SAINTS GLOBAL

ACTIVITY PLAN

3D PRINTING

INTELLECTUAL CORE

Version 2026.1

Companion to the BRC: a series of one-hour activity sessions for use on weekly activity night or at home. Each session declares which requirements it contributes to.

THE CULMINATING EVENT

The supervised first print

Between Sessions 3 and 4, each saint runs his own original part from a sliced file to a finished print on the same printer he prepared in Session 3. A leader is present for the print start and the first five minutes; the print itself runs off-meeting and may take several hours. The saint retrieves the finished part, removes supports, and brings it to Session 4 for evaluation.

INDOOR — THE TROOP PRINTER OR A LEADER-SUPERVISED HOME PRINTER; THE SAINT IS PRESENT FOR SETUP, FIRST-LAYER CHECK, AND SHUTDOWN

4 SESSIONS IN THIS PLAN

SESSION 1 · INTELLECTUAL CORE

60 min target

Walk the printer and what it makes

Know the printer before you use it, and know what it is for.

SESSION AIM

Tour the printer in detail — name the parts, the hazards, and the file-source rules — then look at real printed objects from four kinds of model (architectural, mechanical, process, industrial) and explain what each is for. Saints leave with Step 1 marked and the design assignment in hand: a sketch and a written reason for the part they will model in Session 2.

WALK AWAY WITH

- Can point to the hot end, build plate, moving parts, and fume zone on a real printer
- Can name the four model types and what each is built for
- Can name the two digital safety rules: approved software, no random downloaded files
- Has a sketched subject and one-sentence reason for the part he will design next week

BRING / SET UP

- A real FDM printer (or two), powered down, available for hands-on inspection
- Three to five real printed parts spanning architectural, mechanical, process, and industrial uses
- Photos or printed examples of a heated bed, hot end, and a partial print at first-layer height
- Sketch paper and a pencil per saint, plus the CAD-to-Print Design Plan worksheet
- BRC printouts and pens

THE HOUR

BLOCK 1 · DISCUSSION **Opener — A real printed part** 5 min

Pass a real printed part around the room. Ask each saint: "What can you tell about how this was made just by looking at it?" Take three or four answers — layer lines, visible supports, the orientation it sat in on the bed. Do not correct yet. The point is to put the printer's process on the table as something visible and learnable, not a black box.

SESSION 1 · WALK THE PRINTER AND WHAT IT MAKES (PAGE 2 OF 3)

THE HOUR — CONTINUED

BLOCK 2 · SKILL PRACTICE Tour the printer, name the hazards

18 min

1. Stand the group around the printer with the power off. Each youth points to and names: the hot end, the heated bed, the moving gantry, the spool path, and the on/off switch. If two printers are available, repeat on the second so the group sees that the layout varies but the parts do not.
2. Walk the burn zones. The hot end runs at 180 to 260 Celsius. The bed runs at 50 to 110. Both stay hot for several minutes after the print ends. Each youth states a stop rule for himself: do not touch the hot end at all, ever, even when the printer says idle.
3. Walk the moving-parts zone. The gantry moves fast and does not stop for fingers. Long hair, sleeves, and loose cords stay clear of the printer once it is running. Demonstrate the e-stop if the printer has one.
4. Cover the fume zone. PLA is the safest filament and still ventilated where possible. ABS, nylon, and any resin printer require active ventilation and adult-set rules — no overnight unsupervised printing in a closed room.
5. Digital safety, two rules: print only from approved software accounts the leader knows about, and do not download an unknown .stl or .gcode file from the open internet without an adult checking the source. Hidden malware can ship inside a model file.
6. Leader confirms 1a: each youth can name the hazards and state the rule for each.

REQ 1A

BLOCK 3 · DISCUSSION Four kinds of model, what each is for

15 min

1. Lay out the four real or photo examples. Architectural: a building, a topographic map, a room model — used to plan space. Mechanical: a gear, a bracket, a custom tool handle — used to do work. Process: a jig, a fixture, a print-in-place hinge — used to make or hold something else. Industrial: a one-off replacement part, a prototype housing — used when no manufacturer sells it.
2. Each youth picks one part from the table and explains, in one sentence: which kind it is, and what problem it was solving. Push for the problem, not the description.
3. Discuss what 3D printing is and is not good at. Strong in custom geometry, fast prototyping, low volume. Weak in fine surface finish, high heat parts, true mass production. A poor fit for a job that injection molding does better.
4. Each youth writes on his sketch paper the kind of part he is going to design in Session 2 — architectural, mechanical, process, or industrial — and one real problem it solves for him or someone he knows.
5. Leader confirms 1b: each youth correctly names model types and gives one realistic application.

REQ 1B

SESSION 1 · WALK THE PRINTER AND WHAT IT MAKES (PAGE 3 OF 3)

THE HOUR — CONTINUED

BLOCK 4 · CREATIVE Sketch the part you will model

17 min

1. Hand out sketch paper and the CAD-to-Print Design Plan worksheet. The worksheet is the saint's design notebook for the next three sessions — he fills it in as the design develops.
2. Each youth draws two views of his part: top and side. Mark approximate length, width, and height in millimeters. A real printer's build volume is about 200x200x200mm on a hobby machine — anything larger needs to be printed in pieces.
3. Write the why on the worksheet: what is this part for, where will it live, who will use it. The leader looks for a real use, not a decoration with no destination.
4. Trade sketches with a partner. The partner asks one question: "Could you actually use this part for what you said it is for?" Adjust the sketch if the answer is no.
5. Each youth tells the group, in one sentence, what he is making and why. The leader notes who has a clear subject and who needs a follow-up before Session 2.

BLOCK 5 · REFLECTION Close — Step 1 marked

5 min

1. Confirm on each saint's BRC: 1a and 1b are marked. Step 1 completes in-session.
2. Take the design plan worksheet home. Between sessions, sketch the part in more detail and start a CAD file — even a rough block model. Bring laptop or sketch back next week ready to model in CAD.
3. Any youth without a clear subject pairs with the leader before he leaves to settle on one.

AT THE CLOSE · DEBRIEF

1. Which part of the printer were you least sure about before tonight, and which one are you still least sure about?
2. What kind of part are you designing — and who actually uses it?
3. What is one digital safety rule you will hold even when no one is checking?

Mark 1a and 1b on each saint's BRC after this session — Step 1 completes in-session. The design assignment is homework for Session 2; do not mark 2a yet.

SESSION 2 · INTELLECTUAL CORE

60 min target

Model the part and trace the workflow

Design the part on the screen, then trace how it gets to the printer.

SESSION AIM

Saints develop the CAD model from their Session 1 sketches, write the slicer settings on the design plan, and walk the full digital-to-physical workflow — CAD to .stl to slicer to G-code to printer. The session also covers IP and license rules for any borrowed geometry. Saints leave with a finished design file ready to slice and the workflow understood end to end.

WALK AWAY WITH

- Has a complete CAD file for an original, scaled, purposeful part
- Can trace the steps from a CAD drawing to a finished print without prompting
- Has the slicer settings written on the design plan and knows what each one does
- Can explain license rules for downloaded models and how to credit one

BRING / SET UP

- Laptops with CAD software installed (TinkerCAD, Fusion 360, FreeCAD, or Onshape — pick one and stick with it)
- Each saint brings: the CAD-to-Print Design Plan worksheet and any sketches from Session 1
- One sample .stl file and one .gcode file on a USB drive or open on a laptop, for the workflow walk
- A second laptop with the slicer software open, projector if available
- BRC printouts and pens

THE HOUR

BLOCK 1 · DISCUSSION **Opener — Where the design stands** 5 min

Round the room, under 30 seconds per saint: what is the part, and what is one thing you changed about it since last week? The point is to check that the design is real — sketched, named, and dimensioned — before saints open CAD. Any youth who shows up without a clear subject names it now so the leader can help during the work block.

SESSION 2 · MODEL THE PART AND TRACE THE WORKFLOW (PAGE 2 OF 3)

THE HOUR — CONTINUED

BLOCK 2 · SKILL PRACTICE Walk the workflow end to end

12 min

1. Show one finished CAD model on the screen. Explain that CAD is the geometry — the shape itself, written as math.
2. Export it as an .stl. The .stl is the same shape, broken into thousands of triangles. Show the file size and explain that the printer cannot read CAD; it needs the triangle mesh.
3. Open the slicer. Drop the .stl in. Show the build plate, the model's orientation, and the supports preview. The slicer plans the path the nozzle will take.
4. Slice it. The output is G-code — a long text file of move-to-here, extrude-this-much, heat-to-this-temp commands. Open the .gcode in a text editor for ten seconds so saints see it is plain text the printer reads line by line.
5. Send the G-code to the printer. The printer follows the lines exactly. If the G-code is wrong, the print is wrong; the printer cannot improvise.
6. Leader confirms 2b: each youth can name CAD, .stl, slicer, G-code, printer, and what happens at each step.

REQ 2B

BLOCK 3 · CREATIVE Build the CAD model

28 min

1. Each youth opens CAD and starts from his sketch. Block out the major shapes first — primitive cubes, cylinders, holes — then refine.
2. Walk the room. Check each model against two rules: wall thickness at least 1.2mm anywhere a load passes through, and no overhangs steeper than about 45 degrees without supports.
3. Each youth writes his final dimensions on the design plan worksheet: length, width, height, wall thickness, tolerance. Then fills the material and slicer settings section in pencil — filament type, layer height, infill percentage, supports yes or no, hotend and bed temperatures. Match the values to what the troop printer actually runs.
4. Each youth shows his model to a partner in two minutes: what it is, why it is shaped the way it is, where it is weak. The partner asks one question and the youth either answers or adjusts.
5. Export the model as an .stl and save it where the leader can find it before Session 3. Any youth not finished at the end of the block takes it home and sends the file by the midweek check-in.
6. Leader confirms 2a: each youth has a scaled, original, purposeful design with the worksheet filled.

BY TIER

ENTRY	Use TinkerCAD or a similar block-based CAD tool. Stay with primitive shapes; a useful first part is rectangular with two or three features.
ESTABLISHED	Use Fusion 360, FreeCAD, or Onshape with constraint-based sketches. Build the part parametrically so you can change one dimension and the rest update.
MENTOR	After you finish your own model, sit with one entry-tier saint and help him think through wall thickness and overhangs without doing the modeling for him.

REQ 2A

SESSION 2 · MODEL THE PART AND TRACE THE WORKFLOW (PAGE 3 OF 3)

THE HOUR — CONTINUED

BLOCK 4 · DISCUSSION Whose design is it

10 min

1. Open Thingiverse or Printables on the screen and pick one popular model — a phone stand, a hook, an organizer. Read its license aloud: Creative Commons Attribution, CC Non-Commercial, MIT, or All Rights Reserved. Each license sets a different rule for what a user is allowed to do with the file.
2. Walk the four common cases. Original work: you made the geometry yourself. Downloaded as-is: someone else's file, used under their license. Remixed: someone else's file, changed by you — the remix carries the original license forward. Forbidden: an All Rights Reserved file copied without permission, or any file taken from a company that sells the original product.
3. Each youth states aloud which case his Session 2 part falls into. If anyone is using a downloaded model, he writes the source URL and the license on the design plan worksheet.
4. Discuss credit. When you remix or build on someone else's work, you name the original designer in the project notes. Taking credit for work that is not yours is dishonest whether the file is free or paid.
5. Leader confirms 3c: each youth can name a license type, explain what a remix carries forward, and state the rule for crediting downloaded work.

REQ 3C

BLOCK 5 · REFLECTION Close — Files ready to slice

5 min

1. Confirm on each saint's BRC: 2a, 2b, and 3c are marked. Any youth whose CAD file is not finished commits to sending it by the midweek check-in — a finished .stl is the entry ticket for Session 3.
2. Bring the design plan worksheet to Session 3. The slicer settings written on it tonight will go straight into the slicer next week.
3. Next week the group slices the file, loads the printer, and watches the first layer. Anyone who needs printer time at home arranges it now.

AT THE CLOSE · DEBRIEF

1. What is one decision in your design you can defend — a wall thickness, a dimension, an orientation?
2. Trace the steps from your CAD file to a finished part in your own words.
3. Which case is your part: original, downloaded, remixed, or borrowed — and how do you know?

Mark 2a, 2b, and 3c on each saint's BRC after this session. Confirm each youth has a saved .stl by midweek; do not start Session 3 without the files in hand.

SESSION 3 · INTELLECTUAL CORE

60 min target

Slice, set up, and supervise the first layer

Set up the printer carefully and watch the first five minutes.

SESSION AIM

Saints slice their finished CAD models, prep the build plate, load filament, and run the first-layer check on a real print. The print itself runs off-meeting under leader supervision and finishes between sessions. The session ends with the print queued: file sliced, plate prepped, filament loaded, first-layer check passed.

WALK AWAY WITH

- Has sliced his own design with the settings from the design plan
- Can prep a build plate, load filament, and run a first-layer check without prompting
- Has the troubleshooting card and knows the four common first-layer failures by sight
- Has the supervised first print scheduled — file ready, supervisor named, retrieval date set

BRING / SET UP

- Each saint brings: his .stl file (on USB, by email, or already on the slicer machine) and the design plan worksheet from Session 2
- The troop printer with filament, build plate scraper, isopropyl alcohol, and lint-free cloth ready
- Slicer software open on a workstation
- Printed first-layer troubleshooting card (one per saint)
- BRC printouts and pens

THE HOUR

BLOCK 1 · DISCUSSION **Opener — Files in hand** 5 min

Each saint shows the slicer machine his .stl. Confirm out loud: file present, dimensions match the worksheet, slicer settings written down. Any youth without a finished file does the slicing block as an observer tonight and runs his print after he finishes the file with the leader. Keep this check brief — the work blocks are where the time goes.

SESSION 3 · SLICE, SET UP, AND SUPERVISE THE FIRST LAYER (PAGE 2 OF 3)

THE HOUR — CONTINUED

BLOCK 2 · CREATIVE Slice the design

12 min

1. Each youth, one at a time at the workstation: load his .stl into the slicer.
2. Set orientation on the build plate. Big flat face down; supports facing up if the geometry needs them. Walk why — strong layer lines run along the print, not across.
3. Enter the values from the design plan worksheet: filament type, layer height, infill percentage, supports, hotend and bed temperatures. Read each value out loud as it is entered.
4. Slice. Watch the preview animate the path the nozzle will take. Note the estimated print time and the filament length. A useful first print runs between 30 minutes and 3 hours — anything longer needs to be split or simplified.
5. Save the G-code to the printer's SD card or send it over the network. Write the print time and filename on the design plan.

REQ 2A

BLOCK 3 · SKILL PRACTICE Prep the bed, load the filament

13 min

1. Each youth wipes the build plate with isopropyl alcohol and a lint-free cloth. No fingerprints, no leftover plastic. The bed is what the first layer sticks to; anything on it interferes.
2. Run the bed leveling routine on the printer — manual or automatic, depending on the machine. The nozzle should be one piece of paper above the bed at every corner and the center. Drag the paper; it should catch lightly.
3. Load the filament. Push it through the extruder until clean plastic flows out the nozzle. Inspect the spool path — no tangles, no knots. A tangled spool stops the print mid-job.
4. Check the filament against the spool: type and color match what is written on the design plan, and the spool is dry. Wet filament prints poorly and is often the hidden cause of a bad surface.
5. Each youth states the four pre-flight items aloud: bed clean and level, filament loaded and feeding, G-code is today's file, temperatures match the filament.

REQ 3A

SESSION 3 · SLICE, SET UP, AND SUPERVISE THE FIRST LAYER (PAGE 3 OF 3)

THE HOUR — CONTINUED

BLOCK 4 · SKILL PRACTICE Run the first-layer check

25 min

1. First saint queues his print. Adult supervisor confirms ventilation, the printer location, and the first-layer plan. Press print.
2. The first five minutes are the supervised window. The youth stays at the printer. Watch the nozzle lay the brim or skirt, then the first solid layer. Read the troubleshooting card alongside.
3. Call the first layer aloud: clean lines and good adhesion — keep going. Adhesion loss at a corner, gaps between lines, blobs and ridges, or a bulging base — stop the print, fix the listed cause, restart. Do not run a bad first layer to completion.
4. When the first layer is clean, the youth confirms the print can run unattended (or under remote camera supervision). Write the start time on the design plan and the scheduled finish time, plus the supervisor's name.
5. Repeat for as many saints as time allows. If only one or two prints can start in-session, the rest queue up over the off-meeting week with the same first-layer check from the supervising adult. Each saint's print must have an adult present for the start and first-layer pass.
6. Walk the off-meeting plan with each saint: the supervisor, the print start time, the expected duration, the retrieval date (must be before Session 4), and where the finished part will be stored. Write all five on the worksheet in pen.

REQ 3A

BLOCK 5 · REFLECTION Close — The print is queued

5 min

1. Confirm on each saint's BRC: the in-session half of 3a (setup, prep, first-layer check) is marked. The completion of 3a — a finished part the saint can hold — is marked in Session 4 once the off-meeting print is retrieved.
2. Each saint confirms aloud: supervisor, start time, retrieval date. The print is real once these are written down.
3. Bring the finished part, supports still attached, to Session 4. Do not clean it up first — the leader looks at the raw print to evaluate the result.

AT THE CLOSE · DEBRIEF

1. Which step of the bed prep or filament load gave you the most trouble tonight?
2. What does your first layer have to look like for you to walk away from the printer?
3. Who is supervising your print, and what time does it start?

Mark the in-session portion of 3a (setup, plate prep, filament load, first-layer check) after this session. Do not mark 3a as complete until the off-meeting print is retrieved and inspected in Session 4. Confirm every saint has a supervisor and a retrieval date written down before leaving.

SESSION 4 · INTELLECTUAL CORE

60 min target

Inspect the print, iterate, and sign off

Look honestly at the part you made and decide what to change.

SESSION AIM

Saints arrive with their finished parts in hand. Each youth presents the print, names one flaw, and either explains the design or settings change that would fix it or runs the change at the workstation. The session closes with reflection on what the project taught, a careers walk, and the BRC sign-off.

WALK AWAY WITH

- Has presented his finished print and named one concrete improvement
- Has run or scheduled one iteration — a design tweak or a setting change
- Has named three careers in additive manufacturing and explained the training for one
- Has a signed BRC

BRING / SET UP

- Each saint brings: his finished print (supports still on), the design plan worksheet, and his BRC
- Calipers (one or two for the room, shared) for dimension checks
- Side cutters or pliers for support removal (under adult supervision)
- Slicer machine open for any iteration tweaks
- Half-sheets for the keep-and-change reflection in the Close
- BRC printouts and pens

THE HOUR

BLOCK 1 · DISCUSSION **Opener — Parts on the table** 5 min

Each saint sets his finished print on the table, supports still attached. Go around the circle. One sentence each: did the print finish, and was it what you expected? Do not compare parts yet; just hear the honest answer. The work blocks turn that honesty into real design feedback.

SESSION 4 · INSPECT THE PRINT, ITERATE, AND SIGN OFF (PAGE 2 OF 3)

THE HOUR — CONTINUED

BLOCK 2 · SKILL PRACTICE Inspect the print

18 min

1. Each youth, in turn at the table: pick up his print and remove the supports with side cutters. Adult supervision; eyes protected. Note where the supports left marks and whether the surface they were on is acceptable.
2. Measure the part. Pick the three most important dimensions from the design plan and use the calipers to compare actual to designed. Write the deltas on the worksheet. Anything within +/-0.3mm is normal; anything larger needs a reason.
3. Walk the surface. Look for layer lines, gaps, stringing between features, blobs, warping, and elephant foot at the base. Each youth names one flaw out loud — every print has one — and writes it on the worksheet.
4. Test the part for its actual use. If it is a bracket, load it. If it is a fit part, fit it. If it is a holder, hold the thing it is meant to hold. The test answers a different question than the surface: does the part do what it is for?
5. Leader confirms the completion of 3a: the finished part is in hand and the youth ran the supervised print to the end.

REQ 3A

BLOCK 3 · CREATIVE Identify the cause and the fix

17 min

1. For the one flaw each youth named, work through the cause. Is it a design issue (wall too thin, overhang too steep, hole too small after shrinkage), a slicer issue (wrong layer height, too little infill, supports in the wrong place), or a printer issue (bed not level, filament dry, hotend temp off)?
2. Each youth writes the cause on the worksheet and proposes one fix — either a CAD change or a slicer setting change. The fix has to be specific: not "better infill," but "raise infill from 15 to 30 percent."
3. If time allows, the youth makes the change at the workstation. Adjust the CAD, re-slice, or change the slicer setting and save the new G-code. Even if there is no time to print tonight, the change is documented and ready to run.
4. Each youth explains to the group, in 90 seconds: the flaw, the cause, the fix, and why he thinks the fix will work. Push for the why — guessing is what the iteration teaches against.
5. Leader confirms 3b: each youth identified a flaw, named a cause, proposed a fix, and explained why the change should work.

REQ 3B

SESSION 4 · INSPECT THE PRINT, ITERATE, AND SIGN OFF (PAGE 3 OF 3)

THE HOUR — CONTINUED

BLOCK 4 · DISCUSSION Reflect and look ahead

15 min

1. One saint at a time, two minutes each: what did this project teach you about planning, iteration, and responsibility? Name one specific moment — a design choice you rushed, a setting you got right, a flaw you caught early. Specific examples, not general statements.
2. Each youth names one change he would make if he started over from Session 1.
3. Three careers in additive manufacturing or digital fabrication. Examples: design engineer, manufacturing technician, medical device prototyper, dental lab technician, aerospace process engineer, industrial designer. Each youth names three and picks one to explain in detail — the training (certificate, associate's degree, bachelor's), the typical first job, and one next step he could take this year.
4. Leader confirms 4a and 4b: each youth gave a specific reflection and named three careers with one in detail.

REQ 4A REQ 4B

BLOCK 5 · REFLECTION Close — BRC sign-off

5 min

1. Walk the BRC with each saint, requirement by requirement. Confirm what is done. Anything outstanding — an unfinished iteration, a reprint scheduled — gets a dated deadline on the BRC.
2. Each saint, one line: one habit from this project he plans to keep (sketching before modeling, watching the first layer, writing settings before slicing), and one shortcut he plans to drop.
3. Leader gives each saint one short, specific note by name: one thing he did well in this badge that earned the sign-off.

AT THE CLOSE · DEBRIEF

1. What is one dimension of your part you got within tolerance, and one you missed?
2. What flaw did the supports leave behind, and how would you orient the part next time to avoid it?
3. Which of the three careers you named could you actually take a next step toward this year?

Mark 3a as complete (the off-meeting print finished and the part inspected here), 3b after the iteration block, and 4a and 4b after the reflection block. Anything outstanding gets a dated deadline on the BRC; final sign-off completes when the remaining iteration or written piece is submitted.

HANDOUT 1 OF 3

FROM SESSION 1 — SKETCH THE PART YOU WILL MODEL

CAD-to-Print Design Plan

Fill from Session 1 through Session 3. The slicer block in Session 3 uses the settings written here.

3D PRINTING · WORKSHEET

Plan the part before you slice it.

Fill before Session 3. The slicer block and the print check use what you write here.

1 SUBJECT & WHY

SUBJECT .....

WHY THIS PART .....

.....

Name a real use. Decoration counts only if you say where it lives and why.

2 SKETCH & SCALE

sketch the part — top and side views

LENGTH ..... mm

WIDTH ..... mm

HEIGHT ..... mm

WALL THICKNESS ..... mm

TOLERANCE ..... +/- mm

Walls thinner than 1.2mm crack. Thicker walls slow the print and waste filament.

3 MATERIAL & SLICER SETTINGS

SETTING	VALUE	REASON
Filament type		
Layer height		
Infill %		
Supports y/n		
Hotend / bed temp		

4 SOFTWARE, TOOLS & SOURCE

CAD SOFTWARE ..... SLICER .....

PRINTER ..... FILE FORMAT .....

DESIGN SOURCE .....

If your design uses anyone else's file, name the license (CC, MIT, all rights reserved) and how you credited it.

Finish this worksheet on paper before you open the slicer.

Print this handout for in-person reference during session 1 — sketch the part you will model.

HANDOUT 2 OF 3

FROM SESSION 2 — BUILD THE CAD MODEL

CAD-to-Print Design Plan

Continue filling from Session 1. The slicer block in Session 3 uses the settings written here.

3D PRINTING · WORKSHEET

Plan the part before you slice it.

Fill before Session 3. The slicer block and the print check use what you write here.

1 SUBJECT & WHY

SUBJECT .....

WHY THIS PART .....

.....

Name a real use. Decoration counts only if you say where it lives and why.

2 SKETCH & SCALE

sketch the part — top and side views

LENGTH ..... mm

WIDTH ..... mm

HEIGHT ..... mm

WALL THICKNESS ..... mm

TOLERANCE ..... +/- mm

Walls thinner than 1.2mm crack. Thicker walls slow the print and waste filament.

3 MATERIAL & SLICER SETTINGS

SETTING	VALUE	REASON
Filament type		
Layer height		
Infill %		
Supports y/n		
Hotend / bed temp		

4 SOFTWARE, TOOLS & SOURCE

CAD SOFTWARE ..... SLICER .....

PRINTER ..... FILE FORMAT .....

DESIGN SOURCE .....

If your design uses anyone else's file, name the license (CC, MIT, all rights reserved) and how you credited it.

Finish this worksheet on paper before you open the slicer.

Print this handout for in-person reference during session 2 — build the cad model.

HANDOUT 3 OF 3

FROM SESSION 3 — RUN THE FIRST-LAYER CHECK

First-Layer Troubleshooting

Read alongside the first five minutes of any print. Stop the print the moment the first layer is wrong.

3D PRINTING · FIELD CARD

Watch the first layer.

Stand at the printer for the first five minutes. Most failures are visible by then.

1 ADHESION LOSS

corner curls up off the bed

THE TELL

A corner peels up. The part starts rocking or pops loose.

FIRST FIX

Clean the bed with isopropyl. Re-level. Raise bed temp 5C.

2 UNDER-EXTRUSION

lines skip; gaps between passes

THE TELL

Lines look thin or broken. You can see through the layer.

FIRST FIX

Raise hotend temp 5-10C. Check filament for tangles.

3 OVER-EXTRUSION

blobs and ridges along the line

THE TELL

Blobs, ridges, or rough tops. The nozzle drags through goo.

FIRST FIX

Lower flow rate 5%. Check that filament diameter is right.

4 ELEPHANT FOOT

first layer wider than the wall above

THE TELL

The bottom edge bulges out. A finished part wobbles.

FIRST FIX

Lower bed temp 5C. Raise the nozzle 0.05mm at first layer.

5 BEFORE YOU PRESS PRINT

- ☐ Bed clean and level. No fingerprints, no leftover plastic.
- ☐ Filament loaded, dry, and feeding without resistance.
- ☐ G-code is the file you sliced today, not yesterday's.
- ☐ Hotend and bed temps match the filament on the spool
- ☐ Hands off moving parts. Hotend stays hot after.
- ☐ Ventilation on if you are printing ABS or resin.
- ☐ Adult supervisor knows the print is starting.
- ☐ First five minutes: you stay at the printer.

If any box is unchecked, do not start the print.

Stop the print the moment the first layer is wrong. Fix it and start over.

Print this handout for in-person reference during session 3 — run the first-layer check.