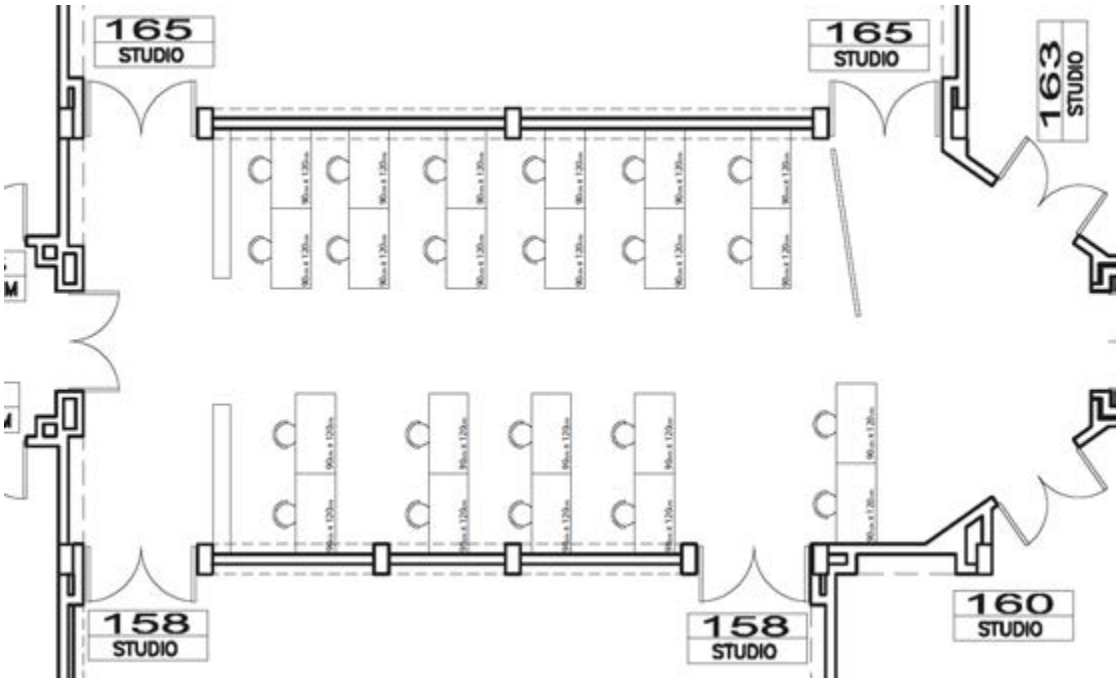
Department of Architecture and Urban Planning
College of Engineering
Qatar University

LABS AND STUDIOS

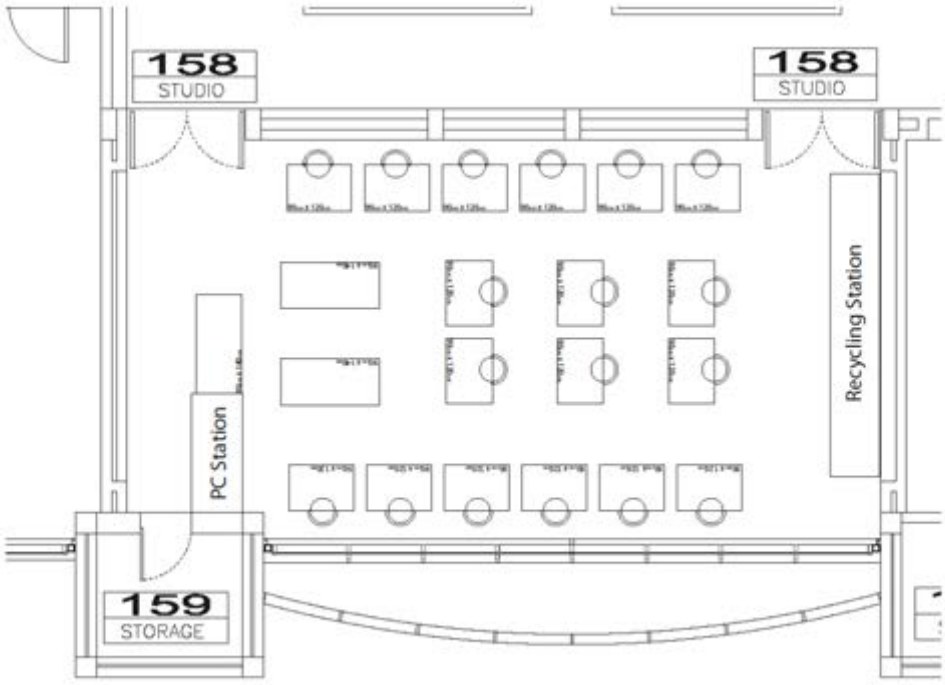
The Department of Architecture and Urban Planning (DAUP) is fully facilitated with all required spaces and equipment to support students during their five years of study with the knowledge and skills to meet professional standards. The following is a description of the available DAUP architectural design studios and labs.

Architectural Design Studio

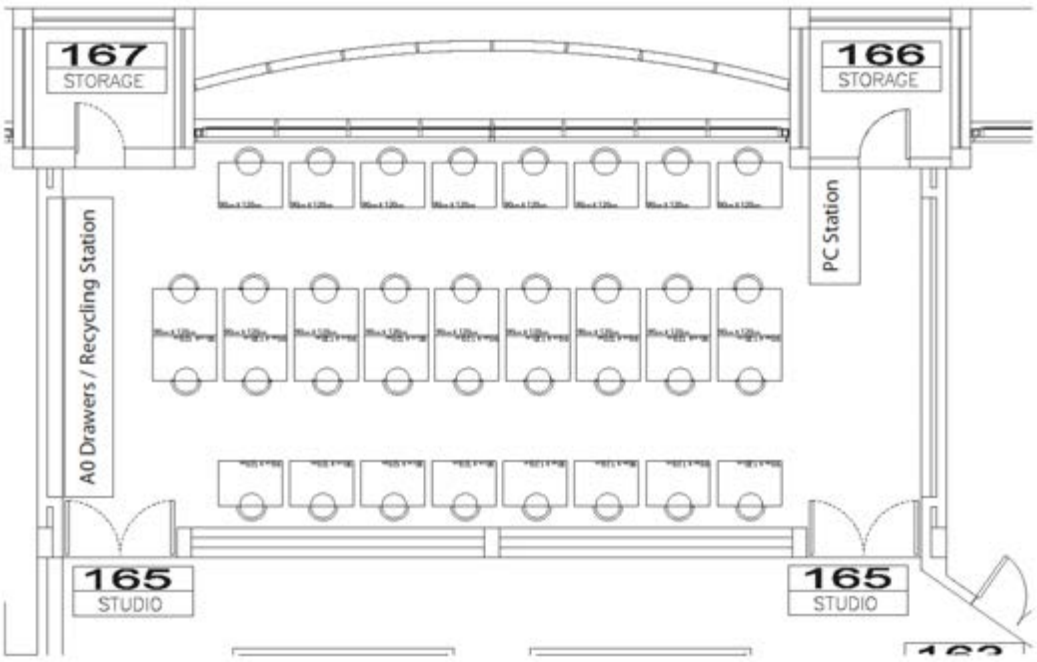
The DAUP has five studios of different sizes ranging between 15 x 8 meters to 18 x 8 meters, which can accommodate 24 to 30 students. Each studio has one or two storage rooms. A recycle section of whiteboards and model-making items are available at the back of each studio. Besides the instructor area, a group of flat tables (measuring 150 X 90 cm) is available for class gathering during project instruction and lectures. All studios have sufficient natural light that mostly comes from a glass wall as shown in the drawing below or else from above. Safety instructions are posted inside studios with first-aid kits. Additionally, in case of an emergency, the arrangement of the tables takes into consideration the efficient evacuation of the space by keeping an area around all studio entrances free of obscructions and wide passways of 90 cm for circulation between tables.



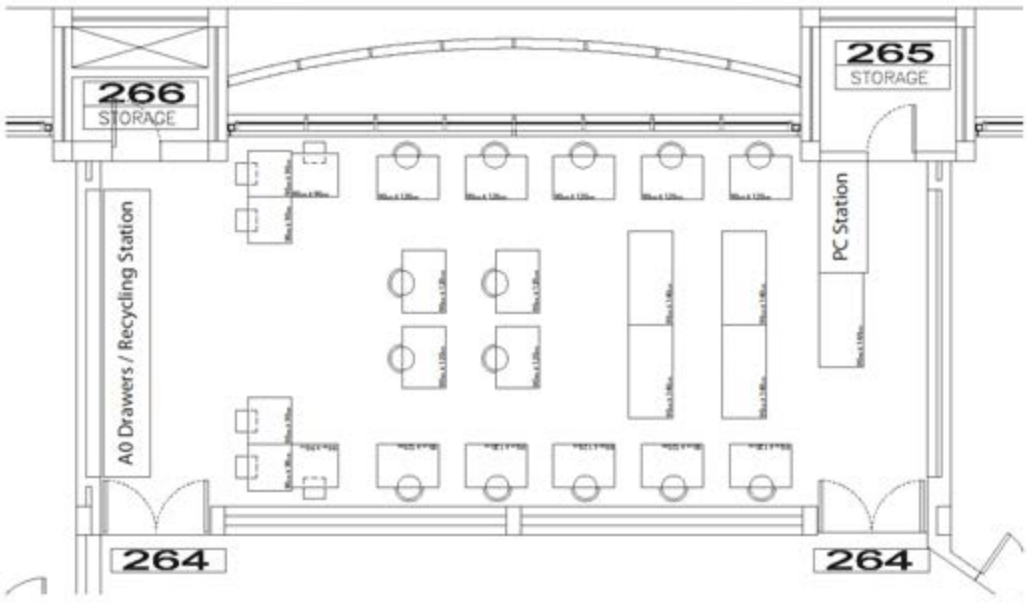
Studio 1. It is an open studio located on the ground floor between Studio 165 and Studio 158. It can accommodate 30 students. The environment creates a distinctive open-space interaction between the students participating in the studio and other students standing by or passing through the space.



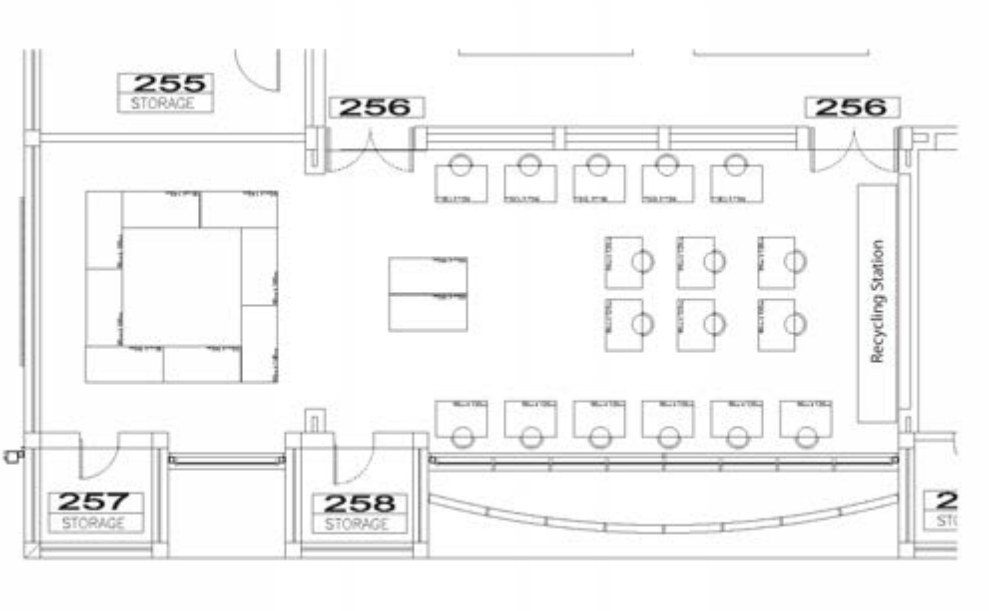
Studio 158 is a small studio located on the ground level, which accommodate up to 24 students. This studio is mainly used for the lower-level studios. The studio layout provides individual workspace to all students, which allows for progressive development of architectural skills such as drafting and sketching through the utilization of the drafting tables available in the layout of the space.



Studio 165 is a large studio on the ground level, which can accommodate up to 30 students. This studio is designated for lower-level studio classes. The studio layout allows for individual workspaces, which are designated by the drafting tables. The tables are available for students to utilize for drafting and sketching techniques. The studio layout allows for collaboration between students on further enhancement of their studio projects.



Studio 264 is located on the first floor and utilized for upper-level design studios. The studio layout is equipped with large drafting tables to accommodate drawing by individual students as well as larger tables for in-class discussion and workshops. The studio incorporates a larger gathering area for senior student studio discussions and desk crits.



Studio 256 is located on the first floor. It is used for upper-level design studios. The layout of the studio allocates individual drafting tables for each student as well as collected seating tables for group work and studio discussions. Projection is available in this studio to allow for presentations to the students.

Labs

The Department of Architecture and Urban Planning progressively promotes its teaching and research facilities to meet a worldwide standard. The enhancement is clear in the addition and update of labs for support-related courses such as construction materials and environment but also provides the necessary facilities to support the design studios. The design process is the outcome of a process of learning to from theory to experiment to final design. The experiment stage includes testing, measuring physical parameters, and model-making at different scales and levels of detail. In striving to improve the quality of education by inclusion of the experimental dimension to our courses, DAUP lab facilities help students to experiment in making the transition from theoretical knowledge to practical experience.

We have six laboratories in the Department:

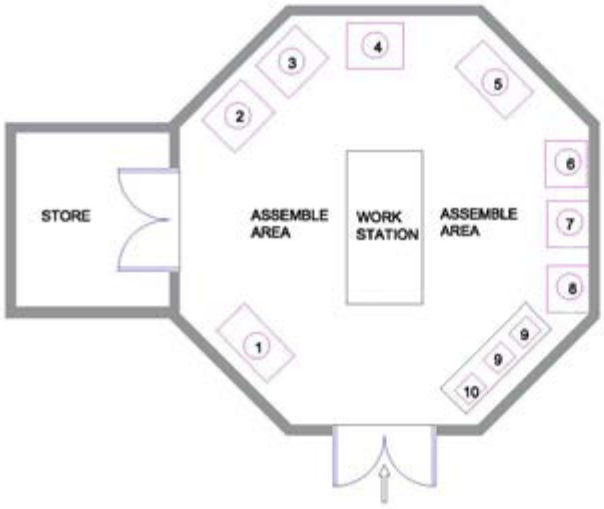
1. Model-making Workshop
2. ArtWork Laboratory
3. Digital Printing Laboratory
4. CAD Laboratory
5. Environmental Laboratory
6. Construction Materials and Building Sciences Laboratory

Students can also benefit from the wide variety of laboratories and facilities in different departments of the College of Engineering and other academic units at Qatar University including:

Building Materials Lab (Civil Engineering)
Surveying Lab (Civil Engineering)
Thermal and Mechanical Systems Lab (Mechanical and Industrial Engineering)

Model-making Workshop

The Model-Making Workshop can accommodate up to 10 students. Students use the workshop to produce architectural prototypes and models as a part of their research and educational program. The workshop is well-equipped with a wide range of hand tools and 13 machines such as a band saw, disc sander, 3D printer, and laser cutter. Additionally, several consumable model-making materials are available free for students including wood pieces, plywood boards, polycarbonate sheets, and white foam boards. Due to safety concerns, students must go through a lesson about safety requirements and lab regulations, which are posted in the workshop. The workshop is part of the Mechanical Workshop, Building B07, Lab 120. It is open from Sunday to Thursday.



MODEL MAKING WORKSHOP

Machine Details
1. Laser Cutter
2. Single Spindle Moulder
3. Disc Sander
4. Planer &Thicknesser
5. Construction saw
6. Meter Saw
7. Band Saw
8. Drill Press
9. Scroll Saw
10. Wood Lath

(left) Some of the equipment available the Model-Making Workshop; and, (right) two students training to operate several types of equipment such as the band saw.

#	**Equipment**	**Specification**	**Quantity**
1		Bobbin Sanders	2
2		Fretsaws & Scroll Saws	4
3		Mortising Machines, Hollow Chisel Mortiser 1/2"	1
4		Wood Turning Lathes	1
5		Mitre Saws	2

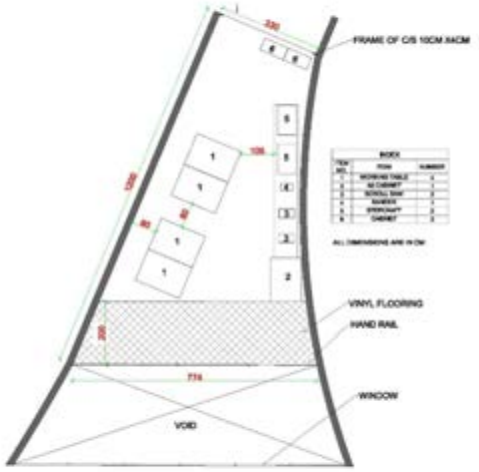
6		250mm 2100W 230V Sliding Compound Mitre Saw	1
7		Mitre Saw Stand Sealey RS15	4
8		Planer Thicknessers	1
9		225mm Quick Release Woodworking Bench Vice 45235 Draper Bench Vice 45235 Draper	4
10		1500W 230V Bench Mounted Spindle Moulder 09536 Draper	1

11		Dust Vacuum	2
12		270 L Comprassor	1
13		Board Saw	1

There are also various hand tools and safety equipment available for the use of the students.

ArtWork Laboratory

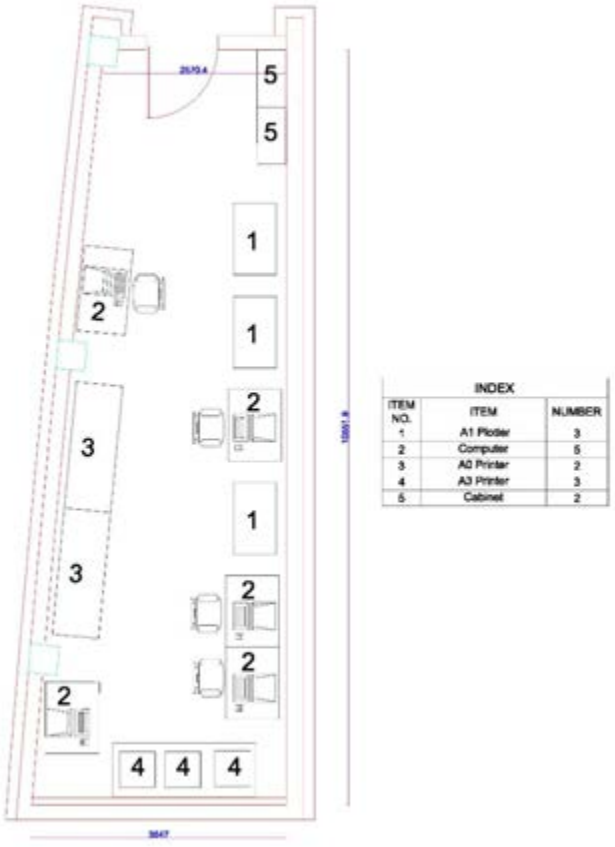
The ArtWork Laboratory is the space where students can work hands-on to develop their 3D thinking skills. The ArtWork Laboratory provides for large working tables and storage spaces for their paintings and sculptures. Students are asked to conceptualize and fabricate serious works of art, both in the form of paintings on canvas and sculptures using building materials. Students are instructed to develop their skills in making objects that reflect their design concept without compromise in the form of mature 1:1 scale paintings and/or sculptures. Students are encouraged to translate their 3D thinking into the material form. The entrance of the ArtWork Laboratory will reflect the nature of work conducted in the space. It will be an art work in itself, while the walls, ceiling and floor are made to professionally display the paintings and sculptures as in professional art galleries.



The layout and a view of the ArtWork Laboratory. It is located on the first floor at the northern side of Female Engineering Building (Building C07. Its location generates an environment that promotes creativities and inspiration by fully relying on natural light. Since the initiating the ArtWork Laboratory (10 October 2017), it has possessed basic furniture. It contains 8 large tables, 23 chairs and 2 cabinets (one A0 Drawer and one metal cabinet). The layout drawing shows the equipment the DAUP is planning to add to the ArtWork Laboratory in the near future. Since the space is unsecured, students under the guidance of heir instructor(s) are working on designing an unattached entry door to secure the place and operate as a piece of art.

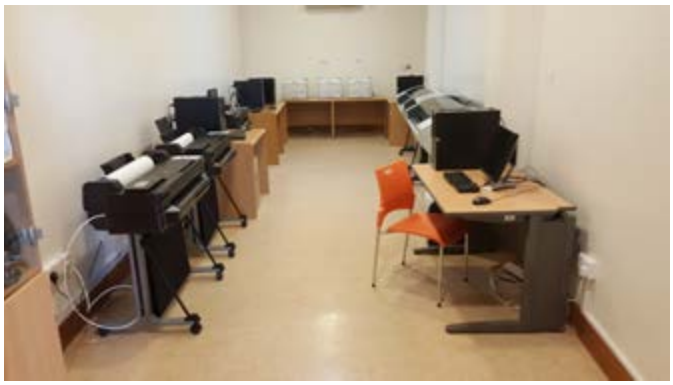
Digital Printing Laboratory

The Digital Printing Laboratory was established on 13 November 2017. It is a space for both traditional printing methods at a small and large scale using paper rolls as well as advance digital printing techniques such as 3D extrusion poly lactic acid polymer printing. The traditional printing scales vary from A0 to A4. The 3D printer allows for prototyping of architectural design forms and spatial arraignments. DAUP students can print assignments and design projects using different paper sizes, free of charge. The Digital Printing Laboratory contains three A3 printers, three A1 plotters, and two A0 Plotters. A variety of software is available for each machine as well as permanent connection to the Qatar University network and internet. The following is the layout of the Lab.



DIGITAL PRINTING LAB

The traditional digital printing space in Room C07-254 and the advance 3D digital printing in Room C07-162.



Digital Printing Lab is located on the second floor, Room C07-254 at DAUP.

Two 3D Digital Printer set in Room C07-162 at DAUP.

CAD Laboratory

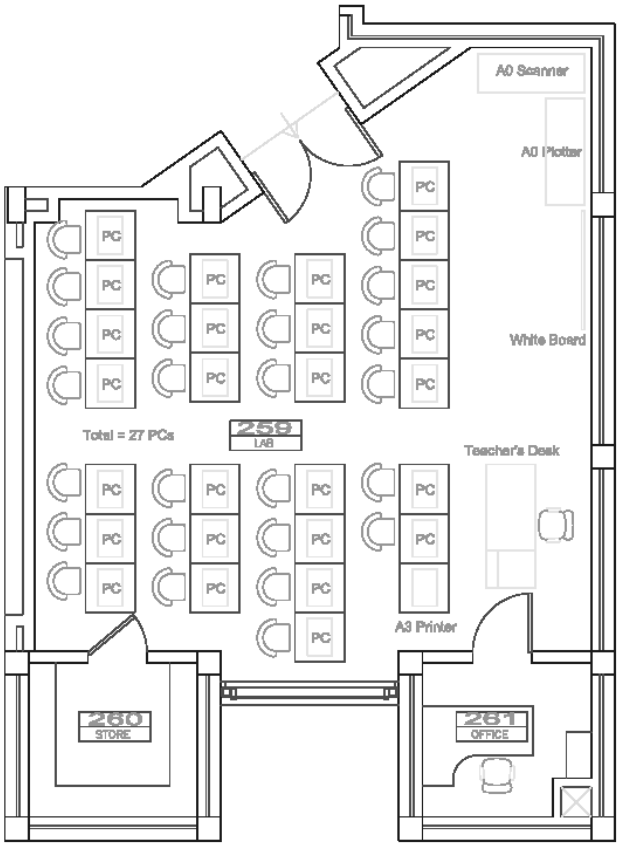
The CAD Laboratory is part of the Department of Architecture and Urban Planning (DAUP), located in room C07-259 on second floor inside the Engineering Female Building. It is open 12 hours a day throughout the academic year. There are 27 student desktop computers in the lab in addition to one printer, one scanner and one plotter, details as follows:

Dell Optiplex aio 7440 (17 Computers)
HP Z400 Workstation (10 Computers)
HP A0 Plotter - DesignJet T1120PS
HP A0 Scanner - DesignJet 4520
HP A3 Printer Color - LaserJet 5550n

A variety of software is available on each machine as well as permanent connection to the Qatar University network and internet.

- AutoCAD 2017
- Revit 2017
- Dynamo 0.9.1
- 3DS Max 2017
- Sketchup Make 2017
- Adobe® Acrobat® XI Pro
- Adobe® Photoshop® CS5 Extended
- Adobe® Illustrator® CS5
- Adobe® InDesign® CS5
- Adobe® Flash® Catalyst™ CS5
- Adobe® Flash® Professional CS5
- Adobe® Dreamweaver® CS5
- Adobe® Fireworks® CS5
- Adobe® Bridge CS5
- Adobe® Device Central CS5
- Adobe® Media Encoder CS5
- Adobe® Extension Manager
- Adobe® Media Player
- Pythagoras 14
- Microsoft Office 2013

Currently, the lab is used for teaching many courses including Graphic Communication II, Surveying for Architecture and Computer Applications. In addition, it is used extensively by DAUP students to prepare and develop their projects in architectural design studio and other related courses.



Layout of the CAD Laboratory at DAUP.

View of the CAD Laboratory at DAUP.

Environmental Laboratory

This Environmental Laboratory is located inside the Construction Materials and Building Sciences Laboratory in Room C07-160.

The first steps towards a reduction in a building's energy consumption lies in architectural design. Energy-efficient building designers combine time-tested passive solar and/or artificial conditioning principles that work with the onsite assets. Sunlight and solar heat, prevailing breezes, and the cool of the earth below a building can provide daylighting and stable indoor temperatures with minimum mechanical means. The mission of the lab is to support the teaching in design studios of climatic design, environmental control, climatic adaptation, and technology intergradation. Sophisticated 3D computer simulation tools are available to model how a building will perform for a range of design variables such as building orientation, wall, window and door type/placement, overhang depth, insulation type and values of the building elements, air tightness, and local climate. These simulations help the students to predict how a building will perform before it is built and enable them to model the economic and financial implications by modeling a cost-benefit analysis and/or life cycle assessment of a building

Environmental Laboratory Equipment

Equipment Designation	Quantity	Courses using the equipment
Heliodon	1	Climate and Architecture All design studios
Lufft E200IR Thermometer/Hygrometer & Laser Pyrometer	1	Climate and Architecture Environmental Control 2
Kestrel 4200	1	Climate and Architecture Environmental Control 2
Kestrel 4500 Weather Meter	1	Climate and Architecture Environmental Control 2
<u>Light Measurement</u> Hagner S4 Hagner Digital Luxmeter	 1 2	Climate and Architecture Environmental Control 1 Environmental Control 2
Infrared Camera IR Cameras Thermography	1	Climate and Architecture Environmental Control 2
<u>Building Diagnostics and Monitoring</u> Data Loggers Campbell data Loggers Tinytag Data Loggers	 2 5	 Advanced Research Purpose Climate and Architecture Environmental Control 2 Urban Plan. in Arid Zones
Swema 3000	3	Advanced research purpose Climate and Architecture Environmental Control 2
Air Humidity Sensor	1	Advanced Research Purpose

		Climate and Architecture Environmental Control 2
Anemometer – Draught	1	Advanced Research Purpose Climate and Architecture Environmental Control 2
Globe Temperature Sensor	1	Advanced Research Purpose Climate and Architecture Environmental Control 2
Air Flow Capture - SwemaFlow 126	1	Advanced Research Purpose Climate and Architecture Environmental Control 2
IAQ Measurements	1	Advanced Research Purpose Climate and Architecture Environmental Control 2
Laptop for Computer Thermal Simulation	1	Advanced Research Purpose Climate and Architecture Environmental Control 2

Description of Different Equipment in the Environmental Laboratory

Heliodon

The Heliodon is for testing the solar access and protection of different design forms used by the students in their projects.

Solar responsive design can significantly reduce energy demand. Solar responsive buildings can harvest the winter sun for heating, they can mediate for the summer sun by reducing the cooling load, and they can collect a small amount of quality daylight year-round to replace most of the electrical lighting used during daylight hours. Heliodons can teach students about these basic concepts, which later allow them to design low-energy, solar responsive buildings. Heliodons are powerful tools for demonstrating the potential and logic of solar-responsive design for students and practicing architects.

Lufft E200IR Thermometer/Hygrometer & Laser Pyrometer

Lufft E200 IR is used as a thermo-hygrometer or laser pyrometer. In IR-mode, students use the E200 IR as a laser pyrometer to measure surface temperatures and evaluate the mean radiant temperature.

Wall surfaces can be checked and thermal bridges detected quickly with the aid of the alarm function. There are 3 Modes:

- Temperature/humidity measurement (TH-mode)
- Contact-free temperature measurement (infrared, IR-mode)
- Dew-point detection on walls (DP-mode)

Kestrel 4200 Pocket Air Flow Tracker

The Kestrel 4200 is a comprehensive HVAC-specific instrument. It measures major environmental condition easily and accurately in the palm of your hand, but also automatically calculates Volume Air Flow (CFM) and Humidity Ratio (grains).

Kestrel 4500 Weather Meter

The Kestrel 4500 Pocket Weather Tracker is capable of monitoring and reporting an exhaustive list of environmental parameters from temperature to barometric pressure, dew point, wind chill.

Light measurements

Hagner S4

The Hagner S4 Universal Photometer is a precision instrument for measuring luminance (measuring angle 1°) and illuminance, in the field as well as in the laboratory, over a range of 0.01 - 199,900 cd/m² and lux, respectively. It can also be used for the determination of some photometric quantities. The full range of Hagner Special Detectors as well as several accessories can be used with the S4. When measuring luminance, the area measured is seen through an optical viewing system. Illuminance is measured using a cable connected detector.

Hagner Digital Luxmeter

The Hagner Digital Luxmeter is a small, handy, and extremely easy-to-use instrument for accurate measurement of illuminance over a range of 0.1-200,000 lux. With both automatic zeroing and on/off switch, the only controls needed are a four-position range selection switch and a hold button for retaining the display value.

Infrared Camera IR Cameras Thermography

For building diagnostics, Infrared IR Thermography is used to detect moisture and energy waste in buildings. A thermal imager shows precisely the problematic locations, which allows for a diagnosis of energy loss areas. Insufficient or poor insulation, building envelope leaks, moisture, and substandard building practices can all contribute to energy loss. An IR camera allows you to quickly find out where your building's energy efficiency requires improvement.

Building Diagnostics and Monitoring Dataloggers

Campbell Data Logger
Data logger CR1000 is the most widely used data logger. It can be used for a broad range of measurements (temperature, humidity, wind, solar radiations, energy consumption, solar energy harvested, and so forth) and control functions. Rugged enough for extreme conditions and reliable enough for remote environments, it is also robust enough for complex configurations.

Tinytag Datalogger
Tinytag data logger is used for continuous measurement of temperature and humidity.

IAQ Measurements (Indoor Air Quality)

Air balancing analysis measuring the performance of a simple or complex HVAC system for providing occupants with a comfortably conditioned space.

- Airflow traverse in ducts
- IAQ diagnostics

Air Flow Measurement

Air Flow Capture-SwemaFlow 126 measures both exhaust and supply air. For supply air, the longer 650 x 650 and 250 x 650 hoods are recommended. The range is from 1,5 to 125 l/s, 5,4 to 450m³/h, 2,3 to 260 CFM. Temperature and barometric pressure are also measured. SwemaFlow 126 is based on the well-known Swema principle, a net of hot wires, which gives a good and accurate mean value of the air flow in the capture opening.

Examples of Environmental Laboratory Experiment

Thermal Comfort Experiment

Aim of the experiment: The main aim of the experiment is to broaden the concept of thermal comfort from simple measurements of temperature to all parameters that affect thermal comfort. It will also demonstrate that architecture design has a major impact on occupant satisfaction by measuring and comparing the thermal comfort in different rooms with different orientation within the campus.

Human-Thermal Comfort can be defined as the state of mind that expresses satisfaction with the surrounding thermal environment. The human thermal sensation is related the thermal balance of the body. This balance is affected by thermal environment parameters such as the air temperature, mean radiant temperature, air velocity, and air humidity as well as physical activity and clothing. Due to individual differences, it is difficult and perhaps not even possible to find a thermal environment that satisfies everybody.

Objectives: The educational objectives of this experiment are:
1. The air temperature is not enough to describe the thermal comfort level as it might be counteracted by mean radiant temperature.
2. Large south-oriented glazing negatively affects thermal comfort level in summer.
3. Temperature setting for cooling should be according to the activity of the space and the clothing of its users.

Courses: List the courses that have this laboratory as an integral component of the curriculum:

1. Climate and Architecture course (ARCT 220)
2. Environmental control system 2 (ARCT332)

Equipment
Air humidity sensor: measures Air Humidity 0...100%RH and Temperature -40…+60° C

Anemometer – Draught: measures omnidirectional air velocity. Omnidirectional anemometer is used to measure low air velocity with USB and RS485 output. Swema 03 meets the requirement of ISO 7726 to be used for ISO 7730 - Ergonomics of the thermal environment.

Globe temperature sensor: Temperature sensor with high-frequency USB output:
- Black globe for measuring mean radiation temperature
- Universal data logger
- Infrared thermometer – laser pointer: Measuring surface’s temp

Lab Safety
The main safety issue in this lab concerns the use of the laser pointer thermometer. The students are instructed to use the instrument with care and not point to towards their own or anyone else's eyes.

Quality Issues
The measurements are done according to the ISO 7730 standard procedure.

Lab Discipline
The student makes a schedule for the use of the instruments since only one set is available. Every student has to sign out an instrument and responsible for it until it is provided to the next student. A lab report is submitted within one week.

Equipment Used in the Experiment

Swema 3000 + Sensors

Shading Experiment: Shading Design Lab using the Heliodon

Aim of the experiment: The general aim of this experiment is to demonstrate the motion of the sun relative to a building for design solar responsive architecture. A well-designed building will harvest the winter sun, mediate for the summer sun, and collect daylight all year. There are many different reasons to control the amount of sunlight admitted into a building. In warm sunny climates, excess solar gain may result in higher cooling energy consumption. In cold and temperate climates, winter sun entering south-facing windows can positively contribute to passive solar heating. In nearly all climates, controlling and diffusing natural illumination will improve daylighting.

Well-designed sun control and shading devices can dramatically reduce building peak heat gain, cooling requirements, and improve the natural lighting quality of building interiors. Depending on the amount and location of fenestration, reductions in annual cooling energy consumption of 5% to 15% have been reported. Sun control and shading devices can also improve user visual comfort by controlling glare and reducing contrast ratios. This often leads to increased satisfaction and productivity. Shading devices offer the opportunity of differentiating one building's facade from another. This can provide interest to an otherwise undistinguished design.

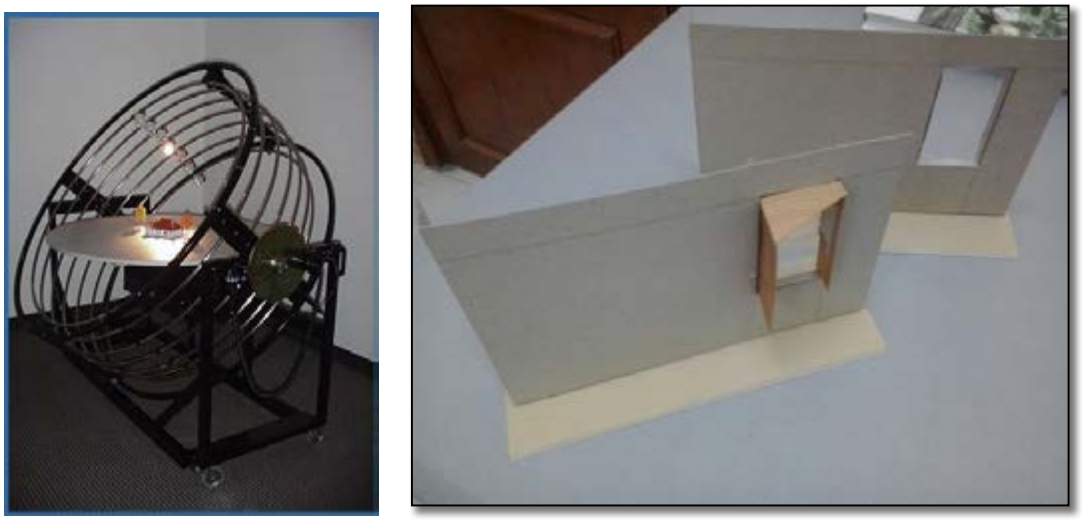
Shading of building and especially openings in a hot climate are the main concerns when providing comfortable indoor environments. This experiment aims to graphically evaluate the shading efficiency of an opening, propose improvement, and test the proposed solution by using Heliodon.

Objectives: The educational objectives of this lab are:

1. Demonstrate the motion of the sun relative to a building to design solar responsive architecture.
2. Evaluate graphically the shading efficiency of a window.
3. Propose improvements to the shading device.
4. Test the improvements by using Heliodon

Courses: List of courses that have this laboratory as integral component of the curriculum

1. Climate and Architecture course (ARCT 220)
2. Environmental control system 2 (ARCT332)
3. All design studios can use Heliodon to test the solar aspects of the project.



View of the Heliodon and a physical model to be tested in the Heliodon

Equipment

Heliodon is used as an:

- Interactive hands-on teaching tool.
- Architectural design tool for testing and comparing alternative designs.
- Presentation tool to explain the virtues of a specific design.

It supports and enhances design processes involving:

- Building forms
- Optimal building orientation
- Shading systems
- Solar collecting systems (passive, active, and photovoltaic)
- Day-lighting (direct beam component)
- Landscape designs that welcome the winter sun and reject the summer sun

Results...

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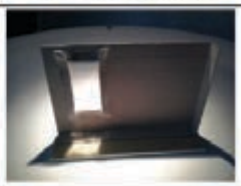
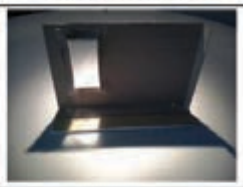
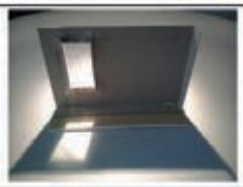
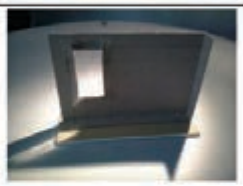
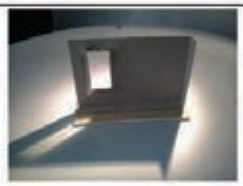
12 pm			
2 pm			
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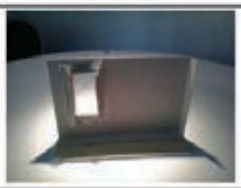
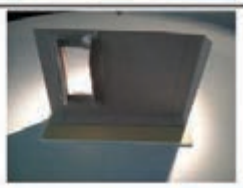
12 pm			
2 pm			

Sample of student's work (Sara Abdurahmane): on the top, the window is analyzed with and without shading; on the bottom, the test results before and after the improvement.

Lab Safety

Students attend demonstration by the instructors and lab technician about the safety requirement followed by a session of training use different types of equipment. See accompanying manual for lab safety policy.

Quality Issues

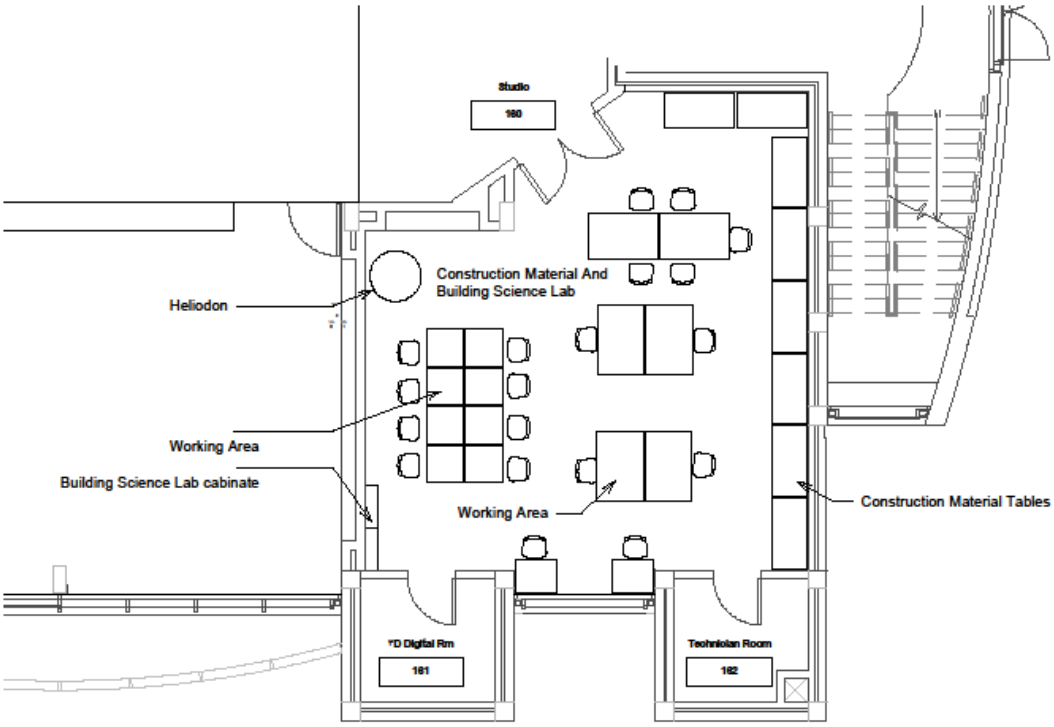
The tests are done according to the user manual.

Lab Discipline

The students make a schedule for use of the instruments since only one Heliodon is available. Every student has to sign in when using the instrument. A lab report is submitted within one week time.

Construction Materials and Building Sciences Laboratory

The Construction Materials and Building Sciences Laboratory is located in Female Engineering Building (C07 Room 160). The lab is used as a lecture room for ARCT 230, Materials and Methods of Building Construction I and ARCT 330, Materials and Methods of Building Construction II. It contains a small library of construction materials and building systems. It has large working tables (150 x 90 cm) and a storage room. In their term project, students work on building models at various scales such as 1/1 and 1/20 to illustrated architectural details and building envelope.



This plan illustrates the layout of the Construction Materials and Building Sciences Laboratory. On the left side is the section designated for Environmental Laboratory.

Two views of the Construction Materials and Building Sciences Laboratory. Materials and building systems (specification, types, details, and construction) are exhibited on walls, while real materials are set on tables for class demonstration and for studying and building details of building construction system.

Prepared by Dr. M. Salim Ferwati
15 November 2017

Updated and Revised 291217/mdm