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INTRODUCTION

- Generation Z, or students **born after 1997** are the majority in today's college classrooms ([1]–[3]).
- Compared to Millennials, Gen Z grow up immersed in technology, regularly play video games, have an even shorter attention span, and prefer engaged and interactive learning ([4]).
- **Gamification is the use of game thinking and game mechanisms** such as points, levels, challenges, leaderboard, badges, or even rewards in a non-game context to engage learners in solving problems ([5]–[7]).

CLASSROOM SETUP

- The engineering graphics course covers freehand engineering drawing, fundamentals of computer-aided design (CAD), CATIA.
- Classes meet in a computer laboratory twice a week for one hour and forty-five minutes each.
- Students were **required to study materials posted online before coming to the class**, per a flipped-classroom arrangement.
- Online materials included videos, audios, PowerPoint files, and interactive study developed under Rise 360 by Articulate.
- Students' final weighted grade is determined by homework (20%), online quizzes (5%), class participation (10%), final project (20%), and three in-class tests (45%).
- **With the gamification, students can earn points through various online and classroom activities** for up to 3% bonus to their final grade.

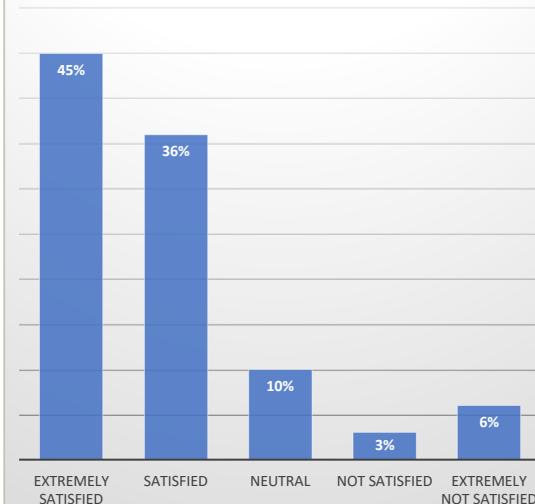
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GAMIFICATION METHODS

- **Online Interactive Study:** To encourage success in the flipped-classroom arrangement, students can **earn up to 2 points** if they earn at least 80% on the quizzes within the interactive studies before class.
- **Online Quizzes:** After the online study, students take an online quiz to formally test their knowledge. Students can **earn up to 4 points for completing the quiz before the class time** with a score of 60% or higher. They can have 3 attempts on the quiz, with the highest grade recorded in the gradebook.
- **PollEverywhere.com Individual Competition:** To encourage individual competition, students can use computers or cell phones to answer multiple-choice questions with **points earned for each correct answer, plus more points for answering quickly**.
- **The total points earned from all the gamification activities were tracked and regularly updated on Canvas.**
- The top three students were posted on a leaderboard at the end of each month on Canvas to encourage continuous competition.

Gamification Points Student Satisfaction Survey



RESULTS

- As seen in the graph, **most students were extremely satisfied or satisfied with the gamification points system**.
- Of the activities, the online **interactive study and online quizzes** were the most highly rated by the students.
- The **leaderboard was the least favored** part of the gamification system. One student said, "I did not like the leader board, it tended to feed peoples ego's making it not fun and making it so I was less motivated to try and win." Toda et al [8] did an overview of negative effects of gamification in education and pointed out that **leaderboards are strongly associated to the loss of performance**.