

Olivia Buckiso

Buckiso 1

Professor E. Hemmer

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Subtracting Algebra From the Equation: Should the College Algebra Requirements be Changed?

Growing up, many students unofficially brand themselves as ‘math people’ or ‘english people’. As they grow older, this distinction turns into those who are more skilled in STEM and those who strive more in the humanities. By the time high school is over and the focus turns to college, those who are not deemed ‘math people’ and have chosen a major not on the STEM track, feel relief to never have to deal with the mental torture that algebra caused them in high school. However, they are rudely awakened when they get their college courses and find themselves right back where they started; staring straight into the daunting eyes of algebra. The article “Against Algebra ” written by Temple Grandin tackles this conversation about higher levels of math being required for all majors in college, not just STEM, and how this is creating major setbacks and barriers for students trying to achieve their goals. Grandin herself is an autistic professor of animal science who received her bachelor's degree in psychology from Franklin Pierce College, her master's degree from Arizona State University and her doctorate in animal science from the University of Illinois at Urbana-Champaign. She later went on to teach animal science at Colorado State university. Given her background, ethos is well established (Britannica). Her article dials into her own background, her experience with math in her education and also acts as a call for action on this topic. Grandin is strong in her desire for a change to help future generations and overall improve the well being and education of those to

come. This article highlights the struggles of those who may have had roadblocks in their education experience with various disorders such as autism and also those who fall victim to the educational system that does not fully take into account individuality and varying approaches to learning. This issue is very relevant at this point in my life as I am part way through my first semester as freshman in college and have to deal with the stress of being on track for my major, while potentially running into any challenging courses that may or may not be critical for my education. Her argument is obviously relevant in society in general, but it feels especially relatable and important to recognize as I enter this phase of my life. Grandin uses the various rhetorical appeals throughout the entirety of her article to heighten the urgency and relevance of her argument.

As mentioned before, Grandin's ethos is partially supported by her educational background. Given that she is certified in various areas, she is deemed as a trustworthy person. In her article, she uses these titles to her advantage to make her points with an extra sense of credibility. She strategically establishes her own credibility very early in her article when she says that "as a professor of animal science, I have ample opportunity to observe how young people emerge from our education system to further study and the world" (Grandin). With this word choice and sentence structure, she encourages the audience to rely on her knowledge as a professor in the field to set the notion that she is well versed and reliable. She does this same tactic a bit later in her piece when she is talking about a change in a specific educational system. She said, "established by this time as a professor at Colorado State University and a consultant, I was in a position to see the difference," which is worded in a specific, targeted way (Grandin). Her intention with this choice in language was to create a certain power dynamic with the audience in which she holds the knowledge they are seeking and she has the utmost wisdom and

opinion in this instance. She shows that as the holder of the position, it specifically deems her with a higher, more insightful perspective on the issue. Beyond her own credibility, Temple Grandin also makes sure to incorporate other people with credible titles that share similar opinions on this conversation. These two people she references are a transplant surgeon at the University of Illinois and a writer for the New York Times, Kate Murphy (Grandin). Again, Grandin makes sure to introduce these women with their titles from reputable programs and positions. With all of her tactics combined and woven throughout the majority of her article, her audience is constantly reminded of the sensible, educated people who are behind the opinions she shares.

Moving on from the baseline of just Grandin's credibility, she also uses logos to support her stance. This is critical in her article because the numbers in statistics do not lie and in fact prove that she is not going out on a whim for an irrelevant topic. Grandin's opinion that the education system does not adhere to different people's capabilities and learning approaches is backed up by various statistics and other strong ideas. She lays down the baseline of math and how, at its core, speaks to specific people differently and how that negatively derails them from a specific path, even though that should not be the case. She states that it is most obvious in the teaching of math, "where we persist a rigid approach that rewards those who 'get it' and leaves the rest- including those with the very kinds of minds our economy and our future most desperately need- with a sense of profound failure" (Grandin). This point gets at the basis of her argument and shows the flawed system that leads those who think differently to believe that they have failed and cannot achieve their goals simply because they cannot follow the "rigid" approach of math. The inclusion of this point could also apply to the appeal of pathos. She recognizes a specific audience that will feel seen as she describes a certain dynamic that the

system fails to accommodate, specifically in regard to math. Another numerical statistic she uses is also very telling. Grandin paints this statistic by sharing how a previously titled dean of the UC Berkeley School of Law has ideal plans for getting rid of the required algebra courses for people who are not STEM majors since they are “largely arbitrary” in order to move closer to a solution for the equity gap and low graduation rates (qtd. in Grandin). She then immediately adds the statistic that out of 170,000 California community-college students “placed in remedial math on the basis of a standardized test, more than 110,000 will not complete the requirements for getting an associate’s degree or transferring to the University of California or California State” (Grandin). With this approach, she provides information from someone with an educational authority status and backs it up with the real numbers. Overall, this inclusion shows just how necessary she believes change is in this situation since it reveals how many students are affected by this educational system.

Grandin also does an excellent job of providing real numbers with the claims she makes which deepens her point by simultaneously making the connection between the statistic and her argument. For example, she notes that the approach taken with math not only failed to guide students finding their footing in the world, but also keeps them failing academically: “By 2017, two-thirds of community-college students and one-third of four-year-college students needed remedial math” (Grandin). She takes this even further by immediately including the detail that “maybe the decline in performance points to a deficiency not so much in how well students master material, but in what we are asking them to master” (Grandin). The inclusion of this statistic shows that she is not up playing her own opinion and making it seem more relevant than it is. The statistic reflects the performance of real people who are having real struggles. It is especially important since it provides the numbers and also brings up a pressing question of

whether the difficulty of the content is truly necessary for everyone. The overall layering of this statistic is especially effective because she makes the connection between the numbers and the actual situation, which makes all the difference in her point. She challenges the meaning of the statistic in a way that still emphasizes the pressing matter in her argument. She does this again when she refers to the statistic that “only 37 percent of 12th graders can do the math needed to start college—we see renewed calls for ‘higher standards’” (Grandin). She breaks down this data and dissects it to its core to make it the most effective in her article. Grandin says that these “‘higher standards’ translate into more bubble filling, when what kids actually need is engagement with real-life projects” and that the systematic flaw over the past 20 years is the way that “the more students fail math, the more math we throw at them, and the more we test them.” By structuring her logistics in this way, she reveals the complex, defective cycle that the education system has trapped its students in and how deeply it impacts them. Grandin knows how to use these numbers to her advantage and dig deep to find the root of the conflict at hand in order to show her audience where and why reform is needed.

While logos is a prominent strength of Grandin throughout her article, she also shows skill in her appeal to pathos. In general, she provides solid evidence that reflects the suffering that this rigid approach to math causes for the young minds at hand. One quote from political scientist, Andrew Hacker, blatantly and powerfully states that requiring math actually “prevents us from discovering and developing young talent” and, further, “in the interest of maintaining rigor, we’re actually depleting our pool of brainpower” (qtd in Grandin). By portraying the situation in this manner, Grandin reveals the root of this flawed system and how much damage it is truly causing in society. This emotion provoking perspective is really eye opening for the audience and the connection between this specific rigorous path to the destruction of the

brainpower in society is crucial for making this point so effective. The passion in this point is very clear and maintains its presence when she makes a similar connection. Grandin references a segment from Paul Lockhart's paper, "A Mathematician's Lament," where he shares his intense interpretation on this matter. He says "If I had to design a mechanism for the express purpose of destroying a child's natural curiosity and love of pattern-making, I couldn't possibly do as good a job as is currently being done—I simply wouldn't have the imagination to come up with the kind of senseless, soul-crushing ideas that constitute contemporary mathematics education" (qtd in Grandin). While this quote is quite lengthy, every word is a dagger to the heart of math and shows the audience how passionate, and even angry, Lockhart is in regard to this topic. The audience has no escape from his overpowering wave of emotion that pours out from this segment. Grandin's selection of evidence is perfect and is a straight segway to appealing to the pathos of her audience.

In addition to portraying other people's evidence to connect to pathos, Grandin's transparency and self reflection to master pathos makes her argument even more cohesive. It is crucial to prioritize pathos when persuading an audience to build an authentic connection, which is exactly what she does. Grandin is very transparent with her audience and upfront about her learning struggles with autism. She shared that she did not talk until she was 4 years old and did not read until she was 8 years old, even with heavy tutoring to help guide her, and that she has always seen the world in a different way (Grandin). She also says that coming from someone who is both autistic and a visual thinker, she is constantly reflecting on the rigid lines of education that cannot account for the diverse, learning minds that are essentially being shut down (Grandin). By being so honest and upfront about herself to her audience, they can feel more inclined to trust her, as she is not being pretentious or hiding anything about herself. She establishes that she understands what it is like to not be able to fit through the narrow hoop that others have already deemed the one correct way such as the approach with algebra. She frames this due to her autism, but she does not limit her message to all other people with autism. Grandin makes a pivotal call for action for anyone that the education system is failing. Her own personal reflection also puts her in an emotionally vulnerable position with her audience. She begins by saying that she cherishes the way she sees the world, even if it sets her apart from others because it is what makes her uniquely herself. Further, she explains that "no two people have the same intelligence, not even identical twins. And yet we persist in testing-and teaching-people in the same way" (Grandin). Grandin really drives the point home when she concludes with the statement that we don't "need Americans to be better at algebra," but we need a system that can help develop kids to "grow up with the imagination to invent the solutions to epidemics and climate change. When school fails them, it fails all of us" (Grandin). Again, this is

another excellent, powerful claim by her. The urgency in this point is really important, as she furthers the argument beyond just the learning kids. She directly addresses a broader audience to show that this flawed system negatively affects everyone regardless of their role in society and that if they want to succeed and operate in a functional society, change is necessary as soon as possible. This is also an effective example of kairos. Given her solid evidence to show why this is important for the students who are learning, her extra step in extending it beyond the classroom is done in a timely manner which makes it even more impactful. Once again, Temple Grandin's strategic use of evidence and her attention to detail when appealing to pathos elevates her article on an untouchable level in which her argument's validity is maximized to the best it can be.

Op Ed:

Getting rid of algebra for non-stem majors raises the pressing question of the general intelligence of our future generations and future workers. If we eliminate this level of math, there is concern about the potential for the students that are missing out on the benefits of this higher level math. Also, for as long as I can remember, I have always been told that math is in everything and will be necessary for anything one might do in their future, whether it be professional or personal. This is ingrained in the minds of young kids from the time they first learn math and follows them as they progress through their schooling experience. Furthermore, one could question if taking the math requirement away would make certain individuals less qualified for jobs, and thus put at a disadvantage, when facing the real world. Most of those points are valid concerns, but the solution is not to enforce high level math for non stem majors. To clarify, I am not suggesting "dropping things like basic or quantitative skills" because "math is important" (qtd in Grandin). However, it is important to recognize that there are "different kinds of math and different kinds of learners and different kinds of real-world applications" and it

is more important to focus on “what will help students down the road in their career” (qtd in Grandin). Algebra, for those not pursuing STEM, is clearly not helping these students actually achieve their goals. Before they even get to their careers, algebra creates barriers along the way. It has given itself the reputation of being the “gatekeeper to mathematical literacy,” which is not only academically discouraging, but also personally challenging (Strauss). Further, it is the “single most failed course in high school, the most failed course in community college, and, along with English language for nonnative speakers, the single biggest academic reason that community colleges have a high dropout rate” (Strauss). That alone shows the negligence in the education system in regard to algebra. It does not account for the people who struggle and need a different way to achieve better comprehension. Clearly, there is a substantial amount of people struggling, so there is no reason that reform can be deemed unnecessary or extra. Algebra creates an unnecessary barrier to success.

Algebra proves to be limiting in earlier education, but it also keeps people from their achievements and creates extraneous stress. Peggy Worthen, wife of former BYU president, was earning her bachelor's degree at Brigham Young University in her 40s but almost failed to do so because she did not pass her algebra exam at first (Strauss). It has even been said to be a “dream-killer” for people who are seeking these degrees but are stumped and held back by the mandatory algebra requirements (Strauss). Even Grandin herself fell victim to this. In her occupation, she teaches veterinarians though she could not get into veterinary school because of the math requirements (Grandin). Other courses screened her out of veterinary school and she had to choose majors with lower math requirements just in order to follow through with her goals. Meanwhile, “less than a quarter of U.S. workers report using math any more complicated than basic fractions and percentages” throughout their time working (Weissmann). In all stages

of life, the rigid approach to algebra teaching holds people back even though it does not need to be that way.

I may only be part way through my freshman year in college, but even I have fallen victim to the exclusive math requirements. I am a business major, specifically business management, and I am required to pass business calculus. I knew this would be difficult for me as I have always struggled with math. However, I did not know it would initially be largely algebra based with an extremely quick pace that lacked depth. Along with most of the people around me, I immediately was confused by the content my professor was teaching. I had learned some of it before, but as I said, math has never been my strong suite. Unfortunately, when my school shut down during the pandemic, most of the following academic year was also virtual. This meant that I had to learn Algebra II online through zoom. I am sure this has contributed to my struggles with math as I progressed through my schooling, but I am also sure that I am not the only one who was impacted this way. Coming to college and having to experience that information at a fast pace, surface level lessons, and complex homework assignments that were never reviewed by my professor was a shock to say the least. The other majors here at Virginia Tech have to complete an ALEKS assessment to determine what math level they should be in. As a business major, that was not an option. The majority of the math we were learning did not even correlate with business. According to the Dean's Annual report for Pamplin, as of 2022 there were around 5,257 undergraduates in 2022. Each of those individuals were required to pass business calculus at some point in their career since it is a requirement to take other math related courses. None of those individuals had a choice, and if they wanted to follow through with pursuing a business degree, they were forced to take business calculus with no placement test to assess their ability.

I, along with several other students that I know, had to go through with dropping this math course because I was at risk of failing. Being thrown into this algebra based course with no warning and indecision of its difficulty left me drowning in the work. I tried to get a tutor and even that was not enough. My anxiety was at an all time high and I called my mom, breaking down in tears, several times to try to find a way to make it through this course. The mental toll it was taking on me was very heavy and could have been avoided. With all of these issues combined, there is a clear solution to this situation. Most of the other majors have to take placement tests and business majors should also have to take one. Allowing students to take a placement test can ensure that they will not be forced into a course that exceeds their abilities. There could also be optional work provided over the summer, prior to taking the course, so at least those who are weaker in the content can attempt to prepare themselves better. Offering several introductory 'business' math courses could also help avoid the issue of forcing everyone through one narrow path or even having a specific test for business majors to be placed into these courses. The process should not be exceedingly difficult, seeing as it has already been done for other majors. Overall, all of the students at Virginia Tech should be given the opportunity to be put in a course that matches their ability to save them from experiencing a downfall in their self-esteem and academic performance.

Reflection:

This paper was really intimidating at first and honestly throughout the process. I am not super confident in my work because I was so unsure the entire time I was writing. I had solid ideas, but I wasn't sure if they answered the assignment correctly. I feel very accomplished to be done with the assignment, but am nervous to get my grade back. This project was definitely a lot of hard work and I feel like I learned a lot about the topic and also my own work ethic.

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