Calculus: A Brain-STEM Approach

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Abstract

In today’s post zombie apocalyptic world, higher education faces immense new challenges, and novel solutions to these challenges are needed if we as teachers want to orchestrate process-based living documents. We report on our recent experiences in teaching Freshman Calculus to a student population that contained a significant percentage of zombies ($\geq 30\%$), as part of the Universities outreach program to help integrate the undead into a traditional 4 year BA/BS programs. This is a dynamic problem with challenges never seen before in traditional educational settings. For one thing, unlike most college courses, discipline becomes a major issue. Additionally the zombie populations itself was in flux across the various sections throughout our study. In most sections the percentage of students that were undead changed drastically - in some soaring up to 100%, while in others plummeting to 0%, making the usual practices of measuring outcomes from learning objectives difficult to impossible. In some cases, the instructors themselves became undead; in most of those cases, data was lost, with the exception of a few bloody, soiled notebooks.

1 Introduction

As the number of undead that walk the Earth increases exponentially [1], it would seem appropriate for traditional universities to make an effort to integrate those undead which qualify into existing academic programs. The alternative of creating separate universities, or programs within universities solely for the undead results in isolation of undead students which we feel leaves them feeling fenced-in and with a hunger for knowledge that is somehow not satisfied. Additionally, such approaches do not expose the typical zombie student to the advantages, challenges and social contracts that living students experience. While we have seen a remarkable increase in the zombie population in general, the undead lack basic social and networking skills, creating a “steel ceiling” in the work place.

Establishing life-long learning skills in the classroom only makes sense as a goal if the students are alive. We wish to find to find the appropriate rubrick for undead learning and then and enhance those skills by integration with the living.

Yet the challenges of teaching the undead are considerable. Few undead, if any, seem able to benefit from the traditional lecture format used in mathematics, and most classrooms are not equipped with the restraints needed to
Figure 1: Sample student work. Zombie presence is strongly correlated with poor student performance on traditional in-class exams, suggesting that take-home exams would be more appropriate. In cases such as this one, the student performed well, but was unable to complete the course work due to personal reasons.

force them to. Constant interruptions in the classroom are a major theme when teaching diverse living/undead populations: interventions by university security, the sounds of gunshots and screams, and oozing blood and the smell of rotting flesh make it difficult to create and sustain a nurturing learning environment where a student can feel safe to ask a question and express intellectual curiosity. See Fig. 1 for an example of high quality student work that was negatively impacted by zombie activity.

2 Neuroscience Background

Student zombie brain function is fundamentally different from that of living human students. In particular, zombies don’t have working brains. This makes it hard for them to learn. They do have active brain stems though. These facts should be always kept in mind when teaching the undead. In particular, we used a draft of a textbook especially written for this course
by our team entitled *Calculus: A Brain-STEM Approach*. The two-track approach of the Brain-STEM approach is to encode calculus a lá Gödel [2] in a series of grunts and moans, thus putting mathematical analysis within reach of the living dead, while at the same time allowing traditional students a new viewpoint.

3 Assessing Student Outcomes

When designing assessment tools to include a zombie cohort, one must bear in mind the unique worldview of the zombie. For example, the design of multiple choice questions may require non-traditional types of distractors. For example consider the following multiple choice question:

1. If \( y = -3x^{12} - \frac{4}{x^2} \), what is \( \frac{dy}{dx} \)?

   (a) \( 36x^{11} - 8x^{-3} \)

   (b) \( -36x^{11} + 8x^{-1} \)

   (c) \( -36x^{11} + 8x^{-3} \)

   (d) \( \text{Aaaargrrraaarrraarrgrrrrrrrrggrrr...} \)

   (e) \( 36x^{11} - 8x^{-1} \)

In such cases we expected a disproportionate number of zombie students to choose (d), but this was never shown to be true, since most zombie exams were illegible due to being covered with zombie “slime”, suggesting that new metrics for student achievement be developed.

4 Student Feedback

Students were solicited for their comments at the end of the term and without going into a statistical analysis, it suffices to say that the student response was mixed. A question that faculty at our university put heavy weight on is “Would you recommend this class to a friend?”. Below are some sample responses:
1. “No because it was really hard to pay attention all term during lecture because of this creepy guy from my dorm who always sat handcuffed right across from me.”

2. “Overall a pretty good class. I’d recommend it to a friend. Except that my friends are all dead.”

3. “Absolutely. The professor really really cared about the students. And I am not exaggerating, one time he had to barricade the door since the building had been overrun by a herd and the students were all cowering under our desks.”

4. “AVOID at all costs. I took this class in HS and my teacher was way better. This professor was always going off on tangents about where it would be safe to sleep and sobbing about his dead wife. And he wore the same clothes every day.”

5. “No big deal, come to class, do the homework and it is an easy A if you make it to the end of the term.”

6. “The book was terrible but I got this other book How to Survive Calc that was really useful.”

7. “I can’t believe I paid money for this. Online lectures would have been much safer but my tent doesn’t have any electricity.”

5 Conclusions

While many of the students who initially registered for the course did not complete it, student popularity is not the only outcome that should be mapped in this mixed cohort. Those students who did complete the course experienced something unique and a common sentiment expressed was that it was experience that they would unable to forget for the rest of their lives.

Additionally our experiment was an important first step in the direction of making zombies stakeholder’s in the development of their own higher-order thinking. Despite the setbacks, we feel that improvements in firearms, restraint technology and biohazard safety clothing that are on the horizon will help to make zombie attendance in calculus a commonplace event.
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References
