ANNEXURE

GEOMETRIC ABSTRACT ART

"Integrating Geometric Abstract Art into 21st-Century Mathematics Education: A STEAM-Based Lesson Plan"

Introduction

Abstract art is a creative expression that utilizes shapes, colors, forms, and lines to create compositions independent of visual references to the real world. It encompasses various styles, including **Lyrical abstraction**, which emphasizes emotion and fluidity; **Geometric abstraction**, which relies on mathematical shapes; **Action painting**, characterized by dynamic, spontaneous strokes; and **Colour field painting**, focusing on large expanses of color.

Geometric Abstract Art is a form of artistic expression that relies on the arrangement of geometric shapes, patterns, and symmetry to create visually engaging designs. By focusing on balance and abstraction, this art form bridges creativity and mathematics. It has found a profound and enduring real life applications , where surfaces are transformed into intricate, harmonious compositions that captivate viewers. Renowned artists like Kazimir Malevich, Piet Mondrian, and Wassily Kandinsky are celebrated for their contributions to this style.

In the 21st century, **Geometric Abstract Art** has gained remarkable relevance in teaching and learning mathematics. It integrates mathematical concepts with real-life applications, fostering creativity, critical thinking, and problem-solving skills. By encouraging student-centered learning and making mathematics more engaging, it bridges the gap between abstract concepts and practical utility. This interdisciplinary approach connects mathematics with Arts and Technology providing better opportunities in architecture, fashion, interior design, and manufacturing, creating meaningful learning experiences for students.

COMPARISON WITH OTHER DESIGN APPROACHES

1. Modern and Minimalist Appeal

- Geometric abstract art aligns with contemporary aesthetics, making it ideal for modern architecture and interior design.
- Other approaches, like figurative or nature-inspired designs, may feel overly ornate or outdated in minimalist settings.

2. Timelessness

- The mathematical precision of geometric patterns ensures their enduring relevance.
- Floral or figurative designs may feel tied to specific eras or trends, limiting their long-term appeal.

3. Customizability

- Geometric art allows for tailored designs, from intricate details to bold simplicity, suitable for diverse tastes and spaces.
- Other approaches may lack the same adaptability, especially in modular or scalable designs.

4. Functionality and Aesthetic Balance

- Geometric patterns excel in merging visual appeal with practicality, as seen in acoustic panels, tiles, and carpets.
- Other designs often prioritize aesthetics over function, reducing their utility in certain cases.

5. Ease of Mass Production

- The repeatability of geometric designs makes them ideal for large-scale production in textiles, ceramics, and fashion.
- Elaborate or nature-inspired patterns are more complex and costly to produce consistently.

6. Space Optimization with Adjustable Geometric Shapes

- **Efficient Space Management**: Geometric shapes can be resized or rearranged to fit specific dimensions, ideal for modular furniture or compact living spaces.
- **Seamless Integration**: Unlike real-life objects, geometric shapes retain their structural integrity when resized, allowing creative and precise solutions.
- **Creative Flexibility**: Enables innovative designs that maximize functionality, especially in irregular or confined spaces.

7. Unified Thematic Designs for Interiors

- **Possibility of Coordination**: Geometric abstract art allows for creating bedsheets, pillow covers, curtains, and wall frames with matching patterns and themes, offering a cohesive and harmonized interior aesthetic.
- **Consistency in Style**: Other approaches, such as figurative or themed designs, might struggle to offer a seamless integration across multiple mediums.
- **Versatility Across Mediums**: The scalability and adaptability of geometric patterns make them suitable for different surfaces and textures, maintaining a unified look throughout the space.

8. Creativity and Predictability

- **Mathematical Influence**: The use of geometric patterns often stems from mathematical principles, fostering creativity and critical thinking to generate innovative designs.
- **Predictable Outcomes**: Unlike other approaches that may rely on abstract or freeform ideas, geometric designs are systematic, ensuring predictable and repeatable results.
- **Advantage in Innovation**: Designers with a mathematical background can leverage geometric shapes to create unique yet precise designs, which is challenging with less structured design styles.

9. Cultural Neutrality

- Geometric art transcends cultural boundaries, fitting seamlessly into global design contexts.
- Figurative or themed designs may be region-specific and less versatile in international settings.

Applications and Advantages

1. *Tiling*





- **Versatile Patterns**: Geometric tiles offer endless design possibilities, including tessellations, symmetry, and spatial illusions, making them suitable for both modern and classic aesthetics.
- **Timeless Appeal**: Unlike figurative or floral designs, geometric patterns maintain relevance across design trends.
- **Durability and Maintenance**: Provides long-lasting, easy-to-clean surfaces for homes and public spaces.
- **Spatial Effects**: Creates depth or makes small spaces appear larger with strategic designs.

2. *Acoustic Wall Frames , Wall Art Frames*




- **Aesthetic and Functional**: Combines sound absorption with striking geometric patterns, blending utility with decor. Geometric wall frames transform empty walls into art pieces,
- **Customization**: Patterns and shapes can be tailored to match the interior design theme, providing both style and practicality.
- **Edge Over Plain Panels**: While traditional acoustic panels focus solely on functionality, geometric designs add a layer of visual sophistication. Frames can double as educational tools or interactive designs, especially in classrooms or offices.

3. *Cups and Plates*





- **Artistic Sophistication**: Geometric patterns elevate simple utility items into artistic dining ware, making meals more enjoyable.
- **Contemporary Style**: Ideal for modern tableware trends, they balance elegance and simplicity.
- **Customizability**: These patterns often incorporate cultural or personal motifs, creating unique pieces.

4. *Fashion Design*





- **Bold and Timeless**: Geometric patterns offer striking visual appeal while transcending seasonal trends.
- **Adaptability**: Easily integrated into clothing, accessories, and jewelry, suiting diverse audiences and materials.
- **Mass Production**: Patterns are easy to replicate, making them practical for both high fashion and everyday wear.
- **Versus Traditional Prints**: Geometric designs provide a minimalist yet bold alternative to florals or nature-inspired prints, which may feel outdated in modern fashion.

5. *Floor Carpets*



- **Dynamic Designs**: Carpets with geometric patterns add visual interest, defining room aesthetics through bold or subtle textures.
- **Comfort and Decoration**: Combines practicality with artistic value, enhancing the ambiance of living spaces.
- **Customizability**: Geometric patterns can be tailored to fit specific dimensions and space availability, ensuring a perfect match for various room layouts and sizes.

6. *Curtain Designing*





- **Scalability**: Geometric patterns can be adjusted to suit different window sizes and room styles.
- **Aesthetic Appeal**: Adds modern elegance or symmetry to interior decor.
- **Fabric Versatility**: Works seamlessly with various materials, from lightweight sheers to heavy drapes.

7. *Bedsheet Designing , Cushion covers*





- **Contemporary Look**: Geometric designs are trendy and timeless, creating visually pleasing bedspreads and cushion covers.
- **Easy Alignment**: Repeating patterns ensure uniformity and appeal across bed sizes.
- **Customizability**: Patterns can match diverse color schemes, from bold contrasts to soothing pastels. Their patterns are easy to integrate with other decor elements, creating a cohesive look.

8. *Ceiling Design*





- **Artistic Ceiling Panels**: Geometric patterns enhance ceiling designs, creating visually captivating spaces in homes, offices, and public areas.
- **Spatial Enhancement**: Patterns can add depth and dimension to rooms, making ceilings appear higher or more dynamic.
- **Lighting Integration**: Geometric ceilings pair seamlessly with lighting fixtures, such as recessed or LED strip lights, to create stunning visual effects.

9. Wall Metal Works





- **Durability**: Metal art lasts longer while maintaining its aesthetic appeal.
- **Outdoor Applications**: Designed to withstand weather conditions, making them suitable for exterior spaces.
- **Transportability**: Lightweight and easy to transport without damage, offering convenience for relocations.
- **Ease of Creation**: Geometric shapes are simpler to design and replicate than intricate figurative patterns.

10. Wooden Door Panel





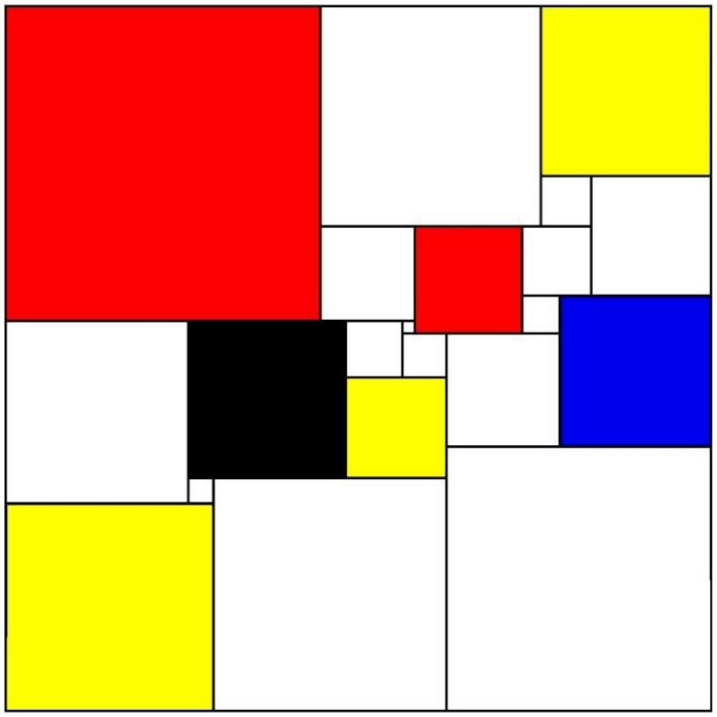
- **Perfection in Mass Production**: Geometric designs ensure uniformity and precision, making them ideal for large-scale manufacturing.
- **Importance of Symmetry**: Ensures a balanced and harmonious appearance across the entire design, creating a cohesive and elegant look for each panel.
- **Enhanced Individual Panels**: Each geometric panel stands out as an artistic element, contributing to the overall beauty of the door design.

Great Mathematical Achievements in Geometric Abstract Art and Their Role in Inspiring Students' Interest in Mathematics

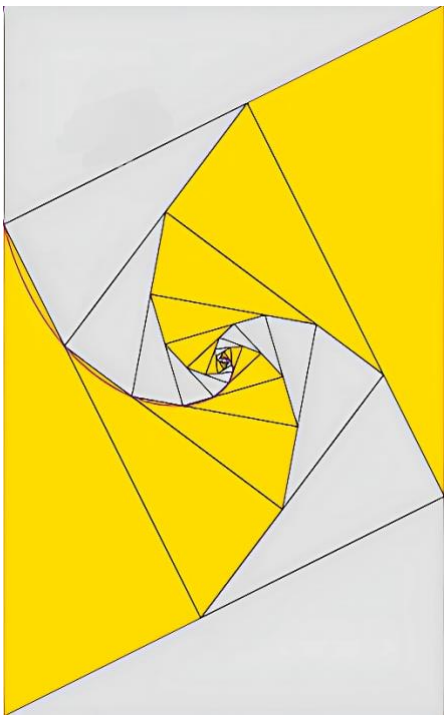
Geometric abstract art, where mathematical ideas manifest in visually appealing patterns, has long fascinated both artists and mathematicians. Many mathematical achievements in geometry have inspired art, and using such examples can be a powerful way to engage students in mathematics.

By presenting mathematics as an aesthetic discipline rather than just a set of calculations, students can develop curiosity, creativity, and a deeper appreciation for mathematical structures. Here are a two notable examples:

1) Squaring a square and Mondrian Art



2) Golden rectangle and Golden whirl



How These Concepts Inspire Students

1. **Visual Learning** – Geometric art provides an intuitive and visually stimulating way to understand abstract mathematical ideas.

2. **Creative Engagement** – Encourages students to experiment, create, and explore mathematical concepts artistically.

3. **Interdisciplinary Thinking** – Bridges mathematics with art, architecture, and nature, making it more relatable and engaging.

4. **Problem-Solving Mindset** – Challenges like squaring the square and constructing golden spirals promote logical thinking and curiosity.

By integrating these mathematical concepts into art-based projects, we can cultivate a deep appreciation for mathematics while making learning fun, inspiring, and memorable.

Expected Competency

Students will develop an understanding of the principles and applications of geometric abstract art, fostering creativity and analytical skills through individual and collaborative activities. They will connect mathematical concepts to real-life contexts by creating designs, exploring practical applications, and utilizing modern technology.

Assessment and Evaluation

Individual Activities:

1. Students will explore and identify **five new practical applications of geometric abstract art**, gaining insight into its relevance in various fields.
2. Students will create **original paintings or designs** inspired by geometric abstract art, demonstrating its application in real-life contexts.
3. Students will create **original paintings** demonstrating remarkable achievements in mathematics such as Fibonacci spiral, Squaring a square and Penrose Triangle.
4. Students will write **essays** and prepare **articles** on Geometric Abstract Art.

Group Activities

5. Organize a **Geometric Abstract Art Competition** among grade six students. Top-level artworks from each class will be exhibited to showcase students' creativity and understanding.
6. Design and decorate the **Math Room or Lab** using geometric abstract art as a yearly activity, culminating in a presentation for the International Day of Mathematics.

Extended Learning with Expert Assistance

7. **Field Visits**: Arrange educational trips to organizations such as **Lanka Tiles** or **Dankotuwa Porcelain** to observe practical applications of geometric abstract art in industry. Students will prepare and submit a **detailed report** on their observations and recommendations for improvements.
8. **Integration of Technology**: Students will utilize **computer graphics and AI tools** to design and organize geometric abstract art within a specified space, integrating technology into the creative process.

Advanced Development of the Lesson Through Full Utilization of STEAM Education

1. Designing and Creating Three-Dimensional Sculptures

Students will expand their understanding of geometric principles by designing and constructing three-dimensional sculptures that combine mathematics, engineering, and art. This activity will emphasize the application of geometry in real-world structures, focusing on spatial reasoning, creativity, and problem-solving. Students will explore concepts such as balance, symmetry, and material properties while building their sculptures.

2. Adding Time as the Fourth Dimension

Students will explore time-based transformations in three-dimensional creations, inspired by dynamic works such as the **Wonder** and the Art of Doing Nothing by **Tom Lawton**. They will design models or sculptures that interact with time through movement, light, or environmental changes, such as kinetic art or installations that respond to external stimuli. This activity connects mathematics, physics, and art, encouraging students to think innovatively about how geometric structures can evolve or interact with their surroundings over time. https://youtu.be/MQmJ0UR4Wk4?si=lNOFZ4Wj0nZb5Dhr

Conclusion

Geometric abstract art is a transformative element of modern mathematics education, offering a unique blend of creativity, real-life applications, and foundational mathematical principles. Introducing this topic to the **Grade 6** curriculum not only fosters interest and engagement but also allows students the freedom to explore their creative potential. By designing their own patterns and artwork, students experience the joy of self-expression while developing critical thinking and problem-solving skills.

One of the key advantages of this approach is the scalability of learning, enabling students to advance from basic two-dimensional designs to complex three-dimensional and even higher-dimensional creations as they progress.

This lesson's simplicity, free from complicated formulae and additional resource requirements, makes it particularly suitable for early introduction. Educational reforms should focus on cultivating this interdisciplinary approach, encouraging students to embrace creativity while building a strong foundation for lifelong learning and future academic and professional success.

In celebration of the International Day of Mathematics, the BRAINSTORMER FOUNDATION, committed to advancing mathematics education through innovative methods, has organized the All-Island Geometric Abstract Art Competition 2025 for school students. This initiative has been made possible with the prior approval of the Ministry of Education. We extend our heartfelt gratitude to **Ms. P. P. Niroshi**, Director of Mathematics at the Ministry of Education, for her timely efforts and invaluable contributions to the success of this event. We hope this competition will become a hallmark event of the BRAINSTORMER FOUNDATION, inspiring generations of students and educators alike.

"Pioneering Humanistic Mathematics to Empower Explorative Skills for a High Profile"

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