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06

6. Conceptual Development

6.1 Introduction

Through theory and case studies the notion of four types of teachers in the facilitation of learning were identified. All of these teachers have different environmental requirements to enable them to teach.

Four teachers as design generators:

Adults as teachers;

Peers as teachers;

The student as a teacher;

And finally the environment as a teacher.

Adults as teachers

The traditional model mostly focused on adults being the primary teachers of students. Space should enable the adult to teach and learners to learn through complying with the basic spatial requirements.

Peers as teachers

Peers act as teachers through social interaction, peer assistance and peer review. These teachings happen in places where students cross paths, pause and communicate. It also happens when work is exhibited, presented and discussed, as well as in places which enable collaboration and group work.

Students teach each other MST through peer assistance, project-based learning and by playing educational games against each other.

The student as a teacher

With the information revolution the student should be trained to become a lifelong learner. He/she should be able to become their own teacher.

Technology and the internet have connected the student to a wide knowledge spectrum. Space should enable students to plug into this knowledge.

The environment should entice students to partake in activity that will allow them to become self-learners through making, manipulating and altering their world.

Space should allow for individual learning, research and investigation to enable self-discovery. Students should be able to act like professionals in real life situations.

6.2 The Environment as an Informal MST Teacher

All buildings have lessons to teach. They have Science, Mathematics and Technology hidden away in their structures, materials, services and how they interact with the natural elements around them. These lessons can be exposed by showing how things work. Students can learn through their own experiences and interactions with the building.

Figure 6.2
This art piece shows the movement of wind currents on a micro scale. By installing a similar permanent art piece students will be able to visualize the usually invisible wind currents.

Figure 6.3
The pyramid acts like the inverse of a prism. Subtractive light theory has been applied and when equal amounts of cyan, green and red are present white light is produced.

Lessons in electrical supply

Figure 6.1 Node light by Odd Matter Studio, resembles circuit diagrams

Lessons in the wind

Figure 6.2 Windswept, Charles Sowers

Lessons in the colour of light

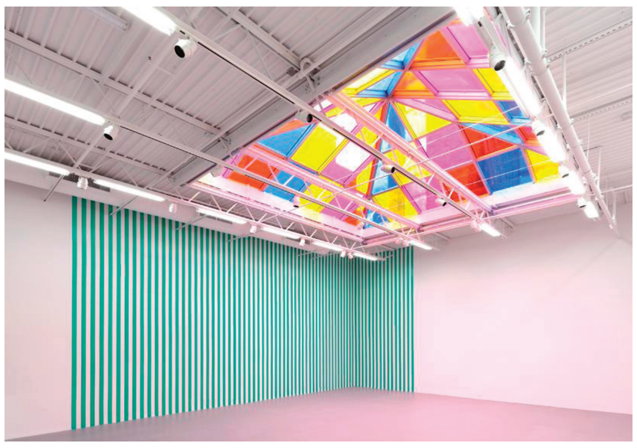


Figure 6.3 Electricity Paper vinyl, installation view 5, Daniel Buren, 3013

Lessons in the sun's path

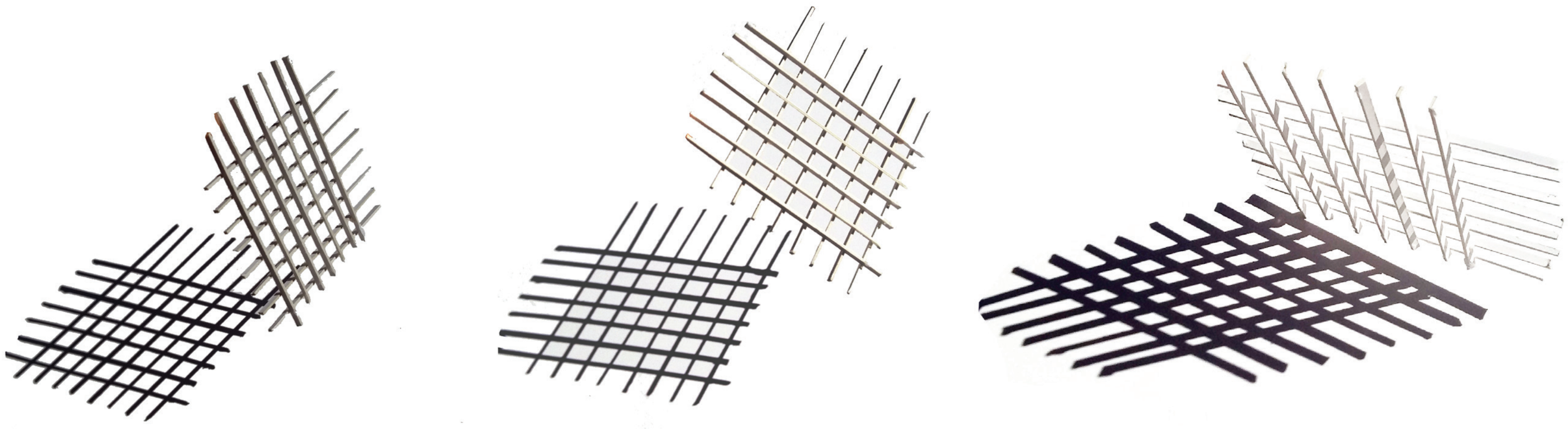


Figure 6.4 Proposed screens for social learning areas.

Figure 6.4
As sunlight interacts with the screens, the angles and lengths of the patterns cast will change. The screens will aim to encourage students to start noticing the Mathematics around them and to appreciate the beauty of it.

Museum Wall - Lessons in objects

By creating a rich environment filled with elements and objects, like one would find in a natural history museum or Science centre, the student can choose to actively engage with an object, thereby unlocking a wonder of the world, forming opinions or actively forming connections between taught concepts and the real world.

Lessons in African Fractals

Ron Eglash talks about the inherent mathematical scaling that exists in African design and by incorporating the African Fractal theories into Mathematics class, how African American students were taught about their Mathematical heritage and this led to an improvement in their understanding of Mathematics (TedGlobal, 2007). The museum wall is envisioned as an African Fractal consisting of 60° triangles (refer to Figure 6.5). Students can interact with this display system by scaling down and scaling up the triangles. The initial concept was to collect seeds, animal carcasses, shells, insects, stones, minerals or any other natural objects and to display them in these museum walls. Through these displays the natural environment (outside) is brought into the school. In the makerspace there will be molds where the students can cast these specimens in modular resin triangles. When inserted into the display wall these triangles become part of the fractal.

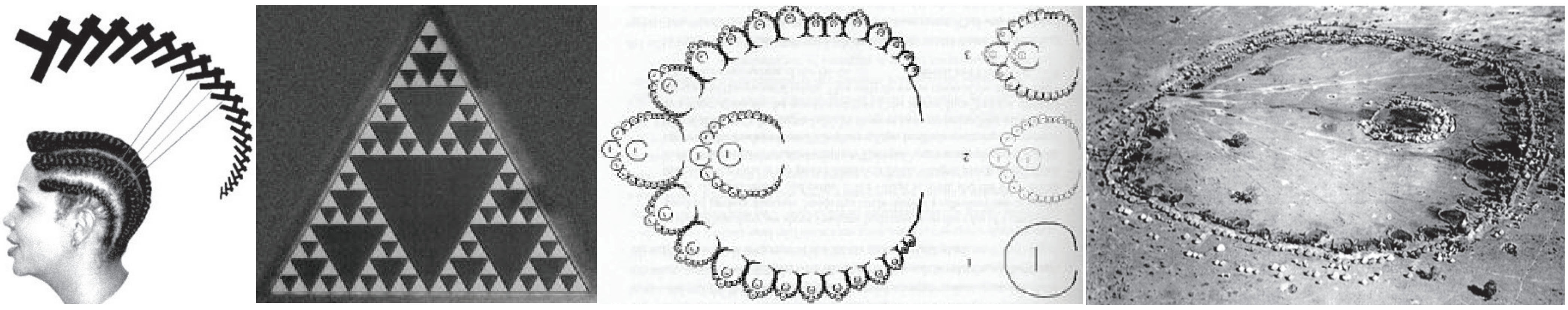


Figure 6.5 African Fractals (TedGlobal, 2007)

Figure 6.6 Museum wall

Science Wall - Lessons in equipment

In all schools there is fascinating Science equipment, materials and specimens locked up in forbidden storerooms only to be revealed to a select few, for a limited period of time. Through exposing these hidden wonders to all, a world of possibilities can be opened up in the students' minds (refer to Figure 6.6 and 6.7).

The Science and Biology storerooms in the school will become glass boxes. Here the shelving system that will become visible through the glass facade will also resemble an African Fractal (refer to Figure 6.5).

A fractal of squares in squares. The change in shape will indicate that the elements on display are functional and should be handled professionally. By exposing the storeroom, students can inquire and assert their educators to teach them through experiential methods.

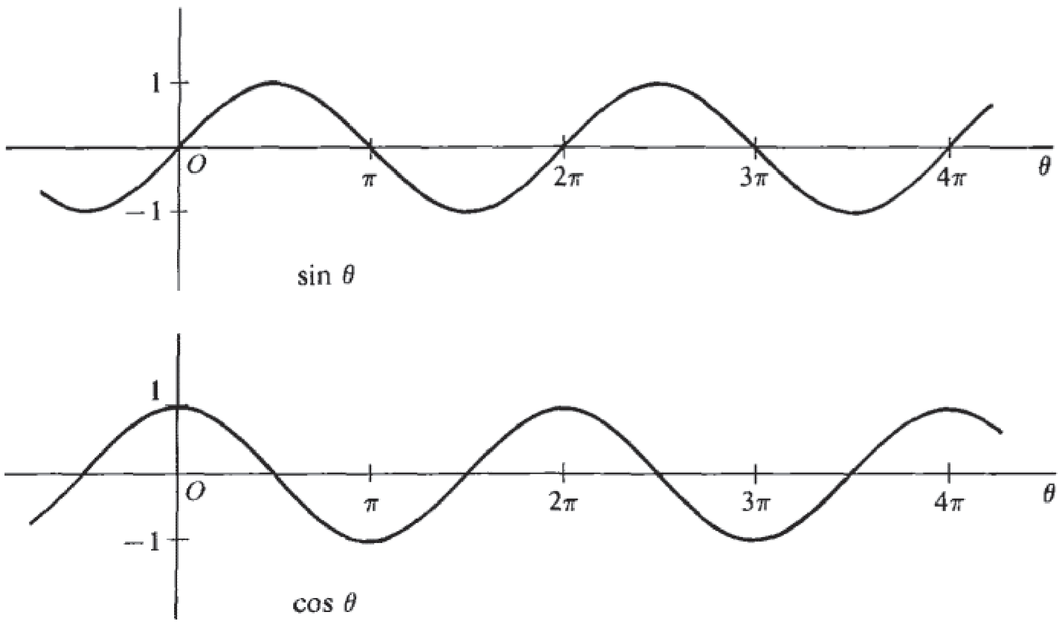
Figure 6.7 Storage wall

Development of Concept into Physical Form

Structure is generated using the principles of the sine and cosine graphs found in trigonometry. The waves depicted in these graphs are also found in nature, such as sound waves and the movement of light in space. The wave thus combines Mathematics and Science and becomes a symbol to use in the creation of interior structure and functional space.

The seperation of the Science laboratory and main circulation artery is thus inspired by the curving angles of the trigonometric graphs. The curving wall creates nieches for students to work, rest or interact with one another. The wall then not only functions as a sound and visual barrier, but becomes an interactive wall. The curves created within the interior also acts as a spatial gradient, allowing users to interpret the space themselves and adapt it to their needs. The shapes of interior intervention acts as visual cues, further enabling the multifunctionality of the trigonometric wall.

Figure 6.8 Conceptual Models



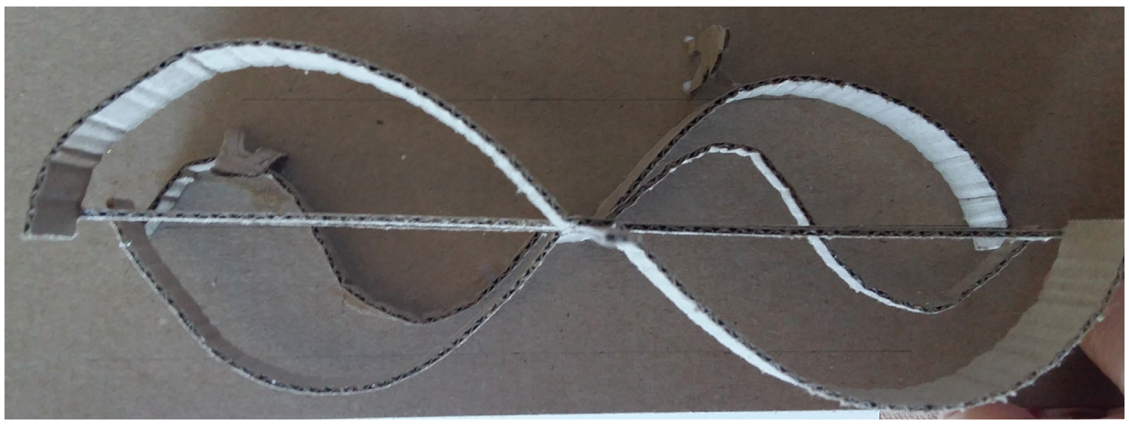


Figure 6.9 Conceptual models developed from Sine and Cosine trigonometric graphs.

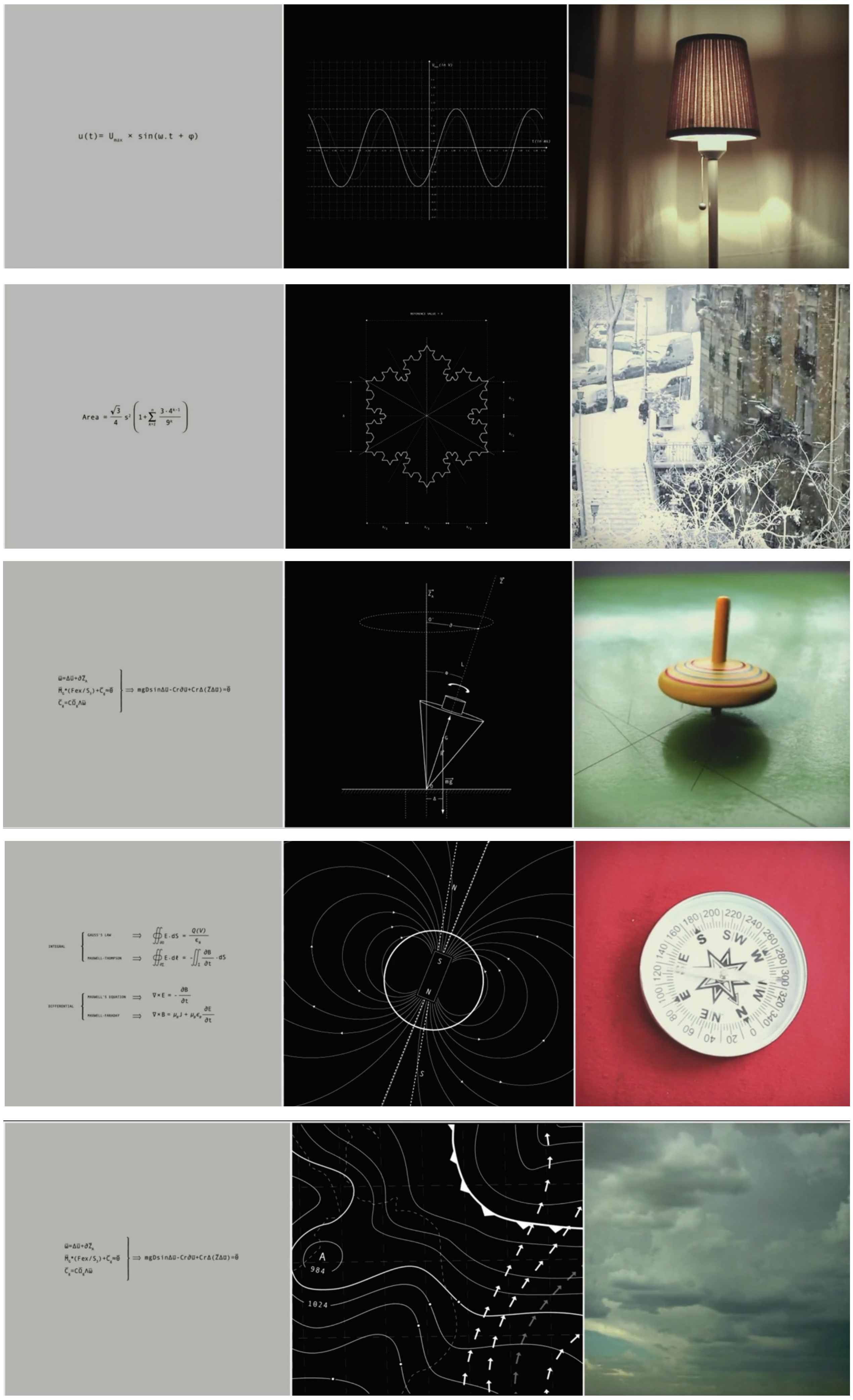


Figure 6.10 Compilation of frames from short film, Beauty of Mathematics (Parachutes, 2013)

Figure 6.10 depicts how, through graphs and equations, it is evident that Mathematics and Science can explain everyday phenomena.

6.3 Conclusion

It is important that the design and the technification thereof allows each of the four types of teachers to teach optimally. This is dependent upon the way space acts as a teacher. The in-depth design focus has been narrowed down to the concept of space as a teacher of MST. Space will be designed to enrich Mathematics, Science and Technology education.