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04

4. Case Studies & Precedent Studies

4.1 Introduction

The following chapter will investigate case studies of local schools and a Science centre. These case studies were conducted to determine appropriate local approaches to MST education promotion. Investigating how resources can be shared between communities, how an interest in Science can be stimulated and determining how adaptive reuse of building stock can provide good practice educational environments in our city centres.

Precedent studies will be conducted to determine how the built environment can promote community, collaboration and how a school can resemble real life. Museum education will also be investigated to determine how informal MST education can happen through Art and the natural environment.

4.2 Case Studies

4.2.1. Streetlight Schools

Typology: Primary school
Location: Jeppestown, Johannesburg
Architects: Fieldworks
Completion: 2016-ongoing
Green Star Rating: 4-Star SA Interiors rating

Background: Streetlight School is located in Jeppestown, Johannesburg. It is an inner-city school housed in an office building which was adapted into a school. The school is a work in progress and will expand as the oldest grade moves to the next grade. Currently, the school has only grade R and grade 1 pupils.

Streetlight Schools are low-cost, innovative primary schools based on a model that focuses on inquiry, exploration, collaboration, relevance, and the use of technology to teach and learn. This approach empowers pupils to master core skills while developing curiosity through project-based learning (SolidGreen, 2016).

In 2016 the Streetlight Schools opened the first school in a mixed-use building located opposite Jeppe Park and walking distance from Jeppe Station. The school initially started as an after-school programme and after two years evolved into a school for 45 pupils. The school plans to expand to 200 pupils in the near future (SolidGreen, 2016).

The architects aimed to establish an interactive learning environment by creating spaces that would strengthen the Streetlight Schools' curriculum. Through adaptive reuse they created a low-cost interior which merges with a high-technology learning model. The school is a multi-functional learning centre which uses green construction principles as far as possible (SolidGreen, 2016).

In February 2016, the total cost spent on the 1,200 sq m project stood at R1,5 million (SolidGreen, 2016). Through the clever use of material, the reuse of existing inner city building stock and systematic expansion the interior of the school presents an affordable solution for the provision of educational facilities in the city of Johannesburg.

As far as possible the design was material-efficient. Dry-wall offcuts,

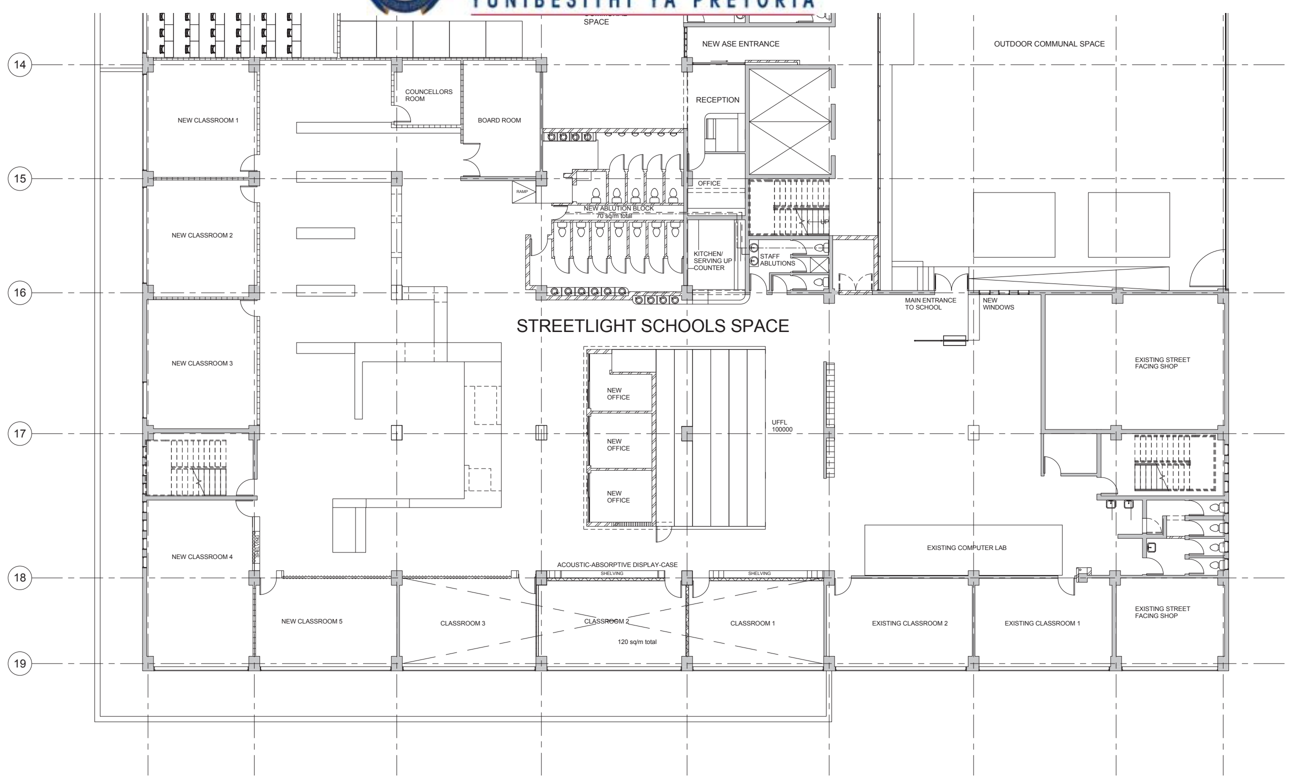


Figure 4.1 Plan of interior layout (Fieldworks,2016)

recycled wooden pallets and reclaimed wooden flooring were used in the project. The bricks and rubble from onsite demolition work was reused (SolidGreen, 2016).

Situated in an area of Johannesburg where the recycling and reclaiming of scrap metal and materials plays a major part for some of the businesses, the school's interior brings reclaimed elements into the school, connecting the city character with the interior. The interior is built out of affordable and easily accessible materials which are used in innovative ways.

The building: Classrooms are placed on the periphery and alternative educational spaces are placed at the core of the school. These spaces have an ambiguous quality enabling them to be used in multiple ways.

One striking feature of the design is the playwall that acts as a divide between different programs without detaching the spaces from each other. The playwall contains niches and spaces that can be used in different ways.

The walls of the classroom are constructed out of a dry wall system that was detailed to form deep window sills. The interior side of the classroom has a gypsum board layer and the exterior wall is clad in a black mesh with timber slats. The interior of the wall contains sound absorbing insulation. Polycarbonate sheeting installed on both sides of the dry walling studs function as large windows on the interior classroom wall. The polycarbonate allows views in from the darker passages beyond, while at the same time obscuring the view out from the lighter classrooms. The polycarbonate sheets also ensure that natural light reaches into the deep interior space.

Lessons learned:

- Alternative educational spaces can be created by using cost effective materials.
- By providing ambiguously programmed spaces students and teachers can use the space alternatively.
- Through cleverly designed details it is possible to create visual links to classrooms and in-between spaces without disrupting the education process.

Figure 4.2 Photo of classroom wall detail (Author:2016)

Figure 4.3 Photo of aquaponics (Fieldworks, 2016)

Figure 4.4 Photo of open theatre space (Fieldworks, 2016)

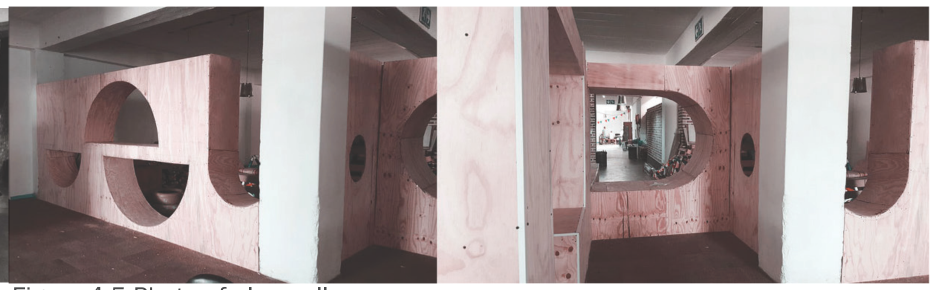


Figure 4.5 Photo of play wall (Fieldworks, 2016)

Figure 4.6 Photo of play wall with ambiguously programmed space (Fieldworks, 2016)

Figure 4.7 Photo of classroom walls with polycarbonate sheet for windows (Fieldworks, 2016)

4.2.2 Bambisanani Community Learning Program

Typology: Science and mathematics facilities
Location: Grantleigh Schools, Mposa, Kwa Zulu Natal
Sponsors: Richards Bay Minerals (Building & transport)
Rotary International (IT)
Architects: TJA - Richards Bay
Completion: June 2012

Students talking about their experience of the project in an online video interview with Bambisanani:

"Now I find life so exciting, so exuberant so much more extra super-sonic."

"I'm doing grade 12, it made me realise that Science is part of how we live everyday. I just got motivated to do my work, to love Science and Maths. Everything is so perfect. The teachers are patient, they make you understand so easily. Everything is perfect. Thank you."

"It's like a dream come true, I've always dreamed of improving my marks in Physics and Maths and they have been improving since I started the Bambisanani project. I'm so grateful, it shows that my future are becoming brighter."

"Especially attending here we help other learners in our school because we take the information that we get here and use it in our school. It helps us, we help one another." (Bambisanani Learning Community Project, 2013)

Background: The Bambisanani project is an example of a multi-disciplinary collaboration where Grantleigh School, an independent school in Richards Bay, together with Richards Bay Minerals (RBM) owned by Rio Tinto, TJ-Architects and the Department of Education partnered to create a Science and Mathematics facility which is intended both for the students of Grantleigh as well as for students from fourteen local rural schools who demonstrate remarkable potential (Bambisanani Learning Community Project, 2013).

360 promising students from Grade 10 to 12 from surrounding schools visit the educational premises for 35 sessions during the course of a year. The learners attend lessons in STEM related subjects, including Mathematics, Science and English. Through this project these learners get access to highly skilled teachers and they are exposed to state of the art Science and Mathematics resources (Bambisanani Community Learning Program, 2013).
They are also exposed to high-tech environments and smart-classrooms. A problem in rural schools is that due to lack of facilities and skilled teachers, students are never able to do experiments. Bambisanani offers them an opportunity for hands-on experience with the many experiments which form part of the Curriculum Assessment Policy Statements (CAPS).

Grantleigh Schools also conduct several teacher training seminars each year. The Science and Mathematics teachers from surrounding schools are invited. Here they have access to lecturers from various South African universities. Workshops are provided by Grantleigh School's staff to cover difficult sections of work (Bambisanani Learning Community Project, 2013).
Shaun McMurtry, headmaster of Grantleigh Schools, in an online interview (2016) stated that the independent sector of schooling recognises the responsibility it carries in terms of its privileged position with regard to access to resources, expertise and facilities. Thus, to extend these resources to the youth from the local rural communities, Bambisanani, which means we stand together in isiZulu, was formed. By recognising that through a collaboration of industry, private schooling and state education we could arrive at a situation which benefits students from local schools which form part of the partnership agreement (Bambisanani Learning Community Project, 2013).
The main purpose of the Mathematics and Science partnership is to ensure that students with potential will be able to apply at universities of their choice for STEM related careers like engineering, metallurgy and geology, which will allow increased opportunity to work in the mining industry.

The building: The roof of the building is reminiscent of the ribcage of a mammal. The bent steel roof of the building reaches down, almost touching the ground at the entrance to the auditorium. The roof exposes how the structure works. The ventilation ducts are exposed and painted in bright colours.

The facilities consist of a double storey Science centre. The building can be divided in two halves. The theory classrooms are located on the western side and double up as the practical laboratories. The eastern side is an auditorium space.

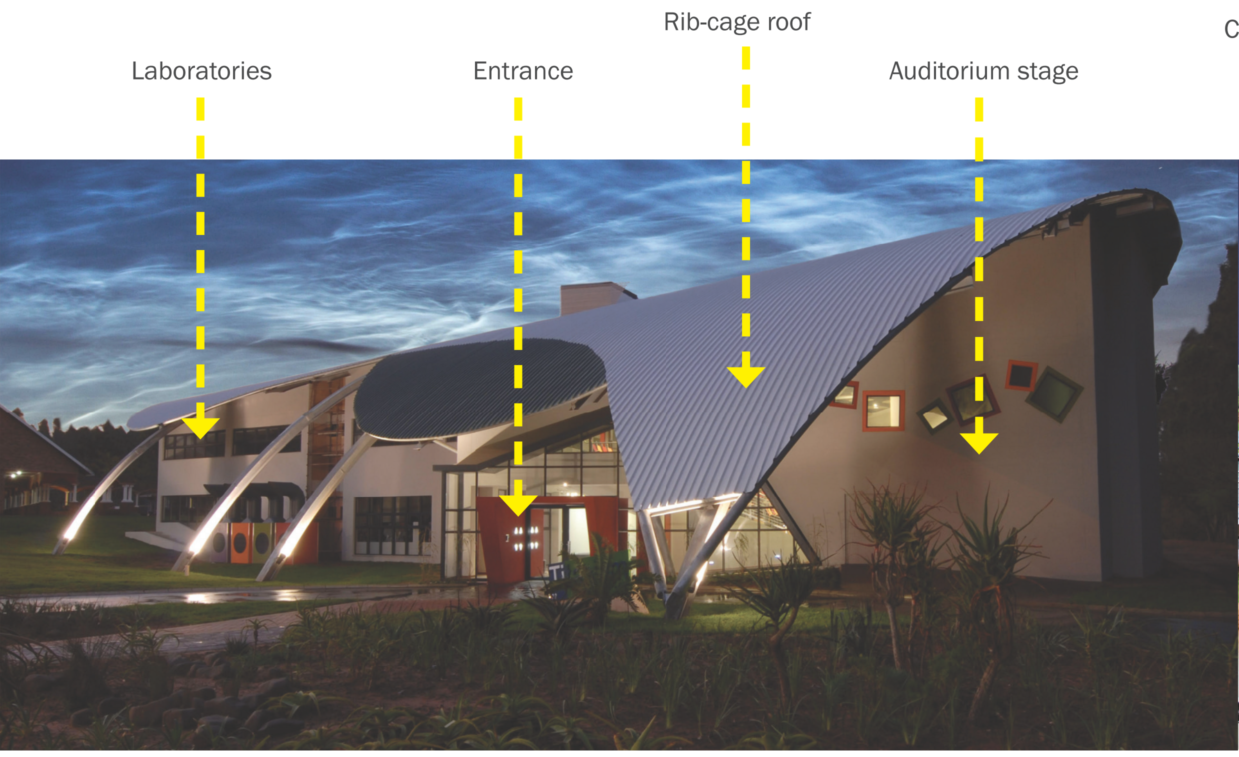


Figure 4.8 Photo looking north-west of Science building (TJA)

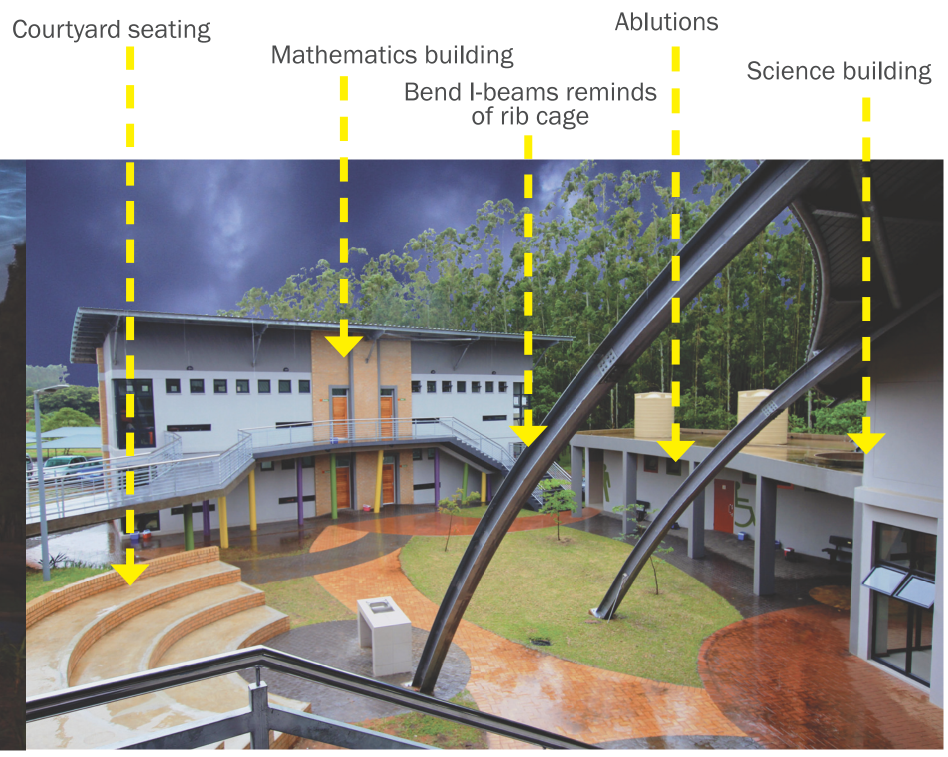


Figure 4.9 Photo from Science building looking out on courtyard (TJA)

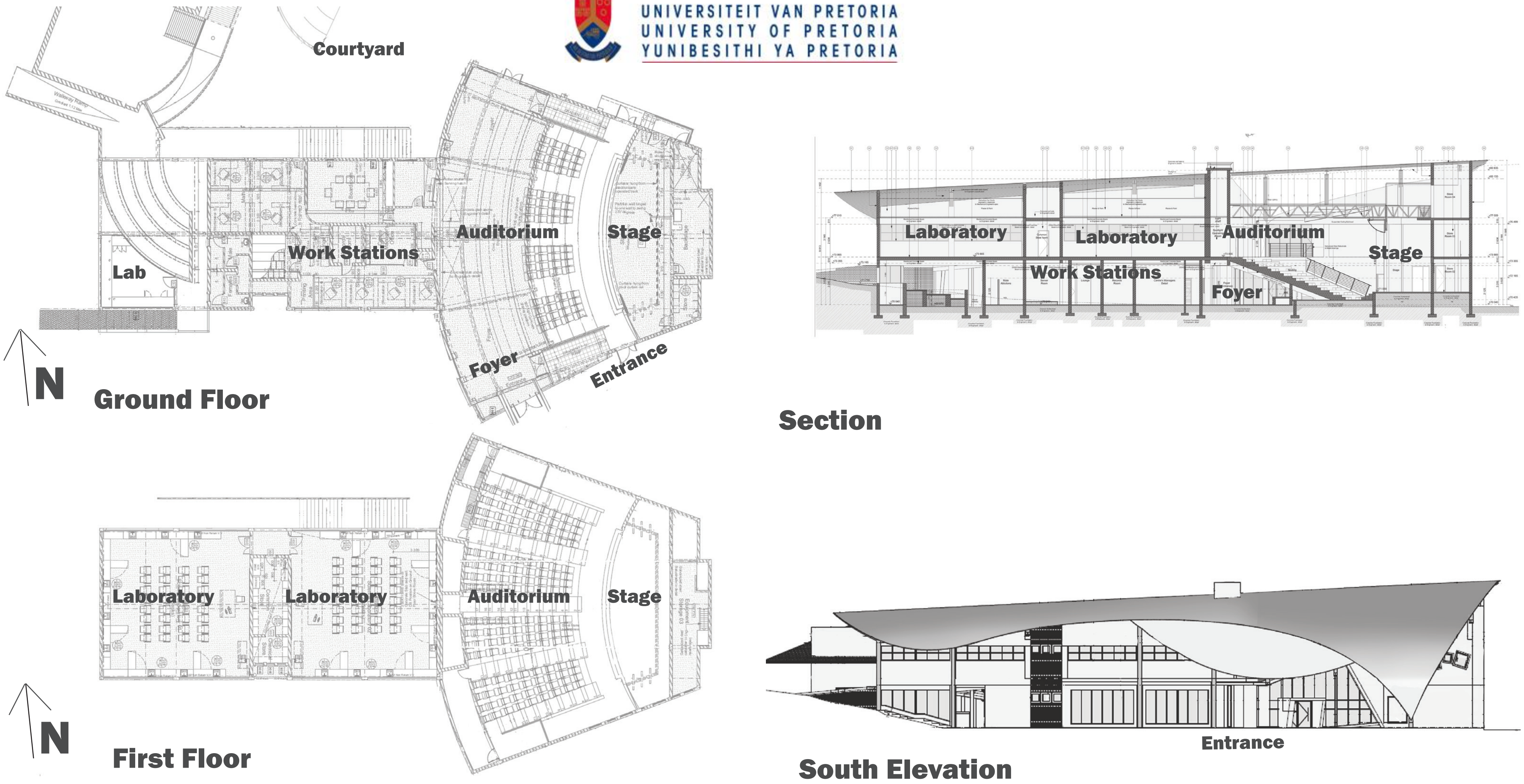


Fig. 4.3 Architectural drawings of the science building (TJA, 2011)

The Auditorium: The stage in the auditorium functions as a laboratory where Science shows can take place. Here Science experiments can be demonstrated on stage in front of a larger audience. The demonstrations are also projected on a screen at the back of the stage. The stage is raised with four steps which improves the view for the audience but divides the audience from the demonstrators creating a theatre-like experience.

The Science show is ideal to get pupils excited about Science and to demonstrate concepts through real life experiences.

The science classrooms and laboratories: The desks are regular seating height with regular height chairs. There is a clear view to the front of the classrooms where the smart board is installed. The tables are rectangular and can easily be rearranged into different configurations. Sinks and fold-out laboratory tables are fixed around the edge of the classroom, allowing for flexible use of space. These laboratory tables are at a comfortable standing height. Some of the plumbing for the basins and the ventilation system are exposed adding an informal educational layer to the space.

The floor also indicates to the user how the furniture should be arranged for the space to function optimally. Computer stations are situated in the back corners of the classroom.

The Mathematics classroom has smaller desks and soft seating. Here the floor finish does not inform layout and the desks cannot be placed side by side due to the desks' legs. The room seems disorganised due to the desks.

Lessons learned:

- Science should be exhibited in a way so that interest and excitement is sparked in pupils, as done by a Science show on the stage in the auditorium.
- The building in itself houses opportunity for informal learning. Here the architects exposed the services.
- The furniture should be designed in such a way that it can be rearranged easily without becoming disorganised.
- Science experiment tables should be at an ergonomic height comfortable for standing and working.
- The interior elements can educate the user how the space can be used, as in the case of the Science laboratory where the floor finish becomes an educational tool.

Figure 4.10 Photo of auditorium seating (TJA)

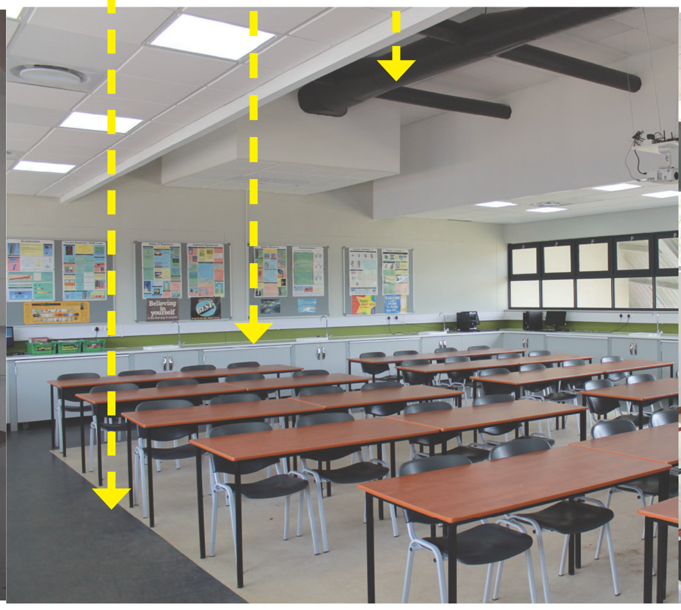


Figure 4.11 Photo of laboratories in Science building (TJA)

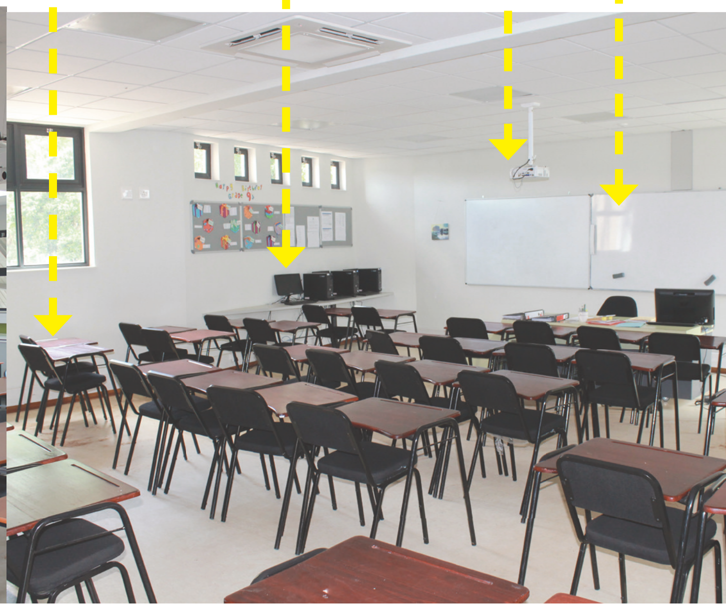


Figure 4.12 Photo of classroom in Mathematics building (TJA)

4.2.3 Sci-Enza
Hands on Science

Typology: Science Centre
Location: University of Pretoria, Hatfield, Pretoria
Organization: Southern African Association of Science and Technology Centres (SAASTEC)
Capacity: 120 pupils in science show and 30 pupils in workshop
Age: Gade R-12
Programme: Camera Obscura, Science Show and Workshop

Background: The Sci-Enza is the oldest interactive Science Centre in South Africa (Nordhoff, 2011).

Reservations need to be made in order to visit the Sci-Enza. They usually visit once a year per grade group. Some visit more than once to cover different topics. Transport costs are covered by the schools and there is a small entrance fee. Schools can request themes. During the school holidays the centre runs a programme for primary schools.

In 1977, the then Exploratorium was founded by Prof. Lötz Strauss. It consisted of an open "laboratory" in the Old Physics Building with the aim of offering students the opportunity to "play" with scientific apparatus in an informal setting. After the Science centre moved to the Natural Sciences Building 1 it became a popular place to visit, for the general public, school students as well as university students. The Camera Obscura was built on the roof of the Natural Sciences Building 1 in 1990. The Exploratorium's name was changed to the Discovery Centre @TUKS. In 2001, the Discovery Centre moved to the Technical Services building. The centre became a truly integrated Science, Engineering and Technology (SET) centre involved in a number of outreach activities.
The centre changed its name to Sci-Enza in 2005 Sci, which stands for sciSnce and Enza for the isiZulu word "sebenza" which means work or to do (Nordhoff, 2011).

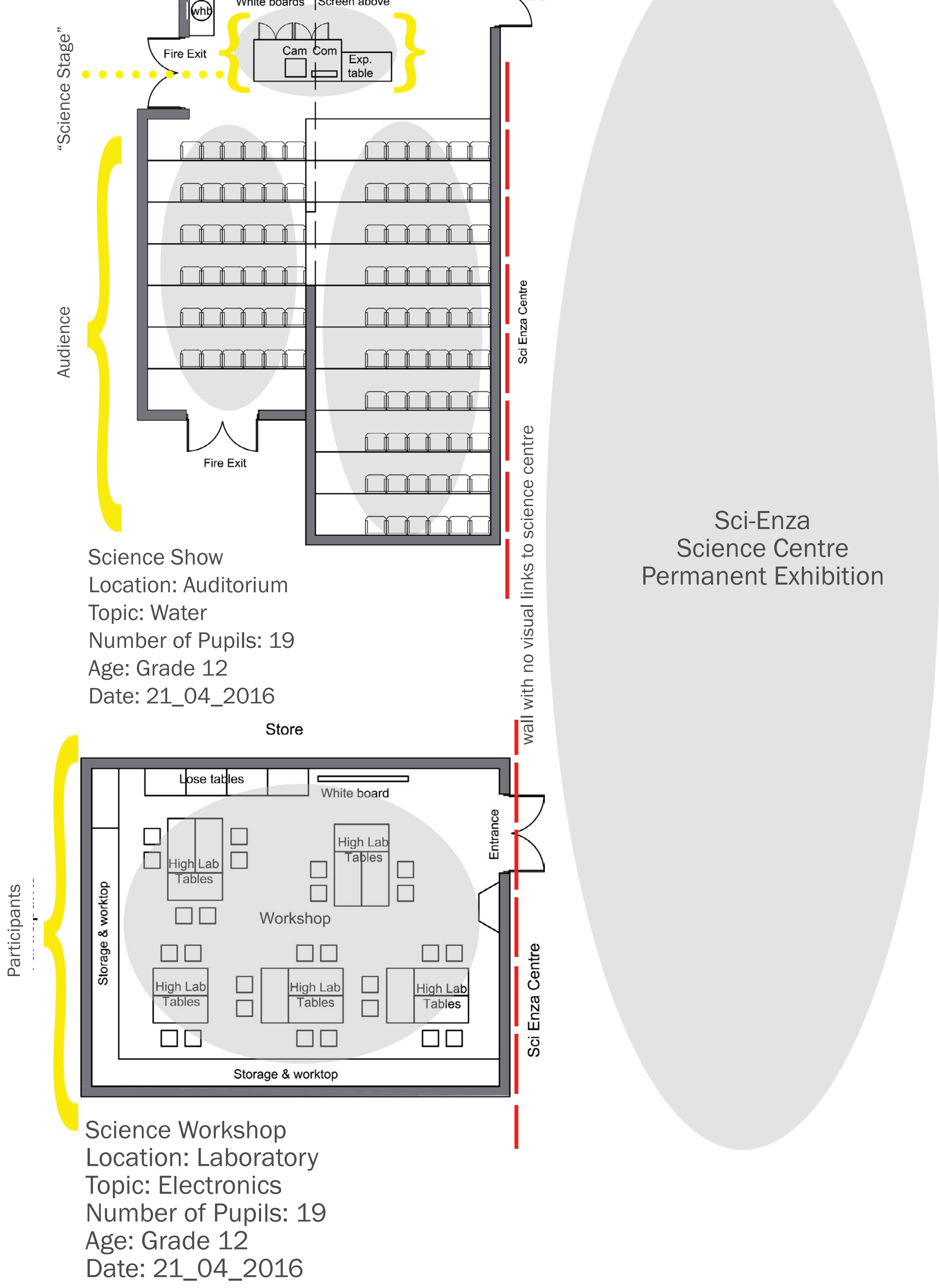


Figure 4.14 Diagrammatic illustration of Sci-Enza plan

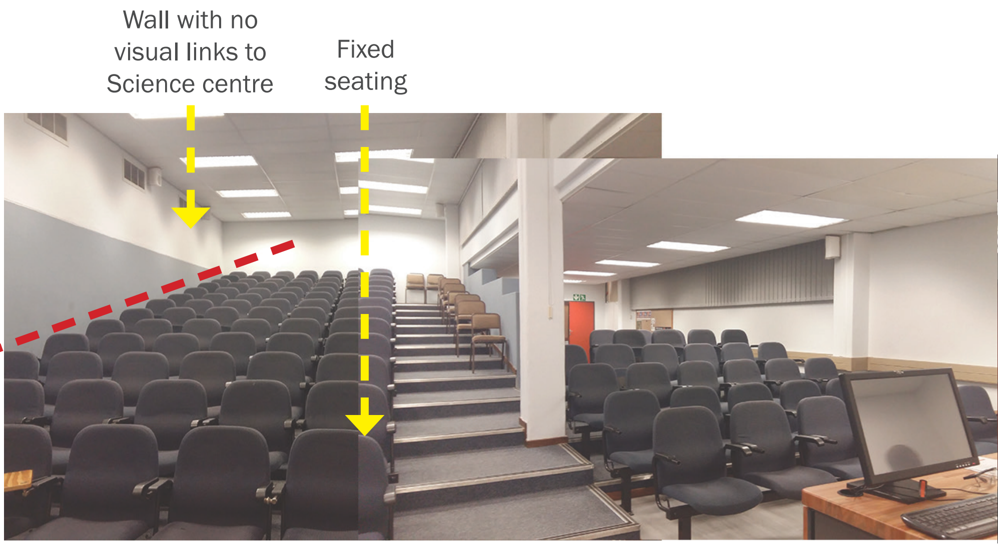


Figure 4.13 Photo of auditorium seating

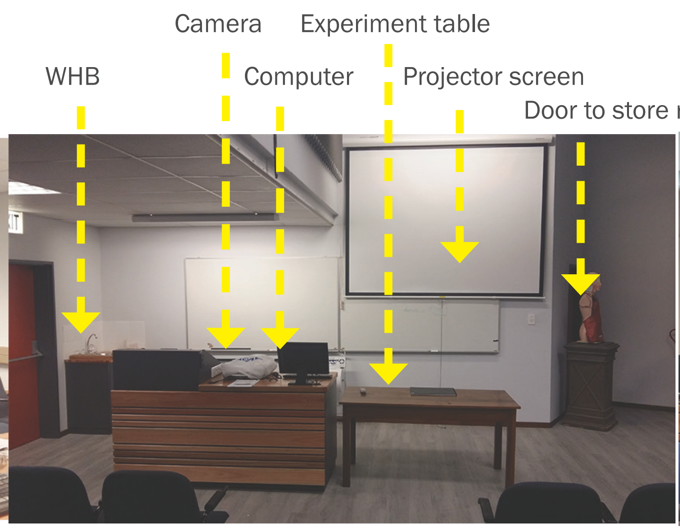


Figure 4.15 Photo of auditorium "Science Stage"

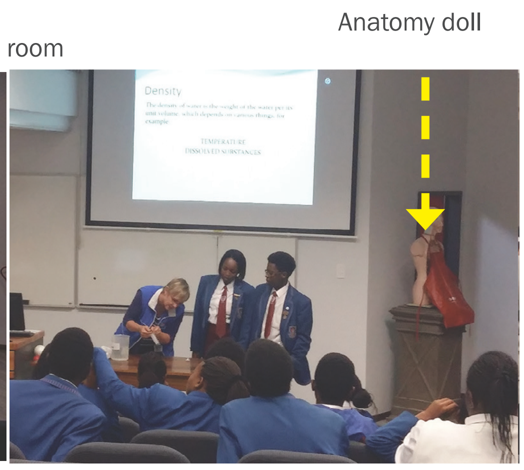
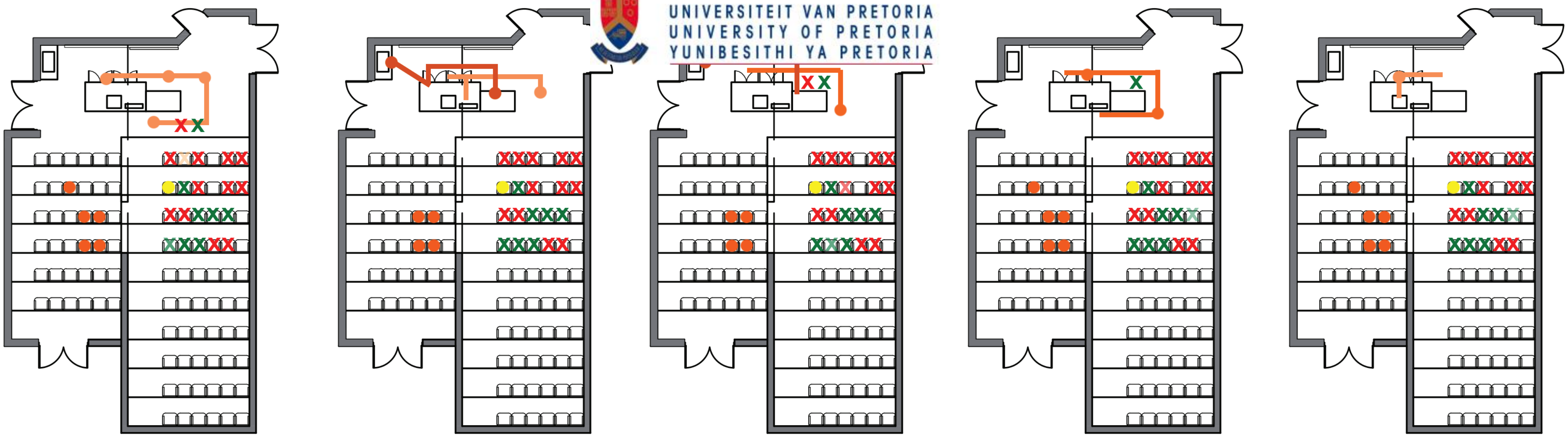


Figure 4.16 Photo of audience participation in science show



Introduction : Ice breaker
Props used : Rope
Participants : 2 pupils & peer assistance

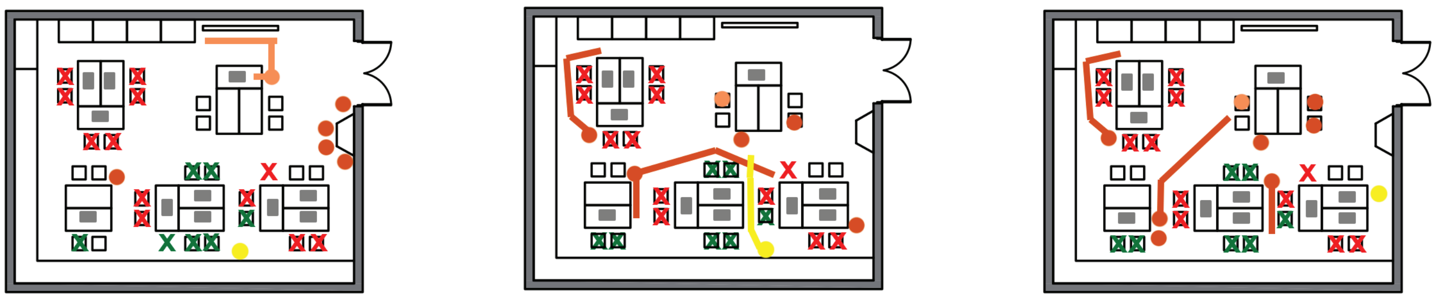
Water Density
Props used: Polystyrene molecule, 2 glasses of water, a kettle food colouring, & dish for spillage
Participants: Instructor & apprentice

Water Solution
Props used: Sugar 2 glasses of water & food colouring
Participants: Instructor, apprentice & 2 pupils

Heat Conduction
Props used: Balloon, candle, water, fire & safetyglasses
Participants: Instructor & a student

Surface Tension
Props used: Bowl, water, pepper, dish washing liquid
Participants: Instructor
Tools: Camera, projector screen

Fig 4.10 Diagrammatic illustration of user interaction in auditorium



Introduction
Instructor explains concepts and how to work equipment.

Workshop exercise
pupils built circuits in pairs from instruction manual.

Workshop exercise
pupils built radio and fan into circuit

Legend
- Main instructor
- Assistant
- Teacher
- X Girl
- X Boy

Figure 4.18 Diagrammatic illustration of user interaction in workshop

The Auditorium: The auditorium is used for Science shows. Here Science experiments are performed with everyday household materials. At the front of the auditorium there is a high level built-in presentation counter and a loose experiment table. The counter has a camera that projects the counter surface onto a screen behind the demonstrator.

The slope of the auditorium's stepped seating is not steep enough, making it difficult for all visitors to see the experiments on the table. The experiment table does not have a video camera even though most of the experiments happen in this space. Pupils are called to the front to become part of the experiments. Access to the storage and water is important in the Science show.

The Workshop: In the workshop room there are experiment tables grouped in clusters of three. The tables and chairs are high so that pupils can stand or sit while working. There is enough room between the tables so that instructors can move from group to group. A movable white board is used to explain the instructions. Pupils work in groups of two and with a larger group of six around a cluster. This enables each student to be part of the exploration but peer assistance from neighboring groups in their cluster is still possible.

There is no connection to gas or water which limits the experiments that can be practised in the space.

Both the auditorium and workshop space are disconnected from the Science Centre. You would not know that there are Science classes happening if you were next door in the centre.

Lessons learned:

- Science and the use of Science should be exhibited in a stimulating way in order to stimulate curiosity and excitement. Here the Camera Obscura achieved this endeavor successfully.
- Students were further enticed through the science show. The space is more of an auditorium than a theatre enabling the demonstrator to include students in the show. Thus, it is better when the experiments are not performed on a stage as this creates a divide.
- Learning could have been extended into the Science exhibition center if there were visual links between these spaces. Passersby could have been drawn in and enticed by visual connections.
- Students working in smaller groups doing practicals stay intrigued and encourage each other to experiment with different solutions.

Figure 4.17 Photo of workshop space

Figure 4.19 Photo of storage in workshop space

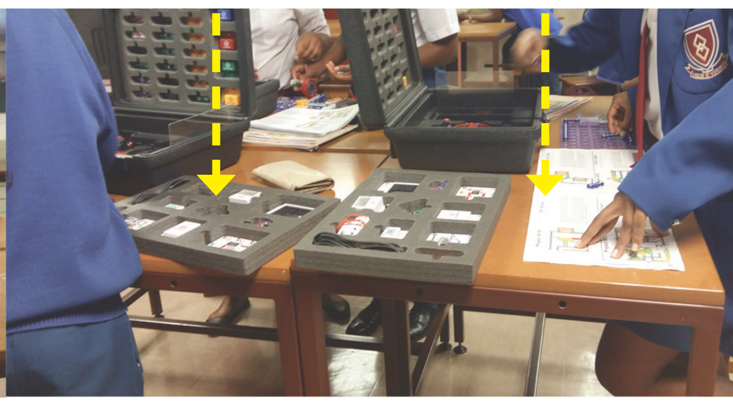


Figure 4.20 Photo of experience-based learning in workshop space

4.3 Precedent Studies

4.3.1 Montessori College Oost, Amsterdam

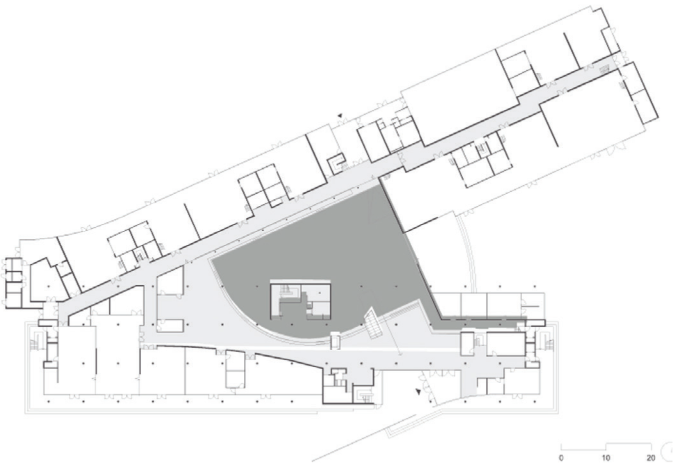


Figure 4.21 Plan of school (Hertzberger:2008)

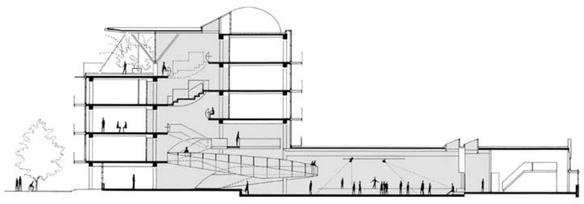


Figure 4.22 Section of school indicating half storeys and circulation (Hertzberger:2008)

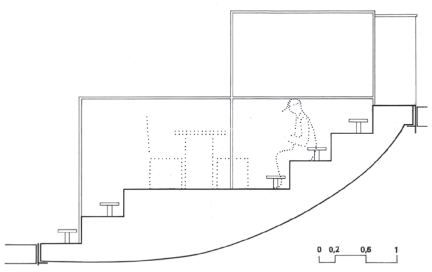


Figure 4.23 Section through working balcony and half storey (Hertzberger:2008)

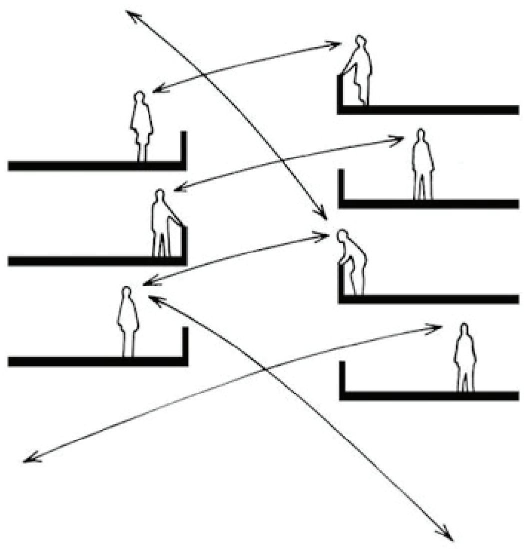


Figure 4.24 Section with visual links created by half storeys (Hertzberger:2008)

Typology: High School
Architects: Herman Hertzberger
Location: Amsterdam, Netherlands
Area: 16.345 m2
Year: 1993-1999

The building: The school was designed to function more like a city than a school. Hertzberger's focus was on the dynamics of movement and circulation through the building. The stairwells are not located directly above each other but they are staggered to create the most number of visual links. The corridors are wider than is necessary. The balustrades contain fold-away workspaces for students to work independently (Eferreiraantunes, 2012).

The central circulation space with its half storeys and working balconies creates spatial complexity and social nodes similar to that present in a city. The half stories strengthen visual links and the working balconies double as stairs. These balconies contain landings that can also accept a chair. They can be used as class space or to meet and hang out (Hertzberger, 2008: 120). The working balconies have lower and higher balustrade details, the higher balustrade screens seated students off while standing students can enjoy the view and connectedness of the space.

The balconies act as a series of small plazas, inviting students to spend time there (Hertzberger, 2008:120).

Classrooms remain a static home base, but the space beyond developed from a traditional corridor into an educational shopping street (Hertzberger, 2008: 124).

The components like the lunch room, library, assembly hall and gymnasium are starting to overlap, absorbed by the school's core. The central space can house activities that were excluded because of lack of space (Hertzberger, 2008:124). These street like spaces have been used by the school's students to shoot a music video. The corridors and squares are used as small stages for different scenes in the video (Pas op je Pas, 2011).

Lessons learned:

- Circulation spaces can become the heart of the school. The arteries that carry the life support of the school. Classrooms should be able to tap into these arteries.
- Visual links should be used to connect students and subjects.
- Social nodes can be used to create a sense of community..

Figure 4.25 Photo of school building exterior (Unknown)

Figure 4.26 Photo of school building interior circulation (Unknown)

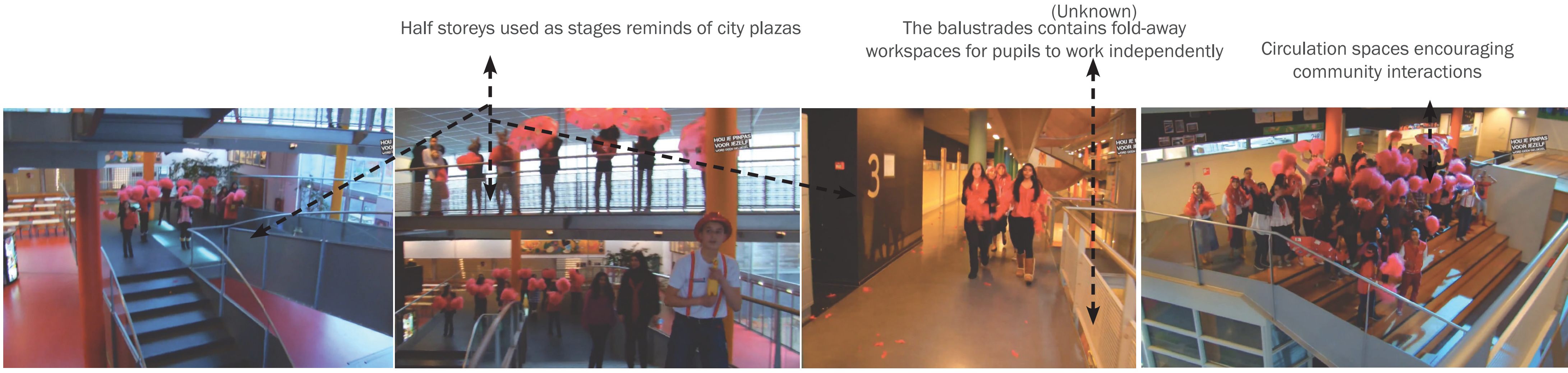


Figure 4.27 Frames from Music Video shot in the school (Bluf Producties, 2011)

4.3.2 MIT Beaver Works

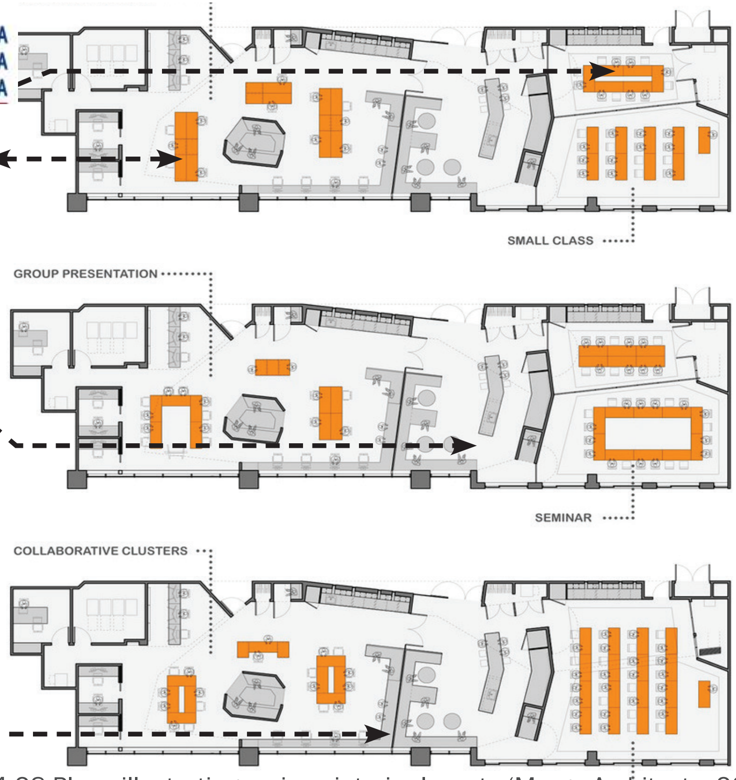


Figure 4.28 Plans illustrating various interior layouts (Merge Architects, 2013).

Architects: Merge Architects
Typology: Prototyping shop/laboratory
Location: Massachusetts Institute of Technology, Cambridge, USA
Area: 4875.0 ft2
Project Year: 2013

Background: MIT Beaver Works is a multi-use research space designed to encourage collaboration between students, faculty and professionals. The centre works with MIT Lincoln Laboratory and MIT School of Engineering. It serves as a place for work and where ideas can be tested and exhibited. The building consists of a research space, a café/lounge, meeting rooms and prototyping shop (Archdaily, 2014).

The building: Merge Architects met the basic functional requirements of fabrication facilities, together with providing highly flexible custom designed elements. The space has a multi-layered transparency. The architectural language attracts innovative thinkers and enables collaboration between researchers. The prototyping shop encourages creative thinking and ensures social interactions (Archdaily, 2014).

The café/lounge serves as the social node for the project. Situated between the classrooms, laboratory and entrance. The wedge-shaped entry space blurs the threshold between private and public by extending the public space of the hallway into the café. The corridor contains windows into the secured lab/prototyping shop (Archdaily, 2014). The large glass window between the lab and café delineates a secured lab zone and blurs the threshold between the two spaces. The glass also becomes a surface for writing on (Archdaily, 2014). The furniture in the lab space is a custom designed, mobile, flexible storage and workspace enabling collaboration. The classroom furniture consists of mobile tables and chairs. Interior partitions of the classroom are adaptable to create flexibility that can accommodate a wide range of functions.

Lessons learned:

- Collaboration spaces where students can test ideas through making prototypes encourages individuals to exchange knowledge with each other through project-based learning.
- Visual links can intrigue a passerby to enter into the facility and actively participate.
- A space's perimeter does not have to be rectangular with perpendicular walls and corners. The perimeter can have a dynamic shape that encourages creativity as long as the interior space it defines stays functional.
- Floor finishes can help organize flexible space.

Figure 4.29 Photo of Café space (Horner, 2014).

Figure 4.31 Photo of classroom (Horner, 2014).

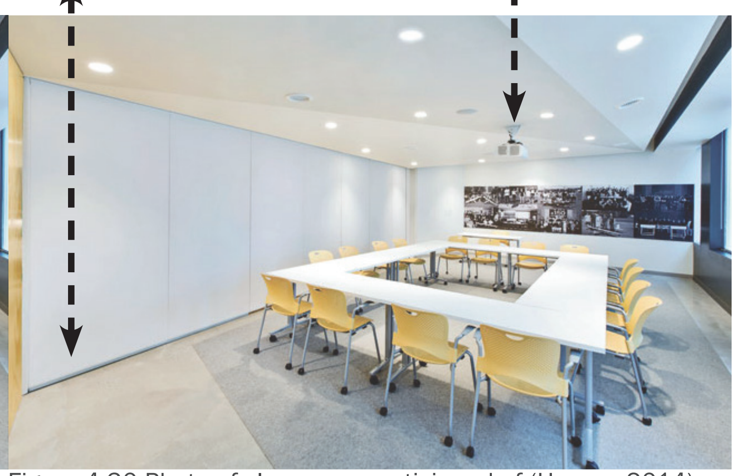


Figure 4.30 Photo of classroom particioned of (Horner, 2014).

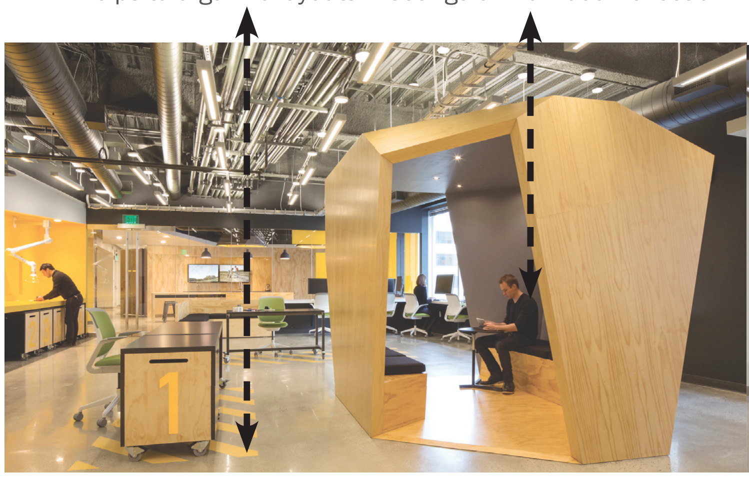


Figure 4.32 Photo of prototyping/ laboratory space (Horner, 2014).

Figure 4.33 Photo of prototyping shop soldering station & storage units (Horner, 2014).

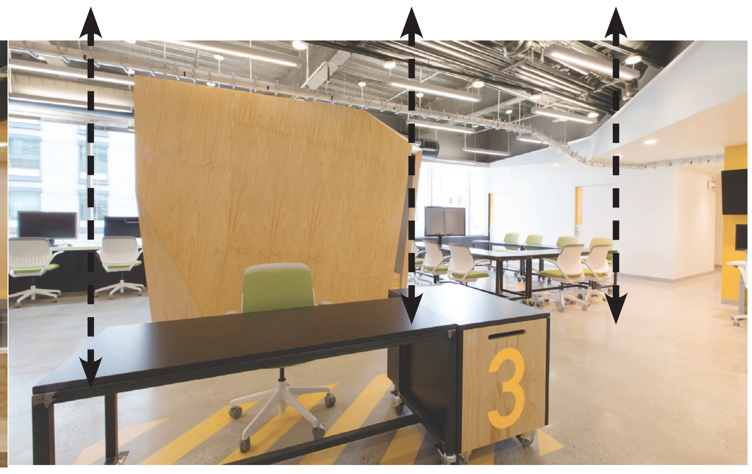


Figure 4.34 Photo of prototyping shop workstation

4.3.3 The Exploratorium: The Museum as a Laboratory

Typology: Museum of Science, Art and Perception
Location: San Francisco, North – America
Building : Adaptive re-use

Background: Through their design for The Exploratorium, the Oppenheimer brothers hoped to restore the sense of wonder and love of the natural world (Hein, 1990:2)

The museum was not built to become a warehouse where ideas could be stored but rather to become a factory, the museum had to resemble nature, a source of raw materials for exploration and the production of new ideas (Hein , 1990:2).

The Exploratorium was modelled on a teaching laboratory. By enabling people to familiarise themselves with the details and procedures of Science and Technology through exploring with unfamiliar apparatus. The aim was to reveal the laboratory as an object of observation and an instrument of inquiry in order to emphasise that Science is found in everyday life (Hein , 1990:2).

A key aspect of the Exploratorium is that teachers, scientists and designers, titled Explainers, work collaboratively to develop exhibits with a learner-centric perspective (Delacote, 1998:2055). The Exploratorium was the first Science museum that broke the tradition of museums, representing Science as a set of achievements already accomplished. The museum was designed to empower people so that they can choose their own future (Hein, 1990:2).

The Exploratorium focused on visitors, rather than on the canon of knowledge of Science. This provides a rationale for reaching out to underrepresented audiences (Hein, 2006:171).

Individual exhibits can be centred on the learner and therefore designed to facilitate individual exploration. The exhibits of the Exploratorium are complex enough to intrigue scientists and simple enough to entice children (Delacote, 1998:2055).

The exhibits: The Exploratorium uses Art and the natural environment to explain Science concepts and scientific phenomena. Through the use of Art knowledge traditionally perceived as exclusive and difficult, becomes accessible to the visitor. Through the use of natural elements like the wind, sun and tide the visitor becomes aware of the all-encompassing role Science plays in everyday life.

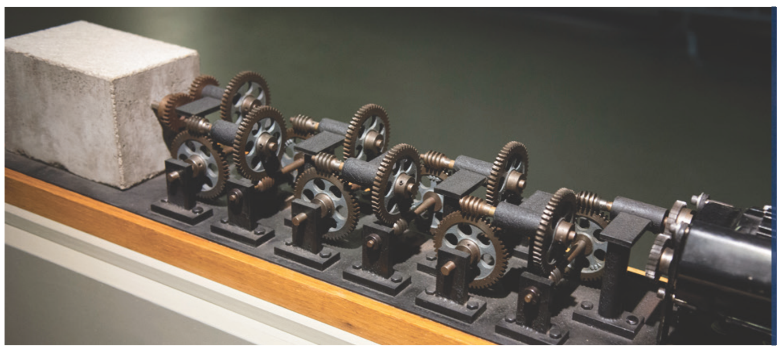


Figure 4.35 Machine with Concrete (Exploratorium).

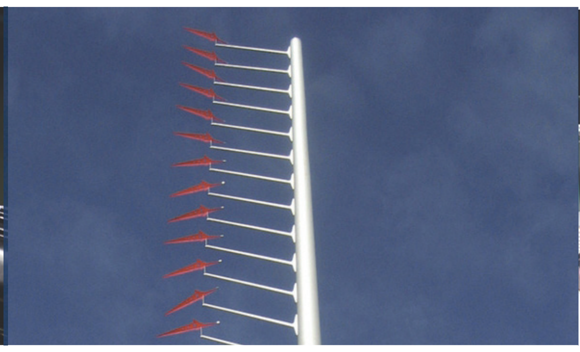


Figure 4.36 Wind Arrows (Exploratorium).

Figure 4.37 Shadow House (Exploratorium).

Art to explain Science: Machine with Concrete by Arthur Ganson
Arthur Ganson's designed a kinetic and mechanical sculpture with this purpose. A motor consisting out of a set of gears is connected to a block of concrete.
The final gear is embedded in the concrete block, the final gear makes one revolution once every 13.7 billion years, but the machine whirls uninterrupted (Exploratorium, 2001). This art piece entices the visitor and encourages self-enquiry to understand the mechanical phenomena on display.

The environment and the elements to create awareness of Science:
One of the exhibits uses wind indicators usually found on a sailboat to expose how the laminar flow of the wind differs depending on height. These indicators are mounted on a flagpole at 30cm intervals. Along San Francisco's shoreline, a difference of only 600 cm in altitude may mean a 90-degree difference in the wind's direction.

Shadow House is a rotating structure made of timber laths and cast shadows. that slowly change in the sunlight. This exhibit reminds the user of the shifting light of a day or season (Exploratorium, 2013).

Lessons Learned:

- Science is all around us and through the use of art and the natural elements it can be highlighted.
- Objects and exhibits should allow for individual exploration.
- Science experiments can be performed with everyday objects.

Figure 4.38 Exploratorium on Pier 15 (Exploratorium).

Figure 4.39 Exploratorium entrance (Exploratorium).

Figure 4.40 Exploratorium interior (Exploratorium).

4.3.4 High Tech High

Typology: Technical High School
Location: Massachusetts Institute of Technology, Cambridge, USA
Area: 4875.0 ft2
Project Year: 2013

Background: The purpose of High Tech High is to provide students with tools so they can learn to make and create things. The school uses computers as tools, just like they use a hammer or a vice grip. Here students are encouraged to find out who they are by mixing the practical application of engineering subjects with art, design and conceptual work. All work spaces in the school represent real environments with real projects, i.e. the type of work that adults would do. This gives clear reason and purpose to school work by grounding it in reality (A4LE, 2009).

The building: The CEO, Mr Larry Rosenstock explains that in many schools the architecture gets in the way. At High Tech High the building looks more like a box than a school. Visitors and students enter into a space that does not recall all the traditional qualities related to a school. The interior feels like a space that a start-up company would have hired. There is a lot of glass in the interior, this reveals what is going on in classrooms and students can see what their peers are doing. The building also acts as a gallery to exhibit students' work. Students get to curate their work, through exhibition they learn from each other. The students start to understand what is good work and what is not and this drives them to produce their best (A4LE, 2009).

The school teachers found that the students are not distracted by all the glass and views. They feel that the students become aware of the movements of their peers and because they can see what is happening they are not stuck in classrooms where they cannot wait to get out of when the bell goes. There are no separate WCs for adults and student. This strengthens the school's philosophy that that students should be treated like responsible adults (A4LE, 2009).

"I want kids behaving like an actress, behaving like a scientist, behaving like a documentary film maker, behaving like a journalist. Not just studying it but being like it" "Adolescence is about trying on new roles and sampling identities" -Larry Rosenstock, CEO, High Tech High (A4LE, 2009).

Lessons learned:

- A school does not have to resemble the traditional school environment.
- Student work should be exhibited and students should have the opportunity to peer review each other's work.
- Engineering subjects can be mixed with art and design to encourage self-discovery.
- Visual links into classrooms does not distract enough to disrupt classes.
- Students should be able to act like professionals would in a career.
- Students should be treated like responsible adults and the built environment should resemble this.

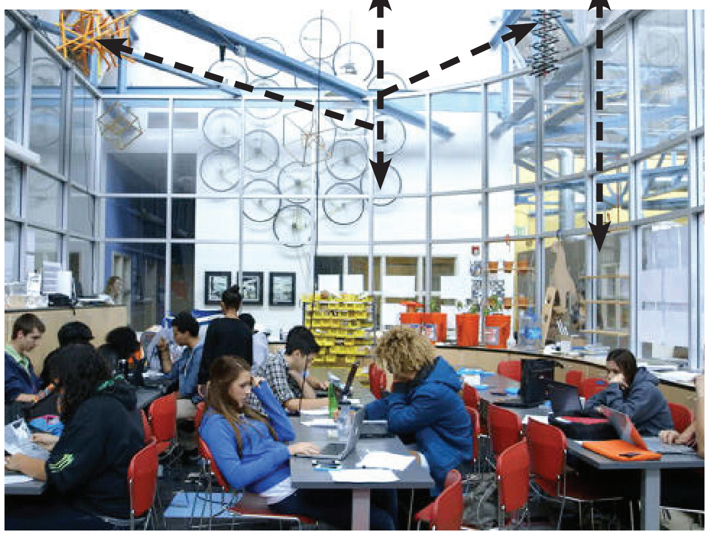


Figure 4.41 Photo of classroom (A4LE, 2009).


Figure 4.42 Photo of student presenting to peers (A4LE, 2009).

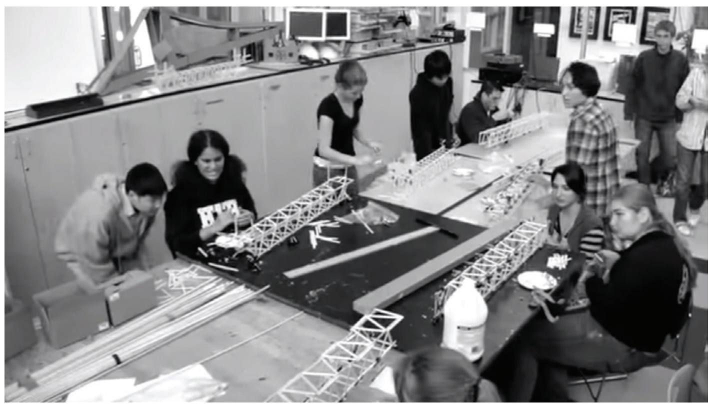


Figure 4.47 Photo of project base learning (A4LE, 2009).


Figure 4.43 Photo of CEO demonstrating his passion for tools and making (A4LE, 2009).


Figure 4.44 Photo of school interior (A4LE, 2009).


Figure 4.45 Photo of student work exhibited (A4LE, 2009).

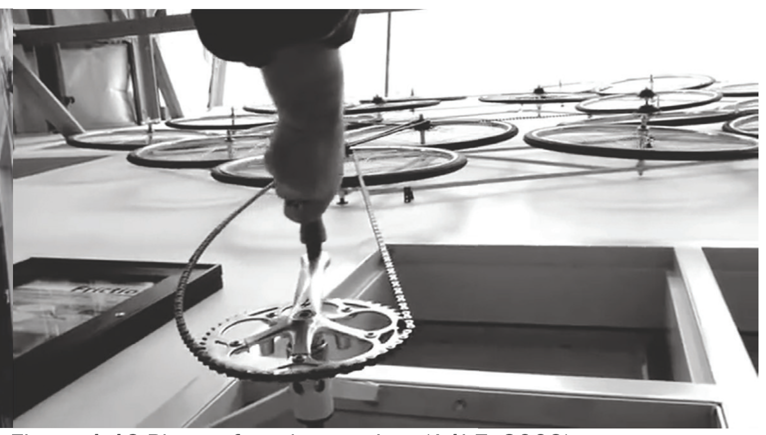


Figure 4.46 Photo of student project (A4LE, 2009).

4.4 Conclusion

Through a thorough investigation of many different educational environments it has been determined that a school environment should be rich with experiences. These experiences can be achieved in many ways. Students do not only learn from their teachers but can also from each other, the environment and they educate themselves. Art should not be separated from MST subjects as it can contribute to the depth of learning. There are lessons to learn and connections to be made all around us and the built environment can reveal these lessons through visual links, by providing appropriate spaces and qualities and by using the natural elements.