STEM-HER
Empowering Women in STEM

Prototyping

05 / The smallest thing that answers the next question

Marharyta Chernyshova · YEP Accelerator

eit Food

Co-funded by the European Union

Plan for 90 minutes

1	2	3	4	5	6
What to test	**Digital prototypes**	**Physical prototypes**	**What counts as evidence**	**Test plan and decision**	**Worksheet and questions**
10 min	17 min	15 min	10 min	13 min	25 min

Back to the booking tool

FROM SESSION 04

Olena owns the interviews.
Iryna owns the test of the booking screens.

WHAT THEY HOLD

A sketch of the booking screens and an idea for a status display on the equipment.



Booking screens

a paper sketch of three screens



Status display

an idea: a small display shows when the equipment will be free

Fictional case, as in session 04. Every result shown is illustrative.

Which artefact answers which question?

Sketch of the booking screens	Do students understand how to book a slot?
A cardboard model of the display	Can a student read from where she stands when the printer will be free?

A sketch cannot show whether the display is readable. A cardboard display cannot show whether people understand the booking steps.

STEM-HER
Empowering Women in STEM

DEFINITION

A prototype is something you can show or run to answer one question.

It can be rough

Parts can be simulated

It ends in a decision

eit Food

Co-funded by the European Union

Four kinds of unknowns



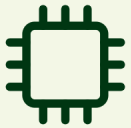
Need

Do students and lab staff want a booking tool?



Usability

Can students book without help?



Feasibility

Can a small board show the right end time?



Delivery

Who will keep the equipment list up to date?

One test answers one of them.

Choose the unknown that changes the next step most

Need	If nobody wants a booking tool, the plan changes	**Large effect**
Usability	If students cannot book, the screens change	**Large effect**
Feasibility	If the display shows the wrong time, the display idea changes	**Medium effect**
Delivery	If nobody keeps the list updated, the pilot changes	Later

CHOSEN FOR THIS TEST

Usability. Iryna's screen test needs only paper or clickable screens.

Illustrative judgement for the case.

Build, measure, learn

Build
the smallest artefact

→

Measure
what happens

→

Learn
what it means

← The result decides the next test.

1. Name the user and the problem
2. Choose one assumption
3. Write what you will measure
4. Write what you will do with the result
5. Then build

Fields adapted from the founder's workbook, sections 1 to 3.

From assumption to build

ASSUMPTION

Students can book a free slot without help.

MEASURE

Whether they finish booking and where they hesitate.

DECISION SIGNAL

Four of five finish without coaching.

BUILD

Three clickable screens.

Provisional example for the case. Adjust the sample and the threshold to your own test.

Digital prototypes

Screens, flows and services you can run in a day.

Six formats, six questions

Sketch or storyboard
checks logic, sequence and scenario

Clickable mock-up
checks the interface and the flow

Landing page or fake door
checks interest before development

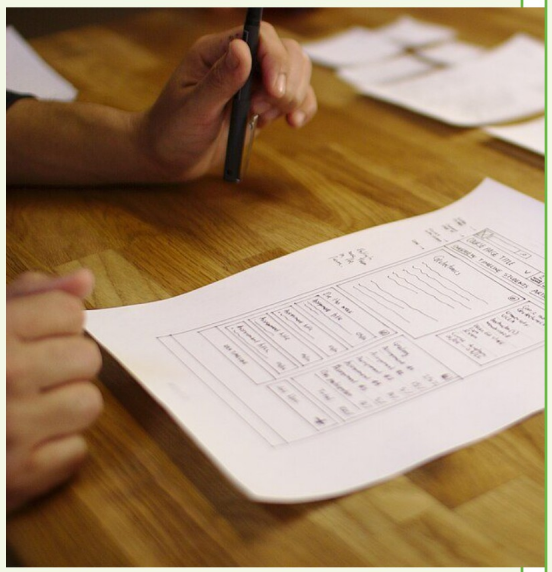
Physical mock-up
checks shape, size and handling

Component or breadboard
checks one technical function

Service role-play
checks the experience of a process

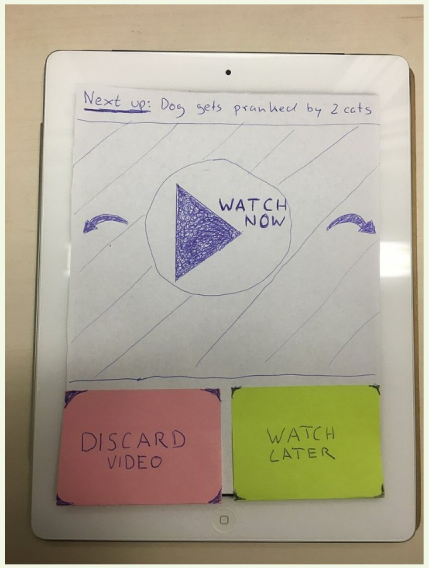
Choose the one closest to your audience and your question.

What a digital prototype can look like



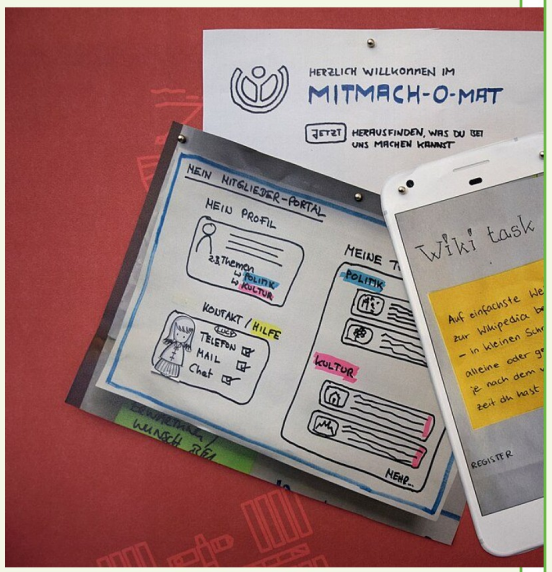
A paper sketch of a web page

Checks the layout and the order of the page.



A hand-drawn screen on a tablet

Checks one screen in a real device frame.



Paper screens next to a phone

Checks the flow before any code.

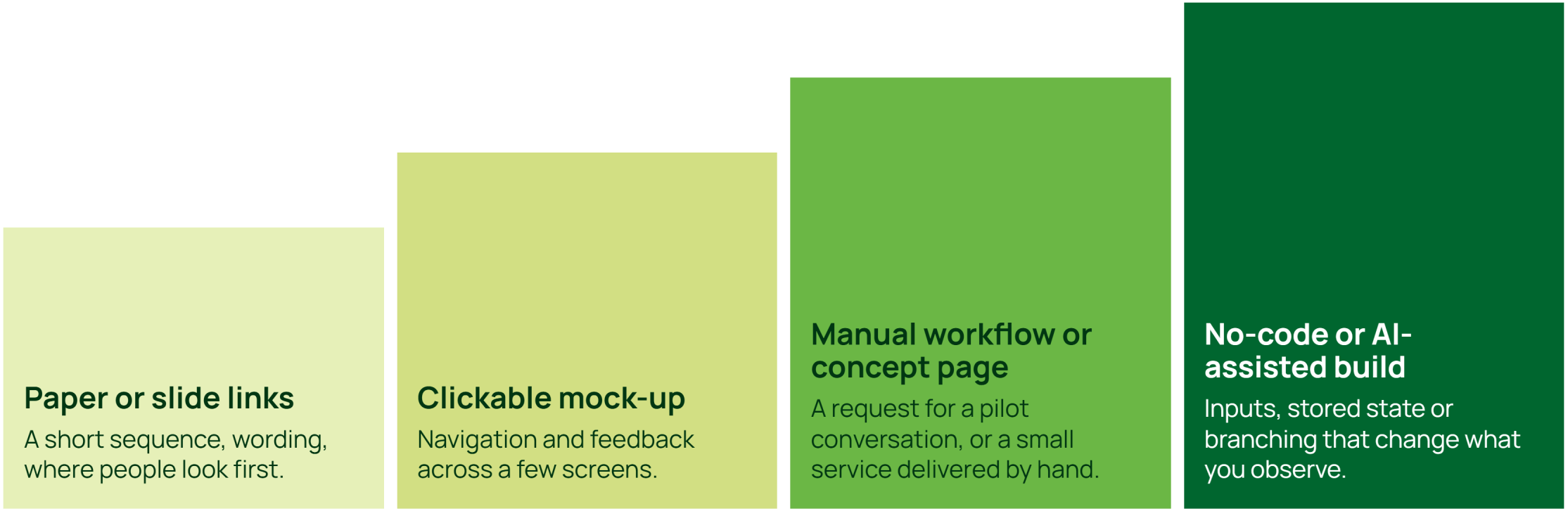


Sticky notes on a paper screen

Parts move and change between tests.

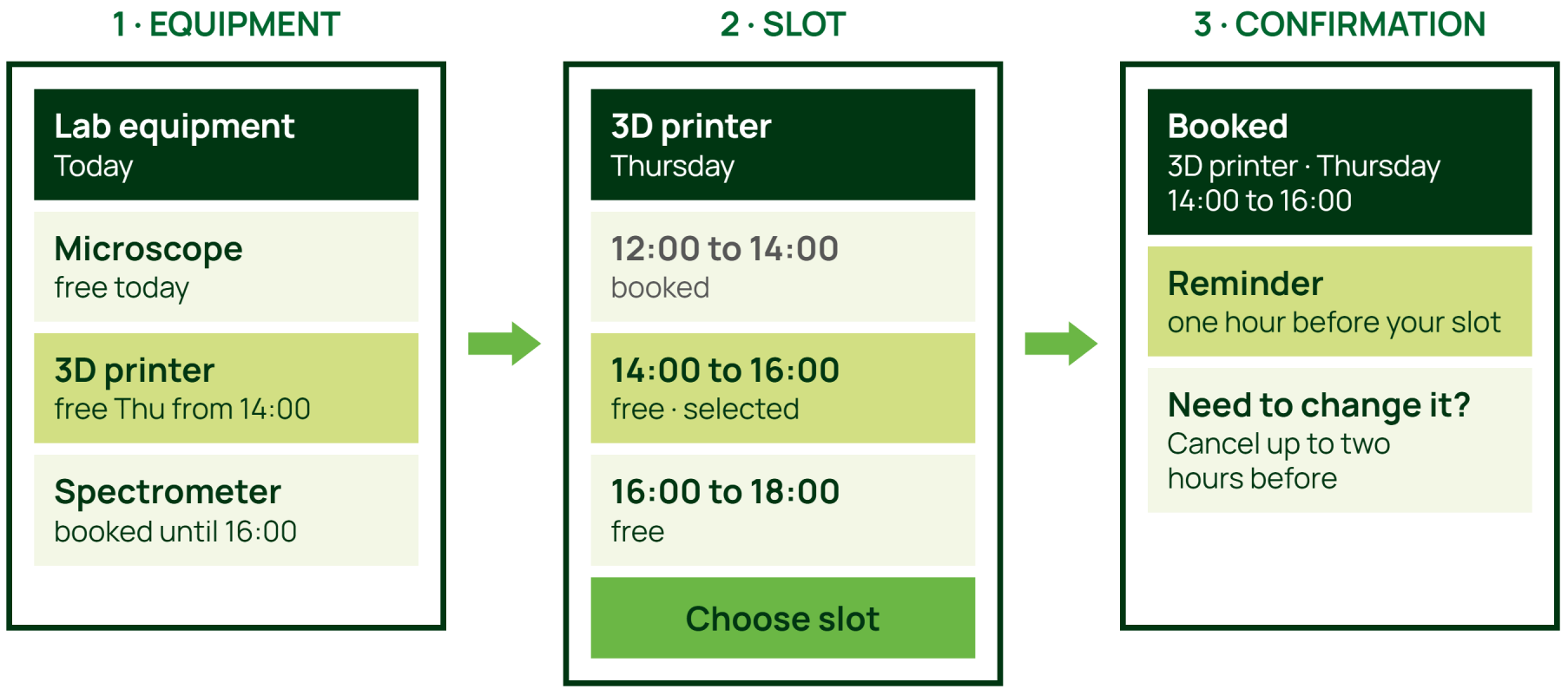
Photos: Sage Ross, Tobe101, Corinna Schuster (WMDE), Jan Dittrich (WMDE). CC BY-SA 4.0, Wikimedia Commons.

How real does it need to be?



Effort and realism grow from left to right. Start at the lowest step that can show the behaviour.

A three-screen booking flow



Simulated data. Screens are a paper or clickable mock-up, with no real bookings behind them.

One neutral task

SAY THIS

"You have just decided to use the 3D printer on Thursday afternoon. Show me what you would do."

THE OBSERVER WRITES DOWN

- **The first action**
- **Any hesitation**
- **What the person says aloud**

Ask "What did you expect here?" after the attempt.

Co-funded by the European Union

What the observer records

Participant	First action	Hesitation	Finished without help
A	Opens the equipment list	None	Yes
B	Opens the equipment list	At the confirmation	Yes
C	Taps the 3D printer	Cannot tell if booking is final	No
D	Opens the equipment list	None	Yes
E	Looks for a search box	Long pause on the list	No

READING

3 of 5 finished without help. The signal was 4 of 5.

DECISION

CHANGE: reword the confirmation, then test again.

Illustrative result for the case.

What must work, what can be simulated

MUST WORK

The text on each screen

The choices people can make

The order of the steps

The wording of the confirmation

CAN BE SIMULATED

Which slots are free

The booking record

The reminder message

The equipment list

The rule: make real whatever affects the behaviour you observe.

Keep the scope small

IN THE TEST

Equipment list

Slot picker

Confirmation

One task. Three screens.

LEFT OUT FOR NOW

Sign-up and login

Calendar sync

Reminder emails

An admin view for the lab manager

Use only the screens the task needs.

A no-code or AI-assisted prototype

EXAMPLE PROMPT

"Draft a three-screen mock-up for booking lab equipment. Use synthetic data. Show a free slot and a booked slot. Give the user one way to confirm. Label simulated inputs. Skip accounts, a database and external calls."

BEFORE YOU SHOW IT

- Use synthetic data
- Check success and error states yourself
- Keep screenshots ready
- Keep real user or lab data out of public tools

Use it when the test needs inputs, stored state or branching.

Prototype, MVP and the core experience

PROTOTYPE

Helps answer a question.

MVP

Lets early users get the core benefit in a narrow use case.

CORE EXPERIENCE

The one improvement that matters most to the first users.

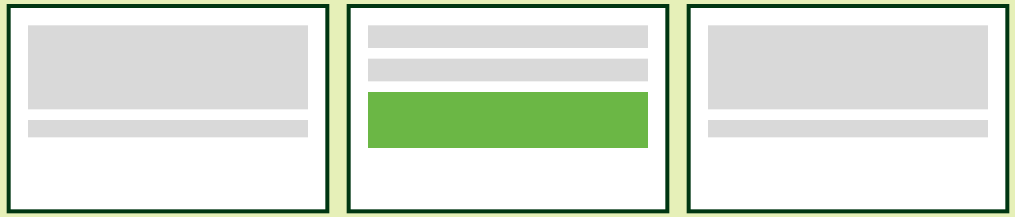
IN THE CASE

Core benefit: book a free slot and get a reminder. The improvement to test first: a confirmation that says “Booked” in plain words and reads well on a phone.

The workbook calls attention to the smallest experience improvement that matters (MLP).

MVP and MLP side by side

MVP: basic functionality



MAIN FOCUS
A basic check of the function and the hypotheses.

LAUNCH GOAL
First feedback and analytics of behaviour.

HOW THE MARKET SEES IT
It works, but may look standard.

MLP: emotional appeal



MAIN FOCUS
A distinctive experience and an emotional connection.

LAUNCH GOAL
Product champions and retention.

HOW THE MARKET SEES IT
It delights people.

THE RISK **Feature overload: spreading across seven features loses the users' focus.**

A quick cycle from idea to first users



Stage 3 uses the 40% heuristic from the fit diagnostic. It needs people who have used the product.

Physical prototypes

Mock-ups, boards and bench tests.

What a physical prototype can look like



A cardboard model

Checks shape, size and how people handle it.



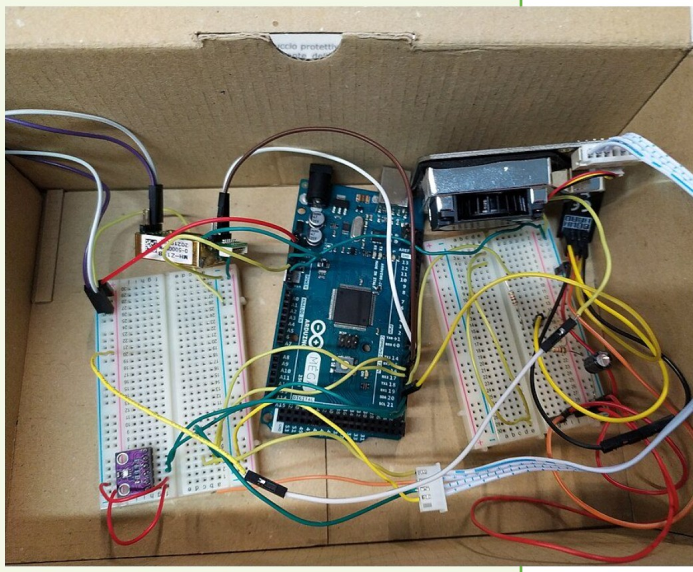
A paper model of a place

Shows layout and how people move through it.



A component on a breadboard

Checks one technical function.



Electronics in a cardboard box

Holds a working circuit before any enclosure design.

Photos: Corinna Schuster (WMDE), CC BY-SA 4.0; TreyDanger, CC BY 2.0; Valerio Bozzolan, CC0. Wikimedia Commons.

Four stages for something physical

1

Feasibility proof of concept

Can the key function work at all?

Can a small board show the right end time on a bench?

2

Looks-like

Form, size, position, handling.

A cardboard display on the real equipment.

3

Works-like

The function and the signal path.

Booking list, board, display.

4

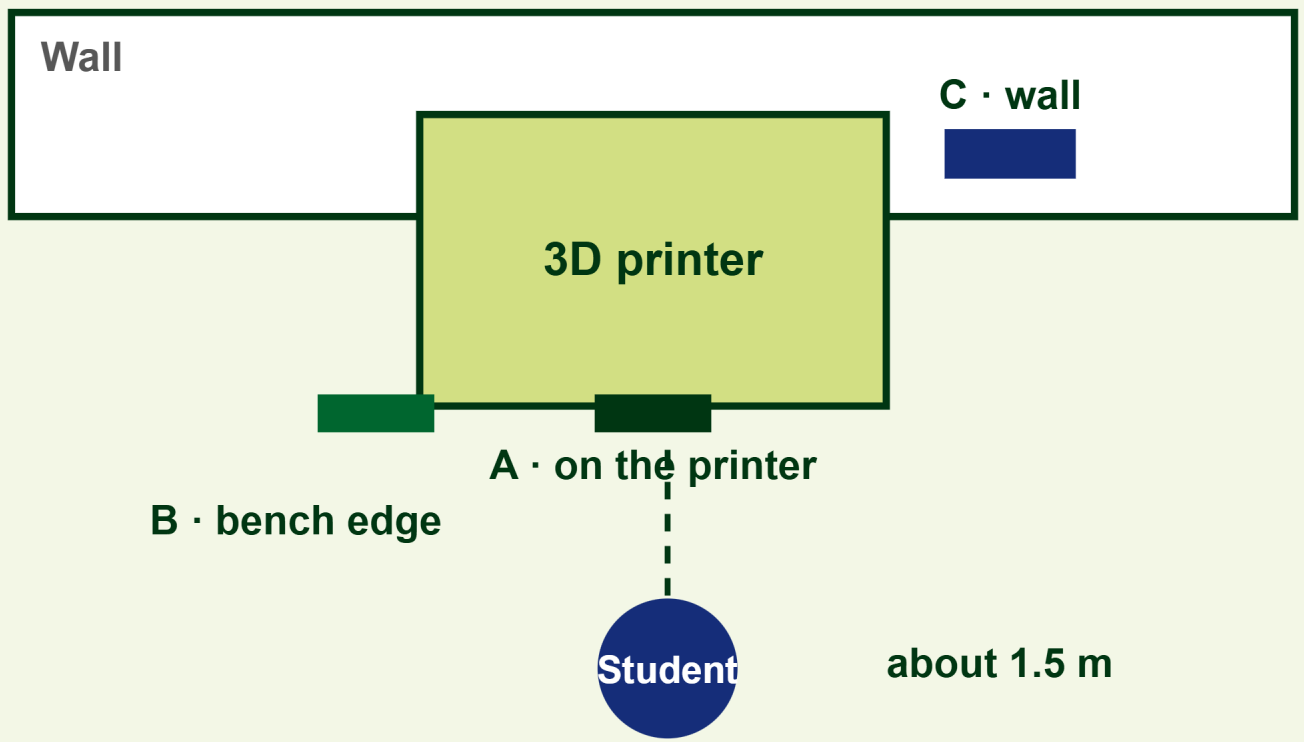
MVP for field testing

Early users, real conditions.

Displays on the equipment in one lab.

Stages as described in MistyWest, The Complete Guide to Hardware Product Development (2021), pp. 24 to 28.

Looks-like: where does the display go?



ARTEFACT

A cardboard box with a paper card: “In use until 16:00. Next free slot 16:00.”

TEST

Ask a student to stand where she would stand and read out when the printer is free.

DECISION

Move the display or enlarge the text if people cannot read it.

Illustrative top view. Positions are examples.

Proof of concept: does the display show the right time?

ON THE BENCH

Booking list, typed in → **Small board**

THE DISPLAY SHOWS

In use until 16:00
Next free slot: 16:00

Free until 18:00
Next booking: Anna, 18:00

Check	Display should show	In 1 min
Starts 14:00	In use until 16:00	Yes
Extended	In use until 17:00	Yes
Ends early	Free now	Yes
Next waiting	Next booking and time	No
Nothing booked	Free all day	Yes

AGREED BEFORE THE TEST

The display matches the bookings within one minute in every check.

Simulated results for the case. The criterion is an example.

Works-like: from booking to display

Booking list	Message	Small board	Display	Student
Simulated: typed in by hand	Real: sent from a laptop	Real: reads the message	Real: shows the end time	Real: reads the display

State what is integrated and which functions are simulated before the test.

What the bench result leaves open

QUESTIONS FOR A LATER TEST

Readability in bright light

Power and cables near the equipment

What happens when the network drops

Who installs and updates the displays

COST COMES IN LAYERS

Parts

Assembly

Testing

Servicing

A parts list gives the cost of parts. The other layers add separate costs.

Co-funded by the European Union

Three questions, three artefacts

Can students read it from where they stand?	A cardboard display on the real equipment	Move it or enlarge the text
Does it show the right time?	Small board, display and a test log	Keep it if every check matches
Does the whole path work?	Booking list, board and display together	Design the next test, with its own field checks

The same logic works for any device. Use diagrams and prewritten observations in class.

Evidence and decisions

What counts, and what to decide in advance.

Write the observation before the test

CONDITION	MEASUREMENT	NEXT DECISION
_____	_____	_____

EXAMPLE FOR THE DISPLAY TEST

Bookings typed in, display on the bench, a person 2 m away.	The end time shown within one minute, checked 5 times.	5 of 5: keep. Fewer: fix the delay and test again.

What would you change in v2?

RESULT

Students find the display. 3 of 5 cannot read the time from where they stand, because the text is small and the printer is in a corner.

DECISION

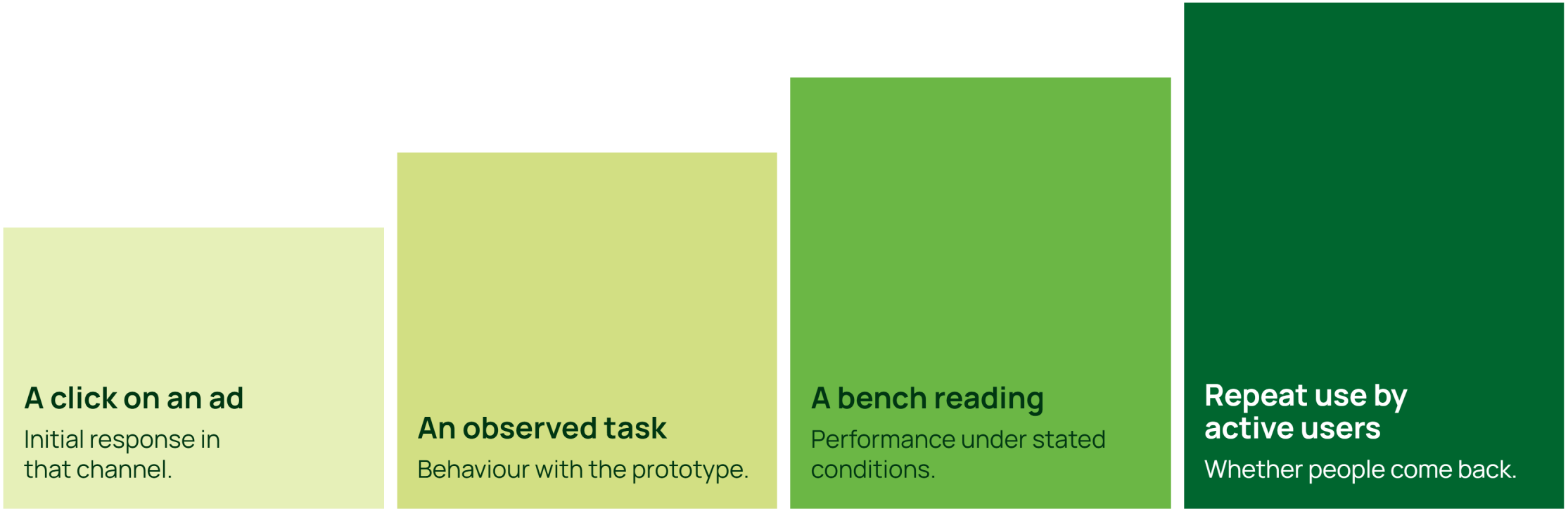
Keep the content.

Make the text bigger and move the display.

Test again with the printer in its usual place.

Illustrative result for the case.

What does each signal support?



Each step supports a different kind of claim. Name the signal when you report a result.

Comparing problem messages

The same offer, described in three ways. Show each one to a similar group and see which gets more replies.

MESSAGE A

Never double-book the microscope again

MESSAGE B

See when the 3D printer is free

MESSAGE C

Book lab equipment in two taps

KEEP COMPARABLE

Audience, offer and format.

TRACK A NEXT ACTION

For example, a relevant reply.

CLICKS MEASURE

Initial response in that channel.

Illustrative messages. A budget is optional.

Product-market fit comes later

NOW

Prototype tests

Do people understand it? Can it work?

NEXT

Pilot use

People use the product in their real routine.

LATER

The fit diagnostic

Asked of people who have used the product.

THE WORKBOOK'S DIAGNOSTIC

“How would you feel if you could no longer use it?” A common heuristic treats 40% answering “very disappointed” as a sign of fit. It needs a sample of people who have actually used the product.

Leave product-market fit open at the prototype stage.

A test plan in five lines

WHO	Five students who use the lab, one at a time.
TASK	Book the 3D printer for Thursday afternoon.
OBSERVE	First action, interpretation and any prompt needed.
DECISION RULE	Four of five finish without coaching: keep. Recurring confusion: change the wording or the order. A step that adds nothing: drop it.
RECORD	The sample and the conditions of the test.

Keep, change, drop

KEEP

The signal you set in advance was met.

CHANGE

The same confusion appears again and again. Change the wording or the order and test again.

DROP

An element adds steps and does not help the task.

The prototype ends with a decision.

A worked example

ASSUMPTION	Students can find the next free slot and book it.
FORMAT AND SCOPE	Three paper or clickable screens with sample data, labelled as a simulation.
TASK AND OBSERVATION	Five students, one at a time. Record the first action, the interpretation and any prompt.
DECISION RULE	Four of five finish without coaching. Write down the sample and the conditions.
TAKE-HOME	Prepare the smallest artefact and run a suitable test.

Worksheet 05, after the session

4 min	4 min	4 min	5 min	3 min
Assumption and signal	Format and scope	What must work, what can be simulated	Task and observation	Decision rule

Output: a prototype and a test plan tied to one assumption. Use your own idea or the booking-tool case.

Take-home test

PREPARE

The smallest artefact that can show the behaviour or the property you want to test.

RUN

One suitable test with a few relevant people, or one safe bench check.

RECORD

One observation, what it supports, one limitation and the next decision.

For hardware: no live electrical or chemical testing without supervision.

Five things to take away

1. Choose the artefact by the question it can answer.
2. Write the assumption, the signal and the decision before you build.
3. Make real what affects the behaviour you observe. Simulate the rest.
4. Name which signal supports which claim.
5. End every test with keep, change or drop.

Co-funded by the European Union

What will you learn next?

QUESTION

What do I need to learn?

PROTOTYPE

The smallest artefact that can show it.

SIGNAL

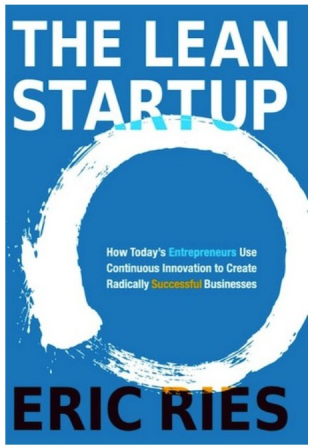
What I will observe or measure.

DECISION

Keep, change or drop.

Bring one line like this into session 06. How you describe the work and what you have learned so far is the topic there.

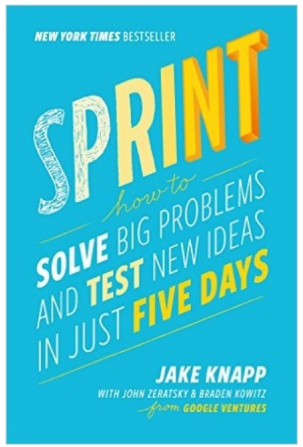
Books worth reading



The Lean Startup

Eric Ries

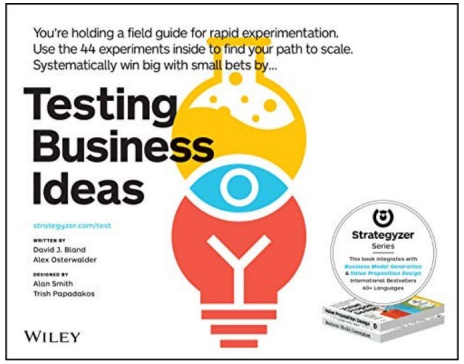
The Build, Measure, Learn loop behind small tests.



Sprint

Jake Knapp, John Zeratsky, Braden Kowitz

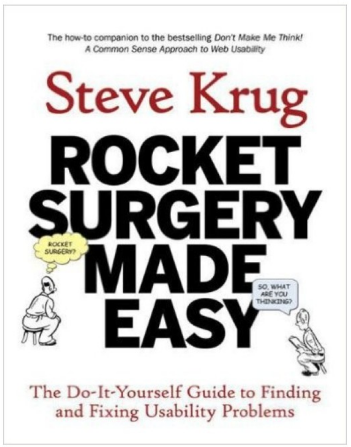
A prototype built and tested with users in five days.



Testing Business Ideas

David J. Bland, Alexander Osterwalder

A field guide of experiments for early ideas.



Rocket Surgery Made Easy

Steve Krug

A do-it-yourself guide to finding usability problems.

Cover images: Open Library. Covers belong to their publishers.

Also worth a look

1 **MistyWest · The Complete Guide to Hardware Product Development**
Free guide (2021). Hardware stages, prototype types and production questions.

2 **Nielsen Norman Group · Usability Testing 101**
Article. How to run a simple usability test.

3 **Google Ventures · The Design Sprint**
The five-day method behind the book Sprint.

4 **Salome Mikadze · Founder's Workbook, sections 1 to 3**
Experiment planning and the fit diagnostic used in this session.

STEM-HER
Empowering Women in STEM

Thank you!

Any questions? You can reach out to

marharyta.chernyshova@yepashstartup.com

Co-funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Institute of Innovation and Technology. Neither the European Union nor the granting authority can be held responsible for them.

eit Food

Co-funded by the European Union