Jata, she wanted to pursue something in math and women's rights. Her project revolved around proving that women played a key role in World War II with Bletchley Park and this was one of the main reasons that the Allied forces had won the war. At first, she researched a lot on Bletchley Park's role itself, realizing that Mavis Batty played a major part. As her project progressed, she decided to create her own Enigma scavenger hunt. This got her looking at the way the code breakers were using math to break codes and build the Enigma machine. She ended up being able to utilize her precalculus class to help her develop the scavenger hunt and Enigma machine (which was made up of tinfoil and some boxes). However, what she really developed was an understanding of how math, as well as history, are both connected from a perspective of the skills that are needed such as problem solving, critical thinking and creativity. Those higher order skills were pushed to the limit as she continuously tried, innovated and ultimately created her supportive creative piece, namely, the scavenger hunt.

Giving students like Jata a chance to pursue their passion, math in this case, in combination with other subjects like history, within a safe environment to take a chance on a project, analyze, improve and try again, gives them the opportunity to realize if they truly want to chase down those dreams in the future. Jata's project garnered attention from CBC once we posted the results on social media. They attended her presentation, interviewed her and it was shared over 200 times. Also, she received praise from Sue Black, OBE and computer scientist, who was one of the people who helped to save Bletchley Park. Sue was able to share with Jata her connection with Mavis Batty, having known her before she passed away. All these things combined to solidify for Jata that she wanted to continue pursuing math and that it was going to give her numerous avenues for an interesting career.

That, I believe, is my job as a teacher, to help students develop skills while finding who they are so they can succeed in the future. You can visit my template for this type of classroom and other Passion Project examples at www.lifelessonlearning.com.

The idea was to connect something we were passionate about to a revolution in modern history.

My approach to history has always been impersonal. Dates and names have never stuck in my head for longer than they took to go in one ear and out the other. I was kind of into that Roman unit, but my friends tell me watching *Gladiator* doesn't actually count as studying. I was obviously not looking forward to an entire semester of memorization and regurgitation of a subject I didn't particularly care about.

Within the first week of Mr Doucet's class we were introduced to the Passion Project. The idea was to connect something we were passionate about to a revolution in modern history. I was terrified. That very helpful premise narrowed the possible topics down to relatively everything, and the only concrete thing I understood was the deadline. When Mr Doucet suggested researching code breaking during World War II, I finally had some small lifeline to grasp on to. This was a way to explore my passion for mathematics in

a course that I would have otherwise loathed. Besides, what kid isn't intrigued by spies and code breaking?

For almost the entire history of the world, battles have been the epitome of concrete and physical. Obey him, protect them, bash and whack the enemy. The major action occurred directly on the battlefield; you simply had to roll with the punches as they came—literally. Espionage had always been field agents infiltrating enemy divisions, overhearing important information and accessing critical documents. However painstakingly won, this information hardly ever majorly impacted the outcome of a battle.

Communication was slow and unreliable; a messenger could be delayed or a letter could be intercepted. Even if the information should have reached someone who might have been able to act upon it, the information was often as unreliable as the methods to send it. In matters of life and death, confusion is not always the preference. Our modern history course taught us of major innovations that were catalysts for revolution.

Very few modern innovations had such a profound effect on military communication, and the world, as radio transmission. During the Second World War, communication was decidedly less tangible. Encrypted messages could pass through brick walls, over enemy camps and across borders. In a game of interceptions, the best encryption won. As tensions and conflicts mounted, it was clear that the Germans had it.

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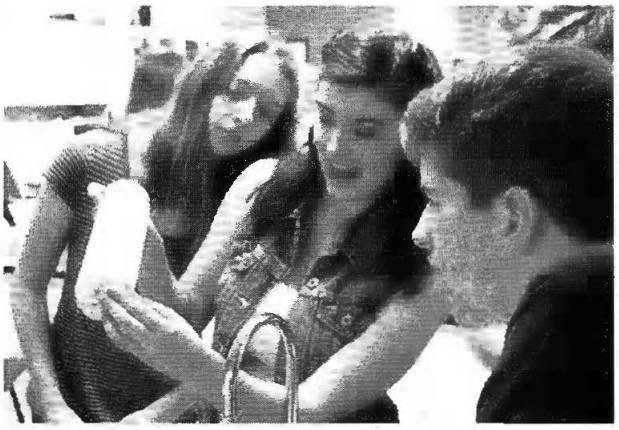
Originally, the Enigma machine was a commercial product designed for businesses or firms to encrypt their financial data. The creators were quick to see the machine's potential military use and began approaching federal governments with the product. Ironically, the encryption machines were even presented to the British government, who chose not to invest. The German government was interested in the product, however. After ramping up the security, the German Enigma resembled the simple commercial product solely on a superficial level. The machine had a standard German keyboard, like a typewriter, and an additional alphabet with illuminated keys. It included a series of rotors that encoded letters and rotated with each additional letter. It also had a switchboard that added an extra layer of security by switching the coded letters for other—seemingly random—letters. By changing the settings of the rotors every night at midnight, the Germans had created a nearly invincible fortress of security. In a total blackout of information, the Allied forces would be subject to almost certain defeat. Britain's Government Code and Cypher School's base for Axis decryptions was at Bletchley Park.



At Bletchley Park, mathematics and problem solving meant lives saved.

Perhaps the most famous name to come out of Bletchley Park is Alan Turing. Before the war, the Polish had developed a method of deciphering Enigma codes with the use of "Bomba" machines. These functioned by checking all possibilities using a series of sheets. The machine was slow, inconsistent and fickle, but it was progress. After being introduced to the Bomba, the concept that a machine could do the quantitative work of a human mind would stay with Turing for the rest of his life. Turing was a theorist, but he couldn't achieve his objective of creating a more efficient version of the Bomba alone. He and Gordon Welchman combined with an Oxford engineering team and created the first Bombe machine. It was not precisely a computer as one still needed to feed the machine a section of code guessed at manually, but Bomba machines could check thousands of possibilities in minutes.

In high school, math seems almost completely unrelated to the world at large. You can barely step into a precalculus classroom without hearing "How will this help me in the real world?" We all want our hard work to mean something more than a number on a test. It was amazingly coincidental that while I was researching how probability was used at Bletchley Park, we had just begun our Combinatorics and Probability unit in precalculus. At Bletchley Park, mathematics and problem solving meant lives saved. Churchill believed that the work conducted at Bletchley shortened the war by two years. Many others believe that the war could not have been won without

the park. It is often said that Bletchley was present at every famous battle in the Second World War, stealthily swaying the balance.

The most confusing part of this project was the creative part. For mine, groups of five had to use a tinfoil and pool noodle Enigma machine to decipher the location of their next checkpoint. It was exactly *The Amazing Race* and it certainly wasn't life at Bletchley Park, but teams had to work together to solve problems under pressure, which was my goal.

The world is composed of dichotomies. You're a naive child or a sophisticated adult. You're a dreamer or a realist. You're a mathematician or an artist. Bletchley Park unabashedly disregarded these constraining labels. Academics, translators, debutantes, actors, novelists, athletes and even chess enthusiasts were recruited to aid their country. Major operations included but weren't limited to university students or graduates. Some of the greatest breakthroughs during World War II were interdisciplinary collaborations of many kinds of thinkers.

This project taught me that I already was a mathematician.

I knew before this project that I wanted to be a mathematician. I knew that I loved numbers and I knew that solving a difficult problem made me irrationally happy. This project taught me that I already was a mathematician. Math never was about numbers or formulas on a page. Math has always been about humans solving problems. All of those countless symbols, complex equations and abstract theories have been about the human race learning to understand and manipulate the world around them. So maybe it was weird that I found my passion for mathematics studying people and civilizations and revolutions, but maybe it wasn't that weird at all.

Armand Doucet is a passionate and award winning educator, leader and business professional with a unique combination of entrepreneurial, teaching and motivational speaking experience. He recently received the Prime Minister's Award for Teaching Excellence as well as a Meritorious Service Medal from the Governor General. He is the creator of www.lifelessonlearning.com which leads the way in placing skills development on equal footing to curriculum content in the classroom.

Jata MacCabe is a self-proclaimed math dork who is equally talented in the classroom as on the improv stage or rugby field. As a Grade 12 student this year, she is looking to pursue a career in math while still being passionate about many other subjects.

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