Design and Implementation of Calc-ONE: A Gamified Approach to Reinforce Calculus Concepts

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Abstract*— This innovative practice full paper describes Calc-ONE, a card game designed to reinforce calculus concepts. In Latin America, there is a common misconception that mathematics is a complicated topic; this generates many paradigms deeply rooted in students. For some time now, different efforts have been made in the design and implementation of active teaching/learning methodologies to increase the academic performance, retention, and intrinsic motivation levels of engineering students in mathematics courses. Introducing gamification into a mathematical engineering course that covers topics such as calculus in various coordinate systems, including polar and parametric representations, holds significant importance. By integrating gamified elements such as interactive exercises, challenges, and rewards, educators can enhance student engagement and motivation. It is well-known that gamification can make abstract mathematical concepts more accessible and enjoyable, encouraging active participation and deeper learning. Furthermore, it fosters problem-solving skills, critical thinking, and perseverance, which are essential for success within engineering. Ultimately, gamification transforms the learning experience, making it more dynamic, interactive, and effective for students pursuing mathematical engineering degrees. Inspired by the popular game Crazy Eights, a simple and flexible shedding card game, where participants begin with a set of cards, aiming to be the initial player to eliminate all cards from their hands matching pairs, we developed Calc-ONE, a unique version adapted specifically for reinforcing concepts in both differential and integral calculus across various coordinate systems. In Calc-ONE, players find cards containing exercises and conceptual questions covering different topics, including curves represented in parametric and Cartesian equations, derivatives, areas, arc length, surface area for curves in parametric and polar coordinates, and conversions between polar and Cartesian coordinates. By leveraging the engaging and interactive nature of the Crazy Eights game, Calc-ONE provides a dynamic platform for students to practice and solidify their understanding of calculus concepts. Its adaptability guarantees that it effectively reinforces fundamental mathematics concepts while making learning enjoyable and effective. The design of Calc-ONE aligns with the constructivist modeling methodology for the design of educational card games and the main course objectives. Thus, each game component is adapted to address specific learning outcomes. The initial feedback from students regarding Calc-ONE has been overwhelmingly positive. More precisely, the qualitative results obtained through structured and semi-structured interviews showed that students agreed that the game provided a fun and engaging way to review and reinforce different calculus concepts. In conclusion, the design and implementation of Calc-ONE offer a promising gamified approach to enhance student engagement and understanding of calculus principles. Further research and evaluation will continue to refine and optimize the game for maximum educational impact.

Keywords—gamification, mathematics, card games, motivation

I. Introduction

Critical thinking heavily relies on a solid foundation in mathematics and encompasses essential competencies for engineers, including comparison, reasoning, analysis, making connections, and problem-solving. Unfortunately, data suggests that many students in Latin America need more exposure to develop these crucial skills [1]. Conversely, most adults do not hold fond memories of their experiences with mathematics during their school years, often recalling it as a complicated and confusing subject. Regrettably, this negative perception of mathematics and resulting frustration is quickly transmitted from adults to children [2].

As evidenced by the results of the mathematics standardized tests administered by the Ministry of Education [3], Guatemala is not exempt from the above-mentioned problem. Despite efforts to enhance the quality of mathematics education, significant progress is still needed. This lack of a strong background in mathematics poses the first obstacle for many students pursuing engineering or any STEM major. In addition to encountering difficulties in their foundational education, students also struggle internally with paradigms associated with numerical courses. Our role as educators is crucial in addressing these challenges and improving mathematics education in Latin America.

In recent years, various efforts have been made to design and implement active teaching/learning methodologies to enhance engineering students' academic performance and intrinsic motivation levels in mathematics courses. In engineering

education, we leverage a rich toolbox of active learning methodologies, including team-based learning, project-based learning, gamification, and the flipped classroom approach. This paper focuses on *gamification*, which involves integrating game elements into non-game contexts to enhance engagement, motivation, and learning outcomes [4]. It is worth emphasizing that *game design* is one of the cornerstones of gamification. In [5], Quevedo defines game design in the context of education as the art of applying design and aesthetics to create a game for formative and entertainment purposes.

Gamification is vital in mathematical engineering courses because it can enhance student engagement and motivation. Integrating gamified elements into the class, such as interactive exercises, challenges, and rewards, not only enhances learning outcomes but also has the potential to create lasting positive memories for students. By transforming the learning experience into an engaging and enjoyable activity, gamification helps to break the paradigm that learning math is tedious and difficult. It is well-known that gamification can make abstract mathematical concepts more accessible and pleasant, encouraging active participation and deeper learning. Furthermore, it fosters problem-solving skills, decision-making, and perseverance, which are essential for success in engineering [6,7]. In summary, in this case, gamification transforms the learning experience, making it more dynamic, interactive, and effective.

In this paper, we introduce the first edition of Calc-ONE, a card game inspired by the popular game 'Crazy Eights,' which is the foundation for the widely-known game 'UNO!™'. Calc-ONE is an innovative educational game that reinforces differential and integral calculus concepts for curves represented in Cartesian, parametric, and polar forms. These topics are essential components of MATH 203, a second-year mathematics course for engineering students. Given the challenging nature of this course, where the analysis of plane curves in parametric and polar equations demands a strong calculus background, the introduction of gamification to facilitate student understanding and enhance their learning experience is deemed crucial.

Educational card games offer students unique opportunities to engage with complex learning processes at various difficulty levels. This approach is consistent with the long-standing recommendation that students develop a solid understanding of mathematical concepts through gameplay before tackling more abstract ideas [8, 9]. Examples of card game implementations in mathematics courses at all levels include titles such as 'Make 10', 'Barathayudha War Story,' 'Uno Stacko,' 'Logarithms and Index Learning Games,' and 'PrimsAR,' among others [10, 11, 12]. To the best of our knowledge, Calc-ONE is the first card game to exploit the 'matching structure' of Crazy Eights, providing a dynamic platform for students to practice and solidify their understanding of calculus principles for plane curves represented by parametric and polar equations.

We used qualitative research methods to assess the effects and overall experience of integrating the gamified element Calc-ONE into our course MATH 203. The initial feedback from students regarding Calc-ONE has been overwhelmingly positive. The results obtained through sentiment analysis [13] of the transcripts of structured and semi-structured interviews revealed that students agreed the proposed game provided a fun and engaging way to review and reinforce various calculus concepts. This analysis indicates that the design and implementation of Calc-ONE offer a promising gamified approach to enhance student involvement and understanding of the course.

The rest of this paper is structured as follows: Section II provides context by outlining the details of the course MATH 203. Section III is devoted entirely to presenting the game design and mechanics of Calc-ONE. Section IV discusses the qualitative results. Finally, Section V concludes and outlines our future work.

II. Theoretical Framework

A. About Math 203

MATH 203 is a second-year engineering course that continues the sequence of study from the previous two mathematics courses. It delves deeper into the study of differential and integral calculus of functions of one real variable, following a more comprehensive approach and providing a more detailed analysis of the subject. This course is divided into five units following the Active Topic Centered Learning (ATCL) methodology introduced in [14]. The first two units introduce the geometry of plane curves, their analysis, and their parametric and polar coordinates representations. The third unit covers indeterminate forms, L'Hôpital's rule, and improper integrals – tools necessary to study series. The fourth unit of the course focuses on the study of infinite series and their convergence, the representation of functions by power series, and its different applications in science and engineering. The course's last unit is dedicated to introducing vector language and its basic operations, setting the language to study vector functions in the following mathematics course. Therefore, the main objective of MATH 203 is to reinforce the students' understanding of differential and integral calculus and apply it to the solution of diverse problems within engineering.

The proposed game is focused on helping students consolidate the concepts studied in the first two units of MATH 203. At the end of these units, we expect the student to be able to (i) understand how parametric equations can be used to describe curves in the plane by expressing the coordinates of a point in terms of an independent parameter, (ii) use polar coordinates as an alternative coordinate system, facilitating the description of particular curves in the plane by using a radial distance and an angle, (iii) find the corresponding cartesian representation of a plane curve (when applicable) described in polar coordinates or parametric equations, (iv) effectively apply differential and integral calculus tools in the context of parametric equations and polar coordinates, enabling the calculation of slopes, areas, arc lengths, and other geometric properties of these curves, and (v) utilize parametric equations and polar coordinates as powerful tools for solving real problems in science and engineering. By focusing on these objectives, units 1 and 2 of MATH 203 aim to empower students with a strong background in calculus within the context of parametric and polar equations, providing them with essential tools for success in further mathematical studies and other engineering courses.

B. Calc-ONE Game Design and Mechanics

To accomplish the MATH 203 objectives outlined above, we developed a novel gamified learning tool called Calc-ONE, inspired by the popular card game 'Crazy Eights.' Calc-ONE is designed to engage students interactively and enjoyably while strengthening their understanding of parametric equations and polar coordinates. It is essential to mention that this gamified approach does not aim to replace traditional educational resources such as lessons, worksheets, and evaluations, among others. Instead, Calc-ONE is an innovative instructional material, offering students an alternative way to practice concepts, develop operational skills, and reinforce learning while participating in a dynamic in-class activity. The integration of Calc-ONE into the course allows students to learn calculus in a fun and engaging manner, thus encouraging deeper comprehension and enjoyment of the topics under study. Calc-ONE is an innovative educational card game typically played by two or three students. As stated above, it is designed to boost calculus concepts, specifically those dealing with curves represented by Cartesian, parametric, and polar coordinates. This section introduces the game mechanics that make Calc-ONE a practical learning tool.

1) About "Crazy Eights"

Crazy Eights is a well-known card game whose goal is to be the first player to get rid of all your cards. Actually, the popular game 'UNO!™' found its roots in Crazy Eights [15]. Crazy Eights is played with a standard deck of 52 cards, excluding jokers. The players take turns playing a card that must match the rank (number) or suit (spades, hearts, diamonds, clubs) of the top card on the discard pile or be an "8", which serves as a "wild card"; this means that when a player plays an "8", they get the chance to choose the new suit that the next player must follow. However, if the player does not have a matching card, they must draw a new one from the deck until they find a playable one. Notice that, as in every card game, Crazy Eights requires a bit of luck and strategy, as every player's objective is to empty their hand while preventing the opponents from doing the same.

Calc-ONE is based on Crazy Eights due to two main reasons. First, Crazy Eights is a game that is easy to learn; it offers endless variations and, at the same time, is engaging and a favorite among card game enthusiasts. Second, Crazy Eights relies on a "matching structure"; this is suitable for integrating mathematical concepts, such as those involved in parametric equations and polar coordinates, into a gaming context. For example, a circle of radius $\boldsymbol{a}$ and center in the origin can be represented in various forms. In Cartesian coordinates, such a circle is described by the equation

$$x^2 + y^2 = a^2 \tag{1}$$

where (x,y) are the coordinates of any point on the circle. Parametrically, a circle can be described by the equations

$$x = a\cos(t) \qquad y = a\sin(t) \tag{2}$$

where t is the parameter varying from 0 to 2π. Finally, in polar coordinates, this circle has a straightforward representation given by the equation

$$r = a \tag{3}$$

Calc-ONE exploits the connection between those representations; for instance, a player might play a card representing a circle in rectangular form, followed by another player matching it with a card depicting the same circle expressed parametrically or in polar coordinates. This matching process helps students make connections between different representations, thus helping students bridge the gap between them and enhancing their understanding.

As a result, the nature of the topics mentioned above makes Crazy Eights well-suited for constructing a game where students have to match the new ideas studied in parametric equations and polar coordinates with those studied in rectangular coordinates. This is particularly important in a constructivist approach [16], where students actively construct their understanding of new concepts based on their prior knowledge and experiences. Calc-ONE facilitates learning by encouraging students to make connections between what they already know and the latest topics under study. It is expected that, by building on their prior knowledge, students develop a deeper understanding of the course content and will be able to apply it in different contexts.

2) Calc-ONE Deck of Cards

The game utilizes a specialized deck of 56 cards; instead of traditional *ranks* found in a standard deck of playing cards, each Calc-ONE card features what we call for shortness, a *mathematical idea*, that is, a concept, definition, theorem, exercise, or problem related to the content of units 1 and 2 of MATH 203. Similarly, in place of standard *suits*, the cards are divided into four *colors*: red, cyan, orange, and maroon. Each color corresponds to a specific aspect: green represents Cartesian coordinates, cyan represents parametric equations, orange represents polar coordinates, and maroon represents graphical representations of the so-called mathematical idea.

The deck of cards used in Calc-ONE is divided into three different categories, each encompassing the mathematical ideas featured in the game. These categories include (i) concepts, (ii) exercises, and (iii) applications. By organizing the cards this way, Calc-ONE offers a comprehensive approach to learning calculus, covering fundamental concepts, providing opportunities for operational skills development through practice exercises, and demonstrating real-world applications of the topics under study. Let us present examples of the cards used in Calc-ONE within each category to clarify the latter ideas.

a) Core Concepts Cards: This category comprises cards related to fundamental definitions and theorems in differential and integral calculus for curves represented by cartesian, parametric, or polar equations. These cards aim to build a solid conceptual framework upon which students can develop their knowledge and skills in calculus. Figure 1 presents an example of four cards in this category where the students are expected to recognize the definition of derivative expressed in its cartesian, parametric, and polar forms.

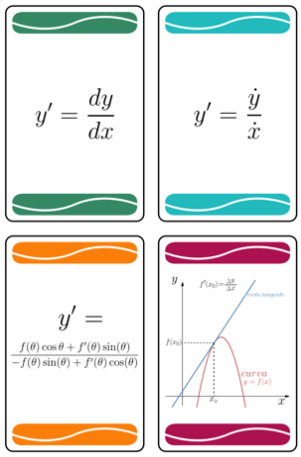

Fig. 1. Set of four cards illustrating the concept of derivative expressed in (a) Cartesian, (b) parametric, and (c) polar form, along with its graphical representation shown in (d).

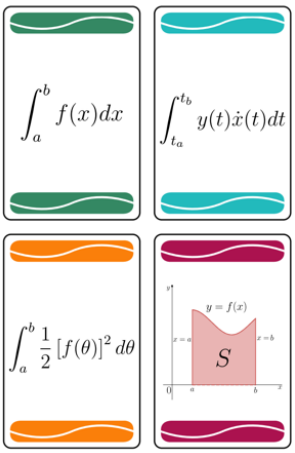

Fig. 2. Set of four cards illustrating the concept of area under a curve expressed in (a) Cartesian, (b) parametric, and (c) polar form, along with its graphical representation shown in (d).

Notice that while the maroon card demonstrates this concept by depicting a plot of a curve along with its tangent line, the red, cyan, and orange cards show the corresponding equation. Figure 2 introduces the concept of area under a curve represented in different coordinate systems. Through these visual aids, Calc-ONE aims to enhance students' grasp of fundamental calculus concepts across various coordinate systems.

b) Operational Mastery Cards: These cards enhance operational skills and proficiency in calculus by offering students various practice exercises. Such cards allow the students to apply multiple tools to solve classical problems in calculus and, as a result, strengthen their understanding of the topics under study. Figures 3 and 4 illustrate examples of card sets within this category. In Figure 3, the focus is on representing a point in the plane in different coordinate systems. In contrast, Figure 4 shows different representations of a curve using Cartesian, parametric, and polar equations.

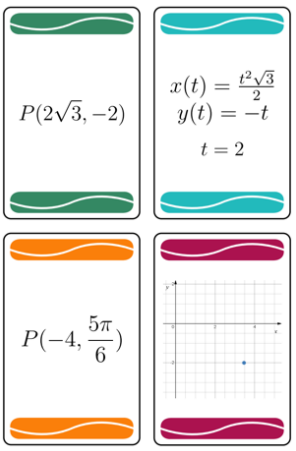

Fig. 3. Set of four cards illustrating the coordinates of a point in (a) Cartesian, (b) parametric, and (c) polar form, accompanied by its plot in the plane shown in (d).

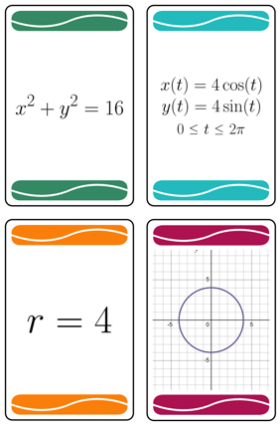

Fig. 4. Set of four cards illustrating the equation of a circle expressed in (a) Cartesian, (b) parametric, and (c) polar form, along with its plot in the plane shown in (d).

Notably, the maroon card in each figure provides a visual illustration of the corresponding point and the curve in the plane, further aiding student's comprehension.

c) Application Cards: This category features cards that introduce students to practical applications of calculus concepts covered in units 1 and 2 of the course. The problems displayed on these cards encompass diverse fields, including geometry, physics, engineering, and science.

Through this category, students are encouraged to gain insight into the relevance and utility of calculus in real situations and enhance their appreciation for the subject. Figures 5 and 6 depict examples of card sets within this category. In particular, Figure 5 illustrates the applications of integral calculus in finding the arc length of a curve expressed in Cartesian, parametric, and polar forms. Similarly, Figure 6 presents a problem involving a surface area of revolution generated by rotating a curve expressed in Cartesian, parametric, and polar forms. Once again, the maroon card in each figure illustrates the corresponding situation.

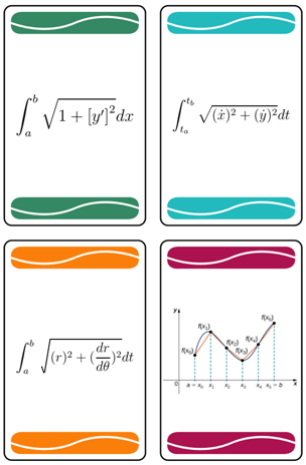

Fig. 5. Set of four cards illustrating the arc length equation for curves expressed in (a) Cartesian, (b) parametric, and (c) polar form, accompanied by their graphical representation shown in (d).

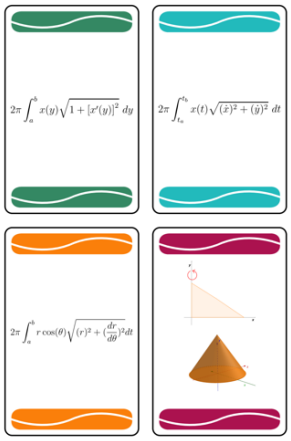

Fig. 6. Set of four cards illustrating the equation for calculating the area of a surface of revolution around the x-axis for curves expressed by (a) Cartesian, (b) parametric, and (c) polar equations, accompanied by their graphical representations shown in (d)

d) Special Cards: finally, to add an element of engagement and strategy into the game, the deck of cards used in Calc-ONE includes special action cards, including Skip, Reverse, Draw One, and Draw Three. These cards enable players to skip turns, reverse the direction of play, or force opponents to draw additional cards. Moreover, these action cards feature humorous facts or inside jokes about the class to make the game even more enjoyable for students and enhance the overall experience. Figure 7 illustrates examples of these cards.

Fig. 7. Examples of special action cards included in Calc-ONE.

3) How to play CALC-One?

Calc-ONE is typically played in small groups of two or three students. At the start of the game, one student takes on the crucial role of the "dealer." This student is in charge of shuffling the deck of cards and distributing five cards to each player. Just like in Crazy Eights, the aim in Calc-ONE is to be the first player to get rid of all their cards.

To start the game, the dealer places one card from the deck face up in the center of the table, establishing the "central discard pile." This card serves as the starting point for the game. Now, the players take turns in clockwise order playing cards from their hand onto the discard pile. The card played must either match the *color* or relate to the *mathematical idea* of the top card on the discard pile. For example, a student might play a green card containing a theorem about Cartesian coordinates, followed by another student playing a cyan card containing the same theorem but expressed in parametric form. Figures 1 to 6 illustrate some examples of such matching card sets. This matching process serves two purposes: consolidating ideas within the same coordinate system (through the *colors*) and connecting concepts expressed in different coordinate systems (through the *mathematical ideas*). We expect students to link various mathematical concepts and coordinate systems through sequential gameplay, deepening their understanding and retention of the material.

The game becomes more intriguing when a student cannot play a card from their hand, as they must draw cards from the deck until they find one that can be played. Clearly, if a player lacks mastery of the calculus concepts involved in the game, they may accumulate a surplus of cards, thus reducing their chances of winning. It is important to mention that if the deck runs out of cards, the discard pile must be shuffled by the dealer, and it will become the new deck. Ultimately, the first player to empty their hand of cards emerges victorious.

III. Results and Discussion

The impact of Calc-ONE's first edition was measured using a qualitative analysis. This approach involved an in-depth exploration of participants' experiences and perceptions, allowing for a comprehensive understanding of the intervention's effects beyond quantitative measures. The data

gathered through interviews provides valuable insights into the game's influence on the student's learning and motivation.

We conducted interviews with a total of 10 participants enrolled in MATH 203. In particular, we posed five questions to gauge specific aspects of their experience playing Calc-ONE. Each interview started with the question, "*Can you describe your overall experience with the Calc-ONE game?"* This question invited students to provide a detailed overview of their experience and general perceptions, including their likes, dislikes, challenges faced, and any notable insights gained while interacting with the game. The second question focused on perceived learning outcomes and aimed to explore further the specific ways the Calc-ONE game influenced students' understanding of polar and parametric coordinates. We asked, "*Did the game Calc-ONE help you enhance your understanding of calculus with parametric and polar curves?*" This question prompted students to reflect on how playing Calc-ONE contributed to their comprehension of the mathematical concepts involved in this game, whether through visualizations, matching strategies, or other means. Subsequently, we sought to determine whether using gamification elements enhanced their enjoyment of learning mathematics by asking, *"Do the gamification elements such as Calc-ONE make learning mathematics more enjoyable for you?"* This question aimed to uncover whether or not Calc-ONE positively impacted the students' attitudes toward learning mathematics.

Additionally, we investigated the effectiveness of Calc-ONE as a learning tool by asking, *"How did Calc-ONE contribute to your overall performance in MATH 203?"* This question encouraged students to reflect on whether playing Calc-ONE had any discernible effects on their academic performance, such as improved retention of concepts, problem-solving skills, or motivation to engage with course materials. Finally, we invited students to share their insights on potential enhancements to the proposed game. We concluded each interview by asking students, *"How do you think the Calc-ONE game can be improved?"* This question encouraged students to propose suggestions for refining the proposed game and help us identify areas for improvement to optimize their learning experience not only in MATH 203 but also in the rest of mathematics courses for engineering.

Sentiment analysis [13], a method used to evaluate attitudes and opinions expressed in text, was employed to assess the impact of integrating Calc-ONE into MATH 203 through the interview transcripts. According to [17], sentiment analysis of interviews can provide valuable feedback related to a particular educational tool, such as Calc-ONE. The sentiment analysis of our interview transcripts revealed a predominantly positive sentiment toward the game, indicating that Calc-ONE has been well-received among students. In the rest of this section, we summarize and discuss our findings regarding each question asked to the students.

- *Overall Experience with Calc-ONE:* Most students expressed positive sentiments about their experience with Calc-ONE. They found the game engaging and enjoyable, particularly appreciating the application of mathematical concepts in a fun and interactive way. However, some students noted that the game seems to focus more on matching colors than on the mathematical concept or problem presented in each card. These comments are not surprising; these students effectively discerned the underlying pattern intended by the game's design, which aligns with the desired learning outcome.
- *Perceived Learning Outcomes:* Students generally felt that Calc-ONE helped them better understand the concepts of differential and integral calculus with parametric and polar curves. They highlighted its role in improving visualization, problem-solving flexibility, concept reinforcement, and connection with previous knowledge. Therefore, this suggests that Calc-ONE is a valuable tool for enhancing student learning outcomes. Finally, one student mentioned that the playing format could be improved, i.e., playing the game slowly and more often could enhance students' comprehension. This comment is valuable feedback that will be explored further and considered for future implementations of the proposed game.
- *Enjoyability of Learning MATH 203 with Calc-ONE:* The consensus among students was that playing Calc-ONE made learning MATH 203 even more fun. Most appreciated this game's competitive and entertaining nature, which promotes motivation and engagement in the subject matter. Therefore, these comments highlighted the importance of incorporating game-based learning into the classroom due to its positive impact on the student's learning experience.
- *Contribution of Calc-ONE to Overall Performance in MATH 203*: While most students believed that Calc-ONE could positively contribute to their overall performance in MATH 203 by reinforcing basic concepts, others expressed uncertainty about its direct impact on their academic success. As intended by its design, the students acknowledged the potential of Calc-ONE as a supplementary learning tool but were cautious about overestimating its significance in improving their grades. Finally, some students pointed out that the range of topics covered in these types of gamified activities should be expanded to cover the overall course content; recall that parametric and polar equations constitute only one unit of MATH 203.
- *Suggestions for Improving MATH 203*: Students provided a wide range of valuable tips for improving Calc-ONE; most of them are easy to implement and will be incorporated into the game's next edition. These included adding more cards to prevent deadlocks during the game and enhancing gameplay mechanics by introducing blocking cards or increasing the number of cards in the Calc-ONE deck. Introducing a wider variety of cards with more equations, concepts, and graphics may help diversify gameplay and learning experiences. Students' enthusiasm with Calc-ONE led them to suggest incorporating educational themes through themed decks covering various mathematics levels in order to reinforce a broader range of concepts. One crucial suggestion made by some students was to

include a feedback mechanism in Calc-ONE to enable continuous improvement and enhance the overall effectiveness of the game. Feedback is critical to education as it guides students through their learning path by recognizing their progress and highlighting their areas of opportunity to make them grow [18]. Therefore, feedback must be addressed in any educational activity, even if it involves a game, such as in the case of Calc-ONE.

On the other hand, some students also recommended improving the quality of game materials, such as using better cardboard for the card deck. This recommendation is essential to guarantee the deck's durability and prevent opponents from gaining an advantage by seeing your cards. The students also requested making the game more accessible by providing copies for practicing outside of class or even creating a digital version of Calc-ONE for online playing. Again, this recommendation indicates their enjoyment and engagement with the game. Note that while most students enjoyed the game, they offered constructive feedback to refine its educational value and gameplay experience.

IV. Conclusions

The incorporation of the first edition of Calc-ONE into MATH 203 yielded promising results. The sentiment analysis of the student responses encompasses both positive feedback and constructive criticism. Students overwhelmingly reported high levels of engagement and enjoyment, thus highlighting the game's capacity to blend learning with entertainment. The data gathered also suggests that students perceive Calc-ONE as a valuable educational resource that enhances their understanding of calculus concepts related to parametric and polar curves. Additionally, the proposed game promotes creativity and strategic thinking because it requires students to analyze the equations and problems presented in the cards critically.

Moreover, the competitive nature of Calc-ONE not only motivates active participation but also cultivates a positive learning environment where students feel driven to excel. Despite some suggestions for improvement, most students expressed enthusiasm for the game's ability to make learning mathematics more dynamic and fun. By combining educational content with the excitement of a card game, Calc-ONE transforms the learning experience, making calculus more accessible and enjoyable for students of all levels.

Our future research will focus on refining Calc-ONE to address the identified areas of opportunity (refer to the previous section) while capitalizing on its strengths. It is important to note that although the first edition of Calc-ONE focuses exclusively on calculus over parametric and polar curves, it can be adapted to cover a broad spectrum of mathematical topics. Therefore, considering the student feedback presented in this paper and incorporating creative game variants, Calc-ONE can serve as a valuable resource for educators seeking to enrich the learning experience in mathematics courses of any level. Even more, Calc-ONE's flexibility allows for customization to accommodate diverse learning styles and objectives, making it a versatile tool for mathematics education. The success of this first implementation of Calc-ONE underscores the potential of gamification in education to stimulate student interest and promote engagement in mathematics courses for engineering.

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