

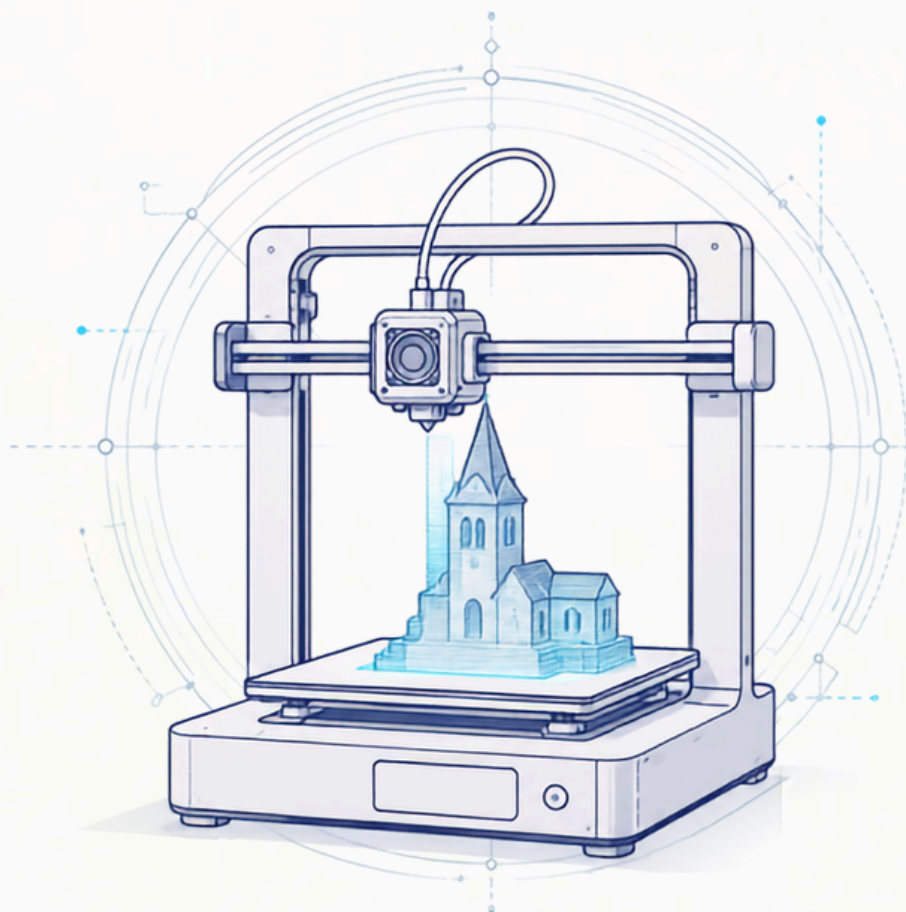


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MODULE 03

3D PRINTING

DIGITAL RURAL EUROPEAN ART
AND MEMORY



Project partners



Project DREAM
Digital Rural European Art and Memory
2025-1-SK01-KA210-ADU-000360122



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How to use this E-book

You can read this ebook before, during or after the session. Each section introduces a concept, connects it with real platforms, and closes with a short activity or decision-making task.

The activities do not require learners to open seller accounts or publish real products. They can be completed as simulations using screenshots, platform pages, draft descriptions or sample files. This keeps the learning practical without forcing beginners to take public or commercial actions before they are ready.

At the end of the ebook, the integrated activity asks learners to plan a complete online sharing route for a 3D model and a smaller optional route for selling the printed object.



Alhambra, Spain.

MODULE INFORMATION

 Module number 03	 Level Beginner
 Topic Practical introduction to 3D printing	 Format Hybrid learning
 Duration 3 hours	 Main output From Need to 3D-Printed Part

About this module

This ebook supports the DREAM module on 3D printing. Its purpose is to help you understand how a digital idea can become a physical object using a 3D printer. The material is designed for beginners and uses clear, practical and progressive explanations. 3D printing is part of additive manufacturing. This means that a part is built by adding material layer by layer. This manufacturing approach makes it possible to create prototypes, customised parts, simple tools, educational models, accessories, spare parts and useful objects for specific needs.

During this module you will mainly work with filament-based 3D printing, also known as FDM or FFF, because it is the most accessible technology for beginners. You will also find a complementary introduction to resin printing, which can produce very fine detail but requires more care in terms of safety, cleaning and waste management.

The aim is not to memorise every printer setting. The aim is to understand the complete process: choosing or creating a model, preparing it in a slicer, checking the machine, printing safely, observing the result and improving the part if needed.



Learning Objectives

- Understand what 3D printing is and how it relates to additive manufacturing.
- Identify real uses of 3D printing in education, home, design, business and work contexts.
- Distinguish, at a basic level, between FDM printing and resin printing.
- Recognise the main parts of a filament 3D printer.
- Know common materials, basic tools and selection criteria.
- Apply safety rules and prepare the workspace properly.
- Understand the workflow from a digital model to a printed part.
- Interpret basic slicer settings: layer height, infill, supports, temperature and speed.
- Understand the importance of calibration, especially the first layer.
- Recognise common printing errors and suggest a first improvement action.
- Understand the basic precautions involved in resin printing.
- Plan a simple part as the final project for the module.

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1. What Is 3D Printing?

3D printing is a way of manufacturing physical objects from a digital file. The printer interprets the design and deposits or solidifies material layer by layer until the full shape is complete. Each layer is thin, but together they form a three-dimensional object. This method of manufacturing is called **additive manufacturing** because it adds material. In other processes, such as cutting wood or machining metal, you start with a block and remove material. In 3D printing, the opposite happens: the part emerges bit by bit, from the base to the top.



Key Concepts

3D model: a digital file that represents the shape of a part.

Layer: each thin level of material that forms the object.

Additive manufacturing: a manufacturing process that adds material instead of removing it.

Prototype: an early version of a part or product used to test an idea.

Iteration: the process of testing, correcting and improving a part.

A key concept is that 3D printing bridges two worlds: the digital and the physical. First, there is a model on screen. Then that model is prepared using software. Finally, the printer transforms it into an object that you can touch, test, measure and improve.

3D printing isn't suitable for everything. It isn't always the quickest, cheapest or most durable method. Its value lies in the ability to create customised parts, prototypes, unique objects, bespoke solutions and small batches without the need for moulds or complex industrial machinery.



Practical Task

Look at three objects around you. For each one, answer:

Could it be made with 3D printing?

Would it be useful to customise it?

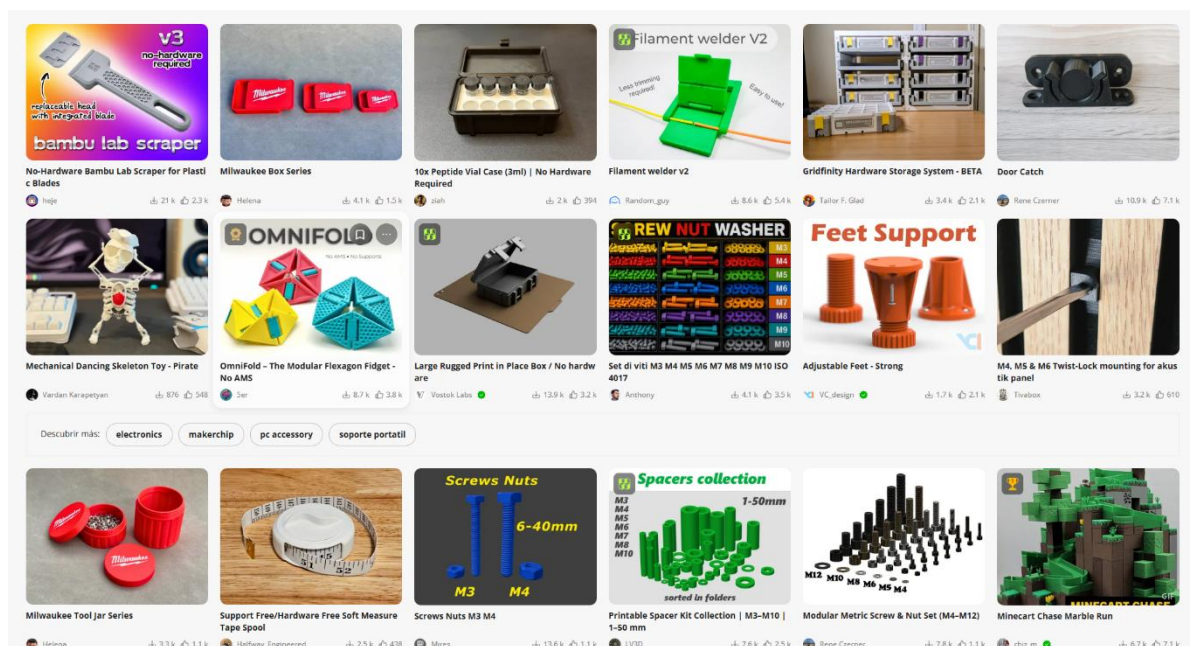
Would it need to be very strong, flexible or only decorative?

What would be the advantage of printing it instead of buying it already made?

Quick tip: Before printing, try to describe the part in a simple sentence: what problem it solves, who it's for and why it makes sense to build it layer by layer.

2. Real-World Uses of 3D Printing

3D printing is used in a wide variety of contexts. In education, it helps to create visual models: geometric shapes, scale models, maps, prototypes or adapted learning resources. Seeing and touching an object can make it easier to understand concepts that are more abstract on paper. In design and entrepreneurship, it allows ideas to be tested before manufacturing a final product. A company can print a casing, a bracket or a test piece to check the size, ergonomics, fit and appearance. If something doesn't work, the design is changed and another version is printed. At home and in maker spaces, it is used to solve everyday problems: organisers, hooks, cable holders, adaptors, spare parts, tool accessories or decorative items. Many pieces do not need to be complex to be useful.



In professional settings, it is also used in medicine, architecture, industry, the automotive sector, jewellery, art, fashion and toolmaking. In these cases, more advanced technologies may be employed, but the basic logic remains the same: design, prepare, manufacture, review and improve.



Video Resource

The 20 Most Useful 3D Prints I Cannot Live Without

Source: Control 3D – original video on YouTube:

<https://www.youtube.com/watch?v=4RXtLuXXdwQ>



Practical Task

Choose a simple need from your classroom, home or workplace. Come up with an idea for a piece that could help. You don't need to draw it in 3D just yet; a description will suffice.

- Name of the object.
- Problem it solves.
- Where it would be placed.
- Approximate dimensions.
- Material you could use.
- Which part would be the most difficult to print.

3. 3D printing, Local Heritage and Community Memory

At DREAM, 3D printing is not presented merely as a manufacturing technology. It is also used as a way of seeing the local environment through fresh eyes. An everyday object, an old tool, a signpost, a traditional pattern, a piece of furniture, an inscription or a family heirloom can all become the starting point for a simple piece. It is not always necessary to reproduce an entire object. Sometimes it is enough to create a label for an exhibition, a mount for a photograph, a small, simplified replica, a template inspired by a local motif, or a support to better preserve or display an object.

The key is to work with respect. When a piece is inspired by heritage, it is worth asking what it represents, who recognises it as significant, whether it can be freely shared, and what story accompanies the object. 3D printing can help to explain, preserve or reinterpret, but it must not strip what belongs to a community of its context.



Examples of pieces linked to heritage

- A 3D label for a community exhibition.
- A display stand for an old photograph or an oral history record.
- A small, simplified replica of a traditional tool.
- A template inspired by a textile, ceramic or architectural pattern.
- A marker for a cultural trail or educational activity.
- A simple replacement part to aid the conservation of an object.

Quick tip: When working with heritage, don't just copy the form: accompany the piece with a brief history so that it retains its meaning.



Practical Task

Choose a local object, place, craft, symbol or memento and answer:

What is its history or purpose?

Which part of it could be represented in a small piece?

Would the piece be practical, educational, decorative or heritage-related?

Who would use it or understand it best?

What would need to be explained so that it doesn't lose its meaning?

4. Basic Technologies: FDM and Resin

There are several 3D printing technologies. In this module, we'll focus on two because they're the easiest to recognise when you're starting out: FDM and resin.

FDM printing uses a spool of plastic filament. The filament enters the printer, is heated in the hotend and emerges through a nozzle as a molten thread. The machine deposits this material layer by layer onto a build plate. It is a very common technology in educational settings, homes, workshops and small businesses.



Resin printing uses a photosensitive liquid. Light cures specific areas of this liquid to create the part. This technology allows for a high level of detail and smooth surfaces, but requires washing, curing, gloves, ventilation and careful waste management.



To start with, FDM is usually the most suitable option. It allows you to clearly see how the part is built, to work with PLA and to practise calibration, slicing and troubleshooting with fewer risks than with resin.

Key differences between FDM and resin

FDM

Material: solid filament wound onto a spool

Method of creating the part: deposits molten plastic layer by layer

Level of detail: sufficient for practical parts, prototypes and learning

Safety: requires care regarding heat, movement and ventilation

Clean-up: usually requires removing the part and cleaning the build plate

Common uses: widely used in education, for supports, simple tools, functional parts and prototypes

Difficulty for beginners: generally more suitable for a first group experience

Resin

Material: photosensitive liquid

Method of creating the part: cures layers of liquid using light

Level of detail: allows for finer details and smoother surfaces

Safety: also requires avoiding skin contact, wearing personal protective equipment and managing waste

Clean-up: resin requires washing, removal of supports, curing and cleaning of tools

Common uses: Resin is used for miniatures, jewellery, dentistry, small models and highly detailed parts

Difficulty for beginners: best introduced as a complementary technology, provided safety conditions are met

Other types of 3D printing: In addition to FDM and resin, there are other additive manufacturing technologies. In this module, they are merely mentioned so that you can recognise them:

SLS (Selective Laser Sintering): uses powder, usually plastic, which is fused using a laser. It is commonly used for functional parts and short runs.

SLM/DMLS, laser metal melting: uses metal powder and enables the production of complex metal parts. It is used in industry, medicine, aeronautics and the automotive sector.

Binder jetting: bonds powder using a liquid binder. It can be used with sand, ceramics, metal or other materials.

Material jetting: deposits small droplets of material and can achieve a high level of detail, as well as incorporate various materials or colours.

Directed energy deposition: feeds material whilst simultaneously melting it using a laser, arc or electron beam. It is mainly used for repairs or advanced metal fabrication.

Sheet lamination: bonds sheets of cut material layer by layer. It is less common in basic training, but forms part of the family of additive technologies.

Quick tip: When choosing a technology, think first about the end use: strength, detail, safety, cost and cleanliness matter more than the initial appearance.



Practical Task

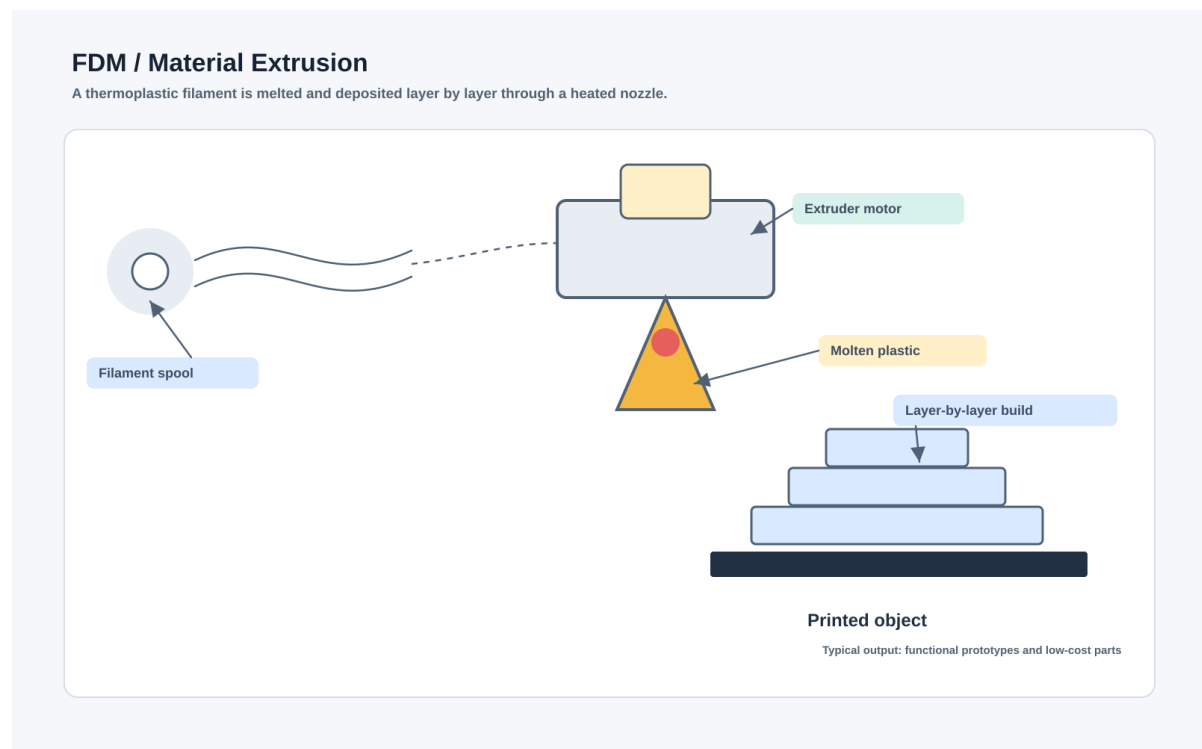
Classify these parts according to the technology that seems most suitable:

- A mobile phone stand.
- A highly detailed miniature.
- A cable storage box.
- A small transparent part.
- A large prototype to check size.
- A decorative figure with fine texture.

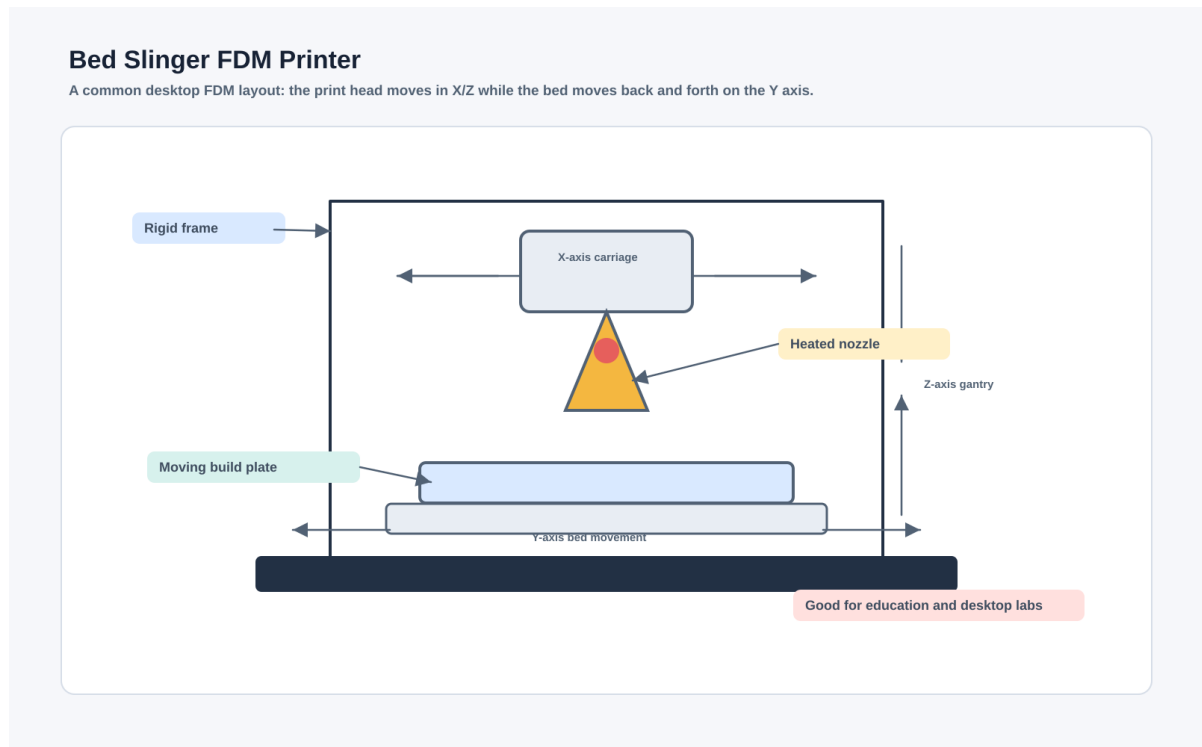
5. Parts of an FDM 3D Printer

Understanding the parts of a 3D printer helps to take the fear out of using the machine and to understand any errors. Although each model varies, many FDM printers share basic components.

The **frame** supports the printer. It must be stable to ensure precise movements. The **build plate** is the surface where the part is formed. It can be heated to improve the material's adhesion. The **extruder** pushes the filament. The **hotend** heats the material. The **nozzle** is the outlet through which the molten plastic is deposited. The fans help to cool the material and control the temperature of the hot end.



The **X**, **Y** and **Z axes** allow movement in three directions. Depending on the printer's design, either the nozzle, the build plate or both may move. The **display** or **control panel** allows you to start jobs, move the axes, load filament and check temperatures.

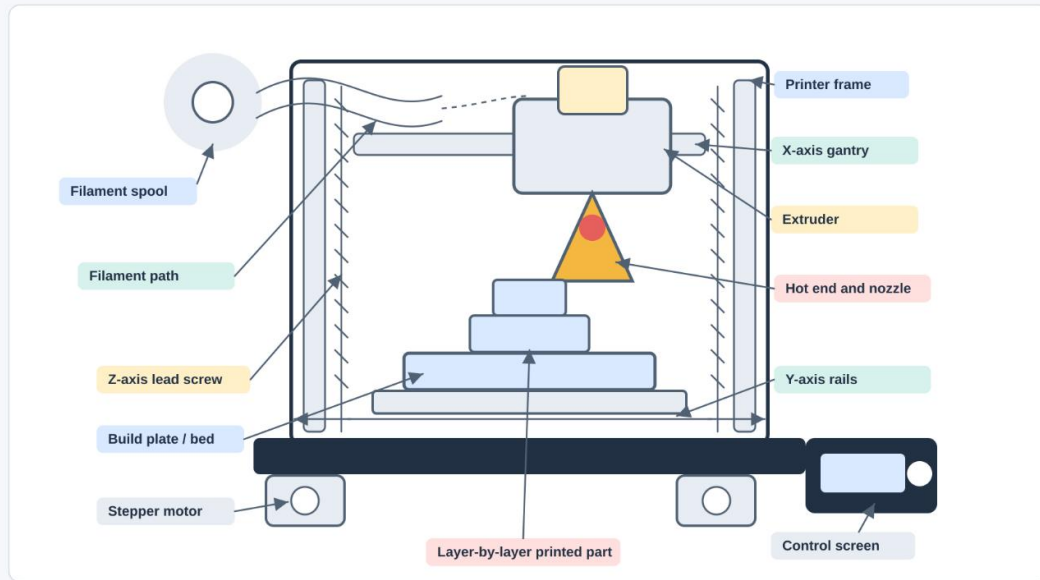


Inspection Checklist

- Filament spool
- Filament path
- Extruder
- Hotend or heated head
- Nozzle
- Build plate
- Control screen
- Movement axes
- Fans
- Cables and power supply

Main Parts of a Filament 3D Printer

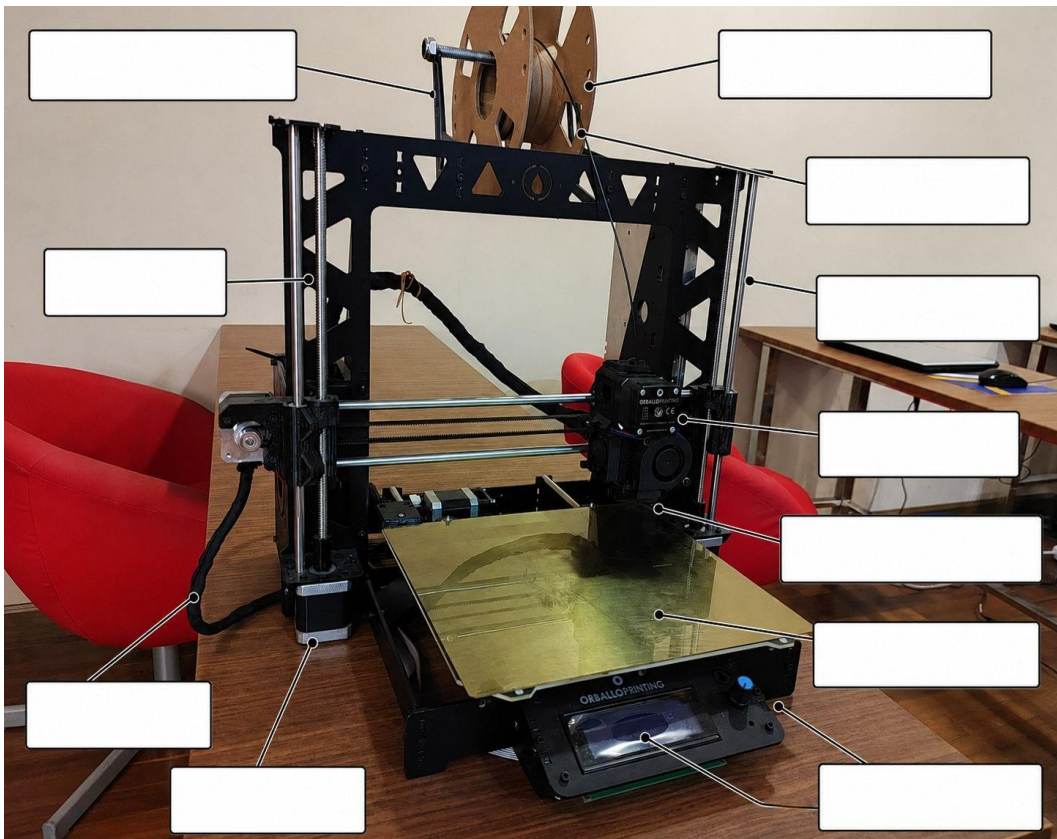
A desktop FDM printer feeds thermoplastic filament into a heated nozzle and builds the object layer by layer.





Practical Task

Look at a real printer or a picture. Point to each part in the list and write one sentence about its function. Example: the nozzle deposits melted material onto the part.



Quick tip: Before touching a printer, locate the nozzle, the build plate, the extruder, the axes and the pause button; recognising the parts helps to avoid many basic mistakes.

6. Basic Materials and Tools

The most common material for beginners is **PLA**. It is easy to print, has low warping and works well for educational, decorative and simple functional parts. For a first practice activity, it is usually the safest and most stable choice. **PETG** is more durable and better suited to certain applications, but it can produce more stringing and may require adjustments. **TPU** is flexible and is used for soft parts, covers or elastic elements. **ABS** and **ASA** are more demanding as they can warp and require better temperature control and ventilation. **Nylon** and **polycarbonate** are technical materials and are not recommended for a first-time experience.

As well as filament, you'll need some basic tools. Some are used to set up the printer, others to remove printed parts, and others to keep your workspace tidy. Not everything is essential from day one, but it's worth knowing about them.

Common Tools

- Cutting pliers for cutting filament or removing scraps.
- A spatula or removal tool, if the build plate requires it.
- Tweezers for removing small strands or bits of material.
- Isopropyl alcohol to clean the build plate when necessary.
- Gloves when handling materials or products that require them.
- Box or bag to protect filaments from moisture.
- Caliper for measuring parts and checking dimensions.



Video Resource

The 30 Essential Tools for 3D Printing

Source: Control 3D – original video on YouTube:

<https://www.youtube.com/watch?v=egKQMPRQ5gM>



Practical Task

Create three lists:

1. essential tools to start
2. useful tools to improve
3. advanced tools

Explain why each item belongs in that category.

Quick tip: Keep your filament dry and tidy; moisture can cause stringing, poor adhesion and uneven surfaces, even with the correct settings.

7. Safety and Workspace Preparation

3D printing requires attention to safety. An FDM printer involves hot parts, electricity, moving mechanical parts and plastic materials. Most risks can be minimised through tidiness, supervision and ventilation. Do not touch the nozzle or the heated bed whilst printing. The nozzle can reach very high temperatures. You should also avoid putting your fingers near moving parts whilst the machine is running. The workspace must be well-ventilated and free from objects that could fall onto the printer. The machine must be placed on a stable surface. Cables must be neatly arranged and free from tension. If a print job is lengthy, it is advisable to check that the equipment is in good working order and that the environment is suitable.

Resin requires additional precautions. Liquid resin must not come into contact with the skin. Nitrile gloves, eye protection, ventilation and a proper system for washing, curing and waste disposal must be used.



Video Resource

Is It Dangerous to Have a 3D Printer at Home?

Source: Control 3D – original video on YouTube:

https://www.youtube.com/watch?v=ZvZ_rssY83Y

Safety checklist

- ✓ The printer is on a stable surface.
- ✓ There is adequate ventilation.
- ✓ There is no paper, fabric or loose objects near the hot area.
- ✓ The cables are tidy.
- ✓ The base is clean.
- ✓ The material is loaded correctly.
- ✓ You know how to pause or stop printing.
- ✓ Do not touch the hot nozzle.
- ✓ When working with resin, wear gloves, safety goggles and ensure there is adequate ventilation.

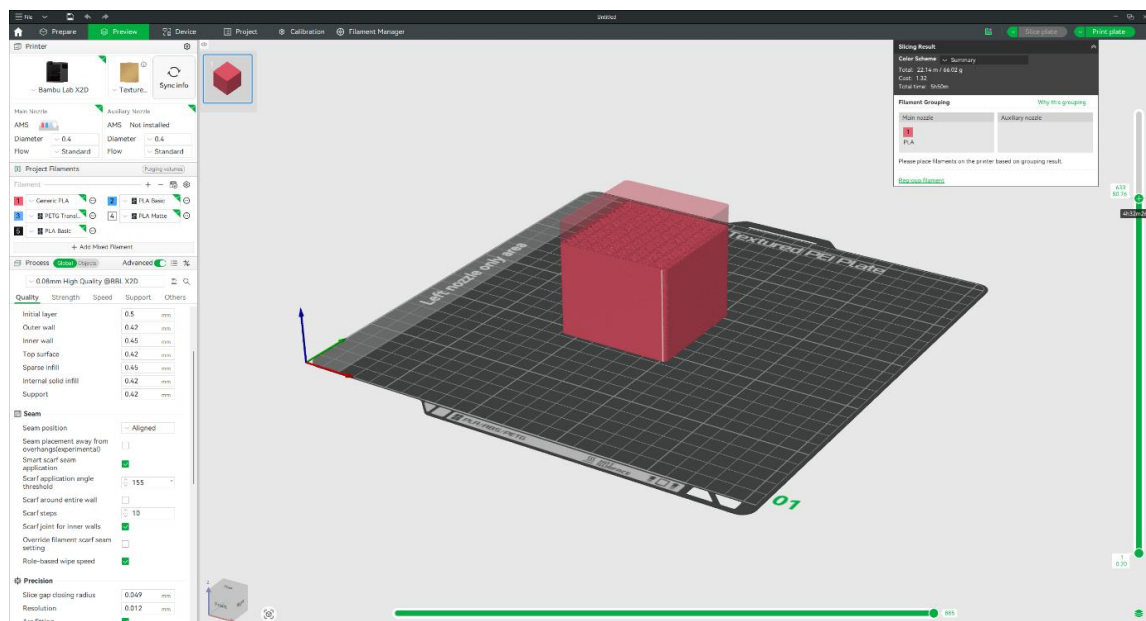
Quick tip: Never leave the first layer unchecked: those first few minutes usually reveal whether the print is going to turn out well or whether it's best to stop it.

8. From 3D Model to Printed Part

A printed part starts as a digital model. The most common formats are **STL** and **3MF**. An STL file describes the shape, but does not contain much configuration information. A 3MF file can include more project data, such as colours, units or printer settings.

The model can be designed from scratch in a 3D programme, downloaded from a model library or modified from an existing file. It is important to respect usage licences when downloading models from the internet.

Before printing, the model must be processed by a slicer. The slicer divides it into layers and generates a file of instructions for the printer, usually called G-code. This file contains movements, temperatures, speeds and the amount of material.



The orientation of the model is a key decision. The same part can be printed in various ways, but each orientation affects strength, supports, finish, printing time and the risk of failure.

Basic Workflow

1. Obtain or design the 3D model.
2. Check the size, orientation and any potential errors.
3. Open the model in the slicer.
4. Select the printer and material.

5. Set the layer height, infill, supports and temperatures.
6. Review the layer-by-layer preview.
7. Export the file for printing.
8. Prepare the printer and start the print.
9. Examine the result and note any improvements.



Practical Task

Find a simple model or use an example model. Before printing it, answer: what size is it, does it need supports, how long will it take, how much material does it use and which area could fail?

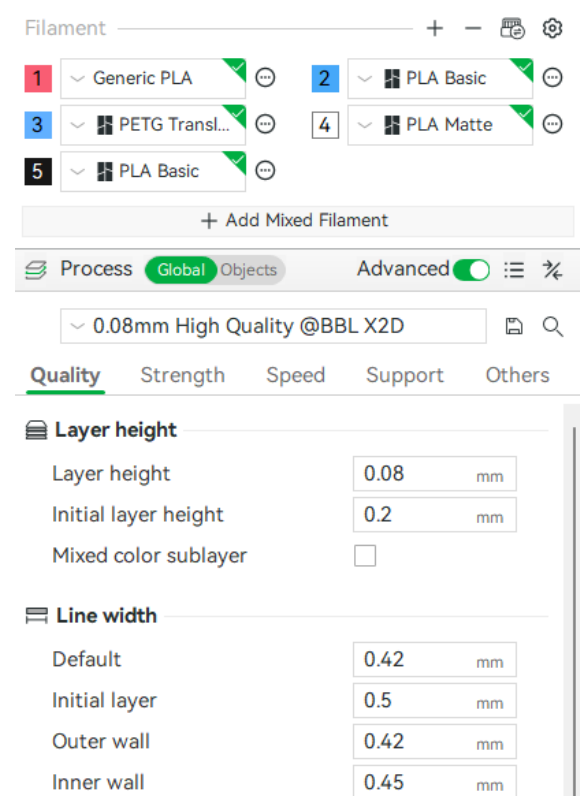
Quick tip: Don't proceed to printing without checking the scale; many parts fail because, although well-designed, they are the wrong size.

9. Slicer, Supports and Print Preparation

The **slicer** is one of the most important tools in 3D printing. It's not enough just to have a good printer: how you prepare the file directly affects the result. Layer height affects detail and printing time. A thinner layer can improve the finish, but increases the printing time. A thicker layer prints faster, but may show more lines. Infill defines the internal structure. A part is not usually solid; infill provides strength without using as much material.

Walls or **perimeters** form the exterior of the part. Increasing wall thickness can improve strength. Temperature affects the flow of the material and the bond between layers. Speed influences printing time and quality. Ventilation helps to cool the plastic, but each material requires different conditions.

Supports are temporary structures. They are used when part of the object is left suspended in mid-air. They may be necessary, but they also use up material, leave marks and need to be removed. It is therefore advisable to position the object correctly before activating them.



Video Resource

Orca Slicer Tutorial: How to Configure Supports

Source: Control 3D – original video on YouTube:

https://www.youtube.com/watch?v=H_d83HNqIJc



Practical Task

In the slicer, change only one setting at a time and observe the preview.

Compare time, material and part appearance using these variations:

- Low and high layer height.
- Infill at 10%, 20% and 40%.
- With supports and without supports.
- Different orientation of the same part.

Quick tip: Always use the slicer's layer-by-layer preview as a mandatory check; this shows supports, voids, times and potential problem areas.

10. Basic Calibration and First Layer

Calibration means adjusting the printer so that the material is extruded in the correct amount, in the correct place and with good adhesion. A poorly calibrated printer can produce weak, warped or completely failed parts. The first layer is the most important starting point. If the first layer doesn't adhere properly, the part may come loose. If it's too squashed, the nozzle may be scraping the bed or the material may be extruding incorrectly. If the lines are spaced too far apart, the nozzle may be too far away or the flow rate may be insufficient.

Other common settings include temperature, flow rate, retraction, pressure, speed and bed levelling. At a basic level, you don't need to master every test, but you do need to understand that each setting addresses a specific problem.

Remember: *It's good practice to keep notes. When you change the filament, nozzle or profile, make a note of what you've altered. This helps you replicate good results and avoid repeating the same mistake.*



Video Resource

How to Calibrate ANY 3D Printer in 2026

Source: Control 3D – original video on YouTube:

<https://www.youtube.com/watch?v=52PAfTFa1RQ>



Practical Task

Observe a first layer and classify it as **correct**, **too high**, **too low** or **irregular**. Write down the visual sign that helped you decide.

Quick tip: If the first layer doesn't stick or is squashed, adjust the settings before trying again: repeating a poorly calibrated print just wastes time and material.

11. Print Quality and Common Errors

The quality of a print depends on the design, the material, the settings, the condition of the printer and the environment. When a part fails, it is best to analyse the problem and change just one thing at a time. A common error is poor adhesion to the build plate. This may be due to dirt, poor levelling, incorrect temperature or a poorly adjusted first layer. Another common problem is warping, when the corners lift due to the material contracting.

Stringing appears as fine threads between parts of the print. It may be related to temperature, retraction or filament moisture. Misaligned layers may indicate problems with movement, belts, collisions or excessive speeds. Open top surfaces may require more top layers, more infill or better flow.



Mini Troubleshooting Guide

If...

- The print is peeling off → check the cleanliness of the build plate, the first layer and the temperature
- There are strings → check temperature, retraction and filament moisture content.
- Corners are lifting → check adhesion, ventilation, temperature and material.
- Areas are missing or there are gaps → check flow, nozzle and speed.
- Layers are misaligned → check the belts, movements and any potential impacts.
- The top surface isn't closing properly → check the top layers, infill and flow.



Video Resource

Improve the Quality of Your Parts with This Essential Setting

Source: Control 3D – original video on YouTube:

<https://www.youtube.com/watch?v=Taf5gJeOoG0>

Perfect Top Layer: Smoothing Keys in 3D Printing

Source: Control 3D – original video on YouTube:

<https://www.youtube.com/watch?v=CsHwWC3ZAew>

The 5 Things You Need to Do to Improve Your 3D Printer in 2025

Source: Control 3D – original video on YouTube:

<https://www.youtube.com/watch?v=0oI2iRWwqUo>



Practical Task

Examine a part with a real fault or a photograph. Describe the problem, identify where it occurs, suggest a probable cause and propose an initial test to rectify it.

Quick tip: Change one parameter at a time and note down the result; that way you'll know which adjustment actually improved the part.

11. Basic Maintenance

A 3D printer works best if it is kept clean and serviced. Basic maintenance does not involve taking the whole thing apart, but rather preventing minor issues that ultimately affect print quality. Before printing, check that the build plate is clean, that the filament is correctly positioned, that the spool rotates without snagging, and that there are no material residues in the nozzle. After printing, remove the part carefully and clean off any residue if present.

It's also a good idea to periodically check the belts, screws, fans, visible cables and the condition of the nozzle. If the filament absorbs moisture, it may print poorly, causing bubbles or excess stringing. Storing it correctly improves results.

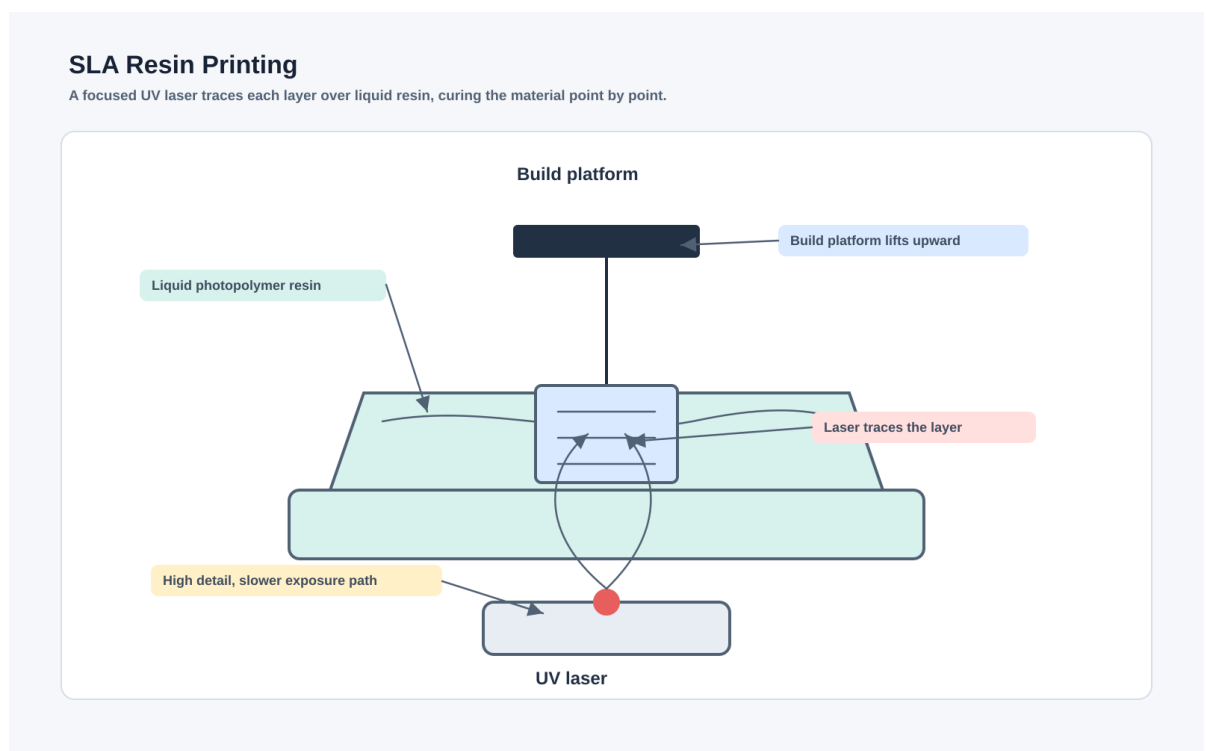
Simple Routine

- **Before printing:** check the build plate, filament, file and workspace.
- **During the first layer:** check adhesion and material extrusion.
- **After printing:** remove the part, clean the build plate and check the finish.
- **From time to time:** check the nozzle, belts, fans and filament storage.

Quick tip: A quick clean-up after printing saves you trouble in your next session: a clean bed, debris removed and filament stored properly.

12. Introduction to 3D Printing With Resin

Resin printing allows you to produce highly detailed parts. Instead of using filament, it works with a liquid resin that hardens when exposed to light. It is commonly used for miniatures, figurines, jewellery, dentistry, small prototypes and parts requiring a fine finish. The process involves several steps: preparing the model, generating supports, printing, washing the part, removing supports and curing with light. The part does not come out of the machine ready to use; it requires post-processing. In this module, resin is introduced as a supplementary option. The aim is to explore its possibilities and the precautions involved, not to replace the initial practice with filament.



Remember: *Safety is paramount. The liquid resin must not come into contact with the skin. Nitrile gloves, eye protection, adequate ventilation and a suitable workspace must be used. Resin residues and contaminated liquids must not be poured down the drain.*

Safety tips for working with resin

- Always wear nitrile gloves. Latex gloves are not the best option for handling resin.
- Avoid contact between liquid resin and your skin, eyes and clothing. In the event of accidental contact, clean the area as per the manufacturer's instructions.
- Work in a well-ventilated area and avoid breathing in vapours whilst handling, washing and curing the resin.
- Wear safety goggles where there is a risk of splashes.
- Keep the resin away from food, drink, children and everyday objects.
- Do not pour liquid resin or contaminated liquids down the drain. Waste must be disposed of in accordance with local regulations and the manufacturer's instructions.
- Cure any leftover resin before disposing of it where applicable, as liquid resin is more problematic than resin that has already hardened.
- Clean tools, trays and the work area thoroughly. Do not mix clean and contaminated materials.
- Label containers and keep the resin sealed when not in use.
- Do not carry out resin work without adequate ventilation, personal protective equipment, a wash-down/curing station and a waste management plan.



Video Resource

How to Print in 3D Resin: Complete Beginner Guide

Source: Control 3D – original video on YouTube:

<https://www.youtube.com/watch?v=RkxrcdKmwAs>

Learn Resin 3D Printing: Slicing, Calibrations, Tests, Supports, Exposure, Cleaning...

Source: Control 3D – original video on YouTube:

<https://www.youtube.com/watch?v=REEnqKuUSiM>



Practical Task

Complete a comparison between FDM and resin using these criteria:

- material
- detail
- safety
- cleaning
- cost
- common uses
- difficulty for beginners

Quick tip: Treat liquid resin as a chemical substance, not as ordinary plastic: use protective equipment, ensure proper ventilation and have a clear plan for cleaning and waste disposal.

13. Final Activity: From a Need to a 3D-Printed Part

The final activity involves designing a simple object and preparing it for printing. It could be a stand, a hook, an organiser, a label, a connector, a lid, a paperclip, a key ring or a useful accessory for the classroom or workplace. The aim is not to create a complex piece. The aim is to apply the entire process thoughtfully: identifying a need, choosing a model, checking measurements, preparing the file, configuring parameters, printing safely and evaluating the result.

Project Sheet

- Name of the item.
- Need it addresses
- Person who would use it
- Approximate dimensions
- Chosen material and reason
- Print orientation
- Need for supports
- Estimated time
- Risks or precautions
- Improvements for a second version



Video Resource

I Wish I Had Known This About 3D Printing When I Started

Source: Control 3D – original video on YouTube:

<https://www.youtube.com/watch?v=Zdnu-EO3YLw>

It Took Me More Than 10 Years in 3D Printing to Learn What I Will Teach You in 10 Minutes

Source: Control 3D – original video on YouTube:

https://www.youtube.com/watch?v=3tM_BmAxifc

Quick tip: Design your first version with a view to learning, not to making it perfect; a simple piece allows you to identify improvements for a second iteration.

14. Digital Wellbeing Tip



Digital Wellbeing Tip

Choose What Deserves Your Attention

Online platforms offer an endless amount of information, entertainment and updates. Your attention is limited, so you do not need to follow everything.

Try this: Choose a few sources, people or topics that are genuinely useful or enjoyable to you and reduce time spent on content that adds little value.

Reflection question: What online content is genuinely worth your attention?

15. Basic Glossary

Nozzle: the part through which the molten material exits in an FDM printer.

Bed or base: the surface on which the part is printed.

Layer: each level of material that forms the object.

Extruder: the mechanism that pushes the filament towards the hot end.

FDM/FFF: a technology that prints by depositing molten filament.

Filament: plastic material in the form of a thread wound onto a spool.

G-code: a file containing instructions that the printer can interpret.

Hotend: the heated area that melts the filament.

Infill: the internal structure of a part.

Slicer: software that prepares the model for printing.

PLA: a common material for getting started with FDM 3D printing.

Resin: a photosensitive liquid material used in SLA/LCD printers.

Support structures: temporary structures used to print overhanging sections.

STL: a common 3D file format.

Warping: distortion that causes the corners of a part to lift.

16. Module Closing

3D printing allows you to transform digital ideas into physical objects. To get started, you don't need to master all the technical settings, but you do need to understand the process and work safely.

You learn best by observing the parts. A successful print shows which settings have worked. A failed print also teaches you something: it shows what to check in the next attempt. By the end of this module, you should be able to explain what 3D printing is, recognise its basic technologies, prepare a simple part, identify common errors, apply safety rules and suggest improvements for a second version.

Quick tip: Focus on the entire process: idea, model, slicer, preparation, printing, review and improvement. This sequence forms the basis for progressing independently.

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