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# **A Failed Context: Reflections on a Mathematics Role-Playing Game about the Flint Water Crisis**

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**Abstract:** We designed a role-playing game based on the Flint Water Crisis for a quantitative reasoning course. While the context seemed perfect both in terms of local engagement and in terms of highlighting the power of the mathematics learned in the course to fight for justice, it turned out to be fundamentally flawed.

## **Introduction**

Quantitative reasoning involves habits of mind which are critical for the functioning of a democracy in the 21<sup>st</sup> century. (Steen, 2001). Ferris State University (Ferris), a mid-sized comprehensive public rural university in Big Rapids, Michigan, offers a course called Quantitative Reasoning for Professionals. Through collaboration with partner disciplines supported by the National Science Foundation under a grant entitled SUMMIT-P (<http://www.summit-p.com>), we developed role-playing games for the course.

The game mechanics were modeled after Reacting to the Past (<https://reacting.barnard.edu/>) (RTTP), a pedagogy that has been proven to inspire student engagement, thinking, and habits of mind. (Carnes, 2018). RTTP games are based on historical figures and events. The mechanics involve assigning students character roles with their own individual goals (“victory conditions”). The characters are grouped into teams, called “factions,” each of which also has victory conditions. In their characters and factions, students collaborate, prepare and deliver arguments, and take votes on decisions on the great historical questions of the game. These decisions determine most character and faction victory conditions. RTTP has proven to be a powerful and effective pedagogy (see, e.g., Stroessner, Beckerman, & Whittaker, 2009; Albright, 2017; Gasper-Hulvat, 2018; Joyce, Lamey, & Martin, 2018). RTTP has been used in quantitative reasoning courses before (Curran et. al., 2012) so the idea was not untested.

We designed two games. The first is intended to be the course opener, used in the first week. The second was to be the conclusion to the course at the end of the term. As such, the first game should have had few to no mathematical prerequisites while the second game should include a selection of the content from the course. The introductory game was based on a budget crisis at a rural health clinic and has been anecdotally successful so far (see Piercey, 2022). The second game was based on the Flint Water Crisis.

## **The Game**

The story of the Flint Water Crisis is told in Hanna-Attisha (2018). In short, the State of Michigan imposed an unelected emergency financial manager on the City of Flint. The emergency manager chose to save money by switching the source of Flint’s water supply from the Detroit River to the Flint River, and this choice led to unhealthy quantities of lead in Flint’s drinking water.

The central tension of the game we designed was between costs of cleanup and the time until the water had sufficiently low lead concentrations. The faster the remediation, the more expensive the process was. One faction was a committee formed by the State of Michigan, most of whom wanted to control the costs. Another faction was a group of advocates, who wanted the fastest remediation method. The

third faction were City Council members, each of whom represented a different geographic region in Flint and had divided loyalties and motivations. The Emergency Manager was also a role that wasn't part of any of the factions.

During gameplay, students would meet in factions to prepare their arguments. When a faction thought they were ready, they would take the initiative and deliver their proposal and argument, and students would debate. Eventually there was a vote on the proposal. Only the City Council voted. If the council voted in favor, the proposal was recommended to the Emergency Manager. The Emergency Manager was the only character to have a decision on adoption. Victory conditions depended on adoption, and as such, this decision process introduced democratic limitations both through representative organs (the City Council) and through the Michigan Emergency Manager Act.

### **The Problem**

This context appeared to be a perfect fit. This was a local problem involving injustice that could be addressed with mathematics. Given the chemical nature of the problem, we saw an opportunity to use exponential functions. Remediation costs could be a linear function of time. Linear and exponential functions are the two pillars of the content of the course. What's more, using their knowledge from the course, the students could set up a spreadsheet ahead of time, with formulas from the algebraic modeling built into the workbook. This illustrates the power of algebra – students could simply change raw data in the spreadsheet to test their theories and make their arguments.

Unfortunately, the context turned out to be a fundamental failure. Students who come from Flint take the course. The problem is still ongoing and is very raw for some students and some in the community. While there weren't any student complaints, the comical way some students approached their roles appeared to trivialize the crisis. For example, during one game, a student adopted the characteristics of a black preacher and delivered speeches with music in the background, all played for laughs. As another example, a student comically adapted the Declaration of Independence. In the end, it felt to us like the people of Flint were tokenized in the game.

### **Concluding Thoughts and Future Goals**

Finding the right context for a role-playing game can be a delicate balance. One must address the desired content, select a context that is exciting and motivating for the students, yet one in which there is also sufficient emotional distance.

We are now considering preparing a replacement game based on Chernobyl. Modeling exponential decay along with linear evacuation rates fit well into the scenario, and settings can take place in the Politburo or the Central Committee of the Communist Part of the Soviet Union. There are justice issues related to the treatment of Ukraine by the Soviet Union, issues that have returned to the headlines in 2022. However, given the invasion of Ukraine and the possibility that Ferris could admit Ukrainian refugees, this idea may suffer from similar flaws.

### **Acknowledgements**

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