STEM Project

Global School Design through Geometry

Main school subjects involved
Mathematics

Other school subjects
Science/Physics/Design

Aimed for
students between 12 and 18 years old

Participant Schools

Nika School
Krasnoe Campus

Nika School
Moscow Campus

A'ksent Suisse
International School

Stockbridge American
International School

Supporting Organizations

STEM Practices
Advisor

Organizational
Endowment

Academic
Advisor

ResilienceLab
Association
(Italy)

International Schools
Association - ISA
(Switzerland)

Politecnico di
Milano
(Italy)

School term:
September 2023 - May 2024

Introduction

In the ever-evolving landscape of modern education, the spirit of collaborative and interdisciplinary learning stands as a beacon of progressive pedagogical approaches. This project, titled 'Global School Design through Geometry' will bring together four esteemed secondary-level institutions from different countries. The objective of this interschool STEM project is to cultivate students' practical academic skills and knowledge while fostering cross-cultural appreciation.
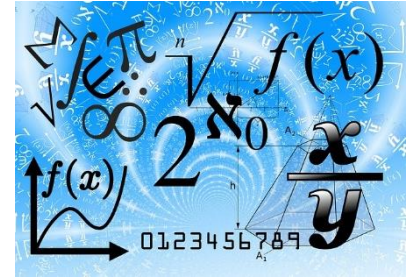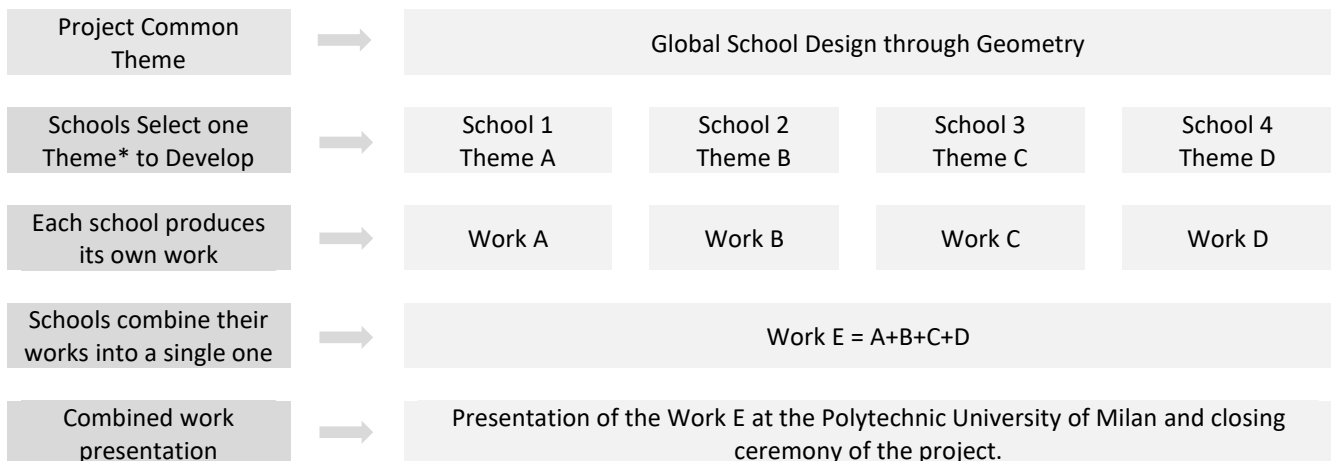
At the heart of this project lies the artful fusion of innovative design and geometry, creating an exciting platform for student teams to explore their creative potential. Each participating school will form a dedicated student team, with each team specializing in a distinct aspect of school design. These facets include architecture, interior design, landscape planning, school attire, and various accessories, all culminating in the grand vision of an ideal school.

Guided by passionate educators, these student teams embark on a collaborative journey of design exploration, tasked with envisioning a model school that seamlessly integrates their respective expertise. The process begins with a shared commitment to cover a theme, thoughtfully selected and agreed upon by the leading teachers.

As the project unfolds, students within each team will dive into their selected design aspects, applying geometric principles and creative ingenuity to their work. Their efforts will result in the development of well-documented design proposals, incorporating their observations, research findings, and innovative ideas.

These design proposals from each school will harmoniously converge to form a unified vision as the project reaches its conclusion. This synthesis will not only preserve the unique perspectives of each school but also unify them into a comprehensive and visionary work—an embodiment of the collaborative power of geometry in design and interdisciplinary learning.

The culmination of this creative journey will manifest in the presentation of the unified final school design at the Polytechnic University of Milan, Italy, in May 2024. This presentation promises to be an insightful and innovative contribution, with the potential to inspire and advance the global conversation on the future of educational spaces.

Project Common Theme	→	Global School Design through Geometry			
Schools Select one Theme* to Develop	→	School 1 Theme A	School 2 Theme B	School 3 Theme C	School 4 Theme D
Each school produces its own work	→	Work A	Work B	Work C	Work D
Schools combine their works into a single one	→	Work E = A+B+C+D			
Combined work presentation	→	Presentation of the Work E at the Polytechnic University of Milan and closing ceremony of the project.			

A list of suggested themes are described on page 4.

Learning Objectives

The learning objectives for the "Global School Design through Geometry" project can encompass a range of academic, cultural, and practical skills. The project aligns with the goals of interdisciplinary learning, cross-cultural appreciation, and creative exploration. These learning objectives aim to provide a well-rounded educational experience that goes beyond academic knowledge and fosters personal and professional growth, cross-cultural understanding, and creativity in the field of school design.

Cross-Cultural Collaboration
- Develop an understanding and appreciation of different cultures and educational systems.
- Collaborate effectively with peers from diverse backgrounds and school settings.

Interdisciplinary Learning
- Explore the intersection of geometry, design, and other STEM fields.
- Apply knowledge and skills from various disciplines to solve complex problems.

Geometry and Design Principles:
- Gain a strong understanding of geometric principles and their application in design.
- Apply creative thinking to design projects, incorporating mathematical concepts.

Project Management
- Learn project management skills, including planning, organization, and time management.
- Work together to meet project milestones and deadlines.

Research and Analysis
- Conduct research on various aspects of design, such as architecture, interior design, and landscaping.
- Analyze data and findings to inform design proposals.

Innovation and Creativity
- Cultivate innovative thinking by generating creative design ideas.
  - Develop the ability to think outside the box and propose unique solutions.

Communication and Presentation Skills
- Improve oral and written communication skills for presenting design proposals.
- Effectively convey ideas to peers and educators in a clear and organized manner.

Teamwork and Collaboration
- Work as part of a team to combine individual contributions into a unified school design.
- Foster a cooperative and supportive team dynamic.

Cultural Sensitivity and Inclusivity:
- Demonstrate cultural sensitivity by considering diverse cultural and educational needs in the design.
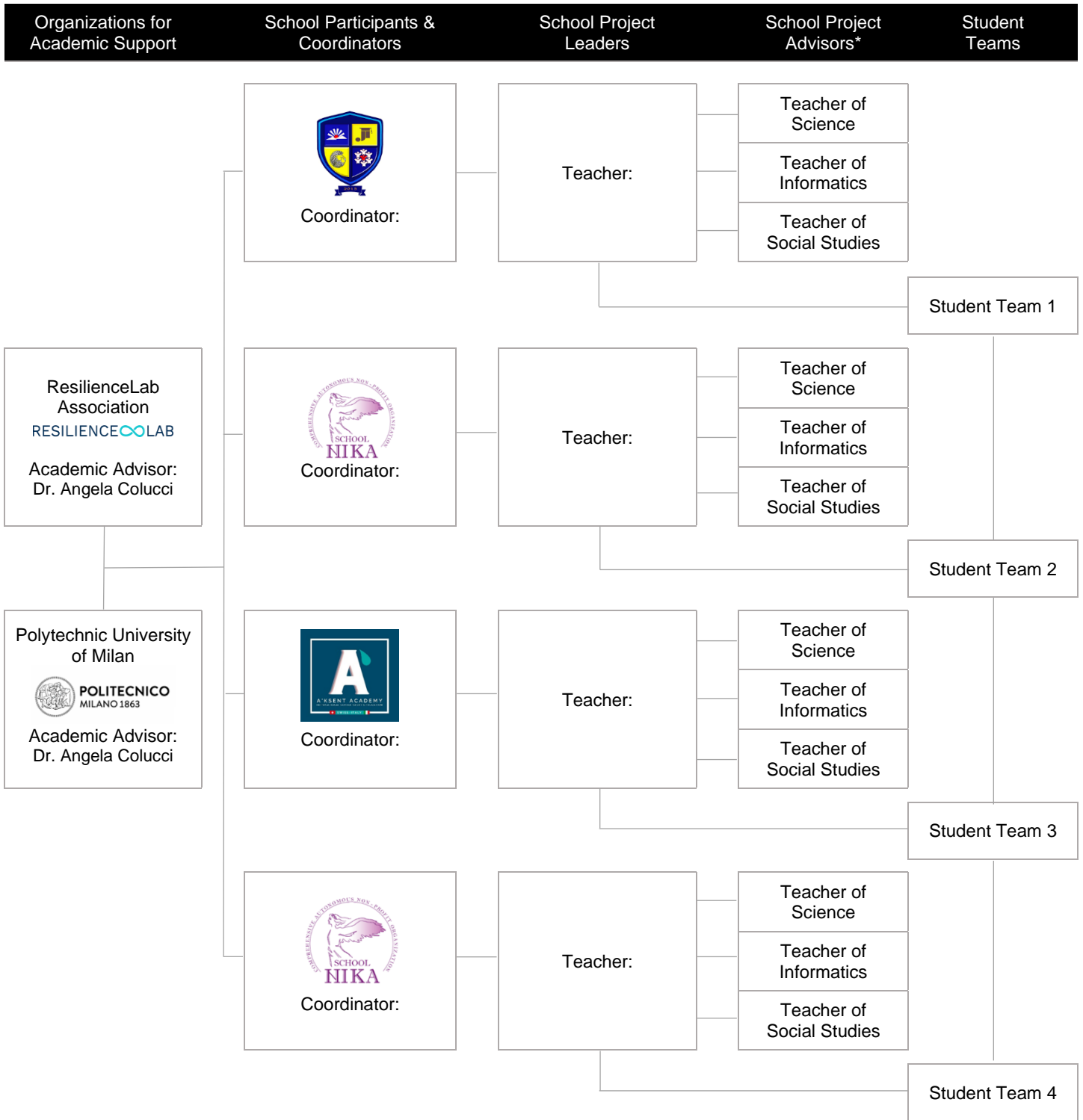- Create inclusive designs that accommodate various cultural preferences and requirements.

Problem-Solving and Critical Thinking
- Develop problem-solving skills by addressing challenges and obstacles in the design process.
- Apply critical thinking to evaluate the feasibility and functionality of design elements.

Culminating Presentation and Public Speaking
- Prepare for the final presentation of the unified school design at the Polytechnic University of Milan.
- Develop strong public speaking skills for presenting the project's insights and contributions.

Organizational Workflow

| Organizations for Academic Support	School Participants & Coordinators	School Project Leaders	School Project Advisors*	Student Teams
	Coordinator:	Teacher:	Teacher of Science / Teacher of Informatics / Teacher of Social Studies	Student Team 1
ResilienceLab Association RESILIENCE∞LAB Academic Advisor: Dr. Angela Colucci	Coordinator: (SCHOOL NIKA)	Teacher:	Teacher of Science / Teacher of Informatics / Teacher of Social Studies	Student Team 2
Polytechnic University of Milan POLITECNICO MILANO 1863 Academic Advisor: Dr. Angela Colucci	Coordinator: (A'KSENT ACADEMY)	Teacher:	Teacher of Science / Teacher of Informatics / Teacher of Social Studies	Student Team 3
	Coordinator: (SCHOOL NIKA)	Teacher:	Teacher of Science / Teacher of Informatics / Teacher of Social Studies	Student Team 4

* School Advisors can develop their own subprojects. For instance:

Science - The science teacher can lead a subproject that addresses the environmental impact of school design. Students can explore sustainable materials, energy efficiency, and environmental considerations in architecture.

Informatics - The information technology or teacher of informatics can guide students in creating physical models or digital prototypes of the school design. This can involve using CAD software, 3D printing, or other relevant technologies.

Social Sciences - The social studies or humanities teacher can lead a subproject that focuses on integrating cultural and historical elements into the school design project. This could include exploring the history of education in different cultures.

Suggestions of Themes for Collaborative School Research
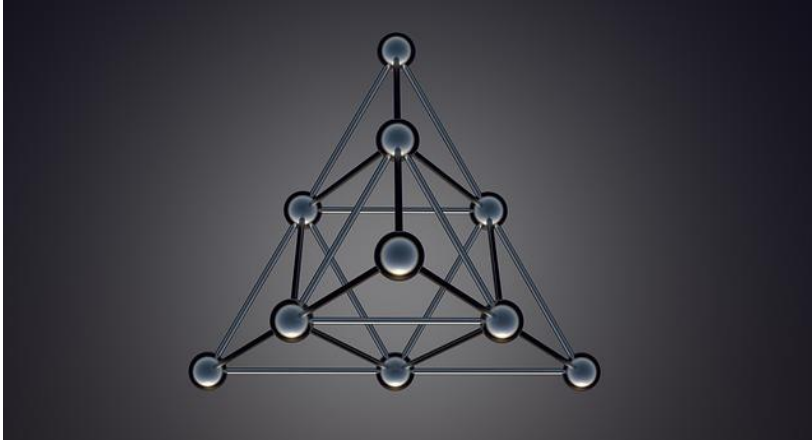
In the 'Global School Design through Geometry' project, students from four esteemed secondary-level institutions will embark on a collaborative journey, specializing in distinct design themes. School 1 focuses on Architecture, School 2 on Interior Design, School 3 on Landscape Planning, and School 4 on School Attire and Accessories. Through the lens of geometry, innovative and culturally-inclusive school environments will be crafted. These themes will harmoniously converge into a visionary presentation at the Polytechnic University of Milan, marking a transformative cross-cultural design endevour.

School Architecture

The architecture team will focus on creating innovative and functional school building designs that optimize space utilization and promote an inspiring learning environment. Students will explore the integration of geometry in architectural elements like facades, roofs, and spatial configurations, ensuring the school's architectural design is aesthetically pleasing and structurally sound.

School Interior Design

The interior design will delve into the art of creating engaging and ergonomic classrooms and spaces that foster creativity and collaboration among students. Students will apply geometric principles to design interior layouts, furniture, and decor, emphasizing the importance of spatial harmony and visual appeal in educational settings.

School Landscape Planning

The landscape planning team will craft outdoor environments that seamlessly blend nature and architecture, offering students a harmonious connection with their surroundings. Geometry will guide the layout of pathways, green spaces, and recreational areas, ensuring a balance between aesthetics, functionality, and sustainability in the school's outdoor design.

School Attire and Accesories

The team working on school attire and accessories will focus on creating a sense of identity and unity among students through clothing and related items. Geometry will be integrated into the design of uniforms, logos, and accessories, ensuring that the school's spirit is reflected in its attire and accessories, fostering a strong sense of belonging.

Operational Characteristics & Estimated Schedule

Time Frame	Work	Operational Characteristics
October - November 2023	Project Initial Organization and Start	- Creation of an interschool group of teacher leaders. Each school will assign one teacher leader to this group. They will meet to coordinate the activities, to establish a shared understanding of goals, roles, and expectations. They will also update the project plan timelines, milestones, and agree to distribute the part of the project to research. For instance, one school team can choose to study landscape planning; other school team the school attire and accessories, and so on. - Creation of the student team in each school. Determine the collaborative platform, the frequency and forms of communication between them, including virtual meetings using Zoom, Google meeting or other similar means. - First virtual meeting between the teams, in order to get to know each other.
November 2023 - March 2024	Project Development	- Students from each school begin research on their assigned themes. - Teachers guide students in locating relevant online and offline resources. - Regular check-ins and collaborative discussions on the project platform to share findings and insights. - Regular virtual meetings between the school student teams in order to share their experiences, discuss arising issues, and exchange useful information. The time and frequency must be agreed between project leaders. Recommended once per month. - Five lectures would be provided by the ResilienceLab Association (Italy) in order to provide useful thematic insights on geometry and designs. The theme for each lecture will be agreed between teacher leaders according to their needs, and proposed in advance to the academic advisor of the ResilienceLab Association. - Each school team will produce a describing their creation. For instance, they could be 3D models, scale models, essays, etc. - Finally, schools will work together on merging their works into a cohesive synthesis to produce one overarching presentation.
May 2024	Field Trip, Project Presentation, Closing Ceremony	- Field trip to Milan (one-week trip). More details will be produced later, as details of activities should be agreed with teacher leaders and the ResilienceLab Association considering the project developments. - Presentation of the Project findings at the Polytechnic University of Milan. - Award of certificates to all student participants and teachers. Awarded by the ResilienceLab Association (Italy) and the International Schools Association.

Documentation of the Activities and Means of Interschool Communications

Each school team should have a "Development report diary" to register details like stages, problems found, things to improve, etc. Project leaders may appoint a student that should be responsible for keeping that diary, take pictures and make short videos on the activities of his team.

Team "............" School Activity Diary	Teacher Supervisor_____ Team coordinator_____ Team members_____ _____ _____	School Logo		
Lesson #	Activity	Working reflections	Difficulties found	Suggestions

Example of diary of activities

Keeping a diary of activities in a school project serves several important purposes. For instance, it provides a detailed record of what has been done throughout the project. Additionally, it documents the progress, milestones, and accomplishments achieved by the project team. This documentation can be valuable as a space for reflection on the project's progress. Team members can analyze what has been accomplished, what challenges have been faced, and how those challenges were overcome. This reflection is crucial for evaluating the project's effectiveness and identifying areas for improvement. Finally, the diary serves as a means of communication within the project team. Team members can refer to the diary to stay informed about the project's status, upcoming tasks, and any changes or adjustments that have been made. This helps to maintain transparency and keeps everyone on the same page.

Blogging

- Blogging in the classroom, especially throughout project work, is a great way for students to document their work and experiences.

- The blog serves as a platform upon which to post written editorials, videos, photos, how-to instructions, and more.

- This would be a great way for students to take initiative, get involved, and share their stories with others.

- Parts of this blog can be uploaded in a collaborative platform in order to share the activities with other schools participating in the project.

Collaborative Platform Engagement

- Utilization of the collaborative digital platforms for cross-school interactions.

- Scheduled virtual meetings or discussion forums to facilitate knowledge sharing, address challenges, and exchange perspectives.

- Platform serves as a repository for research materials, discussions, and updates.

Estimated Budget for the Project

Item	Provider	Aim	Total cost (euros	Cost distribution per school / team (euros)	
5 Lectures (50 minutes each)	ResilienceLab Association (Italy)	To provide useful thematic insights on various aspects of geometry and designs. The theme for each lecture will be agreed between teacher leaders according to their needs, and proposed in advance to the academic advisor of the ResilienceLab Association.	625	School 1	156.25
				School 2	156.25
				School 3	156.25
				School 4	156.25
Field trip to Milan (Italy)	ResilienceLab Association and the Polytechnic University of Milan (Italy)	It aims to immerse students and gain firsthand insights. Additionally, the opportunity to present their collaborative findings at the the Polytechnic University of Milan adds a layer of academic rigor, allowing students to engage with a broader audience and fostering their research, communication skills, and academic accomplishment.	To determine on next November / December2023* and will be calculated according to various aspects, including transportation, lodging, meals, and incidentals connected to the trip.	The cost will be distributed among the participant schools, and will be calculated according to the program agreed with The ResilienceLab Association.	

In parallel, the host organization will actively investigate potential sources of funding, such as grants, sponsorships, and fundraising initiatives. This proactive approach intends to mitigate costs and ensure that a broader spectrum of students can participate in this remarkable educational opportunity.

Acknowledgement: *images obtained from Pixabay. Website:* https://pixabay.com/

APPENDIX

Complementary Information and Supporting Material for the Activities

I. Useful resources

Interdisciplinary Learning and Geometry Resources:

1. [National Council of Teachers of Mathematics (NCTM)](#): Provides resources, articles, and lesson plans related to geometry and mathematics education.
2. [Mathematics Association of America (MAA)](#): Offers resources and publications for exploring the intersection of mathematics and design.
3. [Project-Based Learning](#): Provides tools and resources for project-based learning, which aligns with your project's objectives.

Design and Architecture Resources:

4. [Interior Design Education Council (IDEC)](#): Provides information on interior design education and resources for students.
5. [American Institute of Architects (AIA)](#): Offers educational resources and information about architecture and design principles.
6. [ArchDaily](#): A leading architectural platform with articles, case studies, and design inspiration.
7. [Architectural Record](#): A prominent architectural publication with articles, projects, and insights.
8. [Dezeen](#): A design and architecture magazine featuring news, projects, and profiles.
9. [Architectural Digest: Architecture](#): Offers a dedicated section on architecture and design.
10. [The Royal Institute of British Architects (RIBA)](#): Provides architectural resources and exhibitions.
11. [Architect Magazine](#): Offers articles and resources for architects.

Landscape Design Resources:

12. [American Society of Landscape Architects (ASLA)](#): Offers resources and information on landscape architecture and design.
13. [Land8: Landscape Architects Network](#): A platform for landscape designs to share ideas and inspiration.
14. [Landscape Institute](#): Provides resources and publications on landscape architecture.
15. [Garden Design Magazine](#): Features articles and inspiration for garden and landscape design.
16. [The Cultural Landscape Foundation (TCLF)](#): Focuses on the importance of cultural landscapes and their preservation.

Clothing and Accessories Design Resources:

17. [The Business of Fashion](#): Provides insights and articles on the fashion industry.
18. [Fashion Institute of Technology (FIT)](#): Offers fashion-related educational resources.
19. [WGSN](#): A trend forecasting and analysis platform for fashion and design.
20. [Fashion United](#): Features news and insights on the fashion industry.
21. [The Fashion Spot](#): A fashion community with news and discussions.

Interior Design Resources:

22. [American Society of Interior Designers (ASID)](#): Provides resources, articles, and educational materials.
23. [Interior Design Magazine](#): Features interior design projects and trends.
24. [Elle Decor](#): Offers interior design inspiration and articles.
25. [Interior Design Educators Council (IDEC)](#): Provides educational resources for interior design.
26. [Architectural Digest: Interior Design](#): Offers a section dedicated to interior design.

Cross-Cultural Collaboration and Inclusivity:

27. [Culturosity](#): A resource for understanding and appreciating different cultures.
28. [Global Oneness Project](#): Provides videos and stories that promote cross-cultural understanding.

II. Integrating STEAM concepts

Integrating STEAM (Science, Technology, Engineering, Arts, and Mathematics) concepts into the "Global School Design through Geometry" project can enhance the educational experience and help students develop a holistic set of skills and knowledge. Here are some ways to integrate STEAM concepts into the project:

Architecture and Engineering (STEM)
- Students specializing in architecture can explore the structural aspects of school design, understanding how geometric principles influence building stability.
- Engineering concepts can be integrated into the discussion of materials, construction methods, and sustainability in school design.

Mathematics (STEM)
- Geometry and mathematical principles play a central role in the project. Students can delve deeper into geometric concepts and their practical applications in design.

Technology (STEM):
- Utilize technology tools such as computer-aided design (CAD) software for creating 3D models and simulations of school designs.
- Encourage students to explore how technology can enhance the functionality and efficiency of educational spaces.
- Explore how technology can be integrated into school design, from interactive whiteboards to smart classrooms, considering the impact on pedagogy.

Arts (STEAM)
- Interior design and aesthetics are essential in school design. Students specializing in interior design can incorporate artistic elements into their proposals, considering colors, textures, and art installations.

Environmental Science (STEM)
- Explore sustainability and environmental considerations in school design. Discuss how geometric principles can be applied to create eco-friendly and energy-efficient schools.

Science (STEM)
- Study the science behind acoustics, lighting, and climate control in educational spaces, integrating scientific knowledge into design decisions.

Cross-Disciplinary Collaboration
- Encourage students from different specializations to collaborate and apply their STEM and Arts knowledge to solve complex design challenges.
- Foster discussions on how different disciplines intersect to create comprehensive school designs.

Data Analysis (STEM)
- Have students collect and analyze data related to the effectiveness of school designs, such as student performance, well-being, and sustainability metrics.

Innovation and Creativity (STEAM)

- Challenge students to think creatively and innovatively when addressing design problems, considering both aesthetic and functional aspects.

Artistic Expression (STEAM)
- Emphasize the role of art in school design. Encourage students to consider how artistic expressions, such as murals or sculptures, can enhance the educational environment.

III. Science principles and concepts

Throughout this project, students can review various scientific principles and concepts related to:

Interior Design

- *Color Theory.* Teach students about how colors can influence mood and perception. Discuss how to select colors for different areas of the school that enhance the learning environment.

- *Lighting.* Explore the basics of lighting design, including natural light, artificial lighting, and their effects on well-being and productivity.

- *Ergonomics.* Introduce ergonomic principles to help students design furniture and spaces that are comfortable and supportive for students and teachers.

Landscape Design

- *Ecosystems.* Discuss local ecosystems and how landscaping choices can impact biodiversity. Encourage the use of native plants and sustainable landscaping practices.

- *Environmental Sustainability.* Explore the use of rain gardens, green roofs, and other sustainable landscape features that can help manage water resources and promote environmental conservation.

Clothing and Accessories

- *Materials Science.* Teach students about the properties of textiles and materials used in clothing and accessories, focusing on aspects like comfort, durability, and sustainability.

- *Sustainability.* Discuss the environmental impact of the fashion industry and how sustainable choices in clothing design can help reduce waste and promote eco-friendly practices.

Cross-Cutting Concepts

- *Scientific Method.* Encourage students to use a simplified scientific method to investigate and test their design ideas. This includes making hypotheses, collecting data, and drawing conclusions.

- *Data Analysis.* Help students understand basic data analysis techniques to evaluate the feasibility and functionality of design elements, whether in interior design, landscaping, or clothing design.

- *Environmental Impact*. Discuss how design choices in all aspects (interior, landscape, and clothing) can have environmental consequences, and how sustainable design principles can minimize negative impacts.

IV. Examples of classroom activities

School Architecture:

Activity - Paper Structure Challenge (Ages 12-15):

- Provide students with basic materials like cardboard, straws, tape, and string.

- Challenge them to design and build a small-scale model of a school building using geometric shapes and principles they've learned.

- Discuss how various structural elements like columns and arches can be incorporated into the design to enhance stability.

Activity - Virtual School Design (Ages 15-17):

- Introduce students to simple architectural design software or apps (e.g., SketchUp or Tinkercad) or let them create hand-drawn plans.

- In groups, have them design their ideal school building, considering features like classrooms, common areas, and energy-efficient design.

- Encourage them to use geometric principles and explain how these principles are applied in their designs.

Interior Design:

Activity - Mood Board Creation (Ages 12-15):

- Provide magazines, catalogs, and online resources for students to find images related to interior design.

- Ask students to create mood boards representing the desired ambiance of a specific school space (e.g., library, cafeteria) using cutouts and collages.

- Discuss how color, lighting, and materials contribute to the atmosphere.

Activity - Redesigning a Classroom (Ages 15-17):

- Give students a floor plan of a typical classroom.

- Challenge them to redesign the classroom layout to optimize space, functionality, and student engagement.

- Encourage them to incorporate ergonomic principles and sustainable design ideas into their plans.

Landscape Design:

Activity - Miniature Garden Design (Ages 12-15):

- Provide students with small containers or plant pots, soil, and various miniature plants.

- Task them with designing a miniature garden landscape, considering factors like plant choices, arrangement, and space optimization.

- Discuss the importance of biodiversity in landscaping.

Activity - Sustainable Outdoor Spaces (Ages 15-17):

- Challenge students to create a plan for a sustainable outdoor school space, such as a courtyard or garden.

- Have them research and select native plants that require minimal water and maintenance.

- Encourage them to incorporate rainwater harvesting and renewable energy solutions.

Clothing and Accessories:

Activity - Upcycled Fashion (Ages 12-15):

- Provide students with old clothing items, fabric scraps, and sewing materials.

- Task them with upcycling these materials to create new clothing or accessories. Discuss the concept of recycling and repurposing.

- Encourage creativity and sustainable fashion choices.

Activity - Fashion Design Showcase (Ages 15-17):

- Organize a fashion design competition where students create clothing and accessories based on a specific theme (e.g., "Future of School Fashion").

- Have students research sustainable and eco-friendly materials for their designs.

- Host a mini fashion show to showcase their creations, and discuss how sustainable choices can be stylish and practical.

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