Academic Lab / Makerspace Planning Guide

Spaces Where Concepts Click

Designing 3D Printing Labs for Education

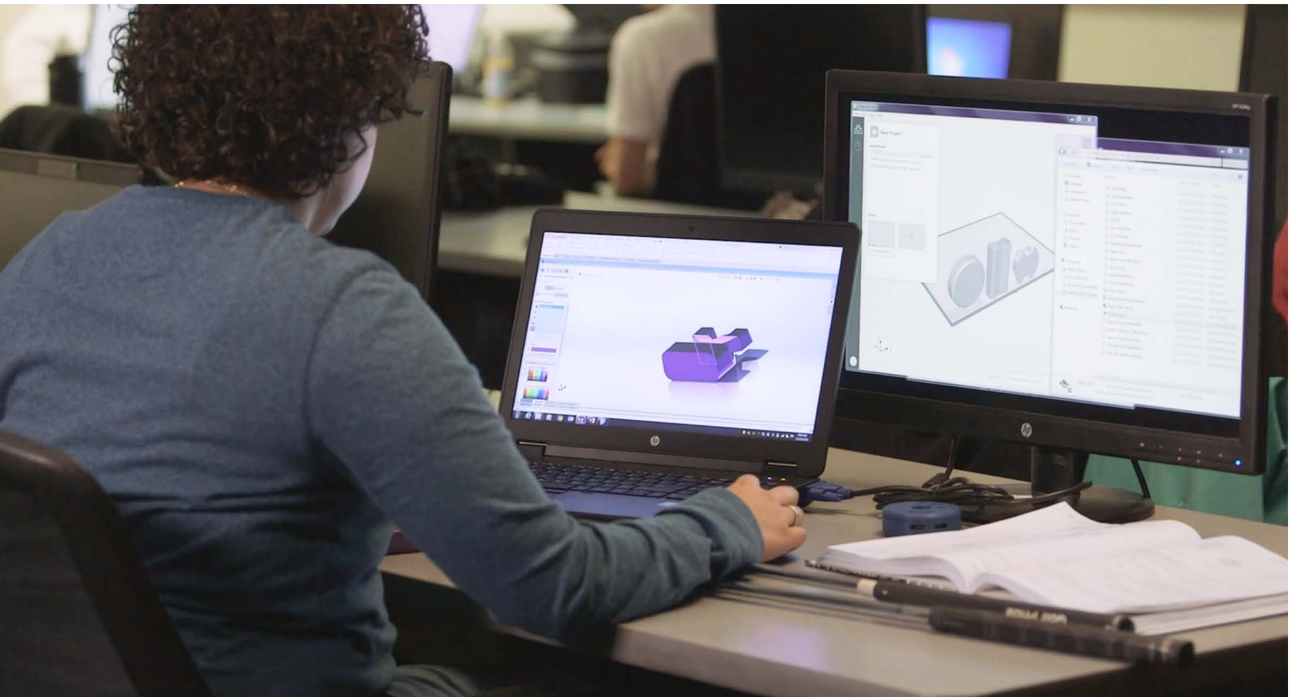
stratasys

Enhancing the Student Experience

3D printing labs give students a space to learn, explore ideas, test designs and solve for real-life problems using technologies that are quickly becoming an industry standard. This is just one of the many reasons why high schools, colleges and universities all over the world are investing in this endeavor.

How do 3D printing labs benefit schools?

- Encourages STEAM exploration on industry-standard equipment
- Offers students opportunities for workforce development
- Reinforces classroom concepts with hands-on application
- Positions schools in the realm of cutting edge
- Powers iterative testing and best-in-class research
- Opens the door for partnership opportunities with local businesses
- Inspires design thinking and problem solving

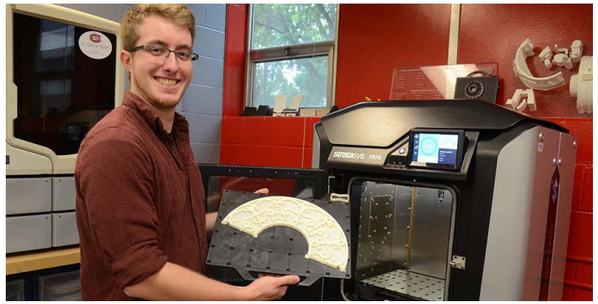


What Does a Best-In-Class Academic Lab or Makerspace Look Like?

The size, shape and purpose of a lab depends wholly on the goals set prior to its construction and will differ from school to school. Here are three examples of labs — ranked from simple to state-of-the-art — that feature both Stratasys FDM® and Polyjet™ technology.

Simple Collaborative Makerspace

Warren Tech Satellite Campus at Lakewood High School
Year Lab Was Created: 2007
Number of Printers: 4
Number of Student Users: 250+
Department Users: Engineering, Design, Art (Ceramics and Sculpture), Dental, Medical and Culinary



Standard Academic Lab

St. Cloud State University
Year Lab Was Created: 2018
Number of Printers: 12
Number of Student Users: 3,500 per semester
Department Users: Engineering, Mathematics, Design, Environmental & Technological Studies and Marketing & Communications

State of the Art Center of Excellence

Savannah College of Art & Design
Year Lab Was Created: 2004
Number of Printers: 22
Number of Student Users: 7,500+ per year
Department Users: Open to all students and majors

Lab Building
Best Practices

Seek Out Samples
Before you even purchase a 3D printer, it's best to order sample parts so you can see and compare the various capabilities of different systems. Plus, samples are great for demonstrating the value and possibilities of 3D printing to key stakeholders.

Keep Facilities in the Loop
As you're planning the layout of your lab, check with facility management to make sure the space you've designated is set up with the right ventilation and power it will need to operate safely and efficiently.

Staff Your Lab with Students
Set up 3D printing apprenticeships, internships or work studies to give students who have a strong interest in 3D printing the chance to enhance their skills on the job. This will also give you the bodies you need to handle the stream of print jobs that may come through.

Hire Knowledgeable Operators
Depending on the size of your lab, you'll want to make sure that you have at least one certified operator on staff to oversee the operation and maintenance of your 3D printers.

Teach Students How to Design for 3D
Offer a minor or a handful of in-depth courses that give students the opportunity to learn how to create and optimize designs for successful prints.

Try Project-Based Group Learning
Have your students learn together by grouping them into teams of three to five. Describe the objective at hand, give an overview of the machine they'll be using to achieve the objective, demonstrate the print process and then task them with replicating that process.

Use the Lab as a Revenue Stream
Besides offering enhanced learning opportunities for students, your 3D printing lab can also double as a service bureau for businesses in your community seeking out 3D printing services.

Start with the Right Number
If you're unsure of how many 3D printers you'll need to meet demand, use this formula to get a baseline number.

# of Potential Users / **350*** Recommended number of users per printer = **# of Printers Needed**

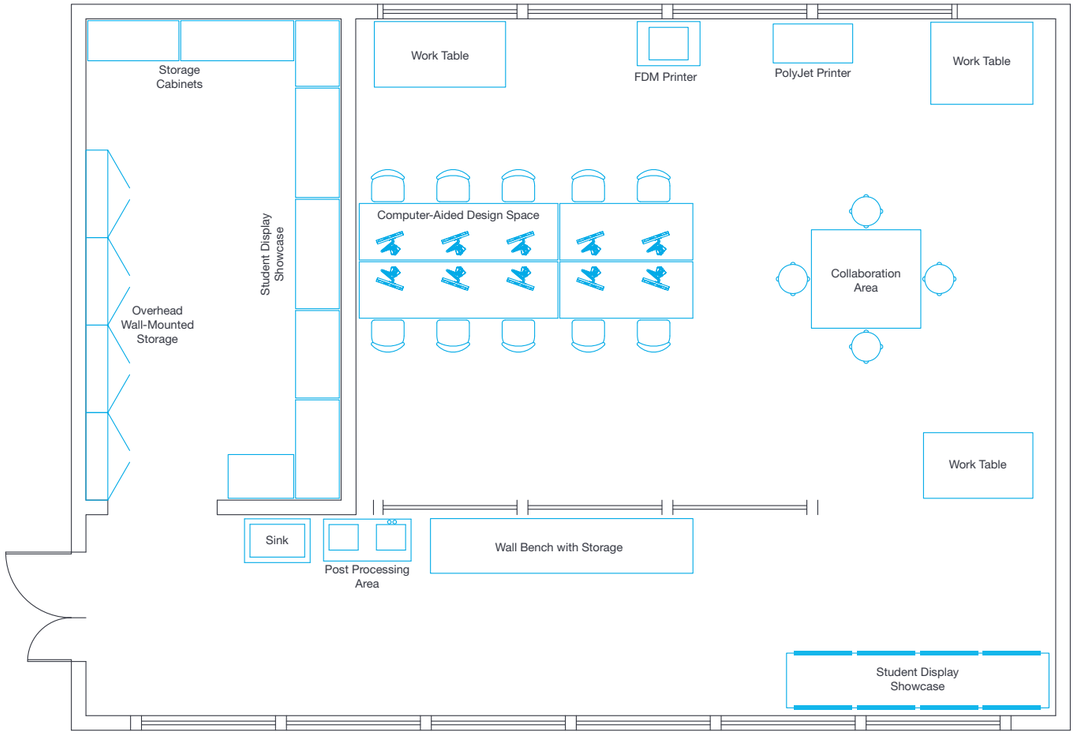
* The recommended number of users per printer may vary depending on the curriculum the printer will be used to support.

Space Planning Checklist:

- ☐ Flexibility (prepare for what comes next)
- ☐ Power
- ☐ Data
- ☐ Ventilation
- ☐ Cooling
- ☐ Water
- ☐ Vacuum
- ☐ Post-processing (wet, dry, paint)
- ☐ Design software and computers
- ☐ Shared collaboration/group work space
- ☐ Separate clean versus dirty
- ☐ Dry storage (humidity controlled)
- ☐ FDM machines for each material family
- ☐ PolyJet machines for each material

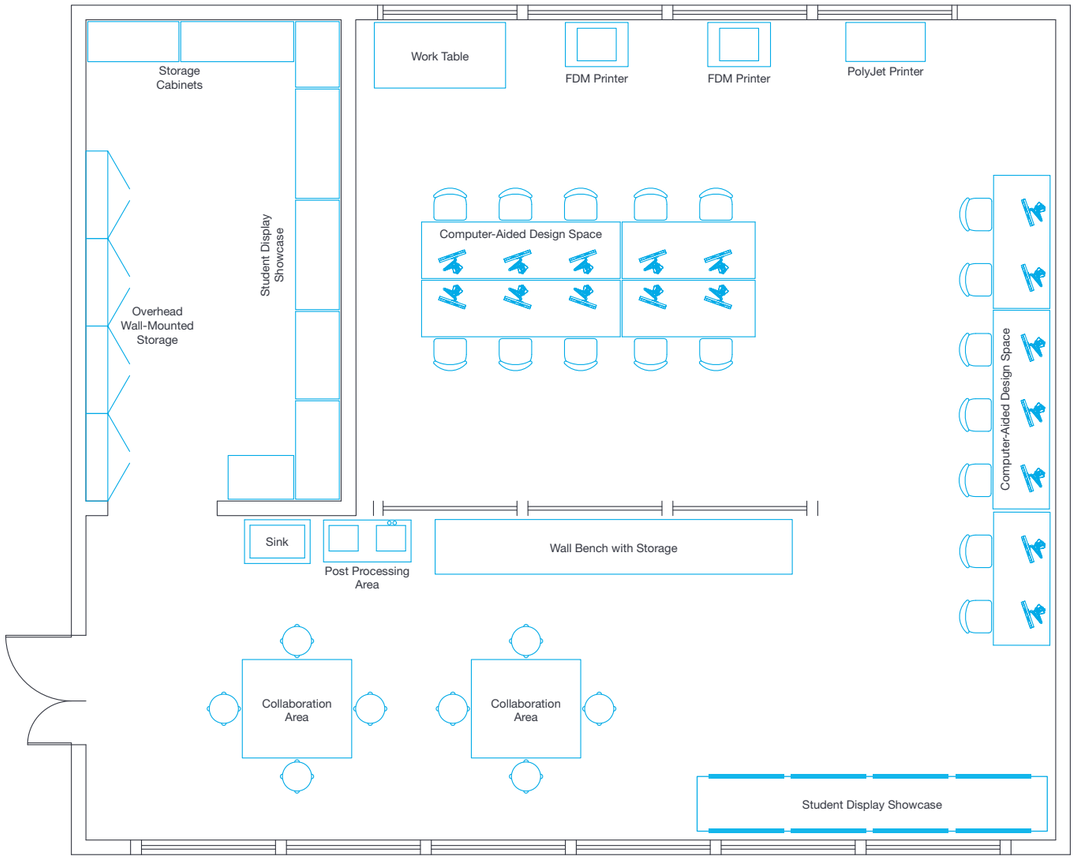
Simple Collaborative Makerspace

Open to all experience levels and specialties, a collaborative makerspace focuses on throughput and creating the final part rather than achieving specific material properties or creating for specific applications. This type of lab is a great place for beginners to learn about 3D printing.



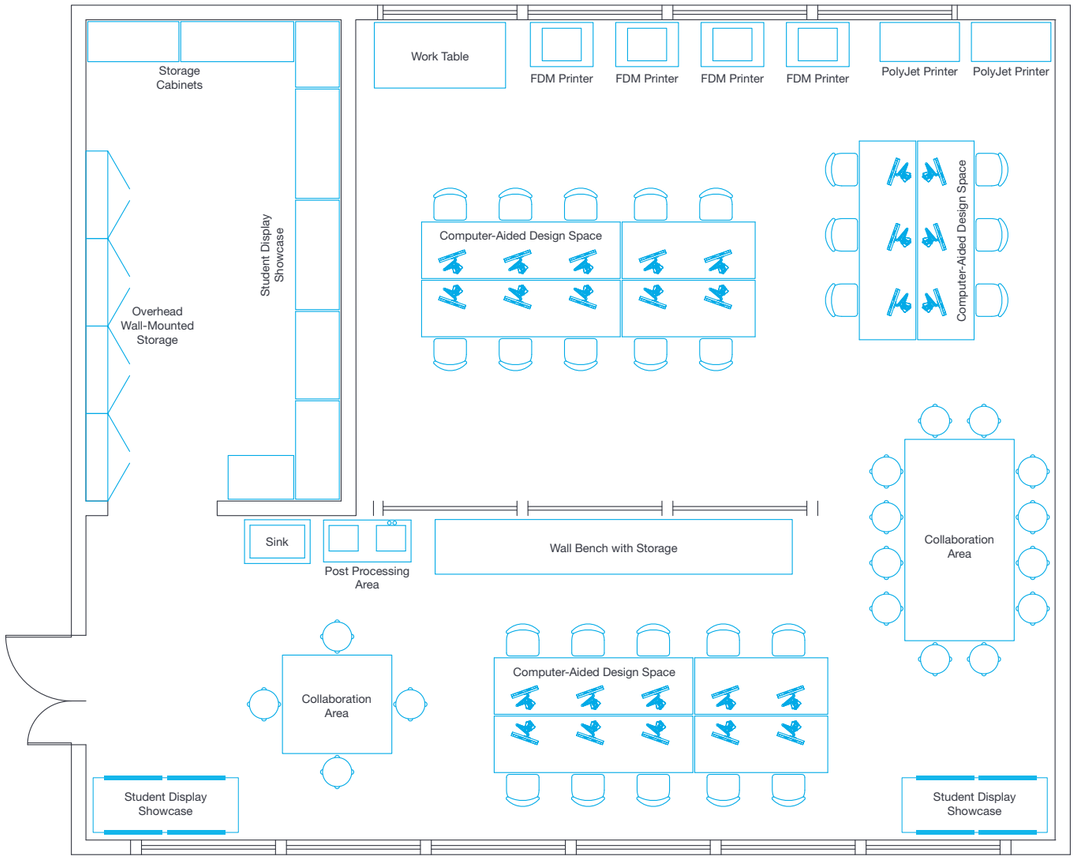
Standard Academic Lab

Only available to students in a specific college within a university (e.g., the college of design or engineering), the academic lab typically features a mix of high-end and user-friendly equipment. This type of lab should also be staffed by knowledgeable experts who would ensure the lab runs like a parts provider.



State of the Art Center of Excellence

Available to students, professors and researchers in a wide range of disciplines, or to all, this type of lab features the latest in high-end 3D printing equipment as well as a streamlined process for part building and delivery. Run and staffed by knowledgeable product experts, this lab also functions as a parts provider and 3D printing resource for the surrounding community.



Selecting 3D Printing Technologies

There are a wide range of 3D printing materials and systems available to you. Being clear about the goals of your lab and your students will help you focus in on the right solution.

FDM Technology

PolyJet Technology

FDM Technology

The most accessible and widely used form of 3D printing is FDM®. FDM 3D printers build parts layer-by-layer from the bottom up by heating and extruding thermoplastic filament. Additionally, properties like toughness, electrostatic dissipation, translucence, biocompatibility, UV resistance and high-heat deflection makes FDM ideal for a variety of applications ranging from basic proof-of-concept models to functional prototypes.

Training Requirements

Knowledge of build setup, minor maintenance, machine operation and finishing.

Facility Requirements

Air-conditioned environment, a dedicated space with ventilation and compressed air for larger systems.

Ancillary Equipment

Support removal system and optional finishing system.

Concept Models | Functional Prototypes | Molds and Patterns | Jigs and Fixtures | Production Parts

Get Reliable Results

Bring industrial-grade 3D printing to the classroom with the easy-to-use, reliable and affordable Stratasys F123™ Series 3D printers.

- **Lower investment.** Get professional 3D printing for an affordable price.
- **Easy to install and set up.** Simply plug in, print, test and learn.
- **User-friendly interface.** No specialized training is required to get started.
- **Accurate, reliable results.** Create complex parts and prototypes with repeatable accuracy.
- **Speedy print times.** Maximize your ability to iterate on designs.

Achieve Automated Efficiency

Achieve ongoing batch production with minimal operator intervention with the Stratasys Continuous Build 3D Demonstrator.

- **Cloud-based management.** Print jobs from anyone, anywhere simultaneously without the risk of downtime.
- **Scalable output.** Easily print one to thousands of parts without interruption.
- **Continuous production.** Automated print setup, assignment and printing powers a continuous stream of parts.

PolyJet Technology

Known for producing hyper-realistic end products with smooth surfaces and ultra-fine detailing, PolyJet™ technology works by jetting liquid photopolymers onto a build tray where each droplet cures under ultraviolet (UV) light. And by combining a variety of photopolymers in specific concentrations and microstructures, PolyJet systems can simulate everything from leather and plastic to human tissue in a broad gamut of colors.

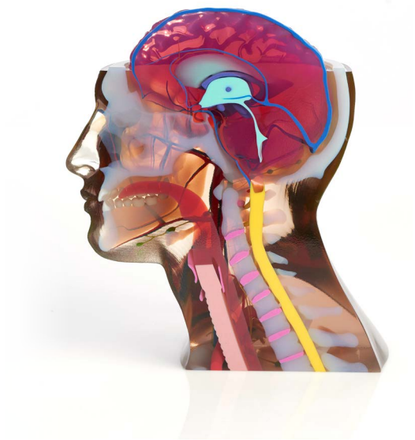
Training Requirements
Knowledge of build setup, minor maintenance, machine operation and finishing.

Facility Requirements
An air conditioned environment and a dedicated space for larger systems.

Ancillary Equipment
Support removal system.

Create Realistic Prints
Give design students and researchers the tools they need to bring their most fantastic ideas and inventions to life with the Stratasys J850™ 3D printer.

- **Extensive color options.** Improve color fidelity by 3D printing with PANTONE® Colors, Solid Coated and SkinTones™.
- **More realistic parts.** Get full-color, transparency and rubberlike flexibility in a single print.
- **Accelerated workflows**. Print concepts 2x faster with the Super High Speed Draft Mode.
- **Material efficiency.** The redesigned cartridge results in a more efficient printing experience.
- **Less downtime.** The large material capacity and an additional material channel reduces downtime between prints.



Concept Models | Full-Color Models | Multi-Material Models | Molds and Patterns | Jigs and Fixtures

Finding a Software Solution

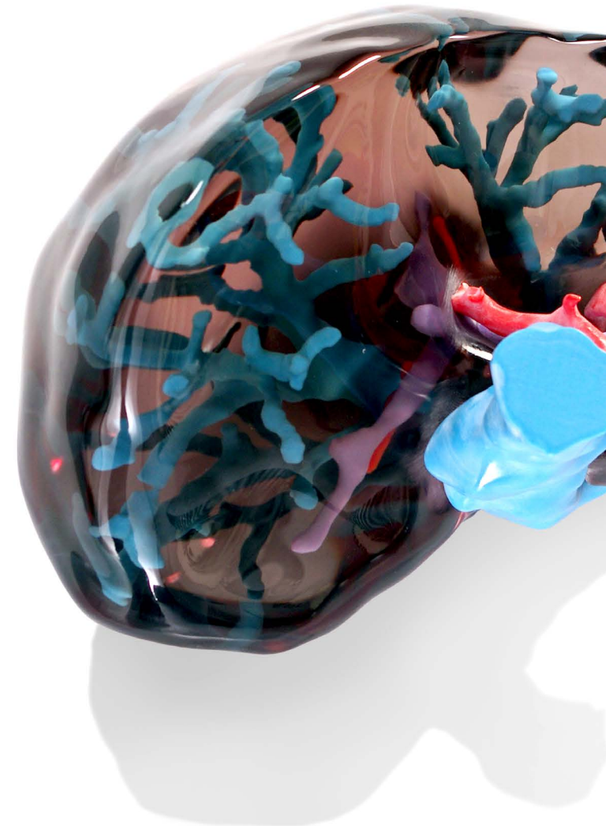
In addition to selecting the right 3D printing systems, having the right software in place can help you create a more efficient 3D printing process from start to finish.

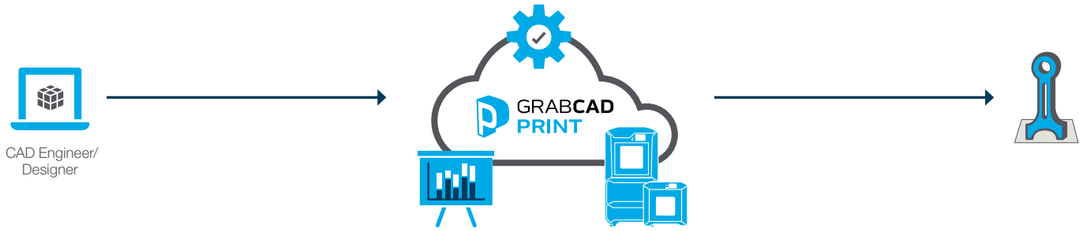
Streamline Workflows
GrabCAD Print™ simplifies the traditional 3D print preparation workflow and provides cloud-based intelligence around printer usage so students can get quality prints, faster.

- Print directly from your favorite professional CAD formats
- Use smart default settings, tooltips and notifications for a seamless printing process
- Maximize print scheduling based on machine availability, job duration and more
- Easily monitor material levels for each printer

Design on the Micro Level
GrabCAD Voxel Print™ allows you to achieve unlimited combinations of colors, textures, transparencies, properties and behaviors with your prints.

- Get precise control of your design at the voxel level
- Fine tune color, shore-value gradients and even texture mapping on a microscopic scale
- Create higher resolution, complex, sophisticated prints
- Manipulate structures and control model behavior





Ready to Start
Planning Your Lab?

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