# From Equations to Entrepreneurship: Students Creating and Selling Function Art

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**Abstract.** *This study explores how integrating entrepreneurship into a Function Art project can develop students' entrepreneurial skills alongside communication abilities. Function Art, created using graphs of mathematical functions in GeoGebra, enables students to apply mathematics creatively in creating artworks. While its educational benefits are known, its real-world applications, such as selling student-created artwork, remain underexplored. Using exploratory survey design, we examined 179 Grade 8–10 students in the Philippines who created and sold framed artwork. Most sold to family and friends, using strategies like explaining math concepts, storytelling, and leveraging personal connections. The findings suggest that Function Art supports communication, and initiative, demonstrating its potential as a meaningful, low-cost approach to STEAM + X learning that connects schoolwork to students' lived experiences.*

## 1. Introduction

The integration of Science, Technology, Engineering, Art, and Mathematics (STEAM) education has been recognized as a way to promote interdisciplinary and creative learning [1]. Recently, educators have expanded this framework to STEAM + X, where 'X' represents a flexible, real-world context such as architecture, culture, and history [2]. The goal of this expansion is to connect STEAM learning to students' real-life experiences, making learning more flexible, meaningful, and responsive to students' needs and interests.

One of the less-explored 'X' domains is entrepreneurship. When entrepreneurship is integrated into STEAM, it allows students to create products and then price, market, and sell them. The experiences that students gain from such entrepreneurial activities may help develop their creativity, problem-solving, communication skills, and can also introduce them to aspects of financial literacy [3].

In addition to the STEAM + X framework, this project is situated within the growing discourse on entrepreneurial STEM education [4], which emphasizes student agency, interdisciplinary collaboration, and innovation as key learning outcomes. Recent scholarship has drawn attention to how power dynamics shape the design and implementation of such curricula [5] often privileging certain forms of expertise, voice, and institutional norms over others. In this context, Function Art serves not only as a pedagogical tool for mathematical modeling but also as a creative entry point for exploring the socio-material conditions of entrepreneurial practice in the educational context.

In this study, we integrated entrepreneurship into our Function Art project in the Philippines. Students used GeoGebra to combine their mathematical knowledge with artistic skills to create artworks based on graphs of mathematical functions. These artworks were referred to as Function Art [6], [7]. After creating their artworks, students were tasked with pricing, marketing, and selling them. While previous work on Function Art has focused on creativity and mathematical understanding, little is known about its role in fostering entrepreneurial skills. This study explores the experiences of

students in creating and selling Function Art. Its goal is to answer the following question: How does integrating entrepreneurship into Function Art promote students' entrepreneurial skills? In doing so, we contribute to the emerging literature on Function Art and the broader conversation around STEAM + X education.

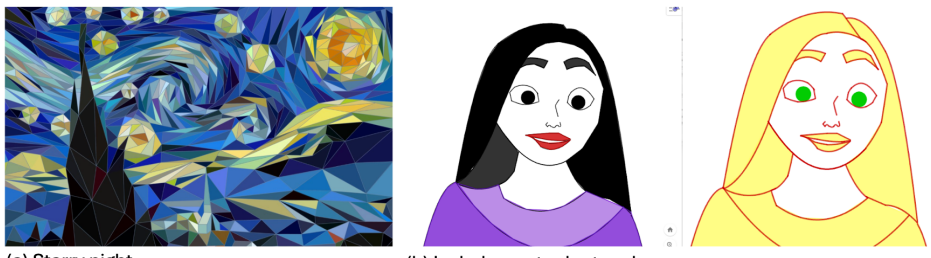
The implementation of Function Art entrepreneurship inherently involves navigating local power dynamics—between students and teachers, between artistic and mathematical norms, and between market-driven and educational values. Entrepreneurial STEM curricula are rarely neutral; rather, they involve implicit negotiations over whose knowledge counts and what kind of entrepreneurship is valued. In this project, student voices were not only heard but acted upon, as learners chose aesthetic directions, pricing strategies, and public communication styles that reflected their own cultural capital and social imagination.

This article forms part of a broader study that investigates the diverse opportunities Function Art offers in mathematics education. Although this paper highlights its entrepreneurial and communicative dimensions, the larger project also explores its role in fostering mathematical understanding, classroom implementation, cultural appreciation, and assessment.

## 2. Literature Review

The use of function graphs in creating artwork in the classroom has been explored since the 1980s. Earlier studies focused on manual graphing (e.g. [8]) and later incorporated the use of graphing calculators (e.g. [9]). When dynamic geometry software (DGS) became popular, students began producing more sophisticated artwork. For instance, they started using more complex functions [10], investigating parametric equations [11], creating abstract patterns [12], and utilizing sliders to create animations [13]. These studies reported that students enjoyed creating art while learning mathematics.

A more recent development in this area is Function Art, an emerging classroom activity that involves creating artworks using graphs of mathematical functions and other tools using GeoGebra [13]. Examples of student-created Function Art are shown in Figures 1a, 1b, and 4. What sets them apart from other similar constructions is that, in addition to graphs of mathematical functions, geometric tools and other visual elements can also be used in the artwork. In Figure 1c, for instance, the color-coded artwork shows a student using function graphs (red) for outlines, conics (green) for the eyes, and polygons (yellow) to color the regions. This level of integration is made possible by GeoGebra, which uniquely combines graphing and geometric tools in a single platform. In other software, these tools are typically separated into distinct applications.



(a) Starry night (b) Isabela – actual artwork (c) Isabela – color coded

Figure 1. Function arts created by Grade 8 Students

Building on the STEAM+X framework, our study adds a novel layer by positioning entrepreneurship not just as a context but as an active component of learning. Students were challenged to go beyond artistic creation by engaging in real-world entrepreneurial tasks; that is, marketing and selling their own artwork. This extension from maker to seller positions students as creative entrepreneurs, requiring them to apply and strategize in utilizing mathematical knowledge, artistic design, and persuasive communication in an integrated manner.

Recent studies have shown that when students create and sell art, they often gain both artistic and business skills. In particular, adding art to entrepreneurship projects can boost students' critical thinking, creativity, and problem-solving skills [3]. In addition, it also helps build confidence and financial literacy [14]. Lastly, it teaches young artists "business, career, and life skills as they prepare to sell their work" [15].

The first clients of new entrepreneurs are usually family and friends [16]. This is especially true in the Philippines, where entrepreneurship often begins within families and local communities. Because of strong family ties, many entrepreneurs start by selling their products to relatives and close friends [17]. These inner circles are not only buyers but also active promoters, especially on social media platforms [18], [19]. Since students use social media in their daily lives [20], [21], these platforms can help them reach more potential buyers. Connecting entrepreneurship to students' everyday experiences, such as family support and social media use, makes business tasks more realistic and manageable. In this study, selling Function Art allowed students to explore entrepreneurship in a way that reflects how many small businesses actually begin in the Philippines.

## 3. Methodology

This study adopted a survey-based exploratory design [22] to investigate students' experiences in the integration of Function Art and entrepreneurship. Specifically, it explored students' participation in creating, marketing, and reflecting on their mathematical artworks. The aim of our study was to understand the entrepreneurial and communication skills students developed, the challenges they faced in marketing their artwork, and how the activity reflected principles of STEAM when extended with entrepreneurship.

One of the most transformative dimensions of the Function Art project was its transgression of traditional disciplinary boundaries. Students did not simply apply mathematics to design or vice versa; they redefined both through their actions. Interdisciplinary STE-A-M initiatives often highlight tensions between subject hierarchies and institutional expectations. By framing entrepreneurship as an aesthetic, civic, and mathematical process, the project created space for new forms of learner identity to emerge.

The students' transition from "problem-solvers" to "entrepreneurial creators" can be understood as a process of identity formation, as they assumed roles traditionally reserved for adults or experts. This resonates with scholarship [23] showing that entrepreneurship in STEM learning environments can foster new expressions of agency and ownership—particularly when learners engage in meaningful, real-world activities that involve risk, collaboration, and public engagement [23].

**Participants and Context.** The study was conducted in a secondary school in the northern part of the Philippines. Participants included Grade 8 – 10 students (14 – 16 years old) who participated in the Function Art project. The project was a performance task that contributed to their academic grade. It consisted of three phases. In the first phase, students explored GeoGebra freely by creating digital artwork without any specific constraints. In the second phase, they attended a webinar on Function Art facilitated by the first author. In the webinar, the first author introduced the students to GeoGebra, provided instruction on graphing mathematical functions, reviewed key concepts on function transformations necessary for creating Function Art, and demonstrated how to create a sample artwork. In the third phase, following the webinar, the students were given one month to create their artwork. After completing their artwork, they printed it on photo paper and then put it in a frame. They were again given one month to market and sell it.

**Data Collection.** Data for the study were collected in two stages. First, students submitted their Function Art projects. These projects were assessed by their teacher as part of their academic performance. Following this, a survey using Google Forms was administered to gather information about their experiences in marketing and selling their artwork. Out of the 287 students who participated in the Function Art Project, 179 completed the survey. This group formed the sample used in the analysis (see Table 1). Of all the respondents, 59 identified as male, 118 as female, and 2 did not specify their gender.

Table 1. Distribution of Student Participants by Grade Level and Gender

| Grade Level/Gender | Male | Female | Unknown | Total |
|---|---|---|---|---|
| Grade 8 | 38 | 69 | 1 | 108 |
| Grade 9 | 19 | 42 | 0 | 61 |
| Grade 10 | 2 | 7 | 1 | 10 |
| Total | 59 | 118 | 2 | 179 |

All respondents were first asked whether they had previously sold any artwork and whether they had attempted to sell their Function Art. Based on their answers, the survey branched into three distinct paths. These branches were as follows:

- Students who successfully sold their artwork;
- Students who attempted but were not able to sell; and
- Students who did not attempt to sell.

Each path contained tailored follow-up questions such as pricing, selling strategies, and difficulty encountered. For those who did not sell or did not attempt to sell, the questions focused on perceived challenges and future intentions. Participation in the survey was voluntary, and all responses were anonymized. Ethical clearance was obtained, and the purpose of the study was explained to participants prior to data collection. In addition, students were asked open-ended questions about how they marketed their artworks. These responses were later analyzed thematically to identify common strategies used by students in promoting their work.

**Data Analysis.** Quantitative information, such as the number of students who attempted or succeeded in selling their artwork, the number of artworks sold, the price of the artworks, marketing platforms

used, and types of buyers, was summarized using descriptive statistics and presented in a diagram. Qualitative data involving students' strategies in selling their artwork were analyzed using inductive thematic analysis [24], which focuses on identifying and interpreting patterns of meaning in the data.

Two coders independently coded the student responses, one using ATLAS.ti and the other coding manually due to the absence of a software license. Although different tools were used, both coders followed the same analytic procedures and unit of analysis. A single sentence was the primary unit of coding; however, many responses contained multiple strategies within one sentence (sometimes two, three, or even four distinct ideas). In such cases, sentences were divided into meaningful segments and coded accordingly. Because of this layered nature of the data, computing interrater reliability was not appropriate, as it would risk oversimplifying the richness of the responses. Instead, and consistent with the principles of reflexive thematic analysis [24, 25], we emphasized collaborative theme development rather than statistical agreement.

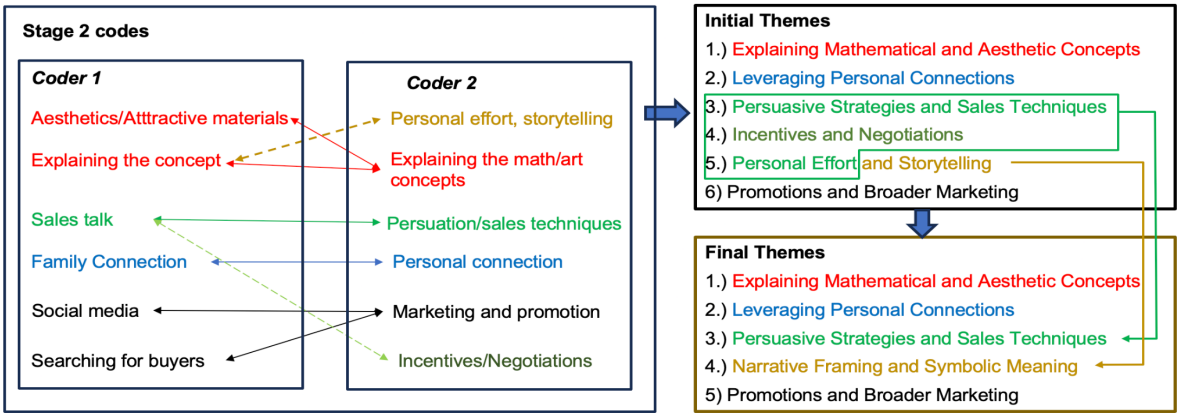



Figure 2. Two-Stage Thematic Coding Process for Student Marketing Strategies

In coding, we adopted two stages of the first phase [26] to organize and refine the data. Stage 1 involved generating short descriptions of students' strategies for selling Function Art, which were treated as initial codes. In Stage 2, similar codes were grouped together and named to identify patterns and support the development of themes (see Figure 2, left box). The coders then compared their Stage 2 codes, noting substantial similarity, and discussed how to integrate overlapping or related codes. This process, illustrated in Figure 2, ensured that themes were co-constructed and refined collaboratively, enhancing the credibility of our analysis without reducing it to numeric agreement counts.

After grouping, the Stage 2 codes were then refined to form the Initial Themes. For example, *Aesthetics/Attractive materials* and *Explaining the concept* from Coder 1 were merged with *Explaining the math/art concept* of Coder 2 (see Figure 2) to form the theme *Explaining Mathematical and Artistic Concepts*. The Initial Themes were then reviewed and refined to create the Final Themes. For example, we decided to merge the initial themes *Persuasive Strategies and Sales Techniques*, *Incentives and Negotiations*, and *Personal Effort* as a single theme, keeping the first label since incentives, negotiations, and personal effort are all persuasive strategies or sales techniques. As a result, the final number of themes was reduced to five (Please see bottom right box in Figure 2).

## 4. Results

**Participation in Selling Function Art.** Out of the 179 students, 165 (92.1%) attempted to sell their artwork while 14 (7.8%) did not. Among those who attempted, 159 succeeded, while 6 did not. Of the successful sellers, 154 sold one artwork, 4 sold two copies of their artworks, and 1 sold three copies.

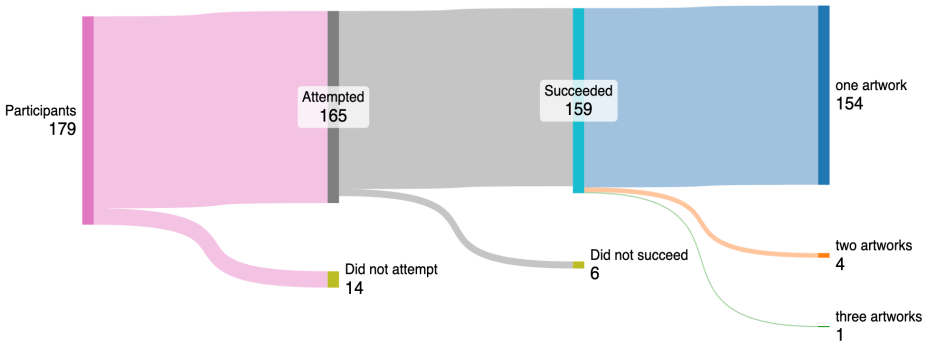



Figure 3. Student Participation and Success in Selling Function Art

Most of the students marketed their artwork directly to family and friends (150), while a few promoted them on social media (5), school exhibits (3), and to strangers (3). The majority of the artworks were bought by family and friends (137), family acquaintances (7), friends outside school (4) and others (6). Most of the students priced their products based on their effort (105), product cost (74), how much buyers were willing to pay (47), and recommendations from teachers and peers (26).

Figure 4 shows the artwork of a student and the transaction between her and the buyer. The artwork was sold for 4500 Philippine pesos. The price range of the 137 sold artworks in Philippine pesos was from 600 to 10,000, with an average of 1460. For the sake of context, the minimum daily wage in the Philippines at the time of selling was 625 Philippine pesos.

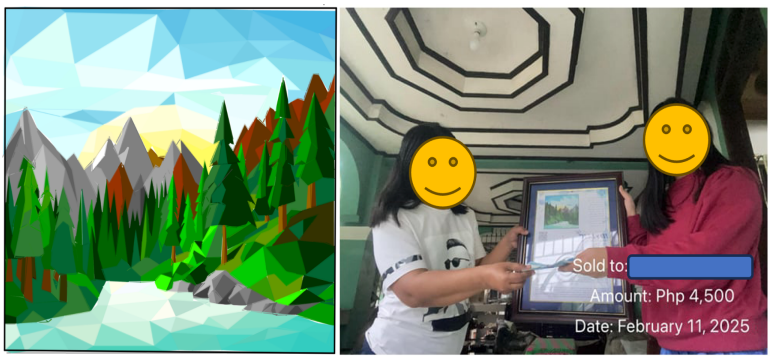



Figure 4. Student Artwork and Buyer Transaction

Even though most of the students were able to sell their artworks, some reported challenges in doing so. These challenges included finding buyers (76), difficulty in setting prices (64), marketing and promotion (42), printing issues (58), and others. Among those who did not attempt to sell their artwork, 6 students responded that they were not interested in selling their artwork, while 2 responded that they did not know how to sell it

**Strategies in Selling Artwork.** To understand how students marketed and sold their artwork, an inductive thematic analysis was conducted on their open-ended survey responses. This process revealed five major themes that reflect the diverse strategies students used. These themes emerged through a careful reading and coding of responses, guided by Braun and Clarke's framework [24]. They represent not only how students approached the selling process, but also how they communicated the value of their work to potential buyers. Below, we detail these themes and present some examples. Note that we presented the students' answers verbatim without editing for grammar or spelling.

***Explaining Mathematical and Aesthetic Concepts.*** This theme captures how students emphasized mathematical concepts, aesthetic features, and visual appeal that contribute to the artwork's uniqueness and value. Many of them emphasized that the artworks were not "drawn" but created using mathematical equations. By explaining how the artwork was generated, the students aimed to enhance its perceived value. This shows the students' appreciation of the mathematical nature of the artwork. For instance, one student shared, "*I provided clear descriptions, including the mathematical functions used, the inspiration behind the piece, and the size and format (digital download, print). I also highlighted the uniqueness of the art form the blend of mathematics and aesthetics.*" Another student explained, "*To attract buyers for my artwork, I explained the effort behind it and how it was uniquely created using math equations. My parents were intrigued by the concept and impressed by my dedication. My first real buyers ended up being my parents, who supported my work.*" These responses showed that students used both technical and aesthetic explanation as part of their selling strategy.

***Leveraging Personal Connections.*** This theme reflects how students relied on existing relationships to market and sell their artwork. Most of them marketed their artwork to their family, relatives, and close friends. Rather than reaching out to a broader audience, many students chose to approach their family and social circles, often citing accessibility, supportiveness, or a sense of obligation from the buyer. For example, one student stated, "*Honestly, just using connections and family members who would be interested.*" Another noted, "*I actually just recommended it to my family members because they are the nearest and easiest customers to reach out and it helped me sell my artwork faster.*" These responses illustrate how students capitalized on personal ties to successfully market their work with minimal resistance.

***Persuasive Strategies and Sales Techniques.*** This theme highlights the marketing strategies that students used in selling their artwork. This includes highlighting their hard work, and finding the appropriate buyers. For example, one student shared, "*I told them that my artwork was done by hard work and it's rare to find GeoGebra arts, and by that it can convince the buyer to buy it*." Another noted, "*We tried to find someone who is really into Harry Potter and found one. The buyer was into Harry Potter and was interested to buy our artwork which is the Hogwarts castle... which is a win-win*." These responses show how students demonstrated creativity and adaptability in how they presented and marketed their artwork.

***Narrative Framing and Symbolic Meaning.*** This theme emphasizes the story or symbolic meaning behind their artwork. Instead of focusing on technical or aesthetic qualities, they shared the

inspiration and story behind their artwork. This approach allowed students to communicate the historical and cultural significance of their artwork to potential buyers. One student explained, "*By explaining why I created my artwork and the story behind it."* Another stated, *"Promoting/telling them about my art and the stories behind it.*" These responses show how students told stories or shared meanings behind their art. This helped buyers connect with the artwork, seeing it as more than just math art but as something with a deeper purpose or inspiration.

***Promotions and Broader Marketing.*** This theme encompasses the broader methods students used to promote their artwork aside from their personal circles. It includes the use of social media and group chats to widen their reach and attract potential buyers. These strategies often combined digital marketing with interpersonal communication. As one student shared, "*I posted it to different GCs and also tried to negotiate with customers at a reasonable price.*" These responses allowed students to reach more potential buyers and expand their sales beyond close contacts.

## 5. Discussion

This study aimed to investigate the students' experiences in selling Function Art. Results showed that most of the students marketed and sold their artwork to their families. The strategies they used in selling were explaining mathematical and aesthetic concepts, leveraging personal connections, using persuasive strategies and sales techniques, narrative framing and symbolic meaning, and promotions and broader marketing. These strategies align with the basic marketing principles such as knowing your audience, using narratives, and promoting through accessible platforms [27]. This supports the idea of STEAM + X as a flexible framework for connecting academic learning with students' real-life experiences [2].

Students primarily marketed their artworks to family and friends. This likely reflects the lack of access to a broader audience, which is understandable given their age and environment. It also highlights students' practicality. They leveraged personal relationships and turned to the most accessible and supportive buyers. This pattern is consistent with previous findings that Filipino entrepreneurs often begin by selling to family and community networks [17]. This implies that these students need more support to broaden their marketing strategies to become professional and sustainable.

Students often explained the story, meaning, and history of their artwork. This shows their ability to attach symbolic meaning to their creation. Their responses suggest that they can frame their artwork within personal, cultural, or historical context. This indicates that students view their outputs not only as Function Art but also as a form of storytelling. When something is relevant and close to them, people might be interested or invested in that artwork and possibly put a high price.

Students used both mathematical and emotional appeals, such as highlighting their effort in creating the artwork to convince buyers. This shows their ability to combine or switch between logical explanation and emotional engagement based on their audience. It reflects the foundational skills of STEAM + X: mathematics and design as foundation, followed by marketing it with persuasive language. This suggests that aside from understanding mathematical concepts, they can also communicate their value to others. This supports Galindo-Durán et al.'s study [3], which found that

combining art and entrepreneurship can boost students' critical thinking, creativity, and problem-solving. However, our participants still need more support in convincing the potential buyers in more professional ways.

Taken together, these findings show that mathematical software such as GeoGebra can be used to create Function Art while supporting both mathematical understanding and real-world skills like communication and entrepreneurship. Students were able to explain their work, connect it to cultural meaning, and adapt their strategies to their local context. This highlights Function Art's potential as a meaningful and flexible approach to interdisciplinary learning.

## 6. Conclusions

This study shows how Function Art can foster students' entrepreneurial and communication skills, highlighting its potential in integrating STEAM and entrepreneurship into the curriculum. By connecting academic content to real-world practice, Function Art makes learning more meaningful, relevant, and empowering for students, particularly in developing communication and initiative.

Since this study was short-term and task-oriented, future research could examine students' long-term development in entrepreneurial mindsets and mathematical application. While most students successfully sold their artworks, sales were largely limited to family and friends; future implementations might provide structured opportunities for broader market engagement through school fairs, local partnerships, or online platforms. Sustaining Function Art may also involve embedding it in school-wide entrepreneurship programs or performance tasks in mathematics and technology subjects, enabling teachers to promote both creativity and practical financial understanding.

**References**


[1] E. Perignat and J. Katz-Buonincontro, "STEAM in practice and research: An integrative literature review," *Thinking Skills and Creativity*, vol. 31, pp. 31–43, Mar. 2019, doi: 10.1016/j.tsc.2018.10.002.

[2] S. E. Bedewy and Z. Lavicza, "STEAM + X - Extending the transdisciplinary of STEAM-based educational approaches: A theoretical contribution," *Thinking Skills and Creativity*, vol. 48, p. 101299, June 2023, doi: 10.1016/j.tsc.2023.101299.

[3] A. Galindo-Durán, J. Uribe-Toril, and F. Martínez-Hernández, "Impact of Artistic Expression on the Development of Entrepreneurial Skills in Secondary Education," *Education Sciences*, vol. 15, no. 2, p. 194, Feb. 2025, doi: 10.3390/educsci15020194.

[4] C. S. M. Ho, "Cross-disciplinary Challenges: Navigating Power Dynamics in Advocating an Entrepreneurial STEM Curriculum," *Res Sci Educ*, vol. 55, no. 1, pp. 11–39, Feb. 2025, doi: 10.1007/s11165-024-10172-7.

[5] C. S. M. Ho, J. Lu, and D. A. Bryant, "Understanding teacher entrepreneurial behavior in schools: Conceptualization and empirical investigation," *J Educ Change*, vol. 22, no. 4, pp. 535–564, Nov. 2021, doi: 10.1007/s10833-020-09406-y.

[6] G. Bautista Jr., T. Prodromou, and Z. Lavicza, "Function Art as a Teaching Tool in STEAM Education," in *Proceedings of the 15th International Congress on Mathematical Education (ICME-15)*, Sydney, Australia, 2024.

[7] G. Bautista Jr., T. Prodromou, and Z. Lavicza, "Function Art: Analyzing Popular Functions and Strategies," in *Proceedings of the 17th ERME Topic Conference MEDA4*, E. Faggiano, A.

Clark-Wilson, M. Tabach, and H.-G. Weigand, Eds. 2024, pp. 65–72.
[8] F. Disher, “Graphing Art,” *The Mathematics Teacher*, vol. 88, no. 2, pp. 124–128, Feb. 1995.
[9] T. Bergthold, “Curve Stitching: Linking Linear and Quadratic Functions,” *The Mathematics Teacher*, vol. 98, no. 5, pp. 348–357, 2005.
[10] D. Beigie, “The Algebra Artist,” *The Mathematics Teacher*, vol. 108, no. 4, pp. 258–265, Nov. 2014.
[11] S. Miller, “Understanding Transformations of Periodic Functions through Art,” *The Mathematics Teacher*, vol. 94, no. 8, pp. 632–635, Nov. 2001.
[12] M. Aktümen and A. Avni, “Geogebra As An Artist’s Paintbrush,” *Malaysian Online Journal of Educational Technology*, vol. 4, no. 1, pp. 17–31, 2016.
[13] G. Bautista Jr., J. Malacapo, F. Gallos-Cronberg, H. Kasti, T. Dana-Picard, and Z. Lavicza, “Function Arts: Linking Mathematics, Technology, and Visual Arts,” *School Science and Mathematics*, pp. 1–13, 2025, doi: 10.1111/ssm.18373.
[14] Heroes of Color, “Jr. ARTrepreneurs,” Heroes of Color. Accessed: June 05, 2025. [Online]. Available: https://www.heroesofcolor.com/jr-artrepreneurs
[15] Mint Arts Guild, “Learn & Earn.” Accessed: June 05, 2025. [Online]. Available: https://www.mintartistsguild.org/learn-earn
[16] S. C. Okoroafo and A. Koh, “The Impact of the Marketing Activities of Family Owned Businesses,” *IJBM*, vol. 4, no. 10, Sept. 2009, doi: 10.5539/ijbm.v4n10p3.
[17] L. Gata, “Families in Philippines,” in *Encyclopedia of Family Studies*, 1st ed., C. L. Shehan, Ed., Wiley, 2016, pp. 1–5. doi: 10.1002/9781119085621.wbefs251.
[18] R. Lavilles, M. A. Tinam-Isan, and E. L. Sala, “Social media as an enabler of women’s entrepreneurial empowerment during the pandemic,” *Asian Journal of Women’s Studies*, vol. 29, no. 1, pp. 136–153, Jan. 2023, doi: 10.1080/12259276.2023.2186633.
[19] E. A. Soledad, “Social Media as A Tool for Direct Selling Business in Dipolog City, Zamboanga Del Norte,” *IJMABER*, vol. 4, no. 1, pp. 63–68, Jan. 2023, doi: 10.11594/ijmaber.04.01.08.
[20] F. E. Dimacangun and J. Guillena, “Social Media Usage and The Academic Performance of Filipino Junior High School Students,” *IJEMDS*, vol. 4, no. 2, pp. 187–206, June 2023, doi: 10.53378/352994.
[21] J. Ditche, “Social Media Use and Junior High School Student’s Academic Performance in the Division of Northern Samar,” *International Journal of Trend in Scientific Research and Development*, vol. 5, no. 4, pp. 1169–1176, 2021.
[22] J. W. Creswell and J. D. Creswell, *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications, 2018.
[23] J. Rahm and A. J. Gonsalves, “Refiguring research stories of science identity by attending to the embodied, affective, and non-human,” *Front. Educ.*, vol. 8, Feb. 2023, doi: 10.3389/feduc.2023.1083992.
[24] V. Braun and V. Clarke, “Using thematic analysis in psychology,” *Qualitative Research in Psychology*, vol. 3, no. 2, pp. 77–101, Jan. 2006, doi: 10.1191/1478088706qp063oa.
[25] V. Braun and V. Clarke, “Reflecting on reflexive thematic analysis,” *Qualitative Research in Sport, Exercise and Health*, vol. 11, no. 4, pp. 589–597, Aug. 2019, doi: 10.1080/2159676X.2019.1628806.
[26] G. Bautista, M. Saimon, W. Yunianto, H. Sami El-Kasti, Z. Lavicza, and K. Fenyvesi, “Challenges and Opportunities in Function Art,” *Journal of Information Technology Education: Innovations in Practice*, vol. 24, pp. 1–12, 2025, doi: 10.28945/5522
[27] Y. Xia, “The 4Ps of Marketing and Applications in Various Brands,” *EHSS*, vol. 16, pp. 165–170, July 2023, doi: 10.54097/ehss.v16i.9601.