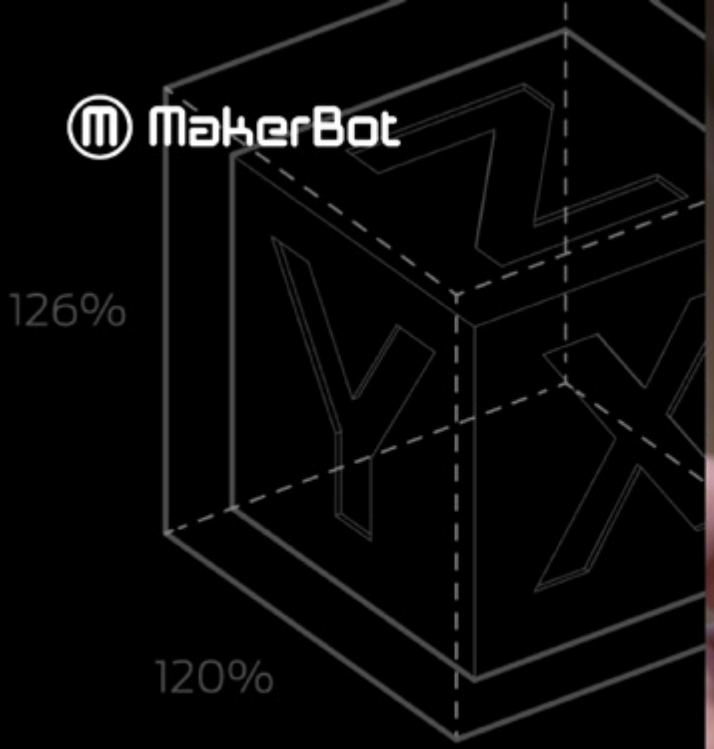
MakerBot



THE DEFINITIVE GUIDE TO:

3D PRINTING IN HIGHER EDUCATION

How to Incorporate Additive Manufacturing Into:

- ☑ **Academic Courses**
- ☑ **Career Technical Education**
- ☑ **Research**

A look at the state of additive manufacturing within Higher Education, Career & Technical Education, and Research and a how-to on leveraging 3D printing to unlock new frontiers in research, academic, and manufacturing settings.

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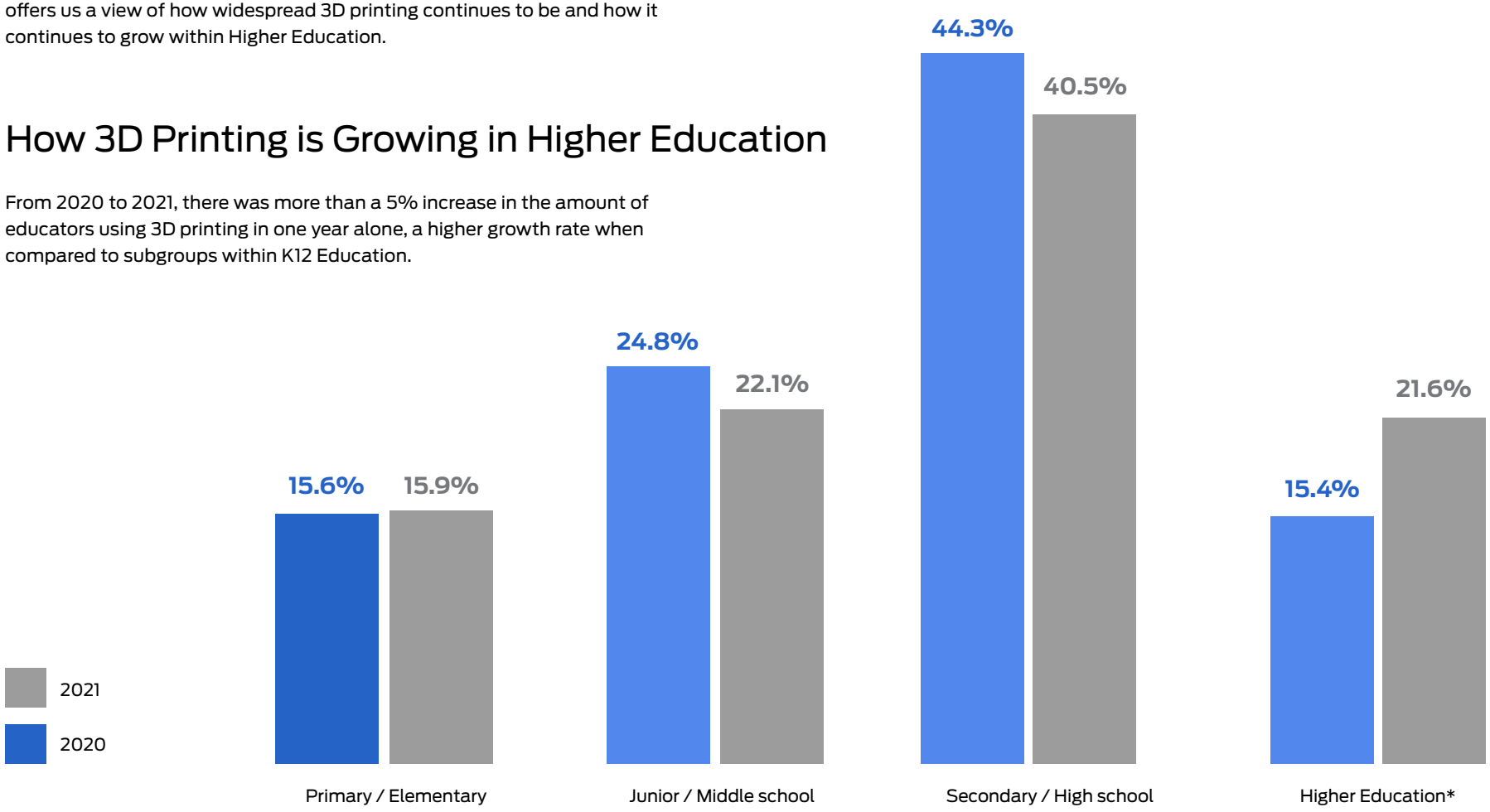
Chapter 1

The State of 3D Printing in Higher Education

Based on responses from over 1,000 education professionals from around the world, the latest report in Trends in 3D Printing and STEAM Education offers us a view of how widespread 3D printing continues to be and how it continues to grow within Higher Education.

How 3D Printing is Growing in Higher Education

From 2020 to 2021, there was more than a 5% increase in the amount of educators using 3D printing in one year alone, a higher growth rate when compared to subgroups within K12 Education.



*Higher Education includes post-secondary education, career & technical education, and research institutions.

3D Printer Adoption in Higher Education

As the use of 3D printing becomes more prevalent, access to 3D printers is critical. Respondents with printers show that 45% of them have at least 1-5 printers, and more than half of respondents having anywhere between 6-21+ printers.

With 16% of the respondents citing upwards of twenty one 3D printers in their institutions.

1-2 PRINTERS

17%

3-5 PRINTERS

28%

6-10 PRINTERS

25%

11-15 PRINTERS

7%

16-20 PRINTERS

6%

OVER 21 PRINTERS

16%

Across the board, the ability to quickly iterate ideas into tangible objects, developing problem-solving skills and encouraging creative thinking were the top reasons respondents adopted 3D printing. Developing Skill Sets for Future Careers and 3D Printing Complementing the In-Class Curriculum were also cited as frequent drivers at 44%.

The practical and technical skills developed from 3D printing are valuable and can be applied both in and out of the educational environment.

What Drives Adoption in 3D Printing within Higher Education

Ability to turn ideas into reality

54%

Encourages creative thinking

47%

Develops problem-solving skills

46%

How was 3D printing used in your institution?

INDEPENDENT PROJECTS (personal student projects)

70%

ACADEMIC COURSEWORK (thesis, projects, lessons, etc)

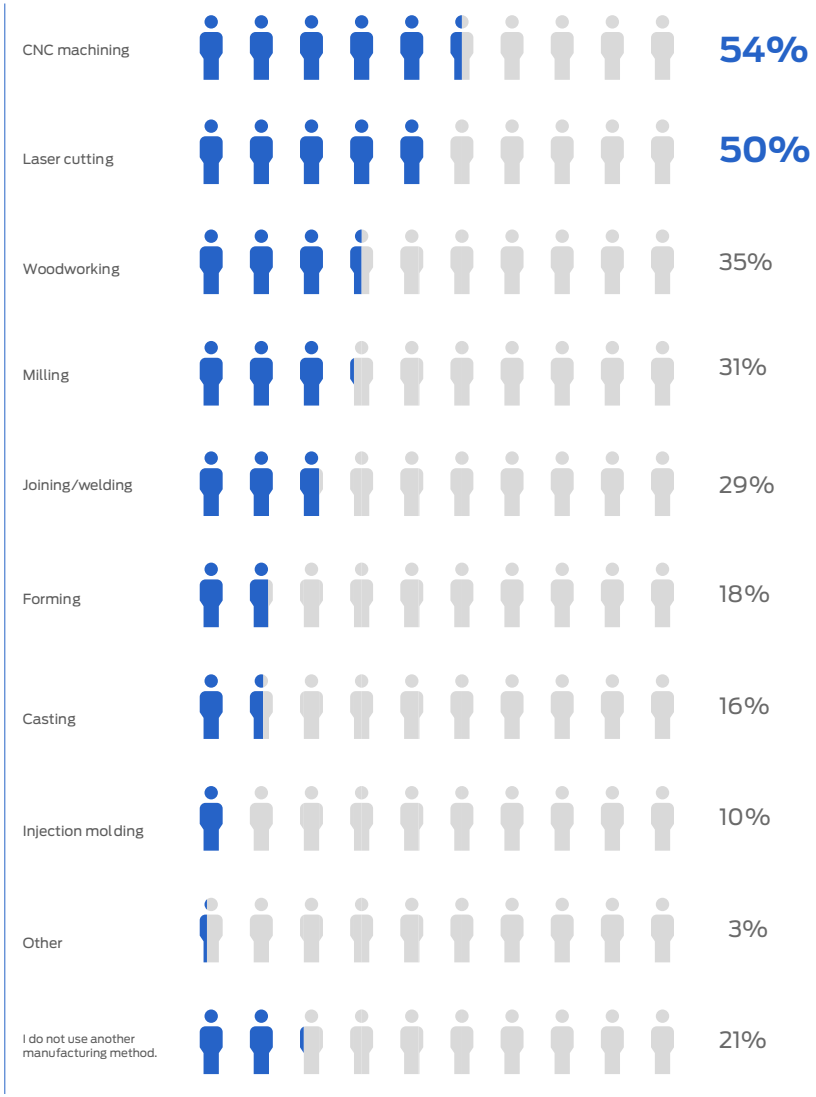
65%

Students, Educators and Professionals in higher education are using 3D printers for more than just coursework.

They're also using it for research (46%) and independent projects (70%).

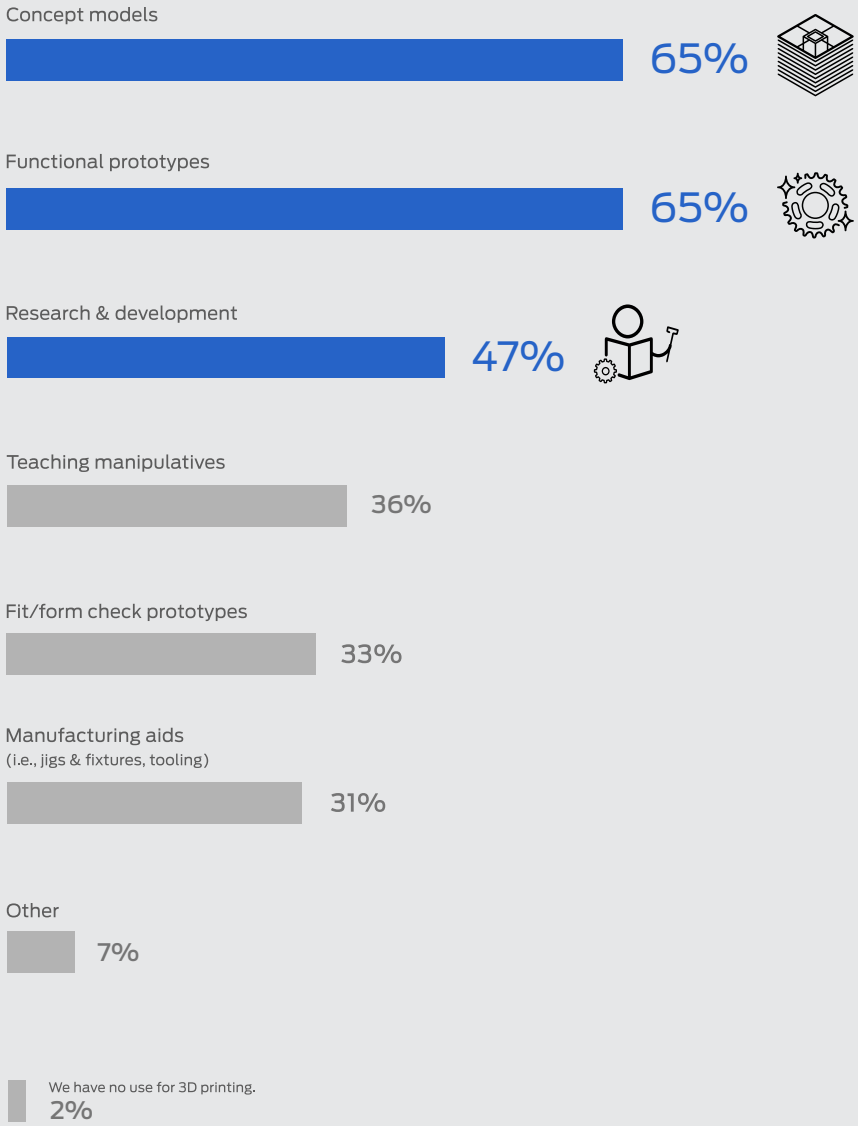
Top 8 Methods Combined with 3D Printing

While 3D printing is a popular tool for prototyping and production, it is typically used alongside other manufacturing equipment. CNC machining (54%), laser cutting (50%), and woodworking (35%) are other popular manufacturing methods in higher education.



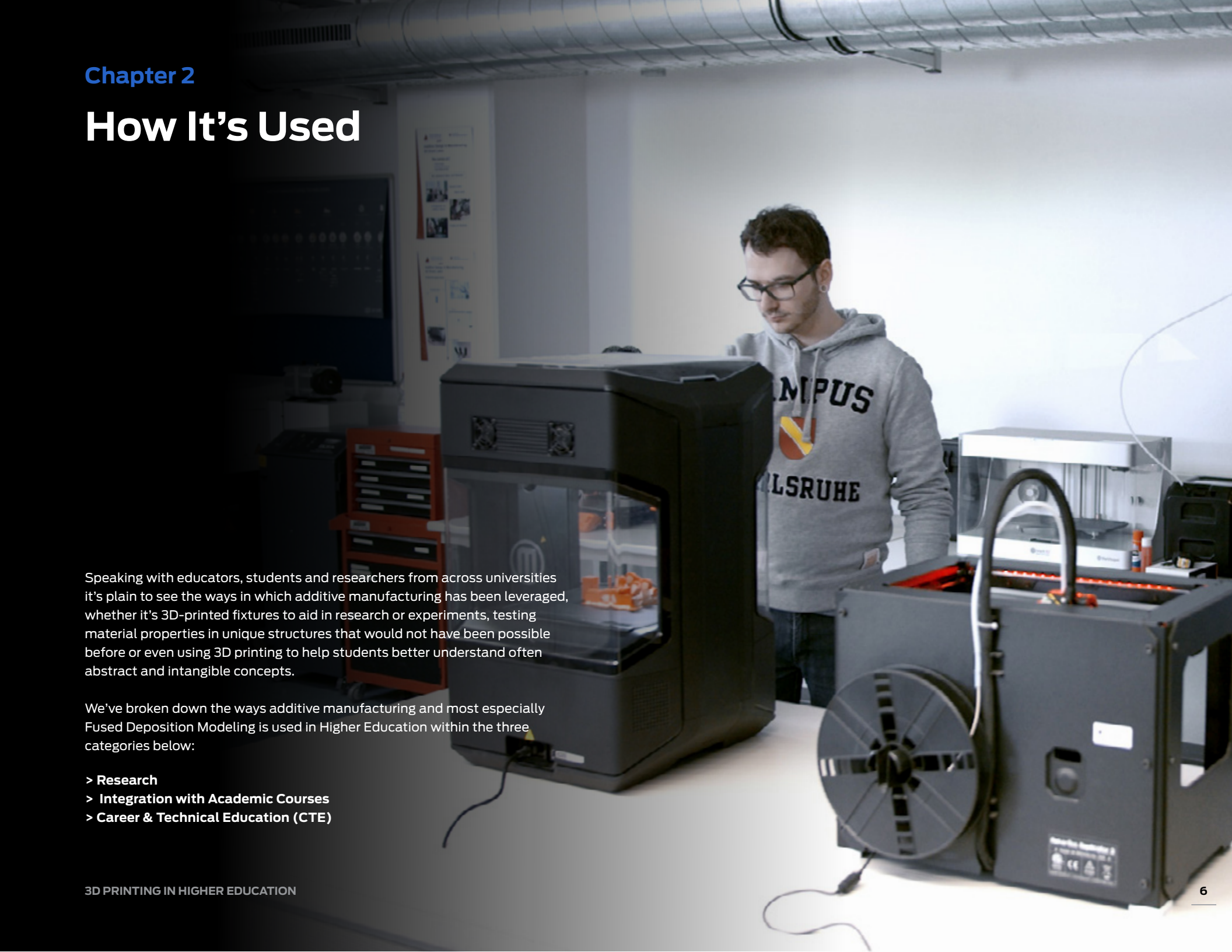
The advancements in technology have propelled the use of 3D printing across a range of applications. Fit, form, check and functional prototyping (98%) were the top applications across higher education, while concept modeling (65%), R&D projects (47%), teaching manipulatives (33%), and manufacturing aids (31%) trailed far behind.

Most Common 3D Printing Applications



Chapter 2

How It's Used



Speaking with educators, students and researchers from across universities it's plain to see the ways in which additive manufacturing has been leveraged, whether it's 3D-printed fixtures to aid in research or experiments, testing material properties in unique structures that would not have been possible before or even using 3D printing to help students better understand often abstract and intangible concepts.

We've broken down the ways additive manufacturing and most especially Fused Deposition Modeling is used in Higher Education within the three categories below:

> Research
> Integration with Academic Courses
> Career & Technical Education (CTE)

Research Purposes

Revolutionizing the Use of 3D Printing

Additive manufacturing is used in a number of ways within the various fields of research in higher education. From designing and printing quick jigs and fixtures to allow for specific tests and experiments within one's field of research to becoming *part* of the research when testing the strength of specific materials under duress or validating material decisions for a number of customized *parts*.

Leveraging 3D Printing within Research

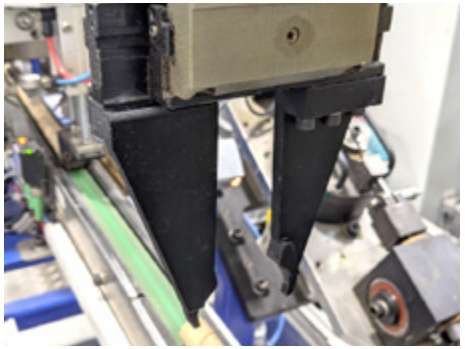
- Experiment, test and support research objectives across various fields of study.
- Design and print durable, custom components that fit specific requirements for the test or task at hand.
- Avoid traditional manufacturing costs and lead times and get finished parts in hours instead of weeks.

3D Printing in Research is Most Commonly Used For:

Jigs

Fixtures

Customized Housing Components



Custom Tools for Specific Research Tasks

Testing Material Properties

Recommendations for 3D Printing in Research:

Design for 3D Printing in Mind

3D printing comes with its own settings like soluble and breakaway supports, overhangs, layer heights and more. When creating custom jigs and fixtures, it's good to know how some of the settings can help strengthen the final 3D print for optimal success.

Choose the Right Material

From concept-testing in PLA to end-use prints in chemical resistant or anti static print materials, there are a lot of materials to consider printing with. Start with PLA or Tough for early concept models and move up to more diverse materials like PETG, ABS-ESD, Nylon Carbon Fiber or even Stainless Steel.

Print Parts of the Design

Creating the right jig, fix, or component for a particular test can take a few iterations. If there's a certain aspect of the design you're working through, print only the specific component that needs more testing to save both time and material.

Academic Courses

Innovation within the Classroom

Bringing 3D printing technologies closer to the student body allows educators to develop new teaching and learning methods with a technology that comes with the inherent ability to better demonstrate abstract concepts and principles, and test new ideas and theories in a tangible form.

Integrating 3D Printing into Academic Courses:

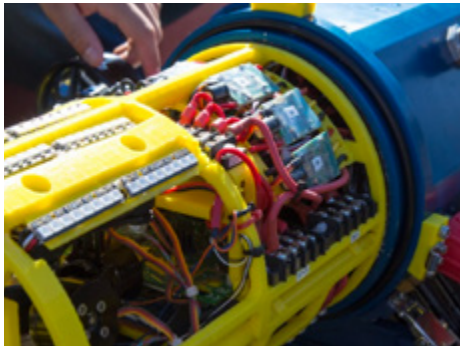
- Allows students to utilize 3D printing for their coursework and test ideas and theories outside of the textbook.
- Gives students working experience in a technology key to STEM-related career paths.
- Builds greater excitement, encourages more collaboration and makes learning new technologies less intimidating.

3D Printing in Academics is Most Commonly Used For:

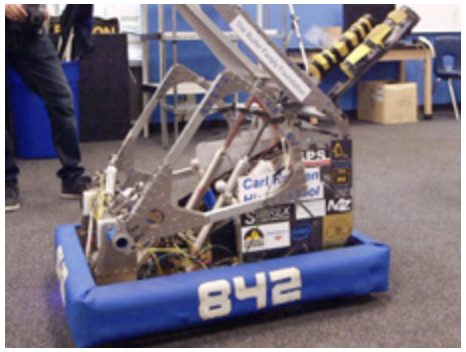
Teaching Aids

Extracurricular Projects

Student Learning Aids



Research Projects



Student Projects

Recommendations for Printing for Academic Courses

Keep 3D Printing Easy

If printing teaching models or learning aids, use the easiest material: PLA - a corn-based low-temp material ideal for prints that are meant for demonstration purposes, display purposes or light handling.

Large-Scale Printing

Drive innovation across a wide range of fields of studies and meet the demands of a large student body by equipping a small fleet of printers that are suitable for beginner and advanced users.

Define the Process

It's important for first-time 3D printer users to know what to expect when 3D printing. Develop training methods such as a group 3D printer training or a one-on-one printer walkthrough that demonstrates how users can download or design 3D models, how they can start their first 3D prints and how they can improve their designs.

Career & Technical Education (CTE)

Gaining a Competitive Advantage

Empower students and young professionals to gain a competitive advantage when it comes to career technical pathways. Having the ability to own and execute on the entire additive manufacturing process enables students to develop cutting-edge skill sets that can adapt with the changing job market.

Why 3D Printing and Career & Technical Education Go Together:

- Students secure a competitive advantage against others in a fast-growing and rapidly evolving job market.
- Better prepare students to step into technical and engineering roles with the tools that industries are using today.
- Provide students and professionals insight into the industrialization of the entire additive manufacturing chain.

3D Printing in CTE is Most Commonly Used For:

Teaching Tools

Developing Technical Skills

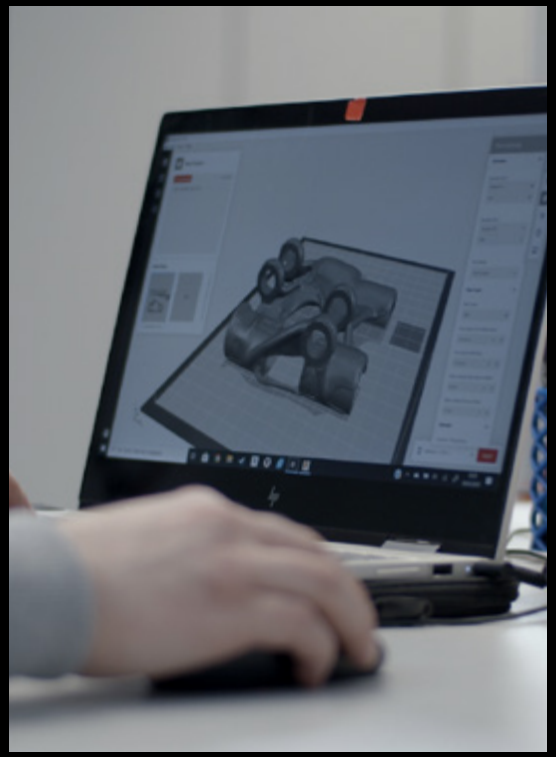
Developing Career Paths

Increase Future Employability

Recommendations for Printing in CTE Programs

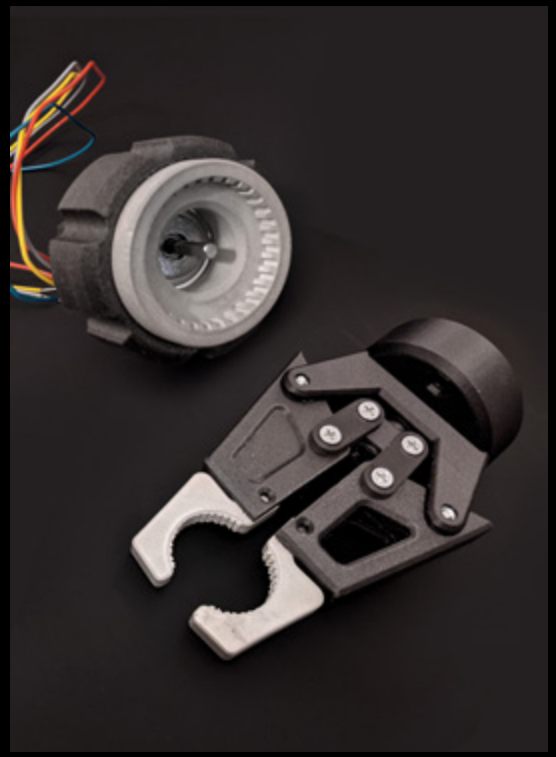
Get Familiar with 3D Printing

Students should familiarize themselves as much as possible with how 3D printing works - from creating and printing 3D models to determining what type of print settings will give them a print with the right amount of strength or the best print resolution.



Own the Process

Create a strong 3D printing foundation for your students that allows them to feel like it's another tool in the tool belt. Promoting students to own the 3D printing process encourages the development of a strong understanding of material sciences, 3D printing methods, and post-processing techniques involved in additive manufacturing.



How it All Works Together

Integrate different types of technologies like CNC machining with 3D printing and demonstrate how 3D printing is not the end tool but part of the manufacturing process.

CASE STUDY SPOTLIGHT

Karlsruhe University of Applied Sciences

Institute: **Karlsruhe University of Applied Sciences**

Educator: **Prof. Dr. Florian Finsterwalder**

Background on the Additive Design & Manufacturing Lab

Founded in 1878 and located in Baden-Württemberg, Germany, Hochschule Karlsruhe, University of Applied Sciences (HsKA) has a long and rich history rooted in research and engineering education. Through its robust technical and academic training, the University prepares students with critical skills to excel in their careers

HsKA is well-equipped with high-tech design, engineering, and manufacturing equipment, including 3D printing technologies. The Additive Design and Manufacturing Lab provides students with access to various polymer 3D printing technologies, such as FDM (fused deposition modeling), SLA (stereolithography) and DLP (digital light processing). The school also has a metal fabrication lab within its Faculty of Mechanical Engineering and Mechatronics available for students to use.

Prof. Dr. Finsterwalder holds up a robotic gripper designed by his students with the help of 3D printing

"I absolutely believe that 3D printing is increasing creativity and professional development. In the past, the opportunities for realizing prototypes were rather limited due to either time or cost or both. Today, 3D printing offers us an opportunity to quickly realize parts and prototypes. "

Prof. Dr. Florian Finsterwalder

Prof. Dr. Finsterwalder teaches the **Additive Design and Manufacturing** courses, where students are taught the foundations of generative design and additive manufacturing on both a theoretical and physical level.

The courses teach students how to conceptualize, design, and transform ideas into tangible objects that they can physically manipulate. Students also dive into the different materials, processes, technologies, and sustainability practices across the additive manufacturing spectrum. Students learn more than just prototyping; they are taught about the industrialization of the entire additive manufacturing chain.

How They Used 3D Printing:

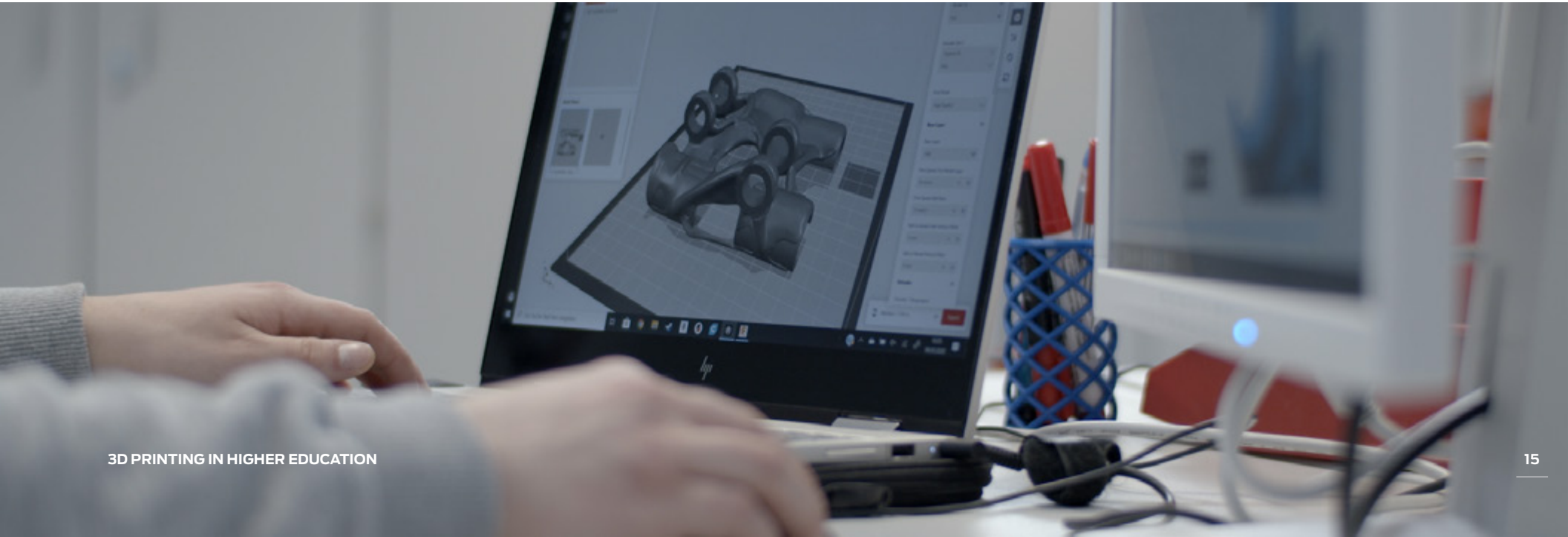
3D printing is increasingly gaining momentum in education, and that is no different at Karlsruhe University of Applied Sciences. For students, 3D printing is a valuable tool for them to turn their ideas into reality, while building the experience and skills they would need for their careers. To give students an opportunity to work in real-world business situations, while supporting local businesses, the University partners with startups to create capstone projects as well as help place them for work after graduation. The region of Karlsruhe has a very vibrant startup culture, dense with commercial and industrial businesses that have shaped the education and focus for many incoming and graduating students.

What They Used:

Machines	Materials
> MakerBot METHOD X 3D Printer	> Nylon Carbon Fiber, Tough PLA
> MakerBot Replicator 2X 3D Printer	> ABS

"The iteration and the process of developing these objects no longer stay at a theoretical level. Students face challenges and difficulties directly and use 3D printing as a problem-solving technique to realize or produce parts, products, or carry out projects,"

Prof. Dr. Florian Finsterwalder

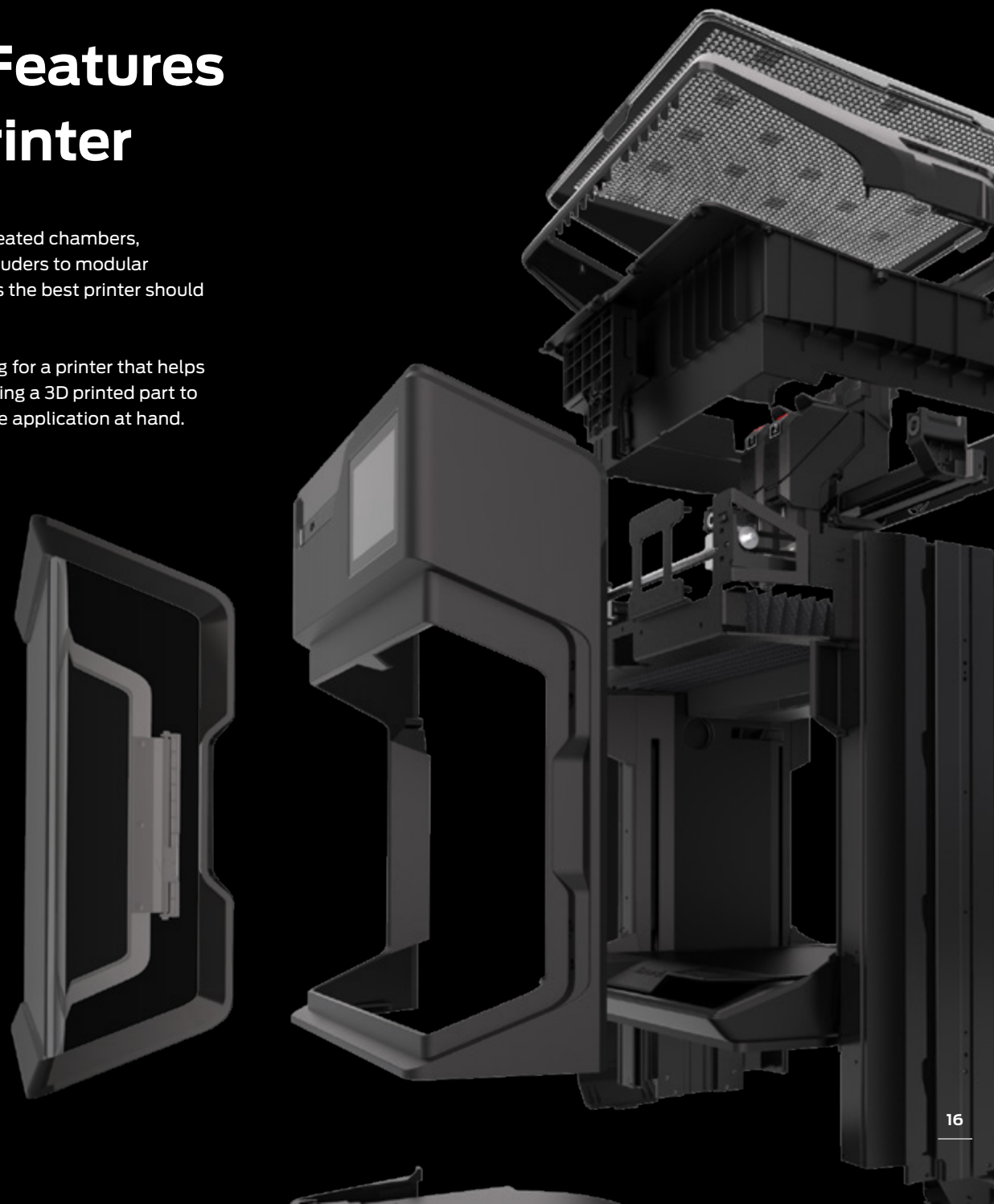


Chapter 3

The Most Important Features To Look For in a 3D Printer

From choosing between printers with either heated build plates or heated chambers, breakaway supports or soluble supports, and even bolted-down extruders to modular extruders, it can get overwhelming choosing between which features the best printer should have.

We've put together some of the key features to look for when hunting for a printer that helps you unlock what's truly possible with 3D printing - from concept testing a 3D printed part to printing with an end-use material with material properties that fit the application at hand.



Dissolvable Supports

There's no getting away from gravity, and that goes for 3D printers too. In order to print more complex shapes that have overhangs or more intricate details we have to print with removable supports, or 3D-printed scaffolding.

3D-printed supports come in two ways: supports that are printed in the same material as your model are called breakaway supports, they typically require tools like pliers to remove from the rest of the print, these supports can be tough to remove and can leave impressions on the model.

Benefits of Dissolvable Supports:

Dissolvable supports on the other hand are 3D printed supports printed in a material that can be dissolved in either water or a chemical solution. Since the supports are dissolved, manual removal with pliers is not necessary.

- **Geometry You Want Without Compromise:** Enable extreme complexity of geometry while maintaining a clean surface finish wherever supports were printed
- **Cleaner Prints:** Reduce the damage caused to a print that might have been more prevalent with non-dissolvable (breakaway) supports
- **Leverage Different Support Materials:** Print with a different support material that breaks away more easily from tricky elastic material such as ABS.

Circulating Heated Chamber & Rigid Frame

A temperature-controlled chamber allows for active heat immersion throughout the printing chamber and allows the printed material to cool slowly, minimizing warping and curling.

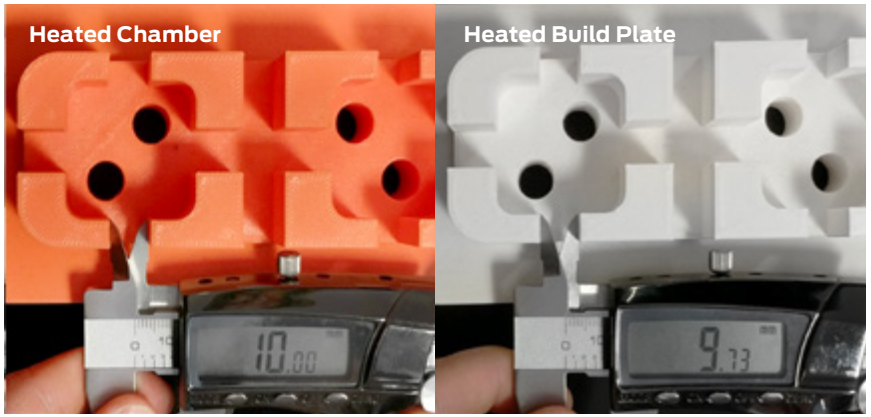
When a heated chamber is combined with a rigid printer frame that is built to withstand the printer's quick jolts as it prints in a combination of movements, it allows the printer to print at a smooth speed with high quality resolution without jeopardizing the ability to meet high tolerances.

Benefits of a Heated Chamber and a Rigid Frame:

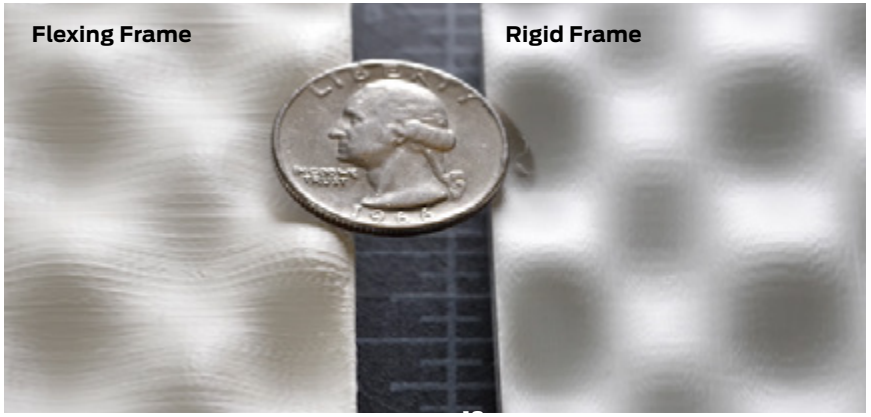
- **Strong Prints:** Produce consistently strong printed parts due to the heat being circulated through every layer of a print.
- **Achieve Tight Tolerances:** Avoid warping from loss of heat and maintain geometrically accurate parts from the first layer to the last
- **Print with New Materials:** Print with experimental materials with a range of mechanical and thermal properties that typically require a higher overall ambient temperature

Why a Heated Chamber Over a Heated Build Plate?

You might be asking why one is better over the other. Many desktop 3D printers use heated build plates to try and regulate their environment and prevent warping on the print bed. This improves adhesion to the build plate for the first layer and... that's about it. On the other hand, a fully-enclosed heated chamber that can warm up to 110ºC provides optimal print conditions from the first layer to the last.



Adding onto the heated chamber, a printer frame that is structurally-optimized to offset printer movements (or flexing) allows a printer to produce more consistent prints that help to better meet geometric dimensioning and tolerances up to +/- 0.2mm.



Material Experimentation & Swappable Extruders

Combining a platform that is equipped with a heated chamber, soluble supports and experimental material extruders that opens the doors to an open platform for advanced engineering materials.

Benefits of Swappable Extruders and Material Experimentation:

- **Leverage Material Properties:** Access unlimited materials with a platform designed for a large range of materials with different thermal and mechanical properties.
- **Unlock All Print Materials:** Use print materials previously inaccessible to additive manufacturing on one platform, like Nylon Carbon Fiber or Stainless Steel.
- **From Concept Prints to End-Use Designs:** Switch from materials meant for day-to-day prototyping use like PLA and Tough to engineering grade materials like Nylon Carbon Fiber and Metal.

Print with the Materials You Want

When it comes to FDM 3D printing, the toolhead or extruder is one of the most important components on a 3D printer. It can determine how your printer prints, what material it can print with and how easy your printer may be to use. It's worth looking into exactly how you can print with a large range of materials - and that starts with the type of extruder the printer has.

Extruder Systems Attachment Styles:

Bolted Down Extruder System:

An extruder that's bolted down is an extruder assembly that is bolted to the printer and is not easily removable.

X - Works well with only 1-2 types of printing materials

X - Tools are required to remove extruder, further disassembly required

X - If an issue occurs in the extruder during a print, print will need to be canceled to diagnose issue.

Latch System Extruder:

A latch system extruder is a modular extruder that is secured to the printer through a latch system, either with a physical latch or magnets.

✓ - Swap between extruders that are designed to print with low-temp, high-temp, flexible and abrasive materials

✓ - No tools required to switch between extruders.

✓ - If an extruder issue occurs during a print, pause the print, install a new extruder and continue printing

Ease of Use

3D printing can already be considered a tricky technology - advanced features like a heated chamber or extruder swapability won't matter if the platform they're on isn't easy to navigate.

Benefits of an Easy-to-Use Printer:

- **Use it Out of the Box:** Being able to use the printer right out of the box without the need to spend time determining the best calibrations for the printer or guessing around as to how the printer's interface works.
- **Swappable Extruders:** The option to swap out extruders when you change the type of print material or run into a jam means you're able to be back up and running within minutes instead of days.
- **Reduced Downtime:** A printer that doesn't require bed leveling or heavy maintenance gives you the time back in the day to create your next new design.
- **Easy, Intuitive Software:** Having an easy to use software with pre-set settings for over 30+ materials removes all the guesswork out of 3D printing and lets you print with ease.

What Else Can Add to the Ease of Use?

A Printer's Interface: The printer's interface is what allows you to directly navigate through different operations on a printer. From loading material, calibrating the printer and pausing a print job mid-print - the way in which a printer's interface is designed is integral to the success of your printer.

Many printers will have an LCD display versus more advancements that offer a touchscreen. Often times the LCD display will have a silicon arrow pad or wheel to navigate around the interface but they can wear over time and delay feedback. Touchscreen displays on the other hand offer direct feedback and make navigating around a printer's interface both easier and faster.

A Connected 3D Printing Platform

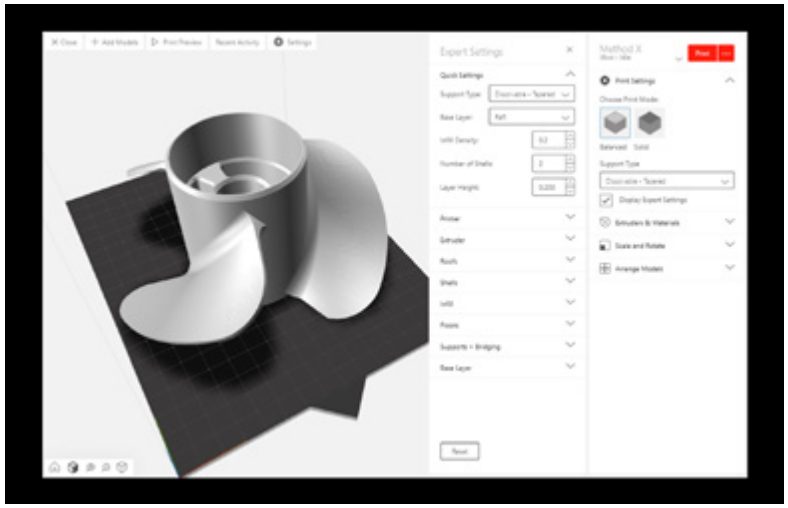
When selecting a 3D printer you'll also want to consider what type of software comes with the printer. A powerful and easy to use software that allows you the ability to remotely monitor your ongoing prints and gain complete oversight on what's printing when and with what material.

What a 3D Printing Software Platform Should Have:

- **Print Monitoring:** Having the ability to monitor ongoing prints (especially larger, longer prints) to make sure everything is going smoothly; and if something goes wrong you can pause the print to avoid wasting printing material.
- **Printer Connectivity:** Need to start a print while away from the printer? A cloud-based software can help you start/pause prints from anywhere you are and help you get complete visibility about the status of your printers.
- **Print Queues:** Add print files to your connected printers to queue up a series of print jobs without having to wait for a print job to complete before starting the next one.

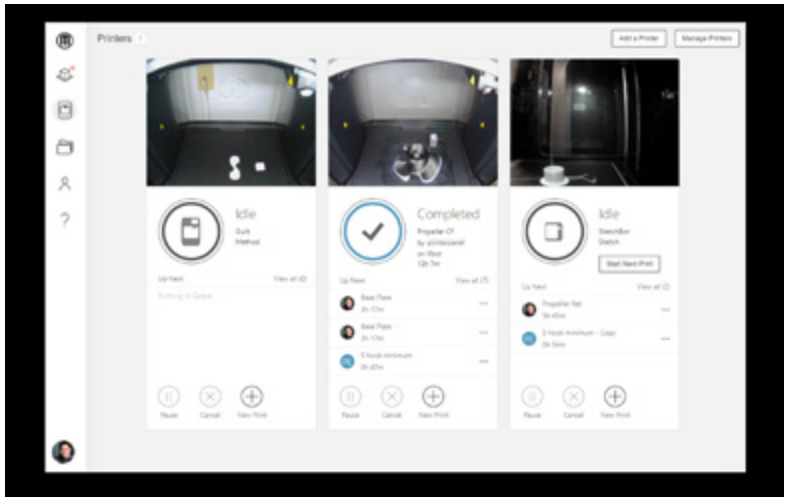
Print Settings

Ideally a software that allows you to adjust print settings, infill, layer height as well as the chamber and extruder temperatures to match your material needs will help you get what you want out of a printer.



Software Installation

Often, bringing new software and technology into academia can be a massive challenge - from getting approvals from an educational institution's IT team to having to deal with getting locked out of your computer every time there's a new software update. Look for a software that has cloud-based compatibility, which, does not usually require software installation or additional approvals from the IT team.



Chapter 4

The MakerBot METHOD 3D Printer Platform

Leveraging the Best Features in 3D Printing

Hopefully, now you have a better understanding of the different ways in which 3D printing is used within Higher Education and if it's something you'd like to explore further.

If you've made it this far and you are interested in taking the next step, take a look at the MakerBot METHOD 3D printer platform. A platform built top to bottom with physical and digital features that work together to deliver a solution capable of printing with a large range of print materials aided by printer features that lends itself to quality, reliable prints, every time.

General Features

> Dual Extrusion
> Dissolvable Support Material
> Open Material Platform
> Heated Printing Enclosure
> Auto-Calibration
> Dimensional Accuracy w/in +/- 0.2mm

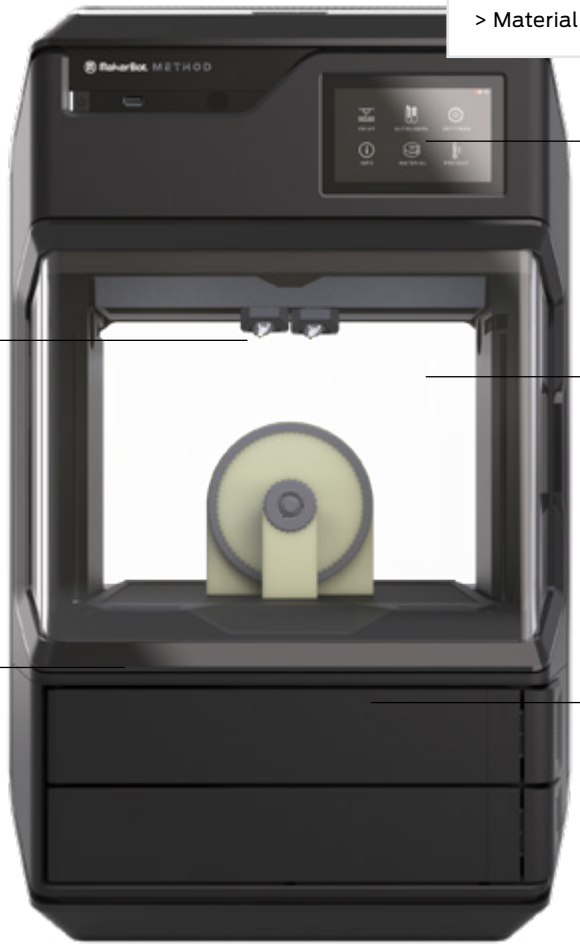
The MakerBot METHOD Platform:

Ideal for

> Users Familar with 3D Printing
> Advanced Prototyping
> Complex Geometries
> Engineering, Manufacturing & Industrial Design Applications
> Material Research

EASY-TO-USE SOFTWARE

Prepare, queue, print, and monitor prints all from one cloud-based software



EASY-TO-USE INTERFACE

The touchscreen interface gives you options for managing your printer and the printing process.

DUAL PERFORMANCE EXTRUDERS

Model Extruder:
Print with: PLA, ABS, Nylon Carbon Fiber, Metal, more.
Support Extruder:
Print with PVA, SR-30, or RapidRinse

CIRCULATING HEATED CHAMBER

Temperature-controlled chamber allows for active heat immersion to minimizing warping and curling.

ULTRA-RIGID METAL FRAME

Printer body stiffness translates directly into print quality and precision. Using a heavy-duty, all metal architecture from the bottom of the printer to the top.

SMART SPOOLS AND SMART ASSIST MATERIAL LOADER

Sealed drawer bays that keep print materials away from humidity and dust for continued print quality.

The Extruders and the Material Library

From a printer's ability to print with different materials or the ability to print with soluble supports - it all factors in when it comes to determining the final iteration of a print.

The MakerBot METHOD Platform allows you to go from concept-testing in PLA to end-use prototypes in chemical resistant or anti-static print materials. Need to leverage a different material property?

- Designing jigs & fixtures that will be in contact with different chemicals? Use PETG
- Printing parts that need to be thermally stable or need to withstand ignition or burning? Use PolyMax PC-FR or PC-ABS FR
- Working with electronics and need to avoid static buildup? Use Jabil PETG ESD or Kimya ABS-ESD

Take a look at our collection of extruders and the most popular print materials compatible with MakerBot METHOD platform printers - from the tried and true types of printing material like PLA, Tough and ABS to newer materials like Nylon Carbon Fiber, SEBS and even Metal.

MODEL EXTRUDERS

Extruder 1A
Ideal for low temp materials like PLA, Tough, Nylon and more.
Extruder included in the METHOD 3D Printer

Extruder 1XA
Ideal for high temp materials like ABS, ASA, and more.
Extruder included in the METHOD X 3D Printer

Extruder 1C
Primarily for printing with Nylon Carbon Fiber, can also print with other materials.

LABS Experimental Extruder
Designed to print with third party 3D printing materials

SUPPORT EXTRUDERS

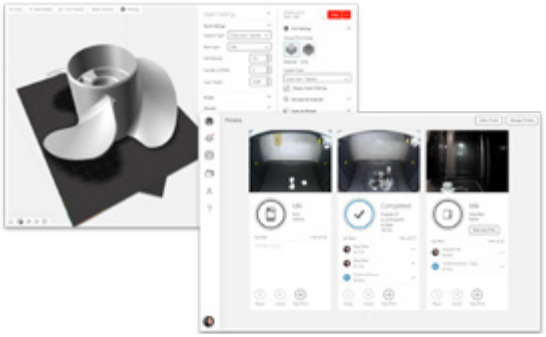
Extruder 2A
Designed to print in combination with low-temp model materials. Will print in PVA - a support material that dissolves in water, similar to Elmer's Glue.
Extruder included in the METHOD 3D Printer

Extruder 2XA
Designed to print in combination with high-temp model materials. Will print with SR-30 and RapidRinse. SR-30 dissolves in a chemical bath and RapidRinse dissolves in water.
Extruder included in the METHOD X 3D Printer

Print Preparation Software

Software is always crucial when it comes to cutting-edge technology and ours is no different. Makerbot CloudPrint is a free, print preparation software for MakerBot printers that requires no software installation. This software converts 3D models into 3D printable files while also giving users the ability to monitor, start, and manage 3D print queues remotely from an online dashboard.

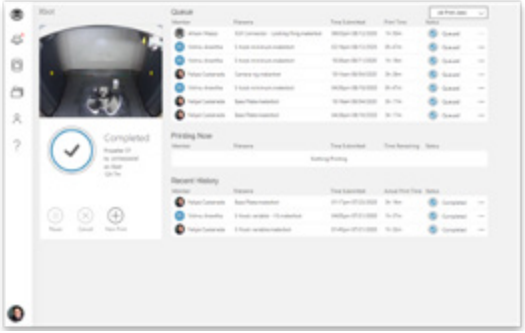
FILE PREPARATION



Edit print settings, change printers and customize print options.

- Upload 3D Models
- Edit Print Settings

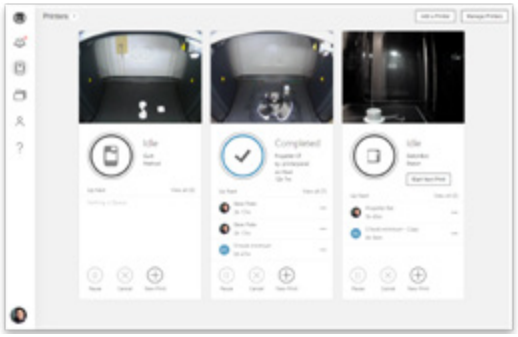
QUEUE PRINT FILES



Add files to your local or remote printers to either print right away or to print at a future point in time.

- Export Printable Files
- Assign Print Jobs to Printers
- Add New Printers

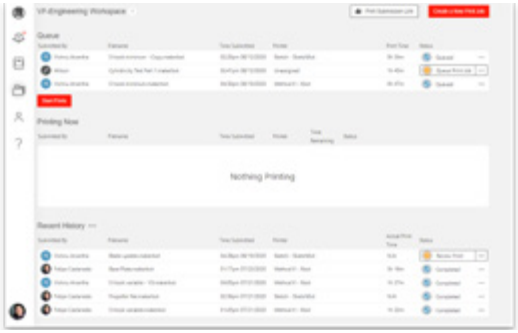
3D PRINT & MONITOR PROGRESS



Access all of MakerBot's print options and 3D print with complete visibility over ongoing prints.

- Remote Monitoring
- Start and Pause Prints
- Change print materials

REPORTS AND STATISTICS



Looking to optimize how your printers are run? Review all your printers' print history and gain insights into material usage, printer use and print success rates.

- See history
- Review Print Log
- Review Material Usage

PLA
Easy to Use

Extruder Material Extruder 1A
Printer METHOD, METHOD X

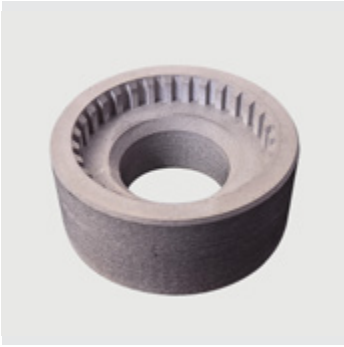
TOUGH
Durable & Easy

Extruder Material Extruder 1A
Printer METHOD, METHOD X

NYLON
Abrasion Resistant

Extruder Material Extruder 1A
Printer METHOD, METHOD X

METAL
Solid Steel



Extruder LABS GEN 2
Printer METHOD, METHOD X

NYLON CARBON FIBER
Peak Strength

Extruder Material Extruder 1C
Printer METHOD, METHOD X

N12 CARBON FIBER
Strength + Moisture Resistant

Extruder Material Extruder 1C
Printer METHOD, METHOD X

PETG
Chemical Resistant

Extruder Material Extruder 1A
Printer METHOD, METHOD X

ABS
High Temp, High Tensile Strength

Extruder Material Extruder 1XA
Printer METHOD X

ASA
Similar to ABS & UV Resistant

Extruder Material Extruder 1XA
Printer METHOD X

SEBS
Highly Flexible

Extruder LABS GEN 2
Printer METHOD, METHOD X

PETG ESD

Static Resistant

Extruder LABS GEN 2
Printer METHOD, METHOD X

PETG CARBON FIBER

Rigid Chemical Resistance

Extruder LABS GEN 2
Printer METHOD, METHOD X

SUPPORT MATERIALS

RAPIDRINSE

Water soluble, prints with ABS-R

Extruder Support Extruder 2XA
Printer METHOD X

SR-30

Soluble in a chemical solution, prints with high temp materials

Extruder Support Extruder 2XA
Printer METHOD X

PVA

Water soluble, prints with low temp materials

Extruder Support Extruder 2A
Printer METHOD, METHOD X

Want to learn more about all of our 30+ materials? Download the MakerBot Materials Guide for METHOD and find the latest additions to our materials platform.

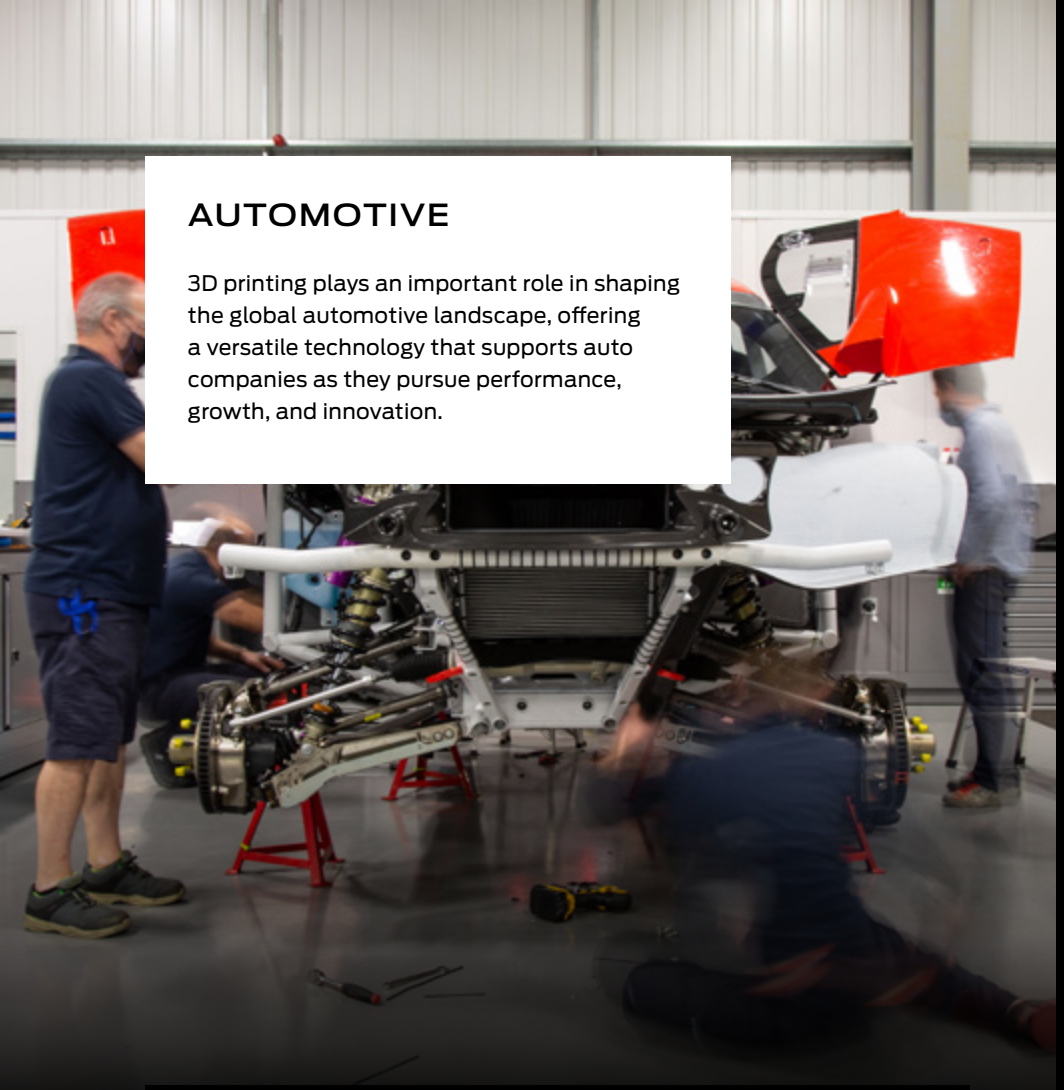
Visit us at www.makerbot.com/3d- printers/materials/method-materials/

Chapter 5

3D Printing Across Industries

The path from higher education into the industrial space is already highlighting the reasons why 3D printing is crucial in education. Additive manufacturing is playing an increasing role in the continued development of robotics, automation, supply chain management, automotive product, product design and so much more.

The ability to design, test, iterate and produce parts on demand and earlier in the production cycle have enabled businesses to become more agile and innovative. See how 3D printing is impacting different industries today and what might be possible for the future.



AUTOMOTIVE

3D printing plays an important role in shaping the global automotive landscape, offering a versatile technology that supports auto companies as they pursue performance, growth, and innovation.

"METHOD is one of the most sophisticated units on the market, from the ease of connectivity––we can run all three of our printers from our laptop––to the advanced materials we were able to use––from ABS to nylon carbon fiber––to the heated build chamber that ensures print accuracy and repeatability every time."

PAUL DOE - CHIEF ENGINEER OF CHASSIS

CASE STUDY SPOTLIGHT

DAKAR RALLY

Paul Doe is the Chief Engineer of Chassis at Prodrive. His job is to design and build the most advanced high performance race cars in the world. In 2020, his task was to build two rally cars from scratch for upstart team BRX ahead of the 2021 Dakar Rally. Learn how Paul and his team leaned on two METHOD X 3D printers - one in the shop and one in the desert for the creation of low volume, high-performance car parts.

SPRINKLER SYSTEM

Printer METHOD X
Material N12 Nylon Carbon Fiber
Print Time 11h 19m

TAILGATE SOCKET

Printer METHOD X
Material N12 Nylon Carbon Fiber
Print Time 2h 27m

RESERVOIR BRACKET

Printer METHOD X
Material N12 Nylon Carbon Fiber
Print Time 8h 38m

AEROSPACE

3D printing has helped transform the aerospace industry and advance innovation across various segments, from commercial and military aircrafts to innumerable research, space and infrastructure applications.

"The METHOD X 3D printer has evolved as a tool, providing us with a high level of reliability during part production. In our line of business, this is essential – especially in comparison to other 3D printers where there's a risk that the final part will not come out as you'd expect."

LUKE COLBY - PRESIDENT & CEO

CASE STUDY SPOTLIGHT

TRITON SPACE TECHNOLOGIES

Luke Colby is the President and CEO of Triton Space Technologies - a Boston, Massachusetts-based engineering design and manufacturing company which specializes in producing rocket propulsion systems. Luke and his team were faced with the challenge of prototyping lunar lander engine components for an upcoming lunar mission on a truncated time-table. They were able to utilize METHOD X to quickly and cheaply test the injector head assemblies (among other parts) before moving into machining stages with expensive space-grade metals.

PUMP VALVE

Printer METHOD X
Material ABS
Print Time 11h 19m

MANUFACTURING

3D printing plays an important role in shaping the global automotive landscape, offering a versatile technology that supports auto companies as they pursue performance, growth, and innovation.

"One of the interesting things about our shop is that right next to our million-dollar machines on the production floor is a MakerBot METHOD, which is about $6,500. And it's that $6,500 machine that is able to keep our million-dollar machines running."

GARY KUZMIN - PRESIDENT AND CEO

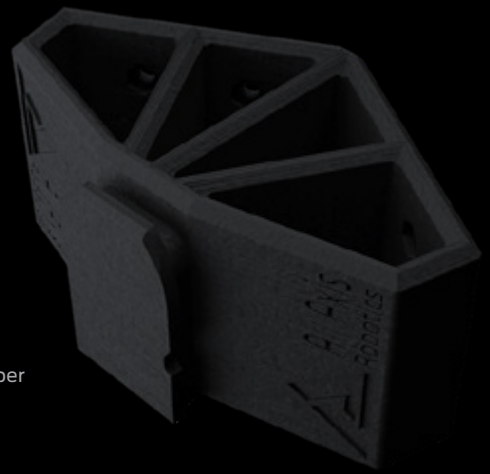
CASE STUDY SPOTLIGHT

ALL AXIS

Gary Kuzmin is the president and CEO of All Axis Machining and All Axis Robotics - a multi-disciplinary metal fabricator manufacturing company based in Dallas, TX. All axis is at the forefront of machine automation, utilizing robotic arms and METHOD X 3D printers to support their million dollar CNC machines - allowing them to produce complex metal parts with peak efficiency.

TAILGATE SOCKET

Printer METHOD X
Material N12 Nylon Carbon Fiber
Print Time 2h 27m



DUAL GRIPPER END EFFECTOR ATTACHMENT

Printer METHOD X
Material N12 Nylon Carbon Fiber
Print Time 11h 19m

PRODUCT DESIGN

Product design and development is at the core of our company. MakerBot 3D printers are used in all phases of product development by designers and engineers in every industry - from consumer electronics to industrial products to medical devices and beyond.

"If we didn't have the METHOD I would have to plan out my prints like everyone else who is using the industrial machine whereas the METHOD is a quick print out that we can just pump out"

BRANDON RODRIGUEZ - SMART DESIGN

Smart Design

CASE STUDY SPOTLIGHT

SMART DESIGN

Brandon Rodriguez is an industrial designer at Smart Design who spends most of his time developing products for OXO. As a designer at one of the big NYC industrial design firms he's no stranger to 3D printers - they have many industrial machines in the workshop. With METHOD in their design bay, Brandon and his colleague Albert Kwak are able to skip the queue for the industrial machines and get industrial-level prototypes in hours instead of days.

OXO KETTLE

Printer Z18
Material TOUGH
Print Time 17h 20m

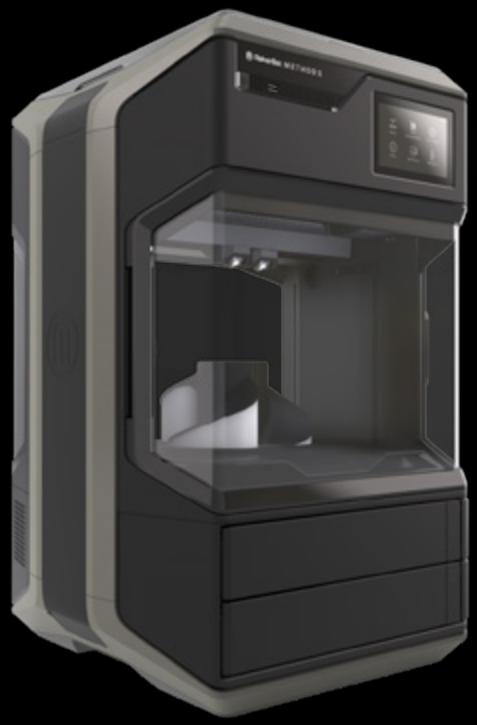
Get started today.

Unlock innovation with the most advanced professional 3D printing platform available.

METHOD

METHOD X

CARBON FIBER EDITION



METHOD X

Visit **makerbot.com/method** to learn more.