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care, judgment, dexterity

6.1 P1 - Education & Training

Project Acronym	Craeft
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Work Package	6
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http://www.craeft.eu/

Executive summary

The Pilot 1 experiment continued on the basis of the work carried out during the project, where the foundations were laid by recording and understanding the craftship gestures and compiling a collection of contents of the workshops, tools and machines used in the various RCIs and implements the first phase of testing the impact of digital tools on learning.

The pilot 1 was based on a model proposed by the CERFAV. As a training organisation and a player in research into digital tools for glass makers or users, CERFAV has the capacity to integrate and evaluate digital tools in learning for the Craeft project.

We discussed with our partners the elements implemented during the pilot 1 experiment in glassblowing with a pipe, so that they could adapt them in turn for each RCI. Discussions focused on the objectives and methodology for setting up pilot 1, with the support of the educational kit. The RCIs produced a proposal based on their specific characteristics, in particular their activity, the way in which knowledge is passed on, their partnership with 'support' structures and their geographical location.

For the second phase of Pilot 1, our approach has been to refine the educational methodology and tools by defining usage scenarios which highlight hybrid modality, so that each digital tool can be optimally integrated into existing learning programmes depending their constraints. Finally, in the spirit of an inductive learning approach, we proposed methods and tools inspired by active pedagogy, in order to best mobilise the interest and motivation of learners.

The first phase of experimentation allowed us to observe the positive impact of digital tools. However, we found that simply superimposing them on traditional tools reduced their effectiveness. We focused on improving usage scenarios by better integrating digital and traditional tools through what we call the hybrid method, with a blended modality learning session approach and defined role for each tool, see teaching kit version 2.

Digital tools, e-learning platforms, glassblowing workshop simulations and 3D plaster wheels were supplemented and improved thanks to feedback from learners collected during the first phase of the experiment.

Given the small number of participants for each RCI, we explored the validity of the results. This allowed us to focus on qualitative feedback and put the quantitative results into perspective.

Inspired by existing practices among learners, we also developed and explored other tools in RCI 1 – glassblowing, video elicitation and 3D demonstrators, which we tested informally, as the testing methodology could not be included in the Craeft project. However, we felt it was important to report on these experiences, given the strong potential of these tools.

The implementation of the experimentation was coordinated by Cerfav, in support of the other RCIs, taking into account the specific nature of each structure in terms of its ability to implement the pilot. The 'ideal' model proposed in the teaching methodology was adapted to the constraints of each RCI, depending on the mode of knowledge transfer, whether formal or informal, and the geographical and socio-economic situation of each. RCI 1 (glassblowing), RCI 2 (porcelain), RCI 5 (wood carving) and RCI 7 (tapestry) are backed by training structures with formal training programmes, while RCI 5 (marble

carving) and RCI 6 (goldsmithing) are part of an informal programme linked to cultural valorisation foundation.

Feedback is specific to each RCI, but some common points emerge:

- Digital tools are well received
- Pragmatic use without exaggeration; they are already part of everyday life
- A gateway for beginners to 100% digital
- A valuable complement to existing tools, to reinforce learning
- A necessary complement to workshop learning
- Essential consideration of the educational and socio-cultural context to optimise their value in use and effectiveness
- A strong attachment among learners to the direct and real handling of materials

In conclusion, the Craeft experiment gives us a snapshot of the possible and desirable uses of digital tools given the current state of technology and methodologies. It also indicates the areas of use that can be exploited immediately and the areas for development and improvement, both for the tools themselves and for the educational methodologies deployed, so that they can be fully efficient and integrated into the craft learning process. It should be noted that digital tools have lower impact on transmission if they are not accompanied by hybrid learning usage scenarios, combining digital and traditional methods while maintaining a strong link with workshop practice. The disparities in constraints for each RCI and their impact on results also lead us to believe that geographical and socio-economic situations must be more taken into account for the effective deployment of digital learning tools in the preservation and sustainability of craftsmanship.

Document history

Date	Author	Affiliation	Comment
15/1/2026	Patricia HEE, David ARNAUD, Noël CRESCENZO	Cerfav	Production of deliverable 6.1 for pilot 1
2/12/2025	Juan José Ortega	CETEM	Report of CETEM experiment
24/11/2025	Danae Kaplanidi	PIOP	Report of PIOP experiment
14/2/2025	Patricia HEE, David ARNAUD, Noël CRESCENZO	Cerfav	Production of deliverable 6.1 for pilot 1
28/2/2026	Xenophon Zabulis	FORTH	Formatting

Abbreviations

CLT	e-learning platform linked to Craeft Studio
AS	Apprentice Studio application, virtual workshop learning
DS	Design studio application, design and 3D/XR modelage.
CS	Craeft Studio application incorporating a virtual training workshop.
CAP	Craeft Authoring Platform, portal providing access to CLT, DS, AS and Craeft Studio.
XR	extended reality, including virtual reality, mixed reality and augmented reality.

Table of contents

Pilot 1
First phase

1 - RCI 1 - Glassblowing with pipe (Pilot 1)

1.1 - Context

The goal of experiment is to measure the impact of digital tools on the learning process.

1.1.1 - participants

Pilot 1 experiment - glassblowing with a pipe, is being carried out with second-year apprentices preparing for their Certificate of Professional Competence (CPC), which they will pass in June 2025. The apprenticeship takes place over two years, alternating between time spent in the company with the apprenticeship master and time spent in the training centre, which we will call cluster. It is during some of these training centre cluster that Pilot 1 will be tested.

The Craeft experiment was made with apprentices volunteered to be part of a TA or T group.

- TA group (Traditional Augmented) is a test group using the Craeft digital tools.
- T group (Traditional) is a control group not using Craeft digital tools.

1.1.2 - digital material

The Craeft digital materials are an e-learning platform and VR glassblowing workshop simulator. All apprentices in the T and TA groups have access to the non-Craeft digital tools available at Cerfav, as FabLab for example.

1.1.3 - timeline

The first phase of Pilot 1 experiment - glassblowing with a pipe, was done in several phases linked with clusters dates of CPC second year apprentices. The assessment of impact of Craeft tools was carried out on the two first clusters of the school year in September and October/November 2024. An additional assessment has been done to assess the first improvement of digital tools in January 2025.

Two or three sessions of two hours were scheduled with the TA group for the three cluster N°7, N°8, N°9, to experiment Craeft digital tools. as well as the follow-up interviews for individual projects for group T and TA.

1.2 - Methodology

1.2.1 - Project’s presentation:

The Craeft project of the experimental process and of the proposed digital tools was presented at full group of apprentices, followed by a discussion of their first impressions. A workshop was carried out in sub-groups with a large-group restitution on these three axes, expectations, issues and fears, proposals, concerning digital tools.

The Craeft project presentation phases are:

- Craeft project presentation
- Craeft digital tools, brief presentation without experiment
- Workshop on the representation of digital tools

1.2.2 - Experiment:

The experimentation with the Craeft tools, the e-learning platform and the VR glassblowing simulator consisted of representing the tools in terms of their principles and operation and having them used independently by the learners in the presence of the trainers. Feedback on first impressions was collected. Questionnaires on the appropriation and mastery of the tools and on satisfaction were completed during the last experimentation session for each cluster, for the TA group.

During the individual interviews, the project follow-up form was presented, with the aim of noting down the tools used to develop the projects during the several clusters. The objective was to measure the use and perception of digital tools, beyond the Craeft tools, in the T and TA groups. For the TA group, feedback on their experience of the Craeft tools was also collected.

In addition, the results of formative assessments carried out during the cluster on one of the cross-cutting subjects, general technology, health, safety and environment or technical drawing, are analysed quantitatively in order to compare the results between the T and TA groups. Here, an assessment in general technology.

Figure 2 - VR studio experiment, cluster N°7

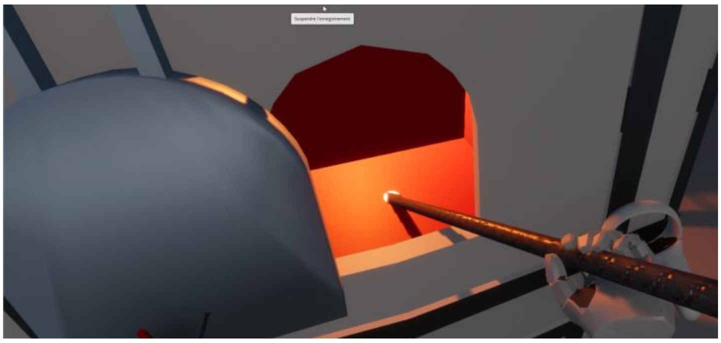


Figure 1 - VR studio experiment, screenshot of simulator

Several phases have been planned:

- a reminder of the Craeft project and appointments for one-to-one meetings. (T+TA)
- discovering and using Craeft digital tools (TA)
- individual interviews (T+TA)
- worshop time for the project (T+TA)

1.2.3 - Assessment:

The evaluation was carried out using various documents to measure the impact of Craeft's digital tools, both qualitatively and quantitatively.

system and documents using for assess Craeft digital tools:

- **On-the-spot feedback [first impressions] -** in large group, during presentation and first experiment of tools (TA - qualitative - with each user, over the course of the clusters).
- **Questionnaire on the initial state of skills** - Evaluate pedagogical progress through the acquisition of professional skills (statistical comparison between group T and TA - quantitative - beginning of scholar year-end) – two times – at the beginning of the phases and before CPC exam.
- **Self-assessment questionnaire on the mastery of tools** - To assess the appropriation and mastery of Craeft digital tools - (TA - qualitative - over the course of clusters if necessary)
- **Personal project follow-up form and interviews** - via a project follow-up form and individual interviews to identify the impact of digital tools - (T + TA - qualitative - at each cluster, put the results into perspective - project follow-up form)
- **Comparison of the results of formative assessments** - carried out by cross-disciplinary subject trainers and collected to measure the impact of the e-learning platform (T + TA - quantitative - over the course of the clusters)
- **Satisfaction survey** - to assess the appropriation of the tools and to gather suggestions for improvement (TA - quantitative - over the course of the groupings if necessary)

1.2.4 - Methodology for analysing qualitative data

In order to be able to analyse the qualitative documents, on-the-spot feedback, satisfaction surveys and individual interviews to identify the dominant themes, work was carried out in several stages:

- copying the data into tables, one table per document with data divided into three columns
  - positive points
  - points for improvement
  - comments
- highlight dominant themes, identify and classify the data according to similar semantic fields and then summarise the dominant themes
- create a coding system so that the analysis can be traced back to the data. To this end, it will be possible to identify which themes correspond to which data, and make the link between the two instances of theme/data.
- carry out a statistical study to measure the weight of each theme identified.

See: annex 3 - coding and data.

1.3 - Results

1.3.1 - Results - project's presentation.

The Craeft project was presented to apprentices at the end of their first scholar year. In addition, we organised a workshop to gather suggestions from learners in order to best adapt the digital tools, which were still in the development phase. This also gave us initial feedback on their perceptions and expectations of these tools and enabled the apprentices to better understand the project. For detailed review, see annex 3.

1.3.1.3 - Overall synthesis of Craeft project presentation

The apprentices were very interested in the project. An exchange of views began very quickly at the start of the presentation and continued throughout.

They asked questions about the medium- and long-term objectives and challenges of this type of project aimed at digitising skills. The relevance of digital tools in learning their trade. The usefulness of the proposed tools, particularly in terms of their maturity.

The following summary of the feedback on the Craeft presentation challenges the project in a positive way, and if the feedback and overall acceptance are mixed, there is one observation at a given moment, which it is interesting to put into perspective with the feedback from the following groups during the actual experimentation of the Craeft digital tools.

- Little support for the TA group - for the Craeft project?
- Questions about the challenges of digitising craft skills, what use will be made of them in the future, fear of being dispossessed.
- Workshop simulation, negative feedback from people with previous experience.
- Simulation too far removed from the reality of the workshop, need to be in touch with the material for apprentice craftsmen.
- No concrete, usable results, especially for 3D tools.
- Need for a design tool linked to production.
- What's it going to do for me?
- Digital tools are not mature enough.
- Expectation of a portal, reference to techniques.
- Attachment to project follow-up.

1.3.2 - Cluster N°7 - Analysis and results of the evaluation of Craeft digital tools.

1.3.2.1 - E-learning platform - results of project assessment documents

The following analysis shows the main themes to emerge from the feedback and satisfaction survey questionnaire for the e-learning platform.

You can find the full coding in annex 3.

Identified themes for e-learning:

1- Pedagogical and didactic effectiveness [PDE]: This theme covers the relevance of learning methods, the educational progression and the effectiveness of formative assessments. It reveals a strong match with the objectives of preparing for the CAP, thanks in particular to the complementary nature of the educational aids.

For example:

> *'The questionnaires and explanatory videos are the site's best asset'* [PDE-1] is a good illustration of the effectiveness of multimodal teaching aids. This feedback is reinforced by the observation *'interactive videos, initial tests'* [PDE-1], demonstrating the positive impact of interactive elements on learning.

2- Ergonomics and accessibility [ERA]: this dimension covers the architecture of the platform, the fluidity of navigation, and the organisation of educational resources. Feedback highlights opportunities for optimising the user experience to facilitate access to content.

For example:

> *'No breadcrumb trail, no possibility of going back in the tree structure when you are in a course' [ERA-1]. This observation highlights a navigation issue. Similarly, 'Quite complicated to find your way around the platform, I find it a bit scattered'* [ERA-2] reveals areas for improvement in course structure.

3- Exhaustiveness and completeness of content [EXC]: This theme covers the enrichment needs identified, particularly in terms of technical drawing, art history and specific technical content. It also includes aspects relating to the internationalisation of content.

For example:

> *'In some courses there are things missing [technical drawing], there are gaps, a video is not enough to understand everything'* [EXC-1], feedback concerning desirable improvements to content. The suggestion *'It would be interesting to add the other specialisations and art history'* [EXC-3] indicates a relevant pathway for enrichment.

4- Linking theory and practice [LTP]: This dimension explores the connection between theoretical learning and its concrete application in the workshop, underlining the importance of being anchored in professional reality.

For example:

> *'Making the link between the videos and the workshop'* [LTP-1] is an essential requirement for the transfer of learning.

Statistical analysis:

The statistical analysis, highlights the weight of each thematic to identify the most often occurring and important. This approach avoids the risk of a marginal theme emerging at the same level as another more relevant to understand apprentices' concerns.

statistical analysis of e-learning data tables

Code	Theme	Occurrences	Percentage	Rank
PDE	Pedagogical and didactic effectiveness	33	46%	1
PDE-1	Quality of learning materials	18	25%	1
PDE-2	Educational Progress	11	15%	3

Code	Theme	Occurrences	Percentage	Rank
PDE-3	Assessment of learning	4	6%	6
ERA	Ergonomics and accessibility	20	28%	2
ERA-1	Navigation and interface	14	20%	2
ERA-2	Organisation of content	4	6%	6
ERA-3	Technical accessibility	2	3%	8
EXC	Exhaustiveness of content	14	20%	3
EXC-1	Core content	9	13%	4
EXC-2	Specific technical aspects	5	7%	5
LTP	Linking theory and practice	4	6%	4
LTP-1	Transfer of learning	2	3%	8
LTP-2	Professional Contextualisation	2	3%	8
Total		71	100%	

Figure 3- table of statistical analysis for e-learning, cluster N°7

Caption: Top four rankings

From this analysis of e-learning data, it can be seen that the four themes most frequently mentioned are, in order of rank, the quality of the learning materials, the navigation and interface, the learning progression and the core contents.

These four issues merit particular attention as an input to implementing improvements to the e-learning platform.

This can be seen in the continued attention paid to the variety of materials, the clear identification of training modules in the learning progression, and the need to supplement and enrich fundamental contents.

The other aspect is improving the site's navigation and interface.

Overview of the self-assessment questionnaire on Craeft tools usage - e-learning.

E-learning platform

The self-assessment questionnaire on the use of the e-learning platform gathers learners' perceptions of their mastery of the tool; it is a personal and subjective feedback, not a test of real mastery. Its aim is to measure how comfortable learners are using the tool and where improvements can be made.

The questionnaire consists of closed questions, the answers to which are shown in the graphs below. Responses to the open-ended comments question are compiled in the ‘Comments’ box.

The answers on the question of usefulness in relation to the personal project are logical insofar as it is a learning tool and not a design or production tool.

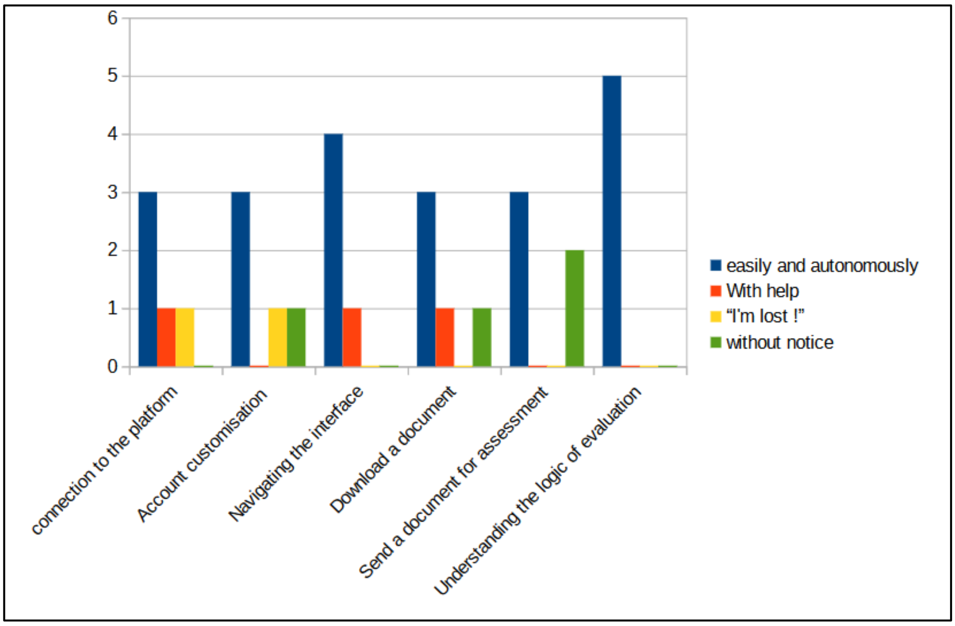


Figure 4 - e-learning self-assessment questionnaire graph, cluster N°7

Comments:

Navigating the interface: *'To go back, you have to go back to the course list.'*

Understanding the logic of assessments: For interactive videos, display if multiple answers. A little scattered.

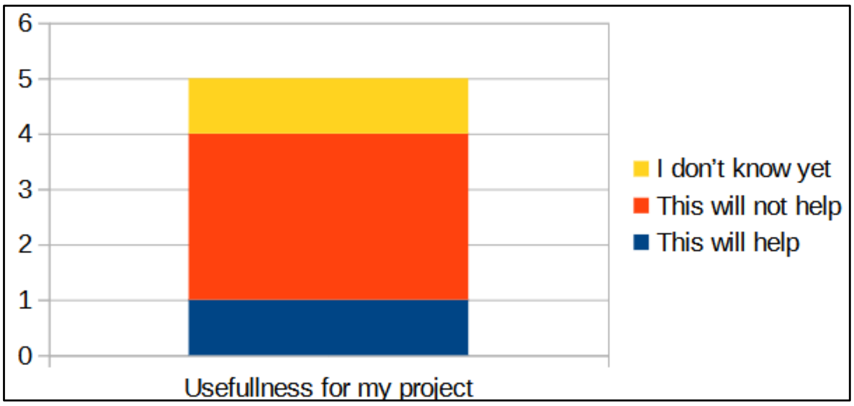


Figure 5- e-learning, usefulness question, cluster N°7

The results show an overall good acceptance and mastering of digital tools in general and on e-learning platform in particular.

The average results for questions about logging on to the platform or personalising an account are due to first-time use. Navigating the interface did not pose any major problems for the apprentices, but they did ask for a general breadcrumb trail to show where they were in the site tree structure.

Understanding the logic of the assessments was a notable positive point, as the 'quiz first' system of prior assessment and the use of quizzes as training tools were generally appreciated, with a request for systematic feedback on 'correct answers' in the results.

Note: the number of apprentices in TA group is five, and limits the representativity of statistical approach.

1.3.2.2 - VR glassblowing workshop simulator - results of project assessment documents

The following analysis shows the main themes to emerge from the feedback and individual interviews.

You can find the full coding in annex 3.

Figure 6 - VR studio experiment, cluster N°7

Identified themes for VR glassblowing workshop simulator:

1- Videogame pedagogical engineering [PEN]: This theme covers the structuring of learning, pedagogical progression and the integration of explicit objectives. It emphasises the importance of appropriate guidance in the virtual environment.

For example:

> *'Setting objectives (small tasks), e.g. making a glass drop' [PEN-1] is a structuring suggestion for learning. 'Having tutorials - e.g. making a cup guided through the steps (process)' [PEN-2] reinforces this progressive teaching approach.*

2- Technical and professional fidelity [FIT]: This dimension concerns the quality of the physical simulation and the reproduction of professional gestures, crucial elements for an apprenticeship in a craft.

For example:

'For the evolution of the viscosity of glass as a function of temperature, if this cannot be modelled continuously, allow for stages' [FIT-1] represents precise and constructive technical feedback.

3- VR Ergonomics and user interface [EVR]: This theme covers aspects relating to navigation in the virtual environment and the accessibility of functionalities, which are essential for a learning experience.

For example:

'Being able to relaunch the application via a menu' [EVR-1] underlines the importance of accessibility of functionalities.

4 - Practical aspects and security [PAS]: This dimension covers the integration of good professional security practices and the management of virtual equipment.

For example:

'Having a seal to put the pipe in at the end of work' [PAS-2] demonstrates the attention paid to good professional practice.

Statistical analysis:

Statistical analysis of VR glassblowing simulator data tables

Comment identical to the statistical analysis for the e-learning platform.

Code	Theme	Occurrences	Percentage	Rank
PEN	Pedagogical Engineering	7	44%	1
PEN-1	Learning structure	4	25%	1
PEN-2	Pedagogical objectives	2	13%	4
PEN-3	Assessment system	1	6%	6
FIT	Technical Fidelity	6	38%	2
FIT1	Physical simulation	3	19%	2
FIT-2	Reproduction of movements	3	19%	2
EVR	Ergonomie VR	2	13%	3
EVR-1	User interface	2	13%	4
PAS	Practical Aspects and security	1	6%	4
PAS-2	Hardware management	1	6%	6
Total		16	100%	

Figure 7 - table of statistical analysis for VR studio, cluster N°7

Caption: Top four rankings - Execo ranking

It emerges from this analysis of the data concerning the VR blowing workshop simulation, that the dominant theme is the learning structure, in equal second place, the themes linked to technical fidelity, physical simulation and reproduction of gestures. Finally, the themes linked to educational objectives and the user interface, also tied for 4th place.

Here again, these issues deserve particular attention when it comes to implementing improvements to VR workshop simulation.

We can note the importance of structuring learning and processes, even before fidelity to technical gestures and the physical simulation of the environment. The themes of learning objectives and the user interface highlight the need for learners to be able to situate themselves in their learning progression.

Overview of the self-assessment questionnaire on Craeft tools usage - VR studio.

VR glassblowing workshop simulator

The self-assessment questionnaire on the appropriation of the VR glassblowing workshop simulator, collects the learners' perception of their mastery of the tool, in the same way as for the e-learning platform, it is a personal and subjective feedback. The aim is to measure the degree to which the trainees have taken ownership of the tool and are comfortable using it, and to identify areas for improvement.

The questionnaire consists of closed questions, the answers to which are shown in the graphs below. Responses to the open-ended comments question are compiled in the 'Comments' box.

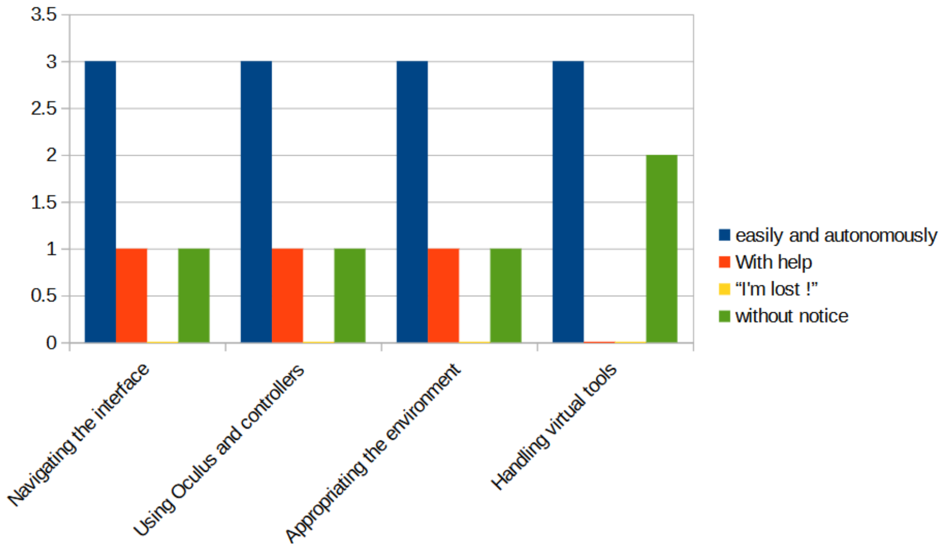


Figure 8 - VR studio self-assessment questionnaire graph, cluster N°7

Comments:

Navigating the interface: Easy, but requires a little training.

Using the headset and controllers: add a tutorial to help you understand the possible commands and actions.

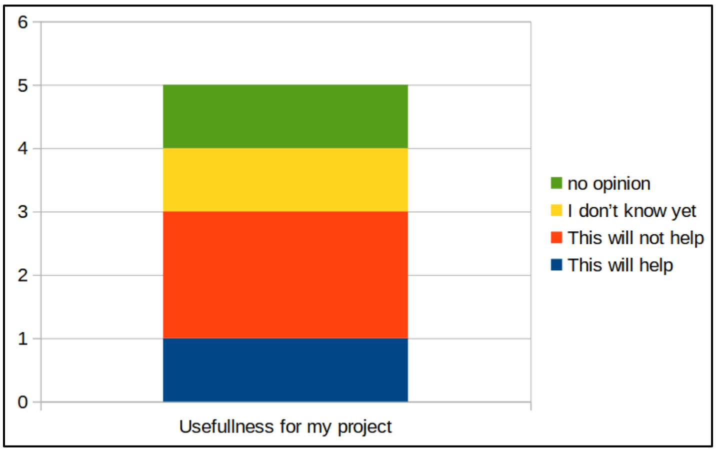


Figure 9 -VR studio, usefulness question, cluster N°7

As for e-learning platform, the results show an overall good acceptance and mastering of VR glassblowing simulator.

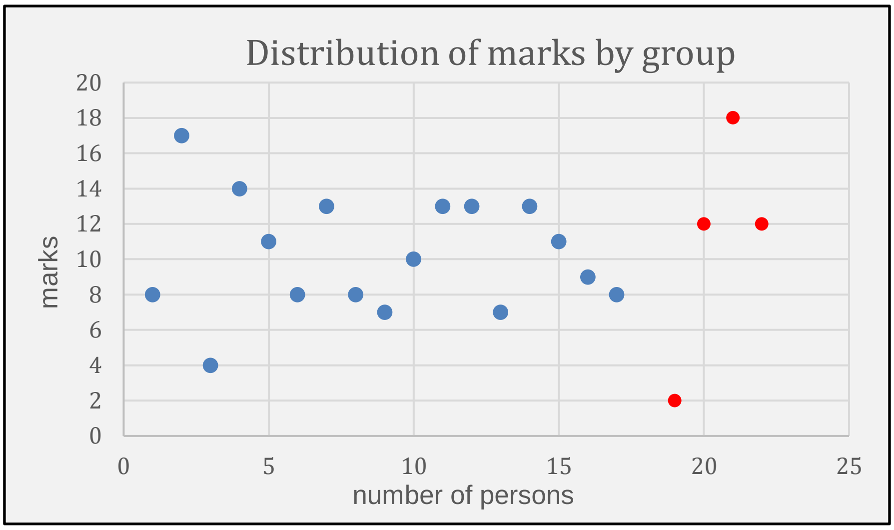
Navigating the interface, using Oculus headset and controllers, appropriating the environment, are mainly good for TA group apprentices.

The score of handling virtual tools is less high than the other aspect of VR studio, due to the imprecision of grabbing tools and physics of simulation. Another aspect of this feedback is the gap between the real physics of the workshop and the virtual physics.

1.3.2.3 - Comparative results of formative assessment in general technology

General technology course is part of cross-cutting matters implemented in the e-learning platform. The aim of this comparison of formative assessment results is to measure the impact of e-learning platform on knowledge acquisition.

This assessment in general technology was carried out on 27 September, the evaluation is rated on 20 and the graph below shows a comparison of the results between the T and TA groups.



Legend: T group ??- TA group??

Figure 10 - TA and T groups general technology assessment results graph

Table of TA an T groups scores, means and standard deviation:

TA group	
TA 1	2
TA 2	12
TA 3	18
TA 4	12
TA 5	

T group		T group		T group	
T 1	8	T 7	13	T 13	7
T 2	17	T 8	8	T 14	13
T 3	4	T 9	7	T 15	11
T 4	14	T 10	10	T 16	9
T 5	11	T 11	13	T 17	8
T 6	8	T 12	13		

TA mean	11.00	T mean	10.18
		Overall mean	10.38
TA std. deviation	6.63	T std. deviation	3.09

Figure 11 - table of TA and T groups score in TG formative assessment

The mean, but also the standard deviation, is higher in the TA group.

Globally the result of TA Group is sensitively better than results of T group. The hHigher note for TA is 18/20 and for T is 17/20. The lower rate of both groups is in TA group 2/20 versus 4/20 for T group.

We hypothesise the importance of apprentices adopting the digital tool, in this case the e-learning platform, if it is to have a beneficial effect on training.

Once again, the number of apprentices in the TA group is not large enough to consolidate a definitive result, but it does allow us to identify a trend.

1.3.2.4 - Analysis and summary of cluster N°7

From the data analysed above, we can identify a number of themes that stand out and will be refined in the overall analysis of pilot 1.

- Good overall acceptance of the tools
- E-learning platform is perceived like a good tool for exam revision
- Quiz as a good tool for memorization
- VR glassblowing simulator perceive as a good discovering tool
- Hight level of expectation on tools improvement

1.3.3 - Cluster N°8 - Analysis and results of the evaluation of Craeft digital tools.

Figure 12 - VR experiment during cluster N°8

1.3.3.1 - Overall feedback on Craeft digital tools

There was no particular feedback for the e-learning tools and the VR glassblowing workshop simulator, as the tools had not changed much between cluster No. 7 and No. 8.

In addition, tools developed in parallel were presented, such as the ‘apprentice studio’ and the ‘community portal’ website. They will be evaluated in the second phase. However, their presentation to the apprentices will enable us to involve them in the development of the tools and to obtain useful feedback for their improvement.

1.3.3.2 - Feedback on the Apprentices Studio presentation

- interesting breakdown of the manufacturing process by stage, but with an additional stage to be able to do or see all the stages from A to Z.

1.3.3.3 - Feedback on VR glassblowing workshop simulator

- good improvements, information on cane temperature before grabbing them for gathering.
- Tooling information well received
- avatar with predefined scenes OK if gestures are precise

1.3.3.4 - Feedback for the "Community portal" site

The site was presented to a large group, followed by a question-and-answer session.

The results show that, while Snapchat and Instagram are the social networks most commonly used, a platform dedicated to the craft trades is attracting interest from a wide range of users, a platform dedicated to the craft trades is attracting interest for:

- find out more
- find another craftsman to work with
- ask for advice when faced with a technical problem
- exchange with trusted peers on a professional forum
- more reassuring than other 'all-comers' social networks
- => access to business referrers

This implies:

- to label the technical level of people: trainees, self-taught, experts, etc.
- have moderation and levels between members, administrator, editor, reader

Other comments:

- interesting for anyone, retraining, those interested in crafts
- access [be able to discover] different professions
- have one translation per language - not everyone speaks English

1.3.3.5 - Return of personal project follow-ups

Methodology: the project follow-ups was done through individual interviews with the apprentices. Project follow-ups allow for a qualitative assessment of the context, place and use of digital tools by apprentices, beyond just Craeft tools. This provides an overview of acceptance, practices, integration and also any difficulties encountered when using digital tools.

- We interviewed nineteen learners, twelve of whom were part of the test group and seven of whom were part of the control group.
- The question framework used for all project follow-ups interview's is in Annex 2.
- The face-to-face interview has been recorded and transcribed with noScribe V0.5 soft. Participants were anonymised by their initials. The codification has initiate on Claude and Mistral AI systems and revised manually.

- A codification has been established for created a link between raw data and analysis, see Annex 3 – thematic analysis coding structure.

The more occurred thematics are:

thematics	TA group occurrences	T group occurrences
Mixed and pragmatic Use - [MXU]	8	7
Learning how to use digital tools. -[DTL]	5	1
Relationship to the material – [RTM]	1	2

Figure 13 - table of the more occurred thematics for N8 cluster

The three themes that emerge are a mixed and pragmatic use of both traditional and digital tools. A necessary learning curve for digital tools, which can potentially be a barrier to their use, and finally a strong attachment to workshop practice and direct contact with the material.

Furthermore, of the five apprentices in the TA group, four plan to use a digital tool to develop their project: laser cutting, parametric 3D modelling and organic 3D VR modelling. Of these four students, two have undertaken 3D modelling in VR, and one has finalized her shape and will be using it in her project.

And of the thirteen apprentices in group T, four used the digital modelling tool to complete their project. JD - 3D modelling and printing, NA - 2D modelling for the stained-glass structure, EG- 2.5D modelling for animation support.

1.3.3.6 - Analysis and summary - cluster N°8

- e-learning
  - waiting for an advanced version
- Apprentice studio and virtual blow-moulding workshop
  - interest in learning about work processes
  - different inputs expected for processes, step by step, from A to Z
  - waiting for precision in the simulation, VR manipulation or avatar.
- Community portal, interest in :
  - a reference site on their profession, open to other arts and crafts.
  - access to technical data, a "business bible
  - talk to expert professionals
  - multilingual access

Overall, a critical maturity and a good knowledge of digital tools.

The effective use of digital tools is a learning process in itself, but not necessarily a desirable one.

A pragmatic and mixed use of digital and traditional tools, if they are useful to them.

An attachment to the relationship with matter.

1.3.4 - Cluster N°9 - Analysis and results of the evaluation of Craeft digital tools.

1.3.4.1 - E-learning platform - results of project assessment documents

The analysis of the hot feedback documents and the satisfaction questionnaire for Cluster 9 reveals the same main themes as those identified for Cluster 7.

You can find the full coding in annex 3.

Topics and quotes:

1- Pedagogical and didactic effectiveness [PDE]

PDE-1 (Quality of learning material)

For example:

‘Good for TG revision’.

‘The course materials (text, video images) helped with understanding’.

PDE-2 (Educational progress)

For example:

‘The course gave you an understanding of glassblowing.

‘Discover the concepts of technical drawing’.

PDE-3 (Assessment of learning)

For example:

‘Quizzes: why a quiz on each part and not an overall quiz?’

‘The questions are always the same, it would be nice if they were given randomly’.

‘Quizzes + auto correction’ [is appreciated].

2- Ergonomics and accessibility [ERA]

ERA-1 (Navigation and interface):

For example:

‘Organisation not super clear if you don't know the site’.

‘The sign-up button to access the courses is a bit special’.

‘A bit hard to find your way around and know where to go at first’.

ERA-2 (Organisation of content):

For example:

‘It's very easy to find your way around the different courses’.

‘The sessions are well organised’.

‘Course structure and organisation of sessions (chapters)’

3- Exhaustiveness of content [EXC]

EXC-1 (Core content):

For example:

‘All the explanations are easy to understand and useful for progress’.

EXC-2 (Specific technical aspects):

For example:

‘Video of the oval layout too fast => difficult to understand’.

‘They could be more detailed, especially about how they work’ [description of the machines].

‘The names [of the tools and machines] are missing.

EXC-3 (Educational supplements):

For example:

'Add a general culture or art history section'.

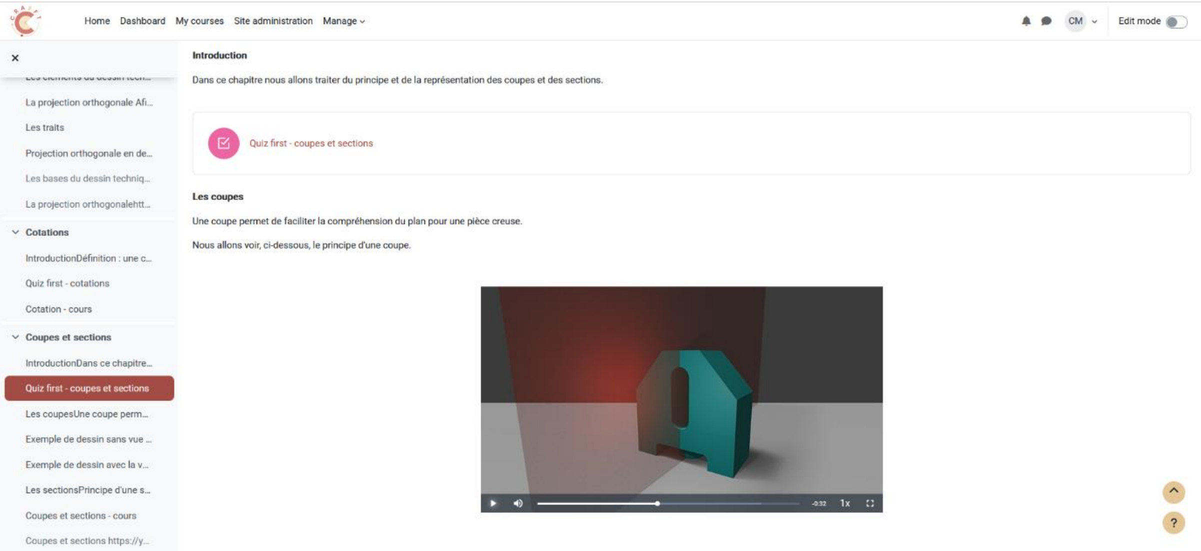


Figure 14 - learning platform, technical drawing course.

Statistical analysis:

We have decided to develop the statistical analysis in relation to Cluster 7. To assess the weight of each theme and identify whether their occurrence is a positive point, a point for improvement or a comment.

Code	Theme	Occurrences	Positive points	Points for improvement	Comments
PDE	Pedagogical and didactic effectiveness	21	17	2	2
PDE-1	Quality of learning materials	14	14		
PDE-2	Educational Progress	2	2		
PDE-3	Assessment of learning	5	1	2	2
ERA	Ergonomics and accessibility	16	11	5	
ERA-1	Navigation and interface	8	5	3	0
ERA-2	Organisation of content	8	6	2	0
EXC	Exhaustiveness of content	8	3	5	
EXC-1	Core content	3	3		
EXC-2	Specific technical aspects	2		2	
EXC-3	Educational Supplements	3		3	
LTP	Linking theory and practice	1	1		
LTP-1	Transfer of learning	1	1		

Code	Theme	Occurrences	Positive points	Points for improvement	Comments
Total		46			

Figure 15 - statistical analysis of e-learning themes, cluster 9.

From the table above, Figure 15, we can see that the theme of the quality of teaching materials carries a great deal of weight, with a high satisfaction rate. For the ergonomics and accessibility theme, we can see a fair satisfaction rate with an expectation of improvement. The core content was appreciated, but there was a demand for additional information on specific technical aspects or complementary modules such as art history or glass culture.

Overview of the self-assessment questionnaire on Craeft tools usage - e-learning.

E-learning platform

As a reminder, the self-assessment questionnaire on the use of the e-learning platform is a personal and subjective feedback and not a test of real mastery of the tool.

The questionnaire consists of closed questions, the answers to which are presented in the graphs below. The answers to the open-ended question are compiled in the 'Comments' box.

This questionnaire, which had already been submitted to the apprentices during Cluster 7, was presented to them again in order to measure changes in their perceptions.

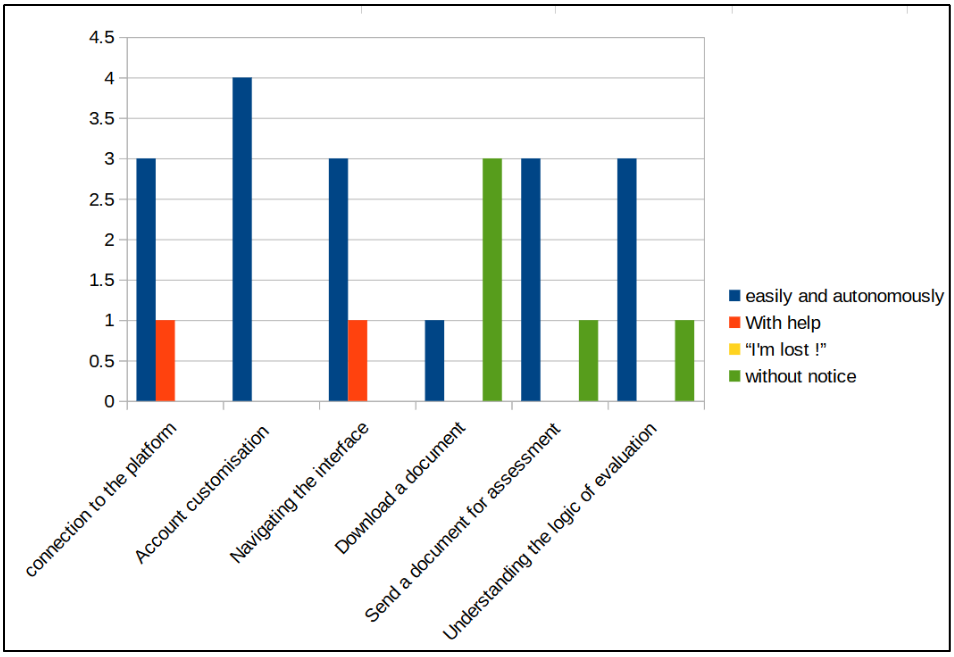


Figure 16 - e-learning self-assessment questionnaire graph, cluster N°9

Comments

Question	Comment
Connection to the platform	‘No problem’
Account customisation	‘Easy to use’
Navigating the interface	‘Everything is well detailed’
Download a document	
Send a document for assessment	‘The button is present at the end of each assessment, so it's simple’
Understanding the logic of evaluation	‘I think it's great that there are assessments for every subject.’

Figure 17 - e-learning self-assessment questionnaire comments, cluster N°9

Note :

1 - The question on the usefulness of the e-learning platform in the personal project was deleted as irrelevant, since it is a learning tool and not a creation or production tool.

2 - Due to the absence of one of the apprentices, the maximum scores are based on 4 and not 5 participants.

As summary we could observed a stability of usage perception on e-learning platform. Especially on 'connection on the platform' and 'navigation on the interface'. 'Account customisation' is progressed, and 'understanding of the logic of evaluation' is slightly lower due to the without notice answer. For download or sending document the without notice answer is understandable because is was not experimented a lot.

1.3.4.2 - VR glassblowing workshop simulator - results of project assessment documents

Summary and analysis of feedback and satisfaction questionnaires for VR glassblowing workshop simulator.

You can find the full coding in annex 3.

Figure 18 & 19 - VR glassblowing simulator experiment cluster N°9

Topics and quotes:

1- Pedagogical Engineering [PEN]

PEN-1 (Learning structure)

For example:

'Two scenarios, discovery, learning it is OK' [preference for] 'A more guided scenario with levels of difficulty'.

'Free access for those who already know and more guided access for beginners'.

PEN-2 (Pedagogical objectives)

For example:

'It's already taking shape.'

'It's a good way to get an idea of what you're getting into before your first workshop experience'.

[Do I find the application useful for learning and memorising gestures?] - 'To view them, yes, but not memorise them'

2- Technical Fidelity [FIT]

FIT-1 (Physical simulation)

For example:

'The glass shifts, it's funny, it doesn't stay in the centre.'

FIT-2 (Reproduction of movements)

For example:

'Be able to turn the cane with the left hand controller'.

'Having magnetism for hand position on the cane for picking'

'The movements are not easy to manage'

'Yes, nice to use. Quite a few bugs, especially when using the canes'.

[good] 'To visualise them, yes, but not to memorise them Real practice is better because you can feel them'.

FIT-3 (Technical accuracy)

For example:

'The big pipe standing there is weird'

'The irons on the 'decor' bench look completely smashed'.

'The lid of the seal should perhaps be removed => to improve the rendering of the texture of the water'

'In the texture, there are different types of cane in fact'

3- VR Ergonomics [EVR]

EVR-1 (User interface)

For example:

'User-friendly VR workshop simulation'

'The videos are not clear'

'Having a board with the tools on the wall, more than the floating panel'.

'Put indications and instructions'

'Information display should arrive by grabbing a coin rather than pointing at it'

EVR-2 (3D navigation)

For example:

'Being able to walk around the workshop'

'Teleportation, the right-hand joystick that turns the pipe and teleports'

EVR-3 (Functionality accessibility)

For example:

'I'd like to be able to grab and use tools with real interaction'

'We need to be able to use the tools'

'Grabbing the tools is a bit complicated'.

'Yes, fairly simple to grab the tools is a bit complicated [to use its] movements are not easy to manage'.

Statistical analysis:

Code	Theme	Occurrences	Positive points	Points for improvement	Comments
PEN	Pedagogical Engineering	20	12	7	1
PEN-1	Learning structure	5	1	4	
PEN-2	Pedagogical objectives	15	11	3	1
FIT	Technical Fidelity	25	3	18	4
FIT-1	Physical simulation	7	1	3	3
FIT-2	Reproduction of movements	8		8	
FIT-3	Technical accuracy	10	2	7	1
EVR	VR Ergonomics	24	7	15	2
EVR-1	User interface	21	7	13	1
EVR-2	3D navigation	1		1	
EVR-3	Functionality accessibility	2		1	1

Figure 20 - statistical analysis of VR studio themes, cluster 9.

In the above table, Figure 20- *statistical analysis of VR studio themes, cluster 9*, we can see that the weight of each theme, PEN, FIT and EVR is fairly similar. The pedagogical objectives seem globally appropriated for the apprentices, with some improvements expected on learning structure. The core expected improvement is on Technical Fidelity and VR Ergonomics.

Overview of the self-assessment questionnaire on Craeft tools usage - VR studio.

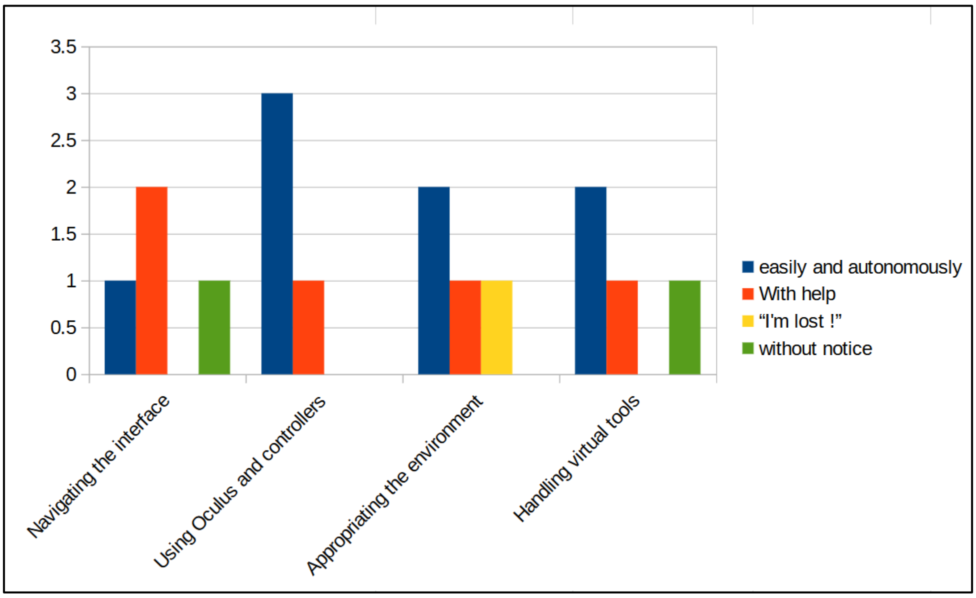


Figure 21 - VR Studio self-assessment questionnaire graph, cluster N°9

As a reminder, the self-assessment questionnaire on the use of the VR glassblowing workshop simulator is a personal and subjective feedback and not a test of real mastery of the tool.

As with the e-learning platform, this questionnaire, which had already been submitted to apprentices at Cluster 7, was presented to them again in order to measure changes in their perceptions.perceptions.

Comments	
Question	Comment
Appropriating the environment	'Not too intuitive'

Figure 22 - VR Studio self-assessment questionnaire comments, cluster N°9

Note :

1 - The question on the usefulness of the e-learning platform in the personal project was deleted as irrelevant, since it is a learning tool and not a creation or production tool.

2 - Due to the absence of one of the apprentices, the maximum scores are based on 4 and not 5 participants.

Overall, the scores for appropriation of the tools on VR studio are lower than for cluster 7. One possible interpretation is that, paradoxically, greater attention was paid to the functions and tools on offer, as they have evolved considerably, and that more detailed exploration reveals gaps in mastery of the virtual environment.

1.3.4.3 - Return of personal project follow-ups

During cluster N°9, sixteen project follow-up interviews were carried out, 5 for the TA group and 11 for the T group.

See annex 3 - Thematic analysis coding structure.

The more occurred thematics are:

thematics	**TA group occurrences**	**T group occurrences**
Mixed and pragmatic Use – [MXU]	2	5
Subcontracting the use of digital tools – [SCD]	2	2
Complexity of digital tools – [CDT]	2	2
Opportunities and limitation of digital tools – [OLD]	12	15

Figure 23 - table of the more occurred thematics for N9 cluster

Of the analysis of interviews done during the cluster N°8, four mains themes emerging:

- Learning how to use digital tools.
- A pragmatic, mixed approach depending on requirements.
- A choice based on the pleasure of making, the relationship with the material.

- Access for all, to a lesser extent.

For cluster no. 9, the theme of mixed and pragmatic use remains the dominant theme, but three others appear to be equally important:

- Subcontracting the use of digital tools.
- Complexity of digital tools
- Opportunities and limitations of digital tools, interaction between the choice of tool and the project.

A lot of apprentices use the FabLab facility at the time in their project, but haven't time or motivation to learn tools, as 3D modelling for example, and subcontract this part of the work. However, digital tools do not seem to have a profound influence on their projects, as learners are adept at choosing tools according to their needs, while being willing to make adjustments when dealing with the subject matter.

1.3.4.4 - Analysis and summary - cluster N°9

E-learning

The quality of the courses and materials is generally appreciated, particularly if the documents provide a plus compared to 'paper courses', video + questions, animated diagrams, platform/classroom interaction.

The strong expectation, rather than criticism, is that the site navigation should be optimised and that new content should be provided, including content that can evolve over time. For example, not always having the same quiz.

VR studio

The apprentices thoroughly tested the workshop simulation.

They were most interested in the workshop tour section, even though the precision of the tool pointing and the way the information is displayed still need to be improved.

As far as the know-how section, the picking, which provided a practical virtual exercise, was much appreciated.

Instinctively, apprentices who are already familiar with glass tend to want to interact with the other tools (bench, blocks, jacks, etc.) after they've picked the glass.

A process approach, detailing the steps involved in making a piece is welcomed but needs to be able to be experimented with in more detail. The question of the level of guidance in the scenario also needs to be refined.

Project follow-up

Project follow-ups is mainly carried out to assess the digital 'appetence' of apprentices, whether with Craeft or non-Craeft digital tools.

As was the case for group No. 8, this shows a pragmatic approach to digital tools usages, even if it means using them via subcontracting.

A strong attachment to the relationship with the material, which is neither a rejection nor a lack of knowledge of digital tools, but a professional life choice.

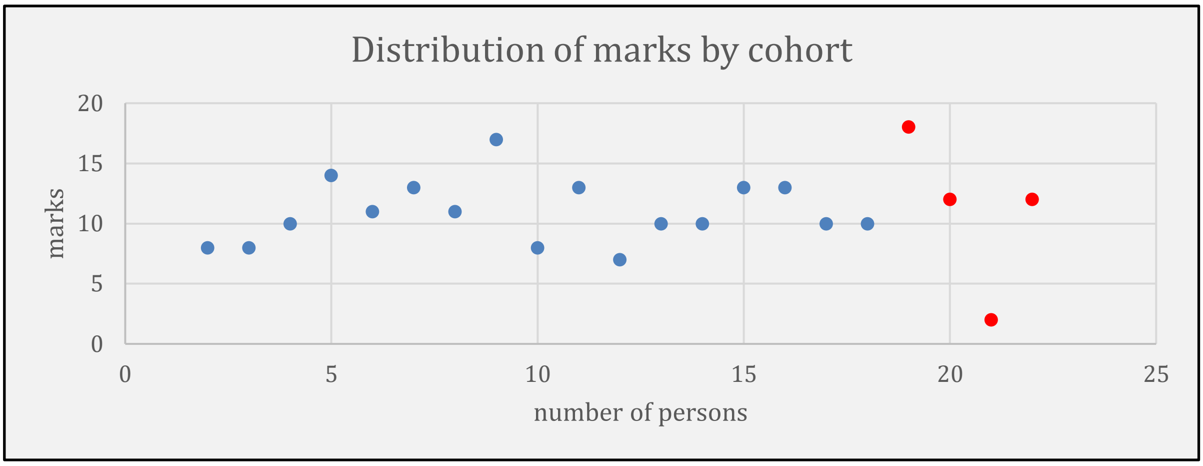
1.3.5 - Cluster No.10 - Analysis and results of the evaluation of Craeft digital tools.

The following sub-chapter covers the part of the glassblowing experience that took place between February, when the first version of the report was published, and June 2024, when the learning programme was completed with the CPC examination, which led to the award of a diploma. These results provide additional insights on the first phase of the Pilot 1 experiment.

1.3.5.1- Comparative results of formative assessment in cross-cutting matters

The following results, take in account the year mean of the students in cross-cutting mater, general technology, Health security environment and technical drawing. The goal is to compare results of the TA-test and T-control groups to identify the impact of the e-learning platform on knowledge acquisition.

General technology

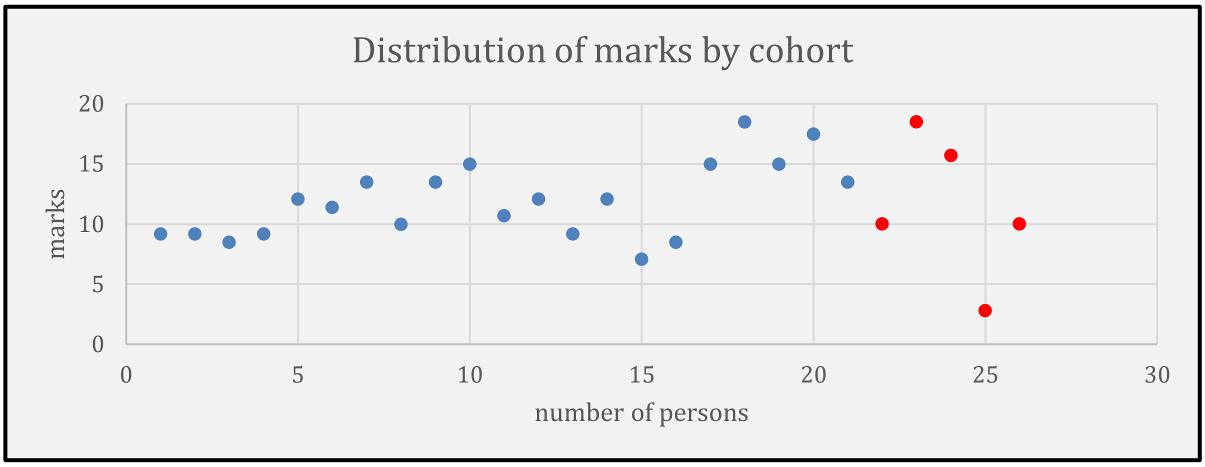


Legend: T group - TA group

Mean T group	10,94	Standard deviation T group	2,61
Mean TA group	11	Standard deviation TA group	6,63

Figure 24- TA and T Groups general technology assessment results graph

Health Security and Environment (HSE)

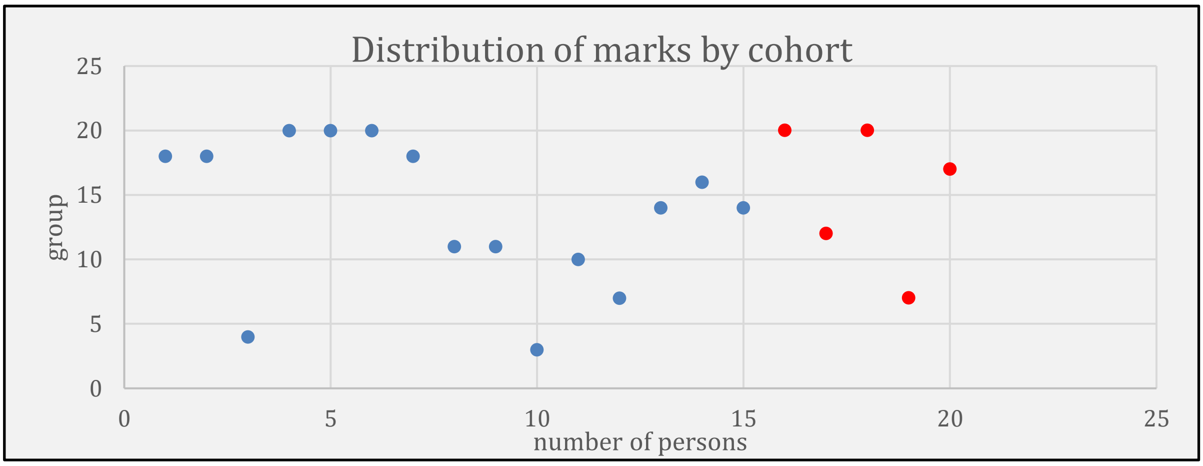


Legend: T group ??- TA group??

Mean T group	11,94		Standard deviation T group	3,10
Mean TA group	11,4		Standard deviation TA group	6,06

Figure 25 - TA and T Groups HSE assessment results graph

Technical drawing



Legend: T group ??- TA group??

Mean T group	13,60		Standard deviation T group	5,74
Mean TA group	15,2		Standard deviation TA group	5,63

Figure 26 - TA and T Groups Technical drawing assessment results graph

The comparison of the results shows a slightly better mean for TA group for general technology and technical drawing, and little beat minus for HSE. For the standard deviation it is almost the same between both groups for technical drawing. Bur for general technology and for HSE the deviation is twice higher for TA group at minimum. See **Error! Reference source not found.**.

General technology		Technical drawing		HSE	
Mean T cohort	10,94	Mean T cohort	13,60	Mean T cohort	11,94
Mean TA cohort	11	Mean TA cohort	15,2	Mean TA cohort	11,4
Standard deviation T cohort	2,61	Standard deviation T cohort	5,74	Standard deviation T cohort	3,10
Standard deviation TA cohort	6,63	Standard deviation TA cohort	5,63	Standard deviation TA cohort	6,06

Figure 27 – Mean and standard deviation for T and TA groups

Note: the low level of member on each group and the imbalance in number between T and TA group, give some indication of the digital tools impact but could not allow for definitive conclusion.

The interpretation of the results could be:

- Digital tools bring a little extra to learning theoretical subjects
- The large standard deviation in two out of three subjects leads us to believe that digital tools are a catalyst for both positive and negative trends depending educational aim, learner autonomy, comprehension, etc.

1.3.5.2- Return of personal project follow-ups

During cluster N°10, fifteen project follow-up interviews were carried out, 5 for the TA group and 10 for the T group.

As reminder, the aim of project follow-up is to record the tools used to develop the projects during the successive groupings. the aim is to measure the use and perception of digital tools for the T and TA groups, in addition to the Craeft tools.

The more occurred thematics are:

thematics	TA group occurrences	T group occurrences
Opportunities and limitation of digital tools – [OLD]	4	4
Collaboration with peers – [CWP]	5	3
Mixed and pragmatic Use – [MXU]	3	4
The relationship with the material - [RTM]	3	4
Subcontracting the use of digital tools – [SCD]	3	3
Learning how to use digital tools - [DTL]	3	3

Figure 28 - table of the more occurred thematics for N10 cluster

For group 10, the two dominant themes that emerge with an equal number of occurrences are the opportunities and limitations of digital tools and collaboration with peers. At the second level, mixed and pragmatic use and the relationship with the material are fundamental trends. Finally, outsourcing the use of digital tools and learning how to use them are two sides of the same coin, because when apprentices need to, they outsource when they don't know the tool or when they aren't motivated to learn it.

Conclusion of project follow-ups of first phase

The way in which apprentices integrate digital tools into their projects highlights a pragmatic and experimental approach. Choices are often guided by the needs of the project and the importance of working with different materials, 'finding solutions by hand'. Although digital tools offer additional possibilities, their complexity and cost can limit their use. Apprentices frequently collaborate with experts and peers to overcome these challenges. One may also question the apprentices' attitude towards digital technology. Digital tools do not seem to be considered by the generation represented by the apprentices as a particular issue and seem to be part of the horizon. For example, a quick statistical analysis shows that out of the 39.458 words in the personal project follow-ups of groups T and TA, the word ‘digital’ appears 47 times, ‘3D’ 17 times, “computer” 27 times and ‘laser cutting’ 7 times.

1.3.5.3- Analysis and summary - cluster N°10

The key points of the results of apprentice’s cluster N°10:

- A careful interpretation of the figures obtained by the analysis of apprentice's marks on the crosscutting matters, due to the low number of participants and unbalanced number of people between the test group and the control group.
- A noticeable impact to be confirmed, digital tools, with a tendency to enable better results. A positive catalyst effect for the most independent learners. An important point to note is to ensure that students who are less interested in digital tools, less motivated or experiencing difficulties are not left behind.
- A pragmatic and opportunistic approach of apprentices for digital tools. A potential difficulty to access or use digital tools, compensate by digital expert’s support. The preferential relation with matter which is a way to found solution in between making and thiking, a “thinking action” and the importance of collaboration with experts and peers.

1.3.6 - Cluster No.11 - personal project assessment

Apprentice cluster no. 11 focuses on the assessment of personal projects. The apprentices organise an exhibition and present their personal projects. A jury assesses the overall performance of each apprentice. This assessment is not taken into account in the final CPC results.

This grouping is presented in order to provide context for the apprentices' curriculum and is linked to the project follow-up interviews.

Figure 29 - Personal project apprentice presentation

The jury's assessments are not presented in the study, as they are primarily qualitative and the criteria focus on artistic quality, oral presentation, communication materials and the involvement of each apprentice. We do not take the results into account because their link with the use of digital tools is difficult to establish and would be inaccurate.

1.3.7- Cluster No.12 - Final results of CPC exam

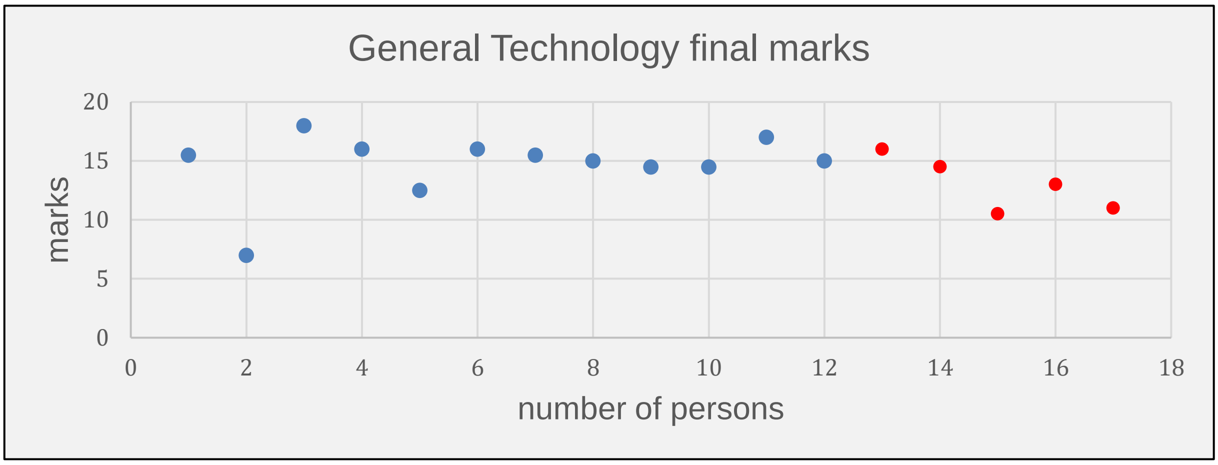
1.3.7.1- Comparative CPC exam results

As with the results of cluster analysis No.10, the aim of comparison of CPC exam results between the TA-test and T-control groups, is identified the impact of digital tools.

To carry out this analyse we've used four types of marks, the General technology, Prevention Health Environmental, Making and Final CPC marks. Other subjects such as art history or visual arts, for example, are not covered by the assessment of digital tools, so their results are not included in this analysis.

The results could be influenced by the absent people to the exam or exempted of a matter (a few of apprentices have already have a CPC diploma and only pass the specifics matter of the speciality)

General technology



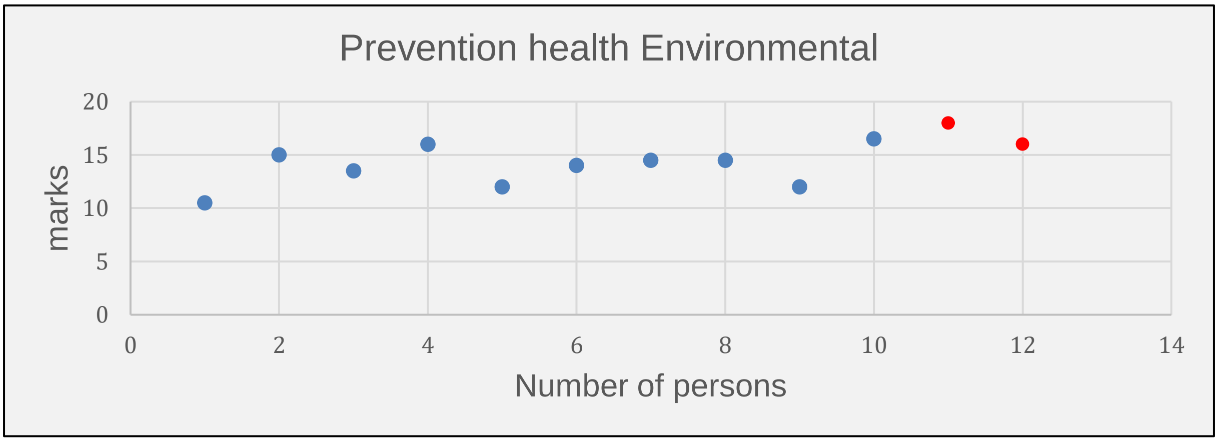
Legend: T group - TA group

Mean T group	14,71
Mean TA group	13,00
with those absent from the examination Mean of overall promotion	13,81
without those absent from the examination Mean of the promotion	14,36

Standard deviation T group	2,78
Standard deviation TA group	2,32
with those absent from the examination Standard deviation of the promotion	3,70
without those absent from the examination Standard deviation of the promotion	2,50

Figure 30 - TA and T groups general technology CPC results graph

Prevention Health Environmental



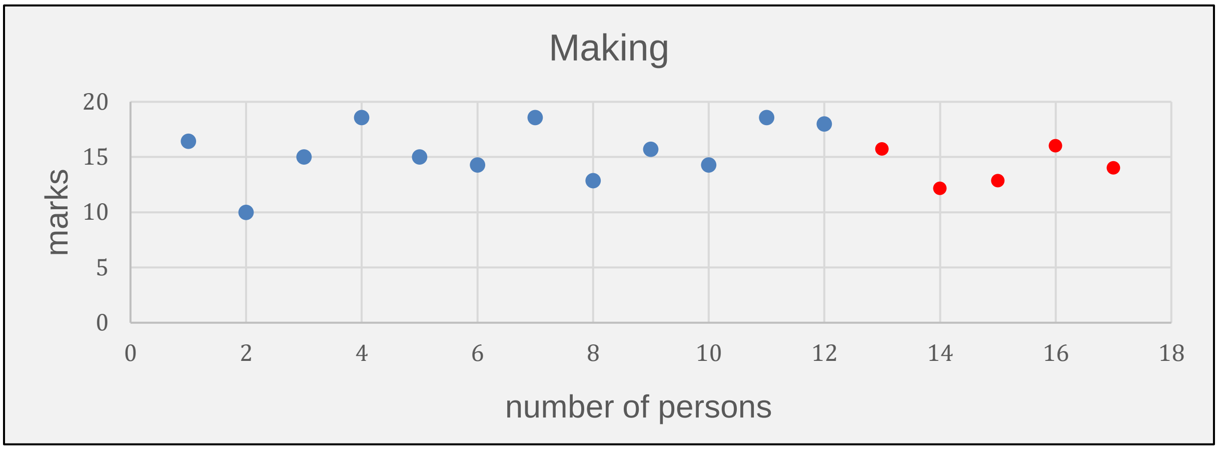
Legend: T group - TA group

Mean T group	13,85
Mean TA group	17,00
Figures established with those not exempt from this matter Mean of the promotion	14,50

Standard deviation T group	1,89
Standard deviation TA group	1,41
Standard deviation of the promotion	1,91

Figure 31 - TA and T groups prevetional health environmental CPC results graph

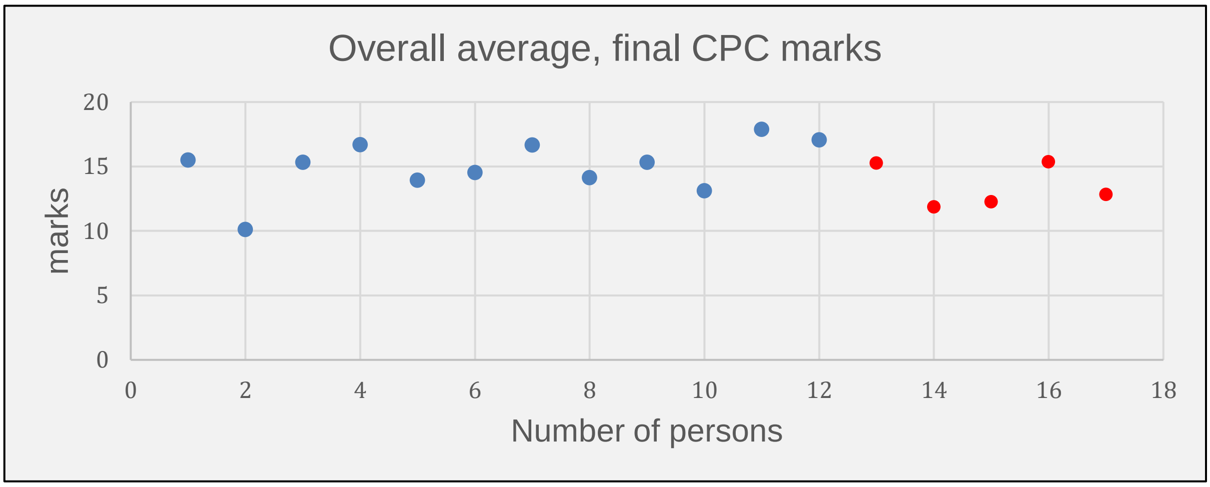
Making



Legend: T group - TA group

Figure 32 - results of groups T and TA in the CPC practical exam

Final CPC marks



Legend: T group - TA group

Mean T group	15,61	Standard deviation T group	2,63
Mean TA group	14,14	Standard deviation TA group	1,70
with those absent from the examination Mean of overall promotion	14,70	Standard deviation of the promotion	3,66
without those absent from the examination Mean of the promotion	15,29	Standard deviation of the promotion	2,15
Mean T group	15,02	Standard deviation T group	2,09

Mean TA group	13,51	Standard deviation TA group	1,68
with those absent from the examination Mean of overall promotion	14,24	Standard deviation of the promotion	3,38
without those absent from the examination Mean of the promotion	14,81	Standard deviation of the promotion	1,76

Figure 33 – Overall results of groups T and TA in the CPC exam

Conclusion

The results of the final CPC exam globally show a slightly better result of control group with more important standard deviation. These results are in opposite way of the cluster No10 ones.

What could be the meaning of this? Our interpretation is first the low number of participants do not allow a definitive conclusion. Second, the thin and fragile impact of digital tools during the first experiment, because we’ve built the usage scenario where the digital tools are an added layer not enough interweave with the situational and traditional tools. We've focused on assessment modality to produce a valid result, with perhaps too rigid work frames to avoid the bias.

Our aim for the final experiment is to strengthen usage scenario with more interweave usage of digital and traditional tools by defining clear and strong parts for each tool and redefined the modalities of tools and educational scenarios.

1.4 - Conclusion of glassblowing experiment.

Experimentation with the 1 education and training pilot for glassblowing has enabled Craeft's digital tools to be tested in learning situations.

It opens up promising pathway for the final version, notably by working on greater interaction and synergy between digital and situational learning. To be fully effective, digital tools must not be used in isolation, without any link to workshop learning.

This is what we're thinking about for the rest of the experiment, and the implementation of mixed educational methods using digital tools directly linked to the workshop experience.

Measuring the impact of digital tools, particularly in terms of successful completion of the apprenticeship and at CPC exam, will only be possible at the end of the current school year, i.e. in June 2025.

One positive point to note is that the adoption of digital tools by apprentice craftsmen is good, provided the tool brings them added value. The central issue is not the adoption of digital tools by craftsmen, but the relevance of digital tools, co-developed with them in their professional practice.

Finally, the apprentices' knowledge and use of digital tools is very mature, depending on the usefulness of the tool in question. There doesn't seem to be any technological fascination with the tool per se; the hammer and VR simulation are available in a toolbox, with reasoned use depending on the objectives.

It's worth noting that the apprentices all have a strong attachment to their relationship with the material and their physical involvement in the workshop. Digital tools are accepted as long as they are not seen as a displacement of this relationship with the material, but as a means of reinforcing the workshop experience.

2 - RCI 2 - Limoges Porcelain - Design Workshop

Figure 34 - Ghost Gestures Workshop, Ceramic Studio, ENSAD Limoges. Image: Inés Moreno

2.1 - Context:

The RCI Porcelain Limoges Design Workshop was developed in close collaboration with professional designers and teachers from the Limoges School of Fine Arts and Design (ENSAD Limoges) and took place from 5 to 8 November 2024. The workshop was conceived and coordinated by designers based on their shared interest in the gestural dimension of know-how as a tool for transmission and exploration in the field of design. Based on the concept of 'ghost gesture' inspired by motion capture, the designers asked to work with a series of digital tools that were specially produced by FORTH according to these requirements and interests. Focusing on a very specific sequence of the traditional porcelain production process, the plaster turning, a series of experimental models were developed to represent these gestures through different media: 3D avatar, hand tracking and skeleton-based view. The four-day workshop involved a group of first- and second-year students from the design and art sections and allowed them to explore this set of experimental digital tools. The workshop focused on the exploration of gestures and postures through the use of ceramic-related tools, integrating digital and physical methods. Starting with the observation of videos, participants analysed, reproduced and memorised gestures, which they then applied to materials such as clay and plaster. This hands-on experimentation was complemented by detailed analysis sessions of fabrication movements, which were put in dialogue with other everyday gestural repertoires in order to explore their different applications in creative processes. Collaborating designers Anne Xiradakis and Jessie Derogy tested some of these tools and developed recommendations for their improvement for wider application.

2.2 - Goal:

Starting from the overarching aim of testing digital tools within porcelain studio practice to gather feedback and recommendations from designers and design students, the workshop focused on three specific objectives:

- Visualizing gestural dimension of porcelain-based know-how:
By depicting porcelain-making techniques with a focus on gestures rather than on the representation of materials or tools, the emphasis was placed on understanding and improving the physical techniques involved in porcelain-making, ensuring that participants could visualise and accurately reproduce key gestures.

- Enhancing postural transmission for teaching:
The workshop explored methods to effectively convey posture and movement techniques, crucial for teaching and mastering porcelain production processes.

- Innovating porcelain design
Participants were encouraged to experiment and develop new approaches to porcelain design, using digital technologies as a means for fostering creativity and extend the boundaries of traditional practices.

2.3 - Methodology:

A crucial aspect of the methodological approach lies in being aware of the needs and interests of designers in their practice which requires actively listening to their challenges and opportunities, especially as their practice develops at the intersection of digital and traditional techniques. The aim is to co-imagine and co-create strategies and devices that enable them to make use of digital technologies to improve accuracy, efficiency and innovation, while remaining deeply connected to the material and cultural roots of the tradition of their crafts. This collaborative perspective gives a central place to the ideas, experiences and insights of designers, with the aim of developing tools that are meaningful and functional with respect to their creative, practical and technical needs.

2.4 - Timeline:

Phases of the workshop process:

1. Workshop preparation (May -June 2024)
    a. Conducted conversations with designers to understand their needs and interests, establishing a foundation for the workshop's focus.
2. Co-construction and development (July – November 2024)
    a. Collaborated with partners (FORTH) to develop an initial set of digital tools tailored to the designers’ requirements.
    b. Worked closely with designers to co-construct the workshop framework and pedagogical approach.
3. Workshop implementation (5-8 November 2024)
    a. Four-day workshop within the frame of the Ceramic Studio of ENSAD Limoges, experimenting with the designed tools and methodologies.
4. Evaluation (December 2024-January 2025)

   a. Assessed the outcomes of the workshop, analyzing participant feedback and the effectiveness of the implemented tools.
5. Future Development (From February – December 2025)
   a. Planning of potential extensions and improvements to expand the initiative further based on insights gained during evaluation and conversations with the designers.

2.5 - Results and Recommendations on the digital tools:

An evaluation was carried out after the practical phase of the workshop by means of a questionnaire which was distributed to the participating students. Of the nine students, only three have answered this questionnaire. The completed questionnaires correspond to the same working group that developed the pedagogical proposal focusing on the skeleton-based gestural representation of the practitioner. From the information collected through these questionnaires, the following results were obtained:

While the structured progression of the workshop provided clarity and focus, the extended time spent on analysis occasionally hindered the flow, with participants expressing a preference for more direct experimentation with materials. The use of digital tools, such as the 3D plaster wheel simulator, introduced innovative possibilities for visualizing and refining forms but revealed limitations in intuitiveness and immersion. Suggestions for improvement included enhancing the digital interface and incorporating tools like connected gloves to deepen the sensory experience. Despite these challenges, the workshop proved highly instructive. It allowed participants to develop new technical and analytical skills, particularly in gesture analysis and material manipulation, while fostering creativity through unconventional tools. The exploration of clay and plaster provided a rich platform for discovery, leaving participants eager to integrate these insights into future projects.

As a complement to this evaluation, a series of discussions were held with each of the three working groups to take stock of the approach and organisation of the workshop, the potentials and limitations of the proposed digital tools. In the context of these exchanges, some participants expressed the interest that the development of digital tools via a video documentation archiving platform could have in the context of their training at school. The students considered that this type of video platform could be an interesting didactic device, as it allows remote consultation, which could be a relevant complement to the presence of the teachers and technicians of the workshop.

2.6 - Conclusions:

RCI's Limoges Porcelain Design Workshop at ENSAD offered the opportunity to explore and refine the dialogue between traditional porcelain techniques and digital tools, focusing on gestures, with the aim of fostering creativity and enhancing the students' learning experience. The workshop successfully engaged participants in gesture analysis and material manipulation. The evaluation phase showed that some aspects of the design of the pedagogical device can be improved, e.g. by better adjusting the balance between analytical phases and practical experimentation to streamline the process and improve the overall fluency. In addition, optimising digital tools, such as improving interfaces and incorporating more immersive tools, would increase the effectiveness and sensory experience of the workshop. The workshop's emphasis on linking traditional practices with contemporary design highlighted its potential to evolve into a more experiential and personalised learning environment. The introduction of video documentation and archiving platforms for distance learning could further contribute to lifelong learning and provide more lasting pedagogical value. The workshop provided an in-depth exploration of gestures, materials and digital tools, offering participants an enriching learning opportunity and demonstrated the potential of digital tools to push the boundaries of porcelain-oriented design, blending heritage and innovation for future creative practices.

3 - RCI 4 - Marble carving & RCI 6 Silversmithing

3.1 - Plan for Marble carving and Silversmithing educational experiment

3.1.2 - Goal:

Informal training through the e-Learning platform

3.1.3 - Hypothesis:

Do the interactive videos offer more information than the traditional ones shown in the museum exhibition?

3.1.4 - Participants:

1 school class divided in two groups; one test group, one control group. Preferably from Junior High School (12+ age).

3.1.5 - Digital material:

Videos focusing on techniques that are presented in the museum in interactive format through the e-Learning platform.

3.1.6 - Timeline:

One experiment per RCI before January 2025. Two more experiments per RCI from March 2025 until January 2026.

3.1.7 - Methodology:

1. Preparation and Planning (October - November)
2. Experiment (November - December)
    a. Initial knowledge quiz to all students
    b. Standard museum tour for schools
    c. Separate class in two groups
    d. Give tablets with interactive video to test group + Satisfaction questionnaire, Quiz?
    e. Knowledge acquisition quiz to all students
    f. Group discussion
3. Analysis (December)
4. Report (December - January)

Complementary informations:

3.1.7.1- Quizzes

- Place techniques in order
- Match tools to techniques

Initial knowledge: Text

Knowledge acquisition: Image

3.1.7.2- Satisfaction questionnaires

- User Experience Questionnaire: standard, we can choose related aspects → quantitative
- Open-ended questions → qualitative

3.2 - Report on educational experiments (WP6.1) in Ioannina and Tinos, Greece

Author : Danae Kaplanidi

Date: January 2025

Partner : Piraeus Bank Group Cultural Foundation

1 - Introduction

This report covers the educational activities that PIOP conducted as part of Work Package 6, Pilot 1 – Education & Training. It consists of four sections containing information about the methodological plan developed with CERFAV's collaboration (pilot leader), the results of each RCI case, and a general reflection. Visual information accompanies the text through photographs taken during the experiments and figures showcasing quantitative results.

PIOP is a cultural institution and thus we decided to focus the educational experiment on informal learning through educational museum activities. Concerning digital aids developed by CRAEFT that could be employed for the experiment, we created interactive videos for the e-learning platform. We used videos or parts of videos that are shown in the museum exhibitions to create interactive videos with the free online software Lumi. The interactive videos included questions about the technique displayed in the video. Our main experiment hypothesis is to see if the interactive videos offer more information than those traditionally shown in the exhibitions.

It was agreed with CERFAV to target pupils from Junior High School. Technically, the interactive videos are available online on CRAEFT's e-learning platform. For the experiment, we used six tablets that were available by PIOP. Timely, so far, one experiment per RCI has been conducted, while two more per RCI will be planned from March to December 2025. A second version of this report is planned for January 2026.

2 - Methodology

According to CERFAV's educational methodological plan, a group of participants is separated in two to form a control and a test group. The test group receives the digital aid developed by CRAEFT, and the control group performs the educational program with the traditional means.

We developed quizzes to measure if supplementary knowledge was obtained through the digital aids or not. The quizzes aim to learn, first, about the initial knowledge of the participants on the represented techniques, and second, about their knowledge acquisition after the overall experiment. The content of the quizzes was inspired by educational material that PIOP's Museums Department prepared as part of their educational activities for children and families. The developed quizzes for the experiment follow the same logic and contain two parts. Part A indicates the processes of a technique and asks the participant to place them in order. Part B consists of a table indicating processes in one column and tools in the other. The participant is asked to match the tools with the appropriate processes. The difference between the quizzes is that the Initial Knowledge quiz is in a text format and the Knowledge Acquisition quiz uses visual information, that is, snapshots of the videos or pictures from the museum's archive. The score of the quizzes was defined as a total of 10 points, with each part rating five.

A satisfaction questionnaire was also used to evaluate the interactive video. We used the standardized survey and analysis tool of the User Experience Questionnaire (UEQ)[1] and completed it with two open-ended questions at the end, asking "What did you like most" and "What did you like less". We have previously used this approach in the Horizon project Mingei[2].

The experiment is divided into three phases. Phase one concerns the initial knowledge of the participants and the traditional educational plan of the museum. First, all the participants complete the Initial Knowledge quiz. After, a museum professional conducts a standard guided tour for schools. In phase two, the participants are separated into two groups. The control group is engaged by the museum professional. The test group receives the tablets and goes through the interactive video. When they finish, they complete the satisfaction questionnaire. In the last and third phase, the participants come together again, and all complete the Knowledge Acquisition quiz. A group discussion takes place at the end to receive feedback on the overall experience.

3. Silversmithing museum, Ioannina

3.1. Experiment and observations

The experiment took place on Friday 22 November 2024. The participants were 10 pupils (three girls and seven boys) accompanied by two professors. We welcomed them at the museum's outdoor café and offered them some cookies and coffee for the professors. We briefly introduced the project and

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[1] https://www.ueq-online.org/, accessed 29 November 2024.

[2] For more information, see *Deliverable 6.5 – Report on Mingei pilots*, released in 2022.

began by sharing the first quiz of the experiment to measure their initial knowledge. Some had trouble understanding the first part of the quiz where it is asked to write the numbers of the processes in the correct order because the numbers were already in order. Others also had questions about the meaning of some words in the quiz's Part B. The professors and I helped them clarify things.

After the quiz, a museum professional guided the group in the museum. Some more active pupils were constantly drawn by screens and QR codes. The videos drew everyone's attention. It was observed that, during the guided tour, they would watch the video from the part played when they arrived at the spot and not wait to watch it from the beginning. For instance, when the group was in front of the filigree technique, which was part of the quizzes, they did not spend much time because the video was finished. On the contrary, at the first exhibited technique, sand casting, the video was at its beginning. The group watched it and then spent more time looking at the tools.

Figure 35 - The participants at the area showcasing the sand casting technique.
© Danae Kaplanidi / PIOP

Before arriving at the area of the experiment, I had a preoccupation with who would volunteer to be part of the test group because there was a group of five boys, some of which were active. I worried that they would volunteer together and work might not be done. I consulted one of the professors and he agreed that it might be better to separate them, if possible. He proposed to ask the girls to participate and then randomly decide on three boys to have a gender balance. He took over the procedure and defined the test group.

The groups were separated into two areas of the museum. The control group was preoccupied with interactive games in the computer area. The test group watched the interactive videos on the tablets. Some pupils compared their scores during the experiment. After the video, they filled out the satisfaction survey. Almost all of them had trouble with the vocabulary and we had to explain some words. This also occurred in Chios when we conducted research with pupils of the same age for the Mingei project in 2019. Nevertheless, the survey cannot be changed because it is standardized.

Figure 36 - The control (left) and test (right) groups (silversmithing). © Danae Kaplanidi / PIOP

When the experiment finished, we invited the control group to join us and shared the Knowledge Acquisition quiz. When everyone finished, we discussed their experience. I asked the test group to describe to the control group what they did. Most were shy or described it minimally, i.e. "We watched a video and filled out a questionnaire". After the professors' encouragement, one spoke a bit more. Generally, they said they liked it and would recommend it to others. Furthermore, they were not tired by the quizzes and questionnaires.

3.2. Quizzes results

The number of each group's participants was uneven. The control group consisted of four people and the test group of six, which can be expected to show higher results. Analyzing the quizzes, overall, the pupils acquired more knowledge through this experience (Figure 37).

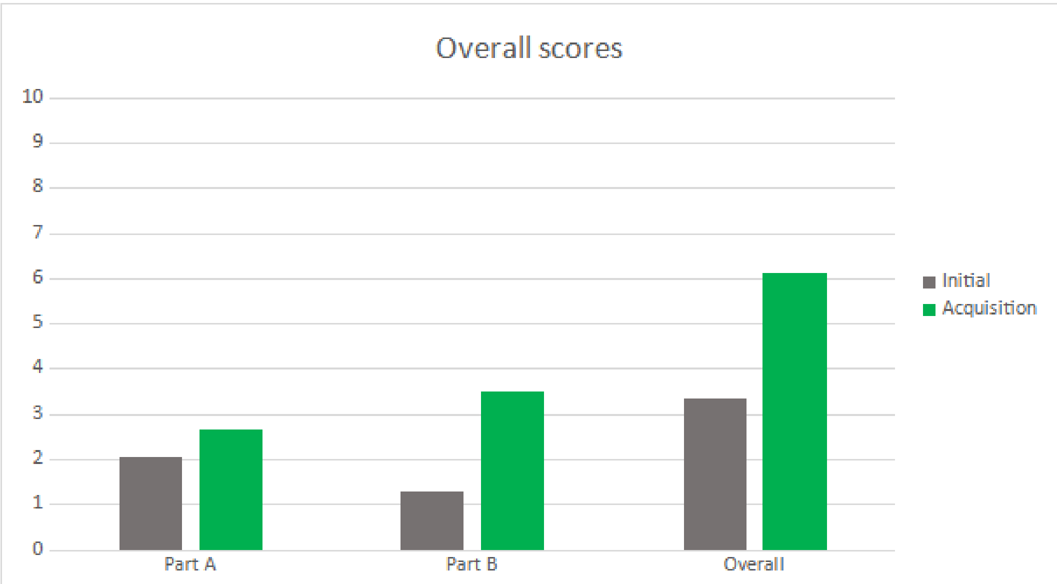


Figure 37 - Overall scores of the experiment (silversmithing)

Looking closer at the results of the Knowledge Acquisition quiz and comparing the performance of the control and test groups (Figure 38), it can be seen that the control group had better scores than the test group.

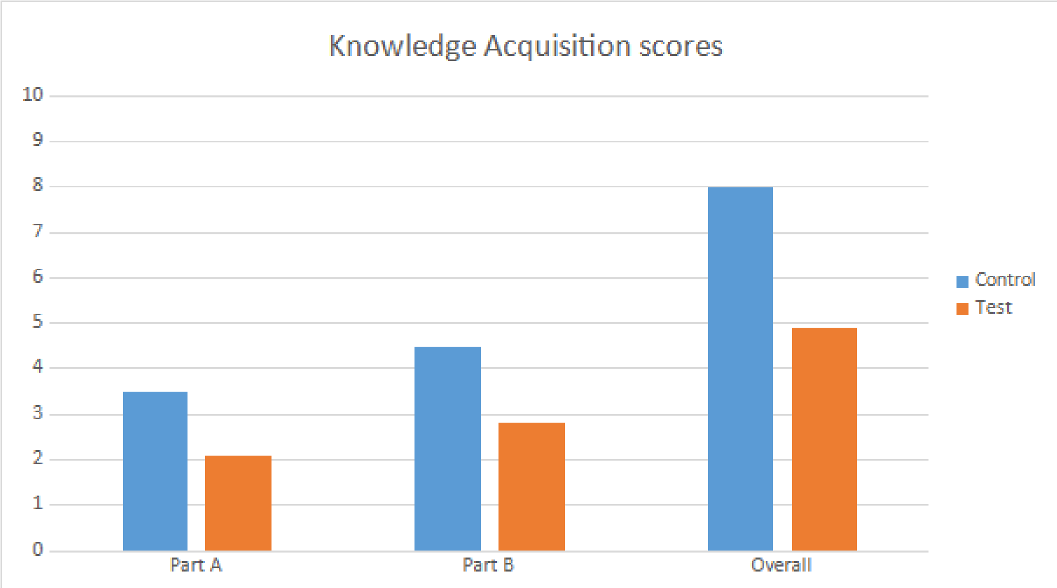


Figure 38 - Knowledge Acquisition scores of the experiment (silversmithing)

Figure 39 and Figure 40 make further comparisons between the Initial and Acquisition scores of the control and test groups, accordingly.

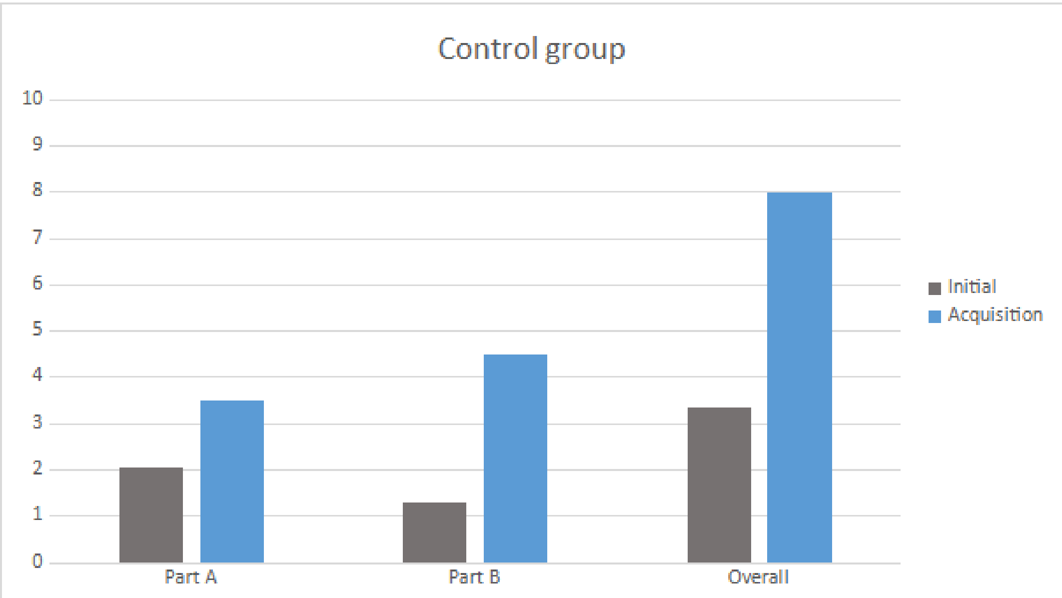


Figure 39 - Initial and Knowledge Acquisition scores of the control group (silversmithing)

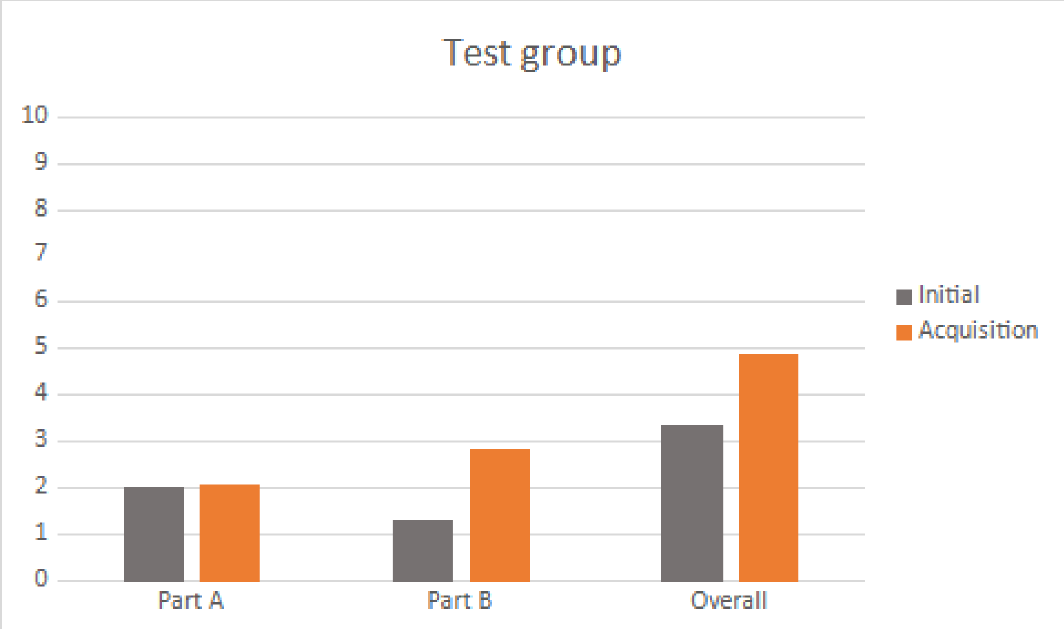


Figure 40 - Initial and Knowledge Acquisition scores of the test group (silversmithing)

In conclusion, it can be said that, for now, it is difficult to interpret the data because (a) the selection of participants for the test group can be considered biased since there was an informed way of thinking and selecting the pupils, and (b) the number of participants, and thus of data, is very low.

3.3. Satisfaction questionnaire results

It should be noted that there was a participant in the test group who gave suspicious answers, that is, she or he answered randomly or copied. This was included in the results because the number of participants was low. It is noted here for future reference.

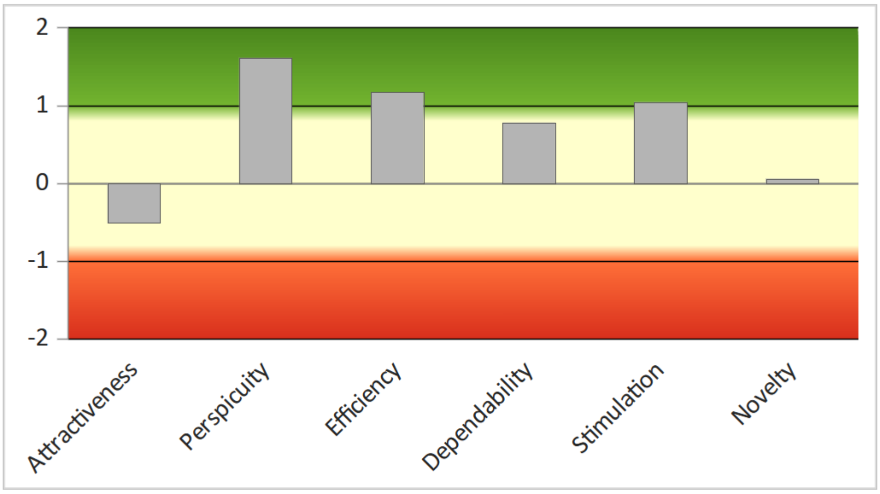


Figure 41 - UEQ results (silversmithing)

Figure 41 shows an overall assessment of the questions regarding attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty. Attractiveness, novelty, and dependability represent a neutral position. Perspicuity, efficiency, and stimulation represent a positive position. In other words, the participants found that the interactive video was easy to understand and practical to conduct, and offered them more information.

Figure 42 groups the above-mentioned scales into pragmatic (Perspicuity, Efficiency, Dependability) and hedonic (Stimulation, Novelty) quality. Pragmatic quality refers to task-related aspects and hedonic to non-task-related aspects.

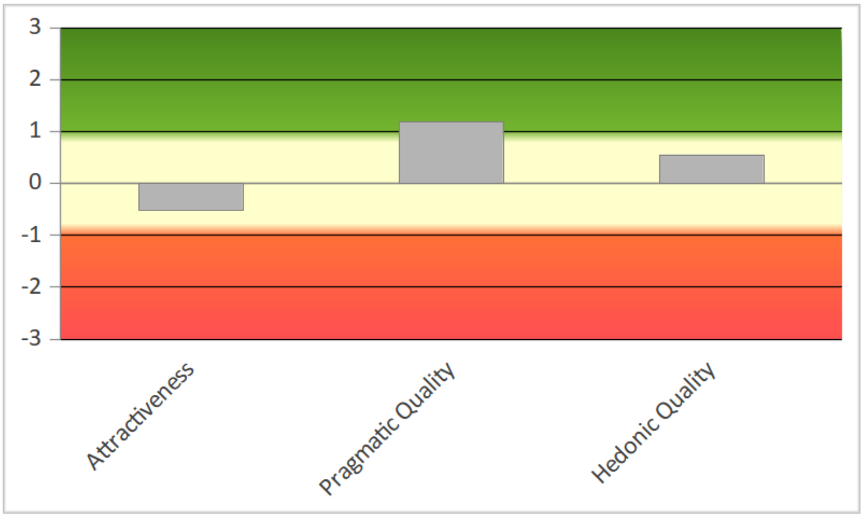


Figure 42 - UEQ results grouping (silversmithing)

In the qualitative questions, the participants seem to have greatly enjoyed how the silver rod is created. Nobody reported any negative issues with the video. In conclusion, it can be said that the educational interactive video was easy, practical, and informative but the way the information was offered did not present something that the participants had not seen or experienced before. As mentioned in the previous section, at the moment, this can only be a quick interpretation because of the low number of data.

4. Museum of marble crafts, Tinos

4.1. Experiment and observations

The experiment took place on Wednesday 18 December 2024. The participants were 18 pupils (eight girls and 10 boys) accompanied by two professors. We welcomed them at the multi-purpose hall of the museum to briefly introduce the project. Afterward, we shared the first quiz of the experiment to measure their initial knowledge. Some had trouble understanding the first part of the quiz where it is asked to write the numbers of the processes in the correct order because the numbers were already in order. We helped them clarify things.

After the quiz, a museum professional guided the group in the museum. It was observed that they spent more time in the first stop related to the quarry techniques. Generally, the pupils did not pay attention to the videos of the museum exhibition because the museum professional drew their attention through an animated tour. In the end, we asked for volunteers for the second part of the experiment with the tablets. A test group of seven pupils (two girls and five boys) was formed. PIOP's CRAEFT team and the test group returned to the multi-purpose hall. The rest of the pupils stayed at the museum premises with the museum professional.

During the experiment, it was observed that the participants were talking a lot to each other while watching the video and answering the questions. After the video, they filled out the satisfaction survey. As in the case of Ioannina, some had trouble with the vocabulary and we had to explain some words. Due to hunger and the rush of the students to leave, we did not perform a group discussion.

Figure 43 - Participants of the test group (marble carving). © PIOP

4.2. Quizzes results

The number of each group's participants was uneven. The control group was comprised of 11 people, and the test group of seven. It can be expected that the control group provides higher results because of the participants' number.

Analyzing the quizzes, overall, the pupils seem to have acquired more knowledge regarding the tools used in each technique, which was the topic of the quiz's Part B. Part A shows a difference of more than one point between the initial and knowledge acquisition quizzes. Nevertheless, both are below average.

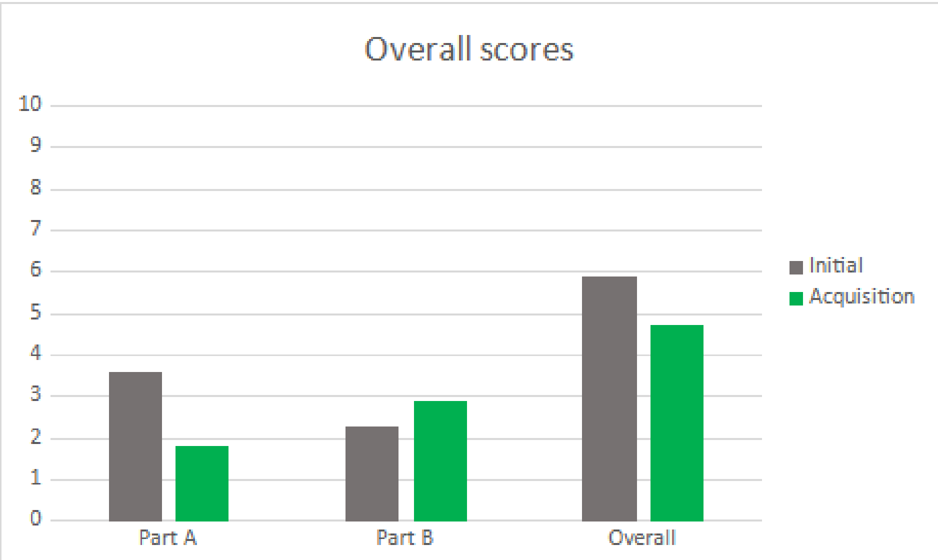


Figure 44 illustrates the overall scores in detail.

Figure 44 - Overall scores of the experiment (marble carving)

Figure 45 - Knowledge Acquisition scores of the experiment (marble carving)

Looking closer at the results of the Knowledge Acquisition quiz and comparing the performance of the control and test groups (Figure 45), it can be seen that, overall, both groups had similar scores.

Figure 46 and Figure 47 make further comparisons between the Initial and Acquisition scores of the control and test groups, accordingly.

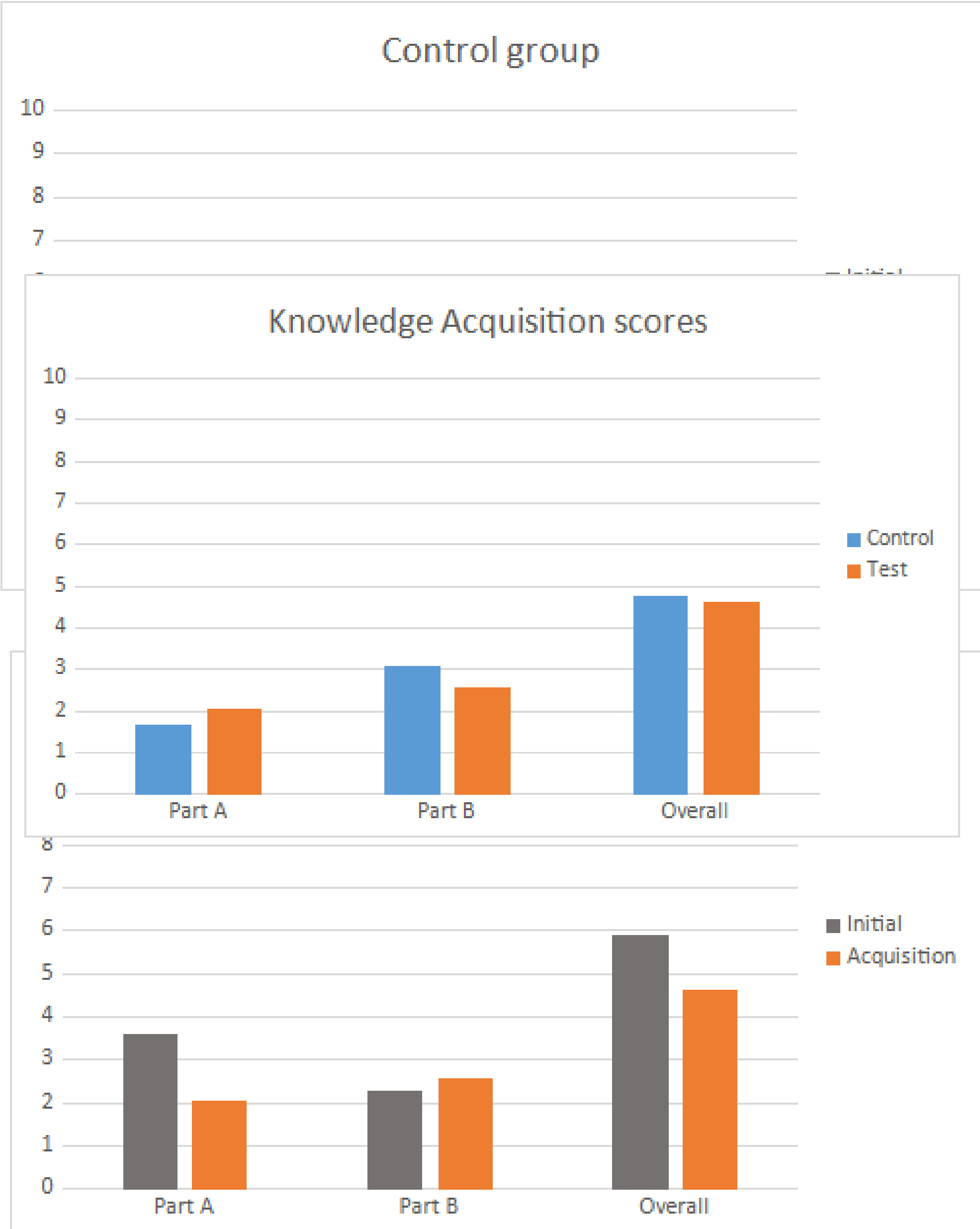


Figure 46 - Initial and Knowledge Acquisition scores of the control group (marble carving)

Figure 47 - Initial and Knowledge Acquisition scores of the test group (marble carving)

In conclusion, it can be noted for future investigation the increase of understanding which tools are used in each process step, and the general higher ranking of initial knowledge. For now, it is difficult to interpret the data more sufficiently because the number of participants, and thus of data, is low.

4.3. Satisfaction questionnaires results

Figure 48 shows an overall assessment of the questions regarding attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty. Attractiveness, novelty, and stimulation represent a neutral position. Perspicuity, efficiency, and dependability represent a positive position. In other words, the participants found that the interactive video was easy to understand, practical to conduct, and met their expectations.

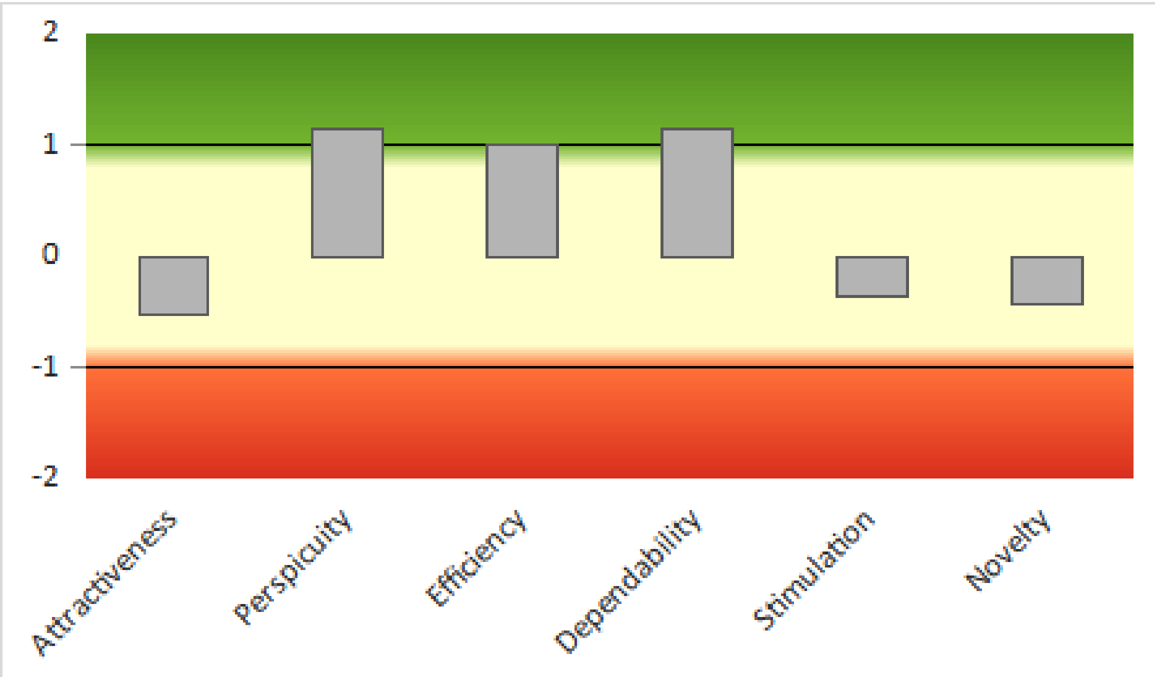


Figure 48 - UEQ results (marble carving)

Figure 49 groups the above-mentioned scales into pragmatic (Perspicuity, Efficiency, Dependability) and hedonic (Stimulation, Novelty) quality. Pragmatic quality refers to task-related aspects and hedonic to non-task-related aspects.

In the qualitative questions, the participants mentioned that they enjoyed the video because it was something they do not use often. They remarked on the craftsman and how he used the tools. Some of them found the sound pleasing but others were annoyed by it. A participant noted that the video was confusing while another wrote it had a short duration.

In conclusion, it can be said that the educational interactive video was easy to use and practical but the way the information was offered did not present something that the participants had not seen or experienced before. As mentioned in the previous section, at this moment, this can only be a quick interpretation because of the low number of data.

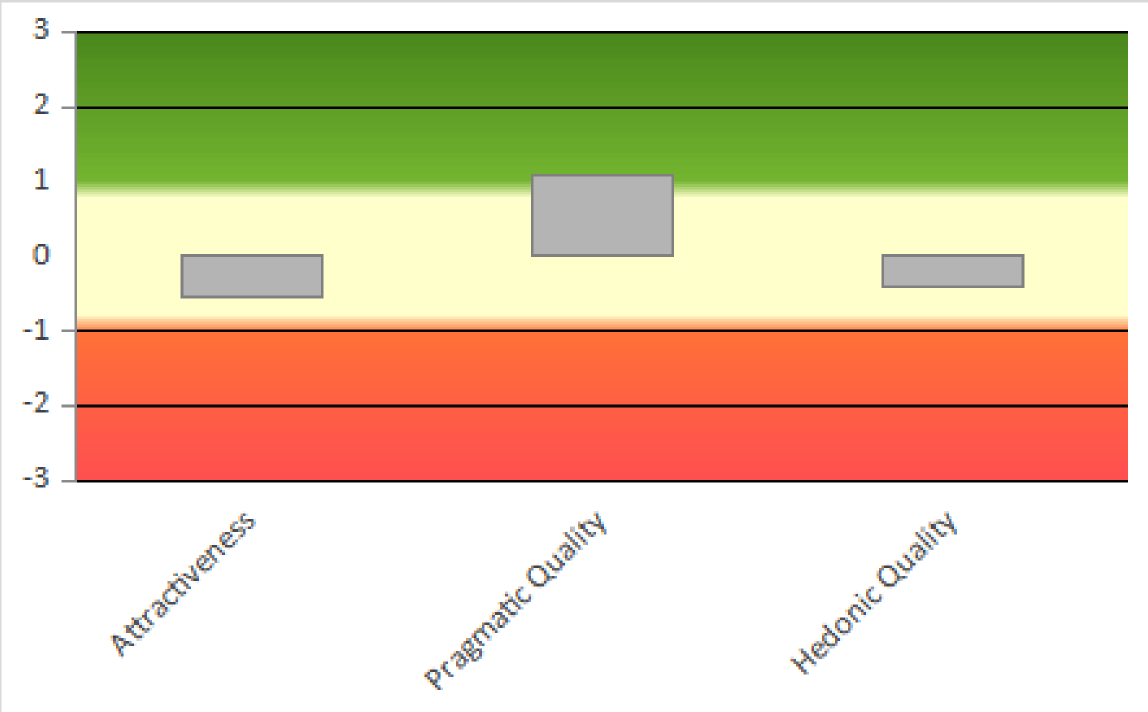


Figure 49 - UEQ results grouping (marble carving)

5. General reflection

Reflecting on the overall methodological plan, in Ioannina everything went according to the plan and was not tiring for any of the participants (organizers, museum professionals, professors, and pupils). In Tinos, the participants got tired, and we had to skip the last group discussion. It can be suggested that offering a treat before the experiment would keep the participants more active. Regarding the first results of the experiments, no general conclusions can be made because of the low number of data. Nevertheless, several concerns arose that will be further addressed with CERFAV before the next experiments. Below is a list of them:

1. Participants' age and quiz content: Are the pupils too young to understand or focus on specific techniques, or is the content of the quizzes too specialized to be able to answer?
2. Quiz design: Reformulate the Parts.
3. Quizzes formats: Do the differences between initial and knowledge acquisition quizzes occur because of the difference in format, i.e. text and visuals? Can it be that visuals used in marble carving are more confusing because the processes look alike?
4. Group's number of participants: Would it be better to try having an even number of participants in the control and test groups to avoid results discrepancies due to this fact?

5. Guided tours by museum professionals: It was observed that each has their style and decides to include or exclude visual aspects of the exhibition during the guided tours. This might be due to three facts. First, the architecture of the museum areas is different. While in Ioannina the exhibition follows a specific trail, in Tinos, the area is wider. For example, the areas dedicated to techniques are large spaces, including tools, materials, and a video on the back wall (see Figure V.1. The area is restricted to visitors while there are chairs far in front of the video to sit and watch.

Figure 50 - Marble craftsmanship museum area. © PIOP archive

During the Tinos experiment, the museum professional gave a more animated tour explaining how the tools work. He grasped the pupils' attention but did not use the videos. In Ioannina, the videos are displayed near the visitor and were used as an aid during the experiment's guided tour. It should be reminded that the guided tour is the one normally performed by museum professionals for schools and was not altered for the needs of the experiment. This reflection aims to point out the role visual aids play in the museum exhibition, and in our experiment's case, how and if they play a role in acquiring more information about techniques.

Notes :

1 https://www.ueq-online.org/, accessed 29 November 2024.

2 For more information, see Deliverable 6.5 – Report on Mingei pilots, released in 2022.

4 - RCI 5 - Woodcarving

Plan for woodcarving

4.2- Goal:

Launch an e-Learning platform as supportive material for in-person trainings

4.3- Hypothesis:

How interactive videos and digital training resources facilitate knowledge acquisition and future practice after in-person training

4.4- Participants:

professionals from companies, VET trainers on woodworking with low skills and knowledge on woodcarving.

4.5- Digital material:

Videos and explanations focusing on initial techniques of woodcarving in interactive format through the e-Learning platform.

4.6- Timeline

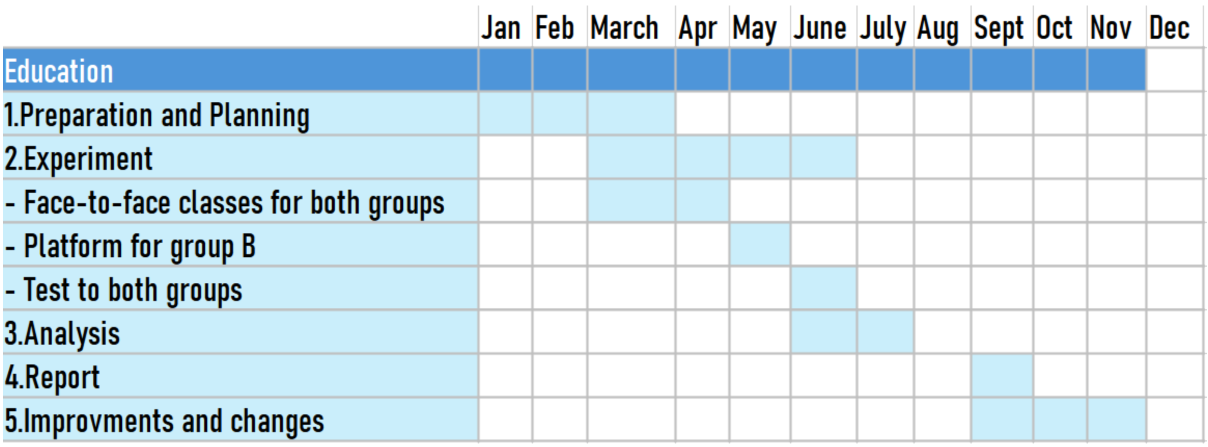


Figure 51 - woodcarving timeline experiment

4.7 - Methodology

1. Preparation and Planning (November – February) – 2024 / 2025
2. Experiment (March-May) - 2025

    a. Initial knowledge quiz to all participants

    b. In-person practical classes in one/two days to introduce them in woodcarving practices
    c. Separate participants in two groups
        i. Group A. E-learning platform. This group will have access to the e-learning platform with all available resources for one month.
        ii. Group B. This group will only participate in the in-person training.
    d. After one month from in-person practical classes:
        i. Knowledge acquisition quiz to all students
        ii. Questionnaire to group A to evaluate the e-learning platform as a supportive training tool.
3. Analysis (June) - 2025
4. Report (June – July) – 2025

4.7.1- Questionnaires & Quizzes

- Initial knowledge: Text (for all on e-learning platform or traditional way with paper ?)
- Knowledge acquisition: Image, text, and quiz: place techniques in order
- Questionnaire to group A: user experience and satisfaction questionnaire quantitative and qualitative
- Knowledge acquisition quiz to all students (for all on e-learning platform or traditional way with paper ?)

4.7.2- Index of training materials in the e-learning platform

1. 1. Contextual information
    a. Introduction to woodcarving
    b. Woodcarving in Yecla
2. Woodcarving. Workshop, tools and materials
    a. The workshop. Tools and equipments
        i. Electrical tools
        ii. Manual tools
        iii. Bench tools
    b. Woods using in woodcarving
3. Workshop considerations
    a. Tools sharpening
    b. Safety considerations
4. Woodcarving. Process and handling tools
    a. Design and drawing
    b. Roughing
    c. Finishing
5. Exercises
    a. Exercise 1.
    b. Exercise 2.
    c. Exercise 3.
    d. Exercise 4

5 - RCI 7 - E-learning Platform Development for Aubusson Tapestry

5.1- Context

Aubusson tapestry training relies on in-person, workshop-based apprenticeship, where aspiring weavers learn directly from master artisans. While this approach ensures the authenticity and precision of the craft, it also limits who can access these specialized skills—only a few students at a time can benefit from expert guidance.

By developing an e-learning platform specifically tailored to Aubusson tapestry, we respond to these challenges. Structuring the training content allows enthusiastic learners, whether hobbyists or seasoned designers, to explore and master the craft. At the same time, interactive modules, detailed visuals, and bilingual glossaries capture the intricate, gesture-based know-how that characterizes Aubusson weaving. This approach complements traditional apprenticeship by providing a flexible, scalable learning environment where learners of different skill levels, schedules, and backgrounds can engage with the tapestry tradition.

5.2- Goal

The primary objective is to design, develop, and implement a dynamic e-learning platform that achieves the following:

1. **Preserves Heritage**
   Digitally document and archive traditional Aubusson tapestry techniques, terminology, and historical context, safeguarding knowledge for future generations.
2. **Expands Accessibility**
   Provide high-quality training modules that can be accessed globally, overcoming regional constraints and enabling remote learning.

5.3- Timeline

- Phase 1: Needs Analysis & Content Collection
    - Conduct interviews with trainers.
    - Gather existing class documentation, including written materials of weaving demonstrations.
- Phase 2: Platform Design & Module Creation
    - Translate and adapt the apprentice’s tapestry documentation into e-learning content

5.4- Methodology

- **Collaborative Content Development**
  A tapestry apprentice’s documentation forms the foundation of the course, supplemented by expert input from master weavers and historical records. All content is carefully

translated, with specialized French terms retained where appropriate and explained via a bilingual glossary.

- **Modular Curriculum Design**

  The curriculum is divided into cohesive modules—covering historical context, theoretical concepts, loom setup, practical techniques, and advanced weaving methods—allowing learners to either progress linearly or select specific topics on-demand.

- **Multimedia Integration**
  Photographs, diagrams and infographics enrich the learning experience.

5.5- Results

1. **Enhanced Preservation**
   By digitizing and organizing centuries-old weaving knowledge, the Tapestry e-learning guarantees that the Aubusson tapestry tradition remains accessible to future generations, even if local transmission decreases.
2. **Global Reach**
   Learners from different regions and backgrounds can now explore Aubusson tapestry, leading to new collaborations, cross-disciplinary projects, and cultural exchanges.

5.6- Description of the e-learning Platform for Aubusson Tapestry Training

We have made significant progress in translating and enhancing training materials for the Aubusson tapestry craft. These efforts ensure that the extensive know-how and cultural heritage tied to Aubusson tapestry-making can be transmitted globally, supporting both preservation and innovation. By transforming the apprentice's in-depth documentation into comprehensive, interactive modules, we aim to deliver a robust e-learning experience for learners of all backgrounds.

5.6.1- A Holistic Approach to Tapestry Training

1. Theoretical Foundations

Historical and Cultural Context

The documentation provides a detailed historical overview of Aubusson tapestry as an Intangible Cultural Heritage. It situates the evolution of the craft within its broader cultural and economic contexts, illustrating how tapestry-making has adapted to changing artistic styles and market demands.

Technical Concepts

Core theoretical modules introduce learners to low-warp tapestry, highlighting why Aubusson developed this specific weaving style and how it differs from other traditions (e.g., haute-lisse). By understanding the structural specificities of low-warp looms, learners gain a framework for the subsequent practical lessons.

2. Practical Techniques

Preparation Steps

The apprentice's documentation lays out every stage preceding the actual weaving process, including:

- Ourdissage (Warp Preparation): Setting precise tensions and counts.
- Heddles Setup: Ensuring the correct passage of warp threads to facilitate efficient weaving.
- Carton (Design Template) Setup: Positioning the design against the warp for accurate translation into the tapestry.

Weaving Techniques

Detailed explanations cover a variety of stitches and methods:

- Perfilage: Creating outlines for motifs.
- Liure: Binding the weft for uniform tapestry surfaces.
- Circle, Curve, and Oblique Weaving: Techniques characteristic of Aubusson workshops that allow complex shapes, gradients, and contours to be realized in woven form.

5.6.2- Translation Strategy and Glossary Development

1. Overcoming Linguistic Nuances

Many of the French technical terms used in Aubusson tapestry-making do not have direct English equivalents, reflecting the specialized nature of this centuries-old craft. In order to preserve the authenticity and precision of these terms, certain words—such as "liure" (a binding technique) and "ourdissage" (the preparation of warp threads)—are intentionally kept in French. This strategy helps maintain the nuances and cultural context associated with these techniques, which might otherwise be lost in an approximate translation.

To ensure users can fully grasp the meaning of these terms, a bilingual glossary has been integrated into the e-learning platform. Learners can hover over or click on the French words to access concise but informative definitions, along with brief explanations of how these techniques fit into the broader tapestry-making process. By combining retention of key French terminology with immediate, user-friendly guidance, the platform manages to bridge the language gap while honoring the cultural and technical richness of the Aubusson tradition.

2. Visual Reinforcement

In the initial documentation, many of the images were in black and white, focusing on specific stages of tapestry weaving without fully conveying the subtle complexity of each step. To address this, we transformed these photographs into labeled diagrams that highlight key components of the loom, as well as the precise gestures involved in the weaving process. Where possible, color illustrations and step-by-step infographics were incorporated to further enhance clarity, giving learners a more immediate and intuitive grasp of the workflow. This combination of labeled diagrams and vibrant visuals caters to different learning styles, ensuring that novices and seasoned practitioners alike can follow each phase of tapestry-making with confidence.

In addition to improving readability, efforts are underway to make these materials fully interactive. Future iterations of the e-learning platform plan to use clickable hotspots within diagrams, enabling learners to zoom in on critical loom parts or to focus on intricate techniques—such as circle weaving or liure—without losing sight of the overall process. By hovering over a particular area or selecting a highlighted detail, users would see close-up images or concise tooltips describing the function, purpose, or specific handling of each element. This approach brings the craft to life, allowing learners to explore the tapestry-making process in a self-directed manner and at a level of detail that suits their individual needs.

5.6.3- E-learning Platform Integration

1. Modular Course Design

All materials—from theoretical essays to practical step-by-step guides—are structured into thematic modules. This approach allows learners to:

Follow a Linear Progression: The e-learning platform is designed to guide learners through a carefully structured path that begins with foundational theory and culminates in advanced weaving techniques. By moving step-by-step—first examining the historical and cultural context of Aubusson tapestry, then exploring loom construction and setup, and eventually mastering the intricacies of weaving itself—users can build a coherent understanding of the craft. This sequential approach ensures that each topic serves as a building block for the next: once learners understand the framework of low-warp tapestry and the rationale behind its unique setup, they can more confidently move on to the practical steps of preparing the warp and harnessing key weaving methods. Finally, advanced techniques such as circle weaving or liure come into sharper focus, as learners have already internalized the theoretical and technical principles that underpin those specialized skills. By the end of this linear progression, participants not only gain proficiency in specific tapestry-making procedures, but also develop a holistic appreciation for the tradition and craftsmanship at the heart of Aubusson's textile heritage.

Select Topics On-Demand: While the platform follows a logical progression for beginners, it also accommodates experienced artisans and designers seeking targeted expertise. Rather than moving sequentially from theory to practice, seasoned professionals can jump directly to specialized modules aligned with their specific goals—whether that means refining techniques like circle weaving or learning about particular dyeing methods. Each module is designed to function as a standalone resource, complete with detailed explanations and visuals. This on-demand approach saves time for advanced users, allowing them to access precisely the insights they need and apply them immediately to ongoing projects. In this way, the platform serves not only as a comprehensive learning tool for newcomers, but also as an adaptable reference library that supports continued mastery and innovation among those already well versed in the tapestry arts.

5.7- Conclusion

By adapting and expanding the tapestry apprentice's documentation into a dynamic e-learning curriculum, we not only preserve and protect the future of Aubusson tapestry-making, but also create a powerful educational tool fully aligned with the work package's mandate to modernize and disseminate craft knowledge. This initiative bolsters WP6.1's overarching objective of developing accessible, high-quality training materials that integrate traditional crafts with contemporary digital practices, ensuring both cultural continuity and innovation in the field.

By meticulously translating specialized French terminology, transforming original visuals into interactive diagrams, and structuring content into modular learning pathways, the project meets WP6.1's criteria for effective, learner-centric design. The Tapestry e-learning platform offers a dual advantage: beginners can follow a step-by-step progression to gain foundational skills, while advanced artisans can access on-demand modules that address highly specific creative or technical challenges. This versatility supports a broad spectrum of learners—ranging from students seeking an introduction to tapestry arts, to established designers exploring new techniques for their work.

By showcasing Aubusson tapestry-making in a format adaptable to diverse user needs and skill levels, the project cultivates an international community of practice, enhances professional development opportunities, and seeds future collaborations across art, design, and technology.

6 - Conclusion of pilot 1 and next steps

6.1- Global Summary

The integration of digital tools into the learning of traditional craftship is viewed positively, and offers many opportunities to enrich the learning experience. However, it is essential to continue improving and adapting these tools to meet learners' needs and expectations, while maintaining a balance with traditional methods. The creation of learning communities and the promotion of international collaboration are also key elements in ensuring the preservation and modernization of traditional know-how.

Acceptance and Perception of Digital Tools

- General acceptance: Digital tools such as e-learning platforms, VR simulators and interactive videos are generally well accepted by learners. They are seen as useful complements to traditional learning methods.
- High expectations: There is a high level of expectation regarding the continuous improvement of these tools, particularly in terms of intuitiveness, precision and content.

Integration of digital and traditional tools

- Complementarity: Digital tools should be used in conjunction with traditional methods to enrich the learning experience. This complementarity makes it possible to combine the advantages of both approaches.
- Attachment to subject matter: Despite the acceptance of digital tools, there is a strong attachment to the relationship with subject matter and traditional techniques. Learners prefer a pragmatic, blended approach.

Improving and adapting tools

- Optimization: Digital tools need to be constantly optimized to meet learners' needs. This includes improving navigation, adding new content, and adapting learning formats.
- Personalization: It's crucial to customize tools to meet the different skill levels and needs of learners, from beginners to advanced learners.

Community and Collaboration

- Community portals: There is a strong interest in creating community portals that serve as reference points for trades, provide access to technical data, and enable exchanges with experts.
- Multilingual accessibility: Multilingual accessibility is important to foster international collaboration and cultural exchange.

Preservation and modernization of know-how

- Preservation: The digitization and organization of traditional knowledge guarantees its accessibility for future generations, even if local transmission diminishes.

- Modernization: The integration of digital tools into the learning of traditional crafts enables these skills to be modernized and disseminated, while ensuring their cultural continuity.

Educational methods

- Diversity of modalities: E-learning needs to be combined with other teaching modalities, such as video elicitation, situational learning and mixed modalities, to avoid becoming a poor, boring tool.
- Learning scenarios: Learning scenarios should include phases of discovery, preparation, implementation and communication, using a variety of learning modalities.

6.2- Next step

6.2.1- common points and specificities

Through the experiences of the various RCIs, we have been able to identify strong common points and specific concerns.

6.2.1.1- Common points (of RCI)

- Good overall acceptance of digital tools
- Expectation of a more integrated experience between digital tools and situational learning 'the extended time spent on analysis occasionally hindered the flow, with participants expressing a preference for more direct experimentation with materials.' RCI 2 porcelain
- The central role of e-learning platforms, both as learning tools and as reference databases of trade knowledge.

6.2.1.2- specificities (of each RCI)

- A variety of audiences and structures. From school groups in Ioannina and Tinos, to ENSAD students in Limoges, to woodcarving and glassblowing apprentices.
- Specific needs, such as the meticulous translation and glossary of tapestry terminology in Aubusson.
- Methods of passing on craft skills that vary greatly from one craft and one geographical location to another.

The final version of pilot 1 education and training will be based on the common points between the different RCI's, while taking into account their specificities.

6.2.2- next step proposal

For the final version of pilot 1 education and training, the aim will be to improve and complete the digital tools, e-learning platform, VR glassblowing simulator, 3D plaster wheel simulator, etc., and to propose enhanced scenarios for the use of digital tools, enabling better interaction between learning modalities.

Secondly, to propose enhanced scenarios for the use of digital tools, enabling better interaction between learning modalities. A breakdown by learning phases to which will correspond the modalities recommended for better integration of digital tools with situational learning, see figure 33 below. The idea is to establish a dialogue between digital practice and workshop practice.

Finally, we aim to develop new tools or transpose existing ones into other fields, such as video elicitation, which enables a reflexive look at and analysis of workshop practice.

learning phases	learning modality			Activities
	e-learning	VR workshop	workshop	
Discovery	tools and machines		optional : workshop tour	Preparation
		workshop tour		
Cross-cutting matters	HSE - GT - Technical drawing - History of glass...			Preparation & Communication
What you should know before practice in workshop	key elements			Preparation & Implementation
			key elements + master	
Process	Glass process & video elicitation methodology			Preparation, Implementation & Communication
			Experiment + master + video	
	experiment report			
Training	process			Preparation & Implementation
		process + basic training (gathering)		
			Experiment & produce	

Figure 52 - layer of educational scenarios

6.2.3- conclusion

The aim is to work with learners to develop effective, relevant digital tools that can be integrated into the organization's learning methods over the long term, in order to structurally modify and sustainably improve the way know-how is passed on, through a mixed use of digital tools integrated with workshop practice.

Pilot 1
Second phase

7 – Final experimentation context

7.1 – Introduction

The Craeft experiment conducted in the second phase on the impact of digital tools on craftmenship learning drew on feedback from the first phase experiment. This allow to improve the usage scenarios of digital tools to optimise their effectiveness and refine the experimentation and analysis methodology.

7.2 - Methodology of experiment

7.2.1 - Conceptual framework and methodology

This study is initially based on situated learning theory (Lave & Wenger, 1991) and cognitive load theory (Sweller et al., 2011), recognising that craft knowledge combines explicit knowledge (techniques, processes, safety rules) and tacit knowledge (sensitivity to materials, precision of movement, aesthetic judgement). During the second phase, the methodological approach evolved to refine the interaction between digital and traditional tools in the learning process. It was enriched by studies on technical gestures (Brill et al., 2002) and explicitation interviews (Vermersch, 2019), aimed at understanding the interaction between learner, task and environment, and exploring tacit knowledge to optimise the impact of digital tools in transmission.

7.2.2 - Study design and pilot implementation

The objective is to co-design and adopt digital tools to preserve and revitalise craft skills, integrating formal and informal learning. An educational kit has been developed, formalising digital tools adapted to training programmes, as well as a teaching methodology and usage scenarios for Craeft tools. This kit is based on a contextual analysis to answer three key questions:

1. How can digital tools be integrated into the glassblowing curriculum?

2. How can their impact on learning be assessed?

3. How can we create an educational model that can be transferred to other professions?

A hybrid strategy has been developed to combine traditional and digital methods, avoiding inefficient overlaps between teaching tools. The usage scenarios promote synergy between tools, offering learners a learning path that is both experiential and cognitive, synchronous or asynchronous.

7.2.2.1 - Representative Craft Instances Studied

While RCI 1 (glassblowing) served as the primary pilot, experimentation was extended across multiple RCIs:

- **RCI 2**: Porcelain design workshop focusing on gesture visualization
- **RCI 4 & 6**: Museum-based learning experiments in marble carving and silversmithing
- **RCI 5**: E-learning platform development for woodcarving

- **RCI 7**: Comprehensive platform development for Aubusson tapestry

The following table shows the distribution of the experiment trough RCI.

RCI	Craft Domain	Participants (N)	Primary Tools Tested	Study Duration	Evaluation Methods
First phase					
1	Glassblowing (CERFAV)	17 apprentices	E-learning platform, VR Simulator	4 apprentice's cluster of 2 weeks	Formative assessments, UEQ, interviews, narratives
2	Porcelain Design (ENSAD Limoges)	9 students	Motion capture, gesture visualization	1 workshop session	Qualitative feedback, self-assessment
4	Marble Carving (Tinos)	18 school students	Interactive video	1 museum session	Knowledge acquisition tests, UEQ, interviews
6	Silversmithing (Ioannina)	10 school students	Interactive video	1 museum session	Knowledge acquisition tests, UEQ, interviews
Second phase					
1	Glassblowing (CERFAV)	19 apprentices	E-learning platform, VR Simulator	2 apprentice's cluster of 2 or 3 weeks	Formative assessments, UEQ, interviews, narratives
2	Porcelain Design (ENSAD Limoges)	*unknown*	Motion capture, gesture visualization	1 workshop session	Qualitative feedback, self-assessment
4	Marble Carving (Tinos)	18 school students	E-learning platform Interactive video	1 classroom session	Knowledge acquisition tests
6	Silversmithing (Ioannina)	8 museum visitors	E-learning platform Interactive video	1 museum session	Knowledge acquisition tests
5	Woodcarving (Yecla)	11 in 3 groups	E-learning platform	6 months	Formative assessments, UEQ,
7	Aubusson Tapestry	/	E-learning platform	/	/
3, 8	Cretan Pottery & Weaving	Limited pilot	Documentation tools	Exploratory	Qualitative observations

Figure 53 - distribution of the expriment through RCI

7.2.2.2 - Modalities of digital tools usage for each RCI

The tables below, see figure 35, describe the modalities of digital tools depending the tool experimented and the constraints of each RCI to implement the Craeft projet. The separated mode is when digital tool is used stand alone or in parallel of traditional tool without specific educational modalities to interweave digital and traditional mode. Hybrid mode is when the digital and traditional educational modalities were interweaved as far as possible.

For RCI 1, the hybrid modality was experiment with informal experiment, out of the sample group of second year apprentices without test and control group. Tools were tested with "Créateur Verriers", students with more artistic and design point of view, and first year apprentices and integrated directly in usual course, the data produced are only qualitative, but could give a trend of the impact of the digital tools when they are more closely integrated with tradition method. In the table below, Figure 54, the modalities are linked, on-line connection everywhere at any time, defined an asynchronous mode where the learners could follow a course independently and separately. At opposite off-line or on-line modality implemented in the one place at same time defined a synchronous mode where the learner working together. Some tool like e-learning platform enabling blended where a course has Asynchronous and synchronous phases like a reverse-classroom method.

	RCI		
	1 - Glassblowing		
Educational tool	**E-learning platform**	**Worshop simulator VR**	**E-leanrning + traditional**
modalities			
Connection	On-line	Off-line	On line/Off-line
Location	Everywhere	Classroom	Everywhere + Trainning center
Time	Every time	Course session	course session
Synchronicity	Asynchronous	Synchronous	Synchronous Asynchronous

	RCI		
	5 - Woodcarving		
Educational tool	**traditional**	**E-learning platform**	**E-learning + traditional**
modalities			
Connection	Off-line	On-line	On line/Off-line
Location	Workshop	Everywhere	Everywhere + Trainning center
Time	Course session	Every time	course session + Every time
Synchronicity	Synchronous	Asynchronous	Synchronous Asynchronous

RCI			
2 - Porcelain	**4 - Marble carving**	**6 - Silversmithing**	**7 - Tapestry**

Educational tool	Simulator + traditional	E-learning platform	E-learning platform	E-learning platform
modalities				
Connection	Off-line	On-line	On-line	On-line
Location	Classroom	Classroom	Museum	Everywhere
Time	Course session	Course session	Visit	Every time
Synchronicity	Synchronous	Synchronous	Synchronous	Asynchronous

legend :	Separated mode	Hybrid mode	Informal experiment

Figure 54 - Craeft approach though each RCI

7.2.3 - Tools and Technologies

The study employed three primary digital tools within the CRAEFT Authoring Platform:

E-learning Platform

- Interactive video content with embedded assessments
- Modular course structure covering technical knowledge, safety protocols, and cross-disciplinary subjects
- Adaptive learning pathways based on prior knowledge assessment
- Multi-modal content delivery (text, video, audio, interactive elements)

VR Glassblowing Simulator (Apprentices Studio)

- Immersive workshop environment simulation
- Physics-based glass manipulation
- Tool interaction and workshop navigation

3D Plaster

- 3D modeling capabilities for project design
- Integration with fabrication tools (3D printing, laser cutting)

7.2.4 - Data Collection and Analysis

Quantitative Data Collection

- **Formative and exam assessments**: Comparative analysis of test scores between test and control group in covered matter by e-learning.
- **User Experience Questionnaires (UEQ)**: Standardized usability assessments using Likert scales
- **Performance metrics**: Time-based analysis of project completion and skill acquisition (tbc RCI 2 & 5)

Qualitative Data Collection

- **Narratives**: Detailed field notes during tool usage sessions
- **Self-assessment questionnaires**: on tool mastery
- **Individual interviews**: Semi-structured interviews exploring tool perception and integration with personal projects
- **Focus group discussions**: Collective feedback sessions on tool effectiveness and improvement suggestions

Analysis Methods

The analysis methods differ depending on the type of data.

- Satisfaction surveys using the Likert scale, the analysis will be statistical.
- Satisfaction surveys with open-ended questions: the analysis will be both semantic and statistical.
- Interviews: these have been codified and an analysis of emerging themes has been carried out.
- The results of student evaluations allow for statistical analysis.

Notes:

1. *For the interviews analyse, some them are recorded, transcribed, and analyse with the support of AI tools.*
2. *The quantitative results are indicators of results but cannot be generalised given the small number of participants for each RCI*

7.2.5 - References

- Bril, B., & Roux, V. (2002). Le geste technique: Réflexions méthodologiques et anthropologiques. Éditions Érès.
- Lave, J., & Wenger, E. (1991). Situated Learning: Legitimate Peripheral Participation. Cambridge University Press.
- Sweller, J., Ayres, P., & Kalyuga, S. (2011). Cognitive Load Theory. Springer.
- Vermersch, P. (2019). L'entretien d'explicitation (9e éd.). ESF Sciences humaines.

7.3 – Participants

7.3.1 - RCI 1 – Glassblowing

First phase:

- Total number of apprentices (AP2 – 23): 30
- Number of students exempt from general matters in the CPC who are eligible to participate in the experiment: 17
- Number of people in the TA test group: 5 – 3 women / 2 men
- Number of people in the T control group: 12 – 10 women / 2 men
- Number of people participating in the experiment: 17

Second phase:

- Total number of apprentices (AP2 – 24): 39
- Number of students exempt from general subjects in the CAP who are eligible to participate in the experiment: 37
- Number of people in the TA test group: 12 – 5 women, 7 men
- Number of people in the T control group: 7 – 5 women, 2 men
- Number of people participating in the experiment: 19

7.3.2 - RCI 4 – Marble carving

First phase:

- 18 pupils (eight girls and 10 boys)
- Test group 7 pupils – 2 girls – 5 boys
- Control group 11 pupils – 6 girls – 5 boys

Second phase:

Same group with the same repartition (tbc from Danae)

7.3.3 - RCI 5 – Woodcarving

Second phase:

- 5 participants – face-to-face course
- 6 participants – Online and hybrid course

7.3.4 - RCI 6 – Silversmithing

First phase:

- 10 pupils (three girls and seven boys)
- 6 test group 3 girls / 3 boys
- 4 control group 4 boys

Second phase:

Different group due to the PIOP organisation constraints.

- 12 visitors
- 8 test group
- 4 control group

8 - RCI 1 – Glassblowing

8.1- Formal experiment

8.1.1 – implementation

8.1.1.1 - Preparatory work (Methodology)

8.1.1.1.1 - Educational aim

The formal experiment aims to evaluate the effectiveness of Craeft digital tools in craft education:

- E-learning platform: Knowledge transmission for transversal subjects and craft techniques
- VR glassblowing workshop simulator: Discovery of workshop environment, tools, and gesture learning
- Community platform: Inter-artisan networking and resource sharing

8.1.1.1.2 - Skills to be learned:

- Theoretical knowledge in cross cutting matter and craft techniques
- Workshop safety and tool identification
- Technical gestures in glassblowing
- Digital literacy and autonomous learning

8.1.1.1.3 - Realization conditions:

- Second-year apprentices in CPC curricula (glassblowing, blowtorch, stained glass, and glass decoration)
- Two experimental groups: Group N°7 and Group N°8
- Division into Test Group (TA) with access to digital tools and Control Group (T) without access

8.1.1.1.4 - Criteria of success:

- Satisfaction surveys on digital tools
- Self-assessment questionnaires on tool mastery
- Comparative formative assessments results
- Qualitative feedback through individual interviews

8.1.1.1.5 - Methodology & protocol of the experiment

<u>**Evaluation instruments:**</u>

1. Satisfaction surveys with open-ended questions (coded analysis)
2. Self-assessment questionnaires on tool usage
3. Individual project follow-up interviews (recorded and transcribed)
4. Formative assessments comparison between TA and T groups

Statistical analysis approach: Thematic coding with occurrence counting and ranking to identify dominant themes while preserving marginal but relevant insights.

Ethics considerations:

- Voluntary participation in interviews
- Gender parity attempted (10 women, 9 men in Group N°7)
- Recorded interviews with participant consent
- Anonymous data processing

Used support, documents, applications:

- Moodle e-learning platform
- VR glassblowing simulator (Khora)
- Craeft community platform
- NoScribe v5.0 for transcription
- Claude and Mistral AI for interview analysis

8.1.1.2 - Implementation activities

8.1.1.2.1 - Cluster N°7

Figure 55 – Glassblowing simulator apprentices' trial

Participants:

- 12 apprentices total (11 present for evaluation)
- 9 completed satisfaction surveys
- 19 individual interviews conducted (12 TA group, 7 T group)

Activities:

E-learning platform deployment

- Initial presentation of Moodle platform logic
- Autonomous navigation and content exploration
- Access to theoretical courses, videos, diagrams, and interactive materials
- Focus on transversal subjects and craft techniques discovery

VR simulator session

- Introduction to VR environment and equipment
- Guided and free exploration modes
- Workshop discovery: tools, safety procedures, spatial organization
- Gesture simulation attempts

Community platform presentation

- Platform demonstration
- Browsing time for exploration
- Oral feedback collection

Project follow-ups interviews

- interviews collection

Cluster N°8

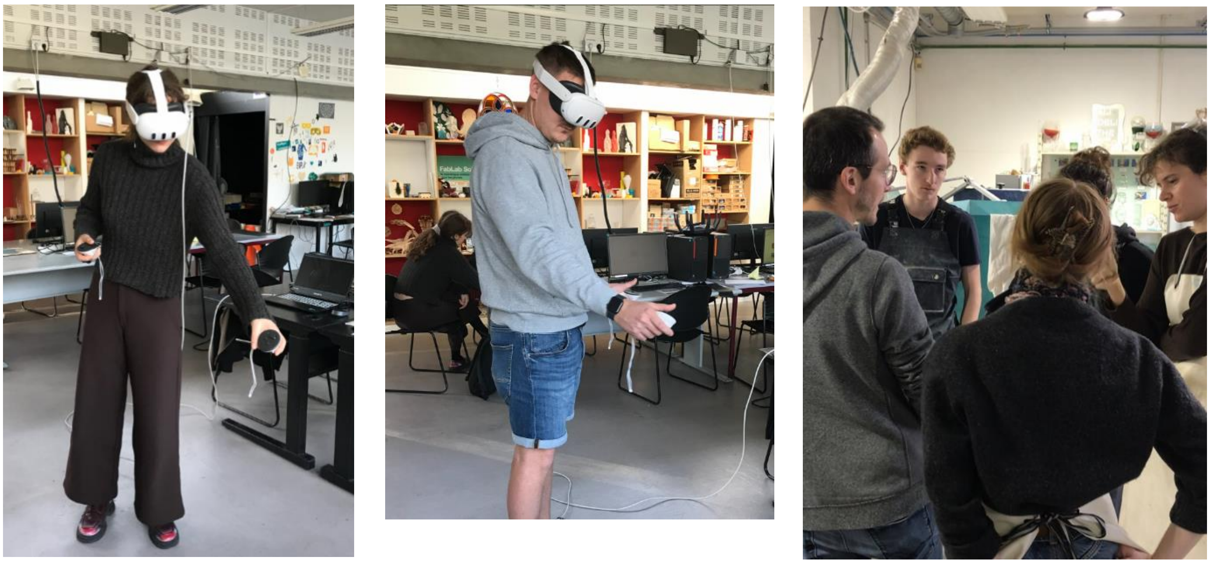


Figure 56 - Glassblowing simulator apprentices' trial

Participants:

- 6 glassblowers in TA group (4 present for VR session)

- Focused experimentation on improved VR simulator version
- 19 individual interviews conducted (12 TA group, 7 T group)

Activities:

VR simulator session

- Testing of updated VR simulation with bug fixes and improvements from Khora
- Focused interview on VR experience (recorded, transcribed, analyzed via AI)

Context note: Due to close timing between groups (mid-September to end-October), satisfaction and mastery surveys were not repeated. Emphasis placed on qualitative feedback through interviews.

E-learning via Cross cutting matter assessment

- Formative assessment in general technology

Project follow-ups interviews

- Interviews collection

8.1.2 – Cluster No. 7 – Second phase, second-year apprentices – analysis and results of the evaluation of Craeft digital tools

Cluster 7 is the first group in the second year of the CPC program for apprentices in glassblowing, torchwork, stained glass, and glass decoration.

8.1.2.1- E-learning platform - results of project assessment documents

8.1.2.1.1 - Overview of e-learning satisfaction survey

The satisfaction survey is constituted by opened questions, the result was compiled in Summary table of the satisfaction survey on the e-learning platform, see below Figure 57.

You can find the questionnaire in annex 2 and the full coding in annex 3.

E-learning					
Positive points	code	Points for improvement	code	Comments	code
Course content: 1- Clarity and organisation of course content					
Well organised, great opportunity to discover other content (other subjects)	[ERA-2]				
Correct	[ERA-2]				
Good organisation	[ERA-2]				

E-learning					
Positive points	code	Points for improvement	code	Comments	code
Excellent	[ERA-2]				
It's fine, it's not too busy	[ERA-2]				
For the most part, it's easy to organise and get started	[ERA-2] [ERA-1]				
It's quite clear and organised.	[ERA-2]				
Very good	[ERA-2]				
Course content: 2 - Has the course given you an understanding of glassblowing, cross-disciplinary subjects, background, description of machines and tools, presentation of the workshop, etc.?					
It's great because it's varied, there are diagrams, text, videos, so for me, who is more visual, it's great.	[PDE-1] [EXC-3]				
		Not particularly	[EXC-1]		
Yes, rather, you have to take the time to navigate	[EXC-1]				
Yes	[EXC-1]				
		Not really	[EXC-1]		
Yes, in some areas	[EXC-1]				
The "physics" courses enable students to understand and grasp the subject matter. On the other hand, these courses allow for revision, re-reading and a new approach.	[PDE-2] [LTP-1]				
Yes, the step-by-step approach is interesting...	[PDE-2]	... but there is a need to see the entire process.	[ERA-2]		
Course content: 3 - Are the explanations of machines, tools and the workshop clear, detailed and useful?					

E-learning					
Positive points	code	Points for improvement	code	Comments	code
Yes	[EXC-2]				
		Not particularly	[EXC-2]		
Yes, rather	[EXC-2]				
... but it could be useful	[EXC-2]	Not very detailed...	[EXC-2]		
Yes	[EXC-2]				
Yes	[EXC-2]				
Yes	[EXC-2]				
Course structure and materials: 1 - Course structure and organisation of sessions (chapters)					
				Very divided into small chapters, but no worse for that!	[ERA-2]
		Not particularly	[ERA-2]		
Clear and well organised	[ERA-2]				
		Chapters may be slightly too short	[ERA-2]		
It's quite simple	[ERA-2]				
Easy to understand, no overload on the screen, pleasant to read.	[ERA-1] [ERA-2]				
Good	[ERA-2]				
Yes	[ERA-2]				
Course structure and materials: 2 - Did the course materials (text, images, videos) help in understanding the subject?					
				Yes, but the instructional videos might be easier to understand if they were shown in a single sequence rather than in short, fragmented videos.	[PDE-2]
Yes	[PDE-1]				
		Not particularly	[PDE-1]		

E-learning					
Positive points	code	Points for improvement	code	Comments	code
Yes, it's always better than a written essay	[PDE-1]				
				I haven't seen any yet (images, videos)	[PDE-1]
Yes	[PDE-1]				
Yes, they illustrate it well	[PDE-1]				
Yes	[PDE-1]				
E-learning platform: 1 - Is the platform user-friendly for accessing course materials, assessments and taking part in discussions?					
Easy conversation between users.	[ERA-1]				
For course materials and assessments, yes...	[ERA-1]	... for the other, I didn't intuitively see where it was, but where it is placed makes sense; I just have no idea how to find contacts on the site.	[ERA-1]		
Yes	[ERA-1]				
Yes	[ERA-1]				
Yes	[ERA-1]				
Yes	[ERA-1]				
E-learning platform: 2 - Are the navigation and instructions provided by the platform clear and useful?					
The platform is user-friendly and easy to navigate.	[ERA-1]				
Mostly yes	[ERA-1]				
Yes	[ERA-1]				
Yes	[ERA-1]				
Yes...	[ERA-1]	... except for triple messages (three-step validation of assessments)	[ERA-1] [PDE-3]		
General feedback: 1 - What specific aspects of the course did you find particularly beneficial or stimulating?					
The general lessons with videos and diagrams are great, and the explanatory	[PDE-1] [EXC-3]				

E-learning					
Positive points	code	Points for improvement	code	Comments	code
videos with JP [cane blowing instructor] are very enriching; you can listen to them again and again.					
The quizzes	[PDE-2] [PDE-3]				
The testing principle	[PDE-2] [PDE-3]				
I found this very useful for the theory lessons.	[PDE-1] [LTP-1]				
The videos and animations	[PDE-1]				
Visuals and examples (video and images)	[PDE-1] [ERA-2]				
General feedback: 2 - Do you have any suggestions for improving this course in terms of content or teaching?					
				For the quizzes, a short training session with one question + correction before the final test [have formative quizzes, with answers given after each question]	[PDE-2] [PDE-3]
		Complete for disciplines other than blowing.	[EXC-1] [EXC-2]		
General feedback: Any other comments?					
In summary, the platform is easy to understand and use.	[ERA-1]				
				Offer this platform as a systematic tool from the first year onwards.	[LTP-1]

E-learning					
Positive points	code	Points for improvement	code	Comments	code
				Do (Q. No. 10) the exercises and quizzes.	[PDE-2] [PDE-3]

Figure 57 - Summary table of the satisfaction survey on the e-learning platform

Identified themes:

To analyse the results of the satisfaction survey, we divided the responses into three categories: positive points, points for improvement and comments, and then coded the responses. *See Satisfaction survey – coded summary table*.

The codification and themes are kept identical over the two years of experimentation so that the evaluation of the e-learning tool meets the same criteria.

Statistical analysis:

The statistical analysis, highlights the weight of each thematic to identify the most often occurring and important. This approach avoids the risk of a marginal theme emerging at the same level as another more relevant to understand apprentices' concerns.

For all that, certain "marginal" themes can bring out new and relevant ideas.

statistical analysis of e-learning data tables

Code	Theme	Occurrences	Percentage	Rank
PDE	Pedagogical and didactic effectiveness	24	33%	2
PDE-1	Quality of learning materials	12	17%	3
PDE-2	Educational Progress	7	10%	5
PDE-3	Assessment of learning	5	7%	7
ERA	Ergonomics and accessibility	34	47%	1
ERA-1	Navigation and interface	16	22%	2
ERA-2	Organisation of content	18	25%	1
ERA-3	Technical accessibility	0	0%	10
EXC	Exhaustiveness of content	17	24%	3
EXC-1	Core content	6	8%	6
EXC-2	Specific technical aspects	9	13%	4
EXC-3	Educational supplements	2	3%	9
LTP	Linking theory and practice	3	4%	4
LTP-1	Transfer of learning	3	4%	8

LTP-2	Professional Contextualisation	0	0%	10
LTP-3	Practical applications	0	0%	10
Total		72	100%	

Legend: Main themes
Themes on the first four ranks

Figure 58 - distribution of responses to the satisfaction survey by codified themes for e-learning

Analysis and quotations on the main themes

In this section, we detail and analyse the main themes that emerged. We have also extracted coded quotes from the satisfaction survey.

ERA-2, *organisation of content*

This theme is in rank one with 18 occurrences, 14 times on *Positive point*, 3 times on *points of improvement*, once in *comments* concerning the cutting of the modules. The Learner after a first contact with a e-learning platform globally appreciated the structuration of knowledges.

'Well organized, great opportunity to discover other content' [other materials]

'Very divided into small chapters but not worse!'

'Yes, the step-by-step aspect is interesting but there is a need to see the entirety of the manipulation.' [videos on the manufacturing process]

ERA-1, *navigation and interface*

The second theme ERA-1, on 16 occurrences, 14 times on *Positive point*, 2 times on *points of improvement.* Getting to handle the platform is going well with oral comments on the need to understand the operating logic of Moodle beforehand.

'Pleasant platform in handling and navigation.'

'Easy understanding no overload on the screen pleasant to read.'

PDE-1, *quality of learning materials*

With 12 occurrences, 10 on *Positive point*, 1 on *points of improvement*, 1 on *comments,* this theme shows the overall good appreciation of the knowledge contents available on e-learning platform. The diversity of learning support and media is appreciated, and globally perceived like a good tool for revisions.

'It's nice because it's varied, there are diagrams, text, videos, so for me it's more visual, it's great.'

'For the theoretical courses, I found it very practical'

'The general classes with video and diagram are great, and then explanation videos with JP [blowing trainer] very enriching one can listen to at will.'

<u>EXC-2, *specific technical aspect*</u>

This theme, counts 9 citations, 6 on *Positive point*, 3 on *points of improvement*, for a majority on question three about course contents, *'Are the explanations of machines, tools and the workshop clear, detailed and useful?'*. This aspect is mainly positively perceived, but it is fragile with 3 of 9 answer in *points of improvement*. The expectation seems to have more precise or complete explanation on the tools or more glass technics traited.

'Not very detailed but it can be used.'

'Complete for disciplines other than blowing.'

8.1.2.1.1 - Overview of the self-assessment questionnaire on tools usage for e-learning.

The following graphs summarised the results of self-assessment questionnaire on mastering tools.

The self-assessment questionnaire on the use of the e-learning platform gathers learners' perceptions of their mastery of the tool; it is a personal and subjective feedback, not a test of real mastery. Its aim is to measure how comfortable learners are using the tool and where improvements can be made.

The questionnaire consists of closed questions, the answers to which are shown in the graphs below. Responses to the open-ended comments question are compiled in the 'Comments' box.

The answers on the question of usefulness in relation to the personal project are logical insofar as it is a learning tool and not a design or production tool.

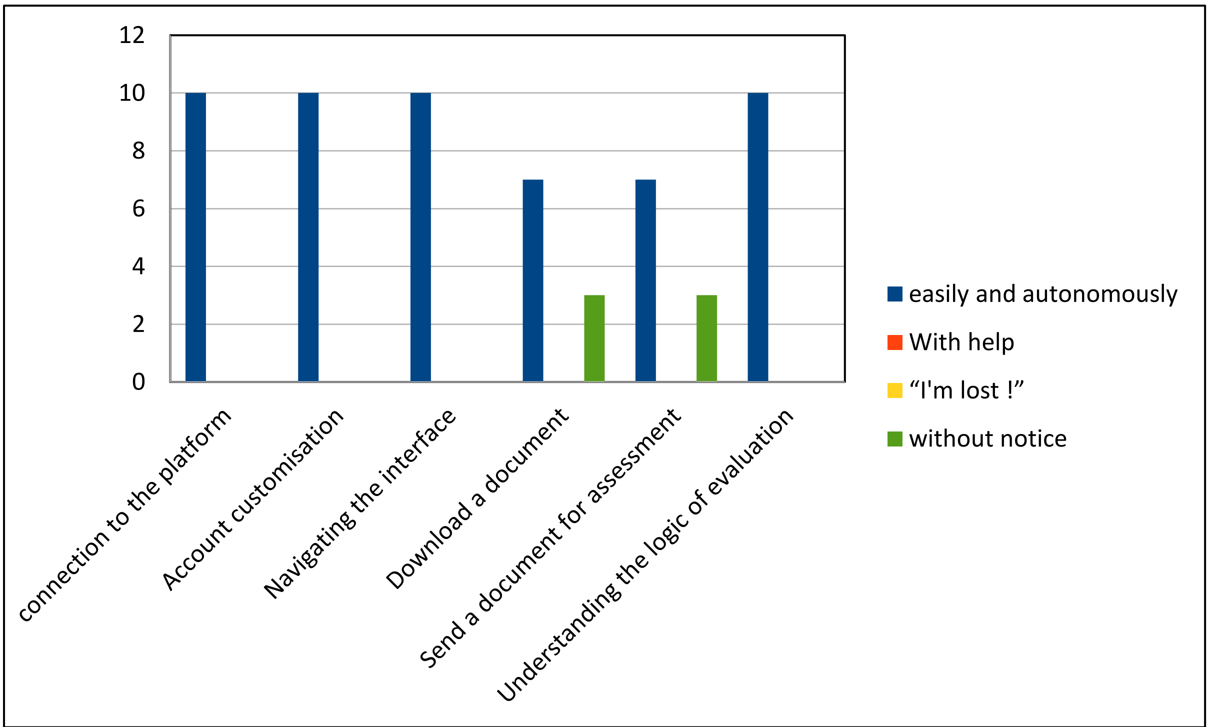


Figure 59- e-learning self-assessment questionnaire graph, cluster N°7

Figure 60 - e-learning, usefulness question, cluster N°7

Comments:

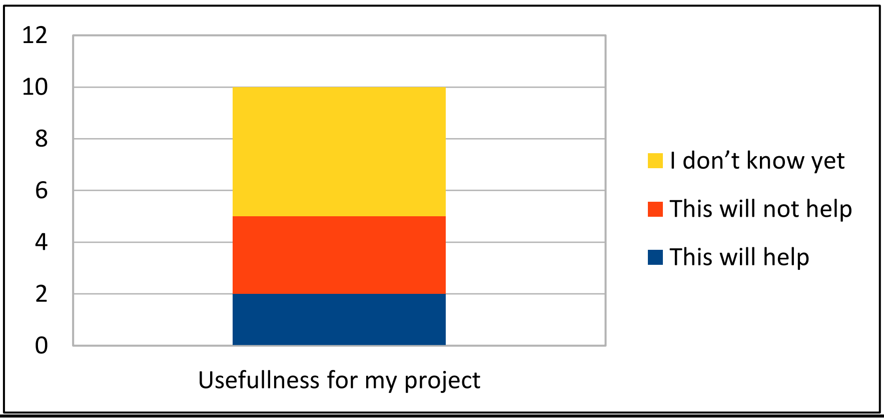
In this second phase of evaluation, the apprentices from the TA group are 12 compared to 5 the previous year. Getting to grips with the e-learning platform was no problem, with the nuance to primary understanding the logic of a Moodle platform.

The platform was considered to be a good tool for discovery other craft techniques and very useful for the review of transversal subjects.

8.1.2.2- VR glassblowing workshop simulator - results of project assessment documents

8.1.2.2.1 - Overview of VR glassblowing workshop simulator satisfaction survey

As for e-learning, the satisfaction survey is constituted by opened questions, the result was compiled in Summary table of the satisfaction survey on VR simulator, see Figure 61, below.



Virtual studio					
Positive points	Code	Points for improvement	code	Comments	code
Interface: 1- Is the VR glassblowing workshop simulation user-friendly for accessing the functions and tasks to be carried out?					
Yes	[EVR-1]				
... but good for beginners	[EVR-1] [EVR-3]	Lacks a bit of detail...	[EVR-1] [EVR-3]		
Yes	[EVR-1]				
Yes	[EVR-1]				

Virtual studio					
Positive points	Code	Points for improvement	code	Comments	code
		NOT ENOUGH (Aiming is quite difficult) [accuracy of the position of the pipe for picking]	[FIT-1] [FIT-2]		
Interface: 2 - Ease of use of functions via controllers (teleportation, tool input, information display, etc.)					
... and then you understand relatively well as you go along	[EVR-1]	Complex to get the hang of at first...	[EVR-1]		
I didn't have any problems	[EVR-1] [EVR-2]				
Yes	[EVR-1]				
Interface: 3 - Ease of use of the interface in general (displaying information, moving around, taking action, 'managing to do what I want')					
... and then you understand it relatively well as you go along	[EVR-3]	Complex to get to grips with at first...	[EVR-3]		
		Some notable bugs	[FIT-1]		
Yes	[EVR-1]				
Yes	[EVR-1]				
Good	[EVR-1]				
Knowledge structure: 1 - Do you prefer free access to the various functions, or a more guided route?					
				Guided	[PEN-1]
				Guided for beginners, but more freedom for those who are already experienced.	[PEN-1]
				Free	[PEN-1]
				Free	[PEN-1]
				Guided	[PEN-1]
				More guided	[PEN-1]

Virtual studio					
Positive points	Code	Points for improvement	code	Comments	code
Knowledge structure: 2 - Did the information media (text, images, videos) help you to discover and understand the blowing workshop?					
Yes	[PEN-2]				
		Not really (I am a glassblower)	[PEN-2]		
		Not too much (I'm a prompter)	[PEN-2]		
Yes	[PEN-2]				
Yes	[PEN-2]				
Knowledge: 1 - Do I find the application useful for learning and remembering the workshop environment, tools and machines?					
		Seeing the location and environment is good, but there aren't enough people moving around to make it feel realistic. [multi-user mode]	[FIT-1] [ASP-3]		
		Not really, even though I'm not a blower, I know almost everything except for a few tool names.	[PEN-2]		
Perhaps for the tools and their names and for the environment.	[PEN-2]	However, when it comes to the movements, I don't think it's relevant.	[FIT-2] [FIT-3]		
Yes	[PEN-2]				
Certainly	[PEN-2]				
Yes	[PEN-2]				
Knowledge: 2 - Do I find the application useful for learning and remembering the manufacturing process?					
I think so, what's great are the little explanatory notes and the opportunity to experiment	[PEN-1] [PEN-2]				
		It might be, but not for me.	[PEN-1] [PEN-2]		

Virtual studio					
Positive points	Code	Points for improvement	code	Comments	code
Yes	[PEN-1] [PEN-2]				
Certainly	[PEN-1] [PEN-2]				
Yes	[PEN-1] [PEN-2]				
Knowledge: 3 - Do I find the application useful for learning and memorising gestures?					
Yes	[FIT-2]				
		No, the app won't tell us if we know anything, so if we're not being monitored, it's almost counterproductive.	[FIT-2]		
		No	[FIT-2]		
		No, not really, gestures are difficult to reproduce in VR.	[FIT-2]		
		No	[FIT-2]		
General feedback: 1 - What specific aspects of the simulation did you find particularly beneficial or stimulating?					
Moving around in space and the small explanatory cards for each tool.	[EVR-1] [EVR-2]				
... For someone who knows nothing about glassblowing, this may help them understand the principle.	[PEN-2]	For now, I don't think it will be useful to me...	[PEN-2]		
It's handy for tools...	[PEN-2]	... but not at all for gestures.	[FIT-2]		
General feedback: 2 - Do you have any suggestions for improving this simulation in terms of content or interface?					
				More developed graphics and more physical supports (cane simulator with sensors)	[EVR-1] [FIT-1]

Virtual studio					
Positive points	Code	Points for improvement	code	Comments	code
				The explanatory windows are too large [beware of the "crop" effect for 2D vision – not everyone has experienced this]	[EVR-1]
General feedback: Any other comments?					

Figure 61 - Summary table of the satisfaction survey on the VR glassblowing workshop simulator

Eleven out of twelve people of TA group were present and nine surveys have completed.

You can find the questionnaire in annex 2 and the full coding in annex 3.

Identified themes:

In this section we kept the same way of analysis as in the e-learning section. See Satisfaction survey – coded summary table.

statistical analysis of VR glassblowing workshop simulator data tables

Code	Theme	Occurrences	Percentage	Rank
PEN	Pedagogical Engineering	29	45%	1
PEN-1	Learning structure	11	17%	3
PEN-2	Pedagogical objectives	18	28%	1
FIT	Technical Fidelity	13	20%	1
FIT1	Physical simulation	4	6%	5
FIT-2	Reproduction of movements	8	13%	4
FIT-3	Technical accuracy	1	2%	8
EVR	Ergonomie VR	21	33%	1
EVR-1	User interface	15	23%	2
EVR-2	3D navigation	2		7
EVR-3	Organisation of space	4		5
PAS	Practical Aspects and security	1	2%	1
PAS-3	Hardware management	1	2%	8
Total		64	100%	

Code	Theme	Occurrences	Percentage	Rank

Legend:	Main themes	
	Themes on the first four rang	

Figure 62 - distribution of responses to the satisfaction survey by codified themes for VR application

_Analysis and quotations on the main themes

PEN-2, pedagogical objectives

This theme is in first rank with 18 occurrences, 13 times on *Positive point*, 5 times on *points of improvement*, VR application is appreciated for the information it provides in terms of knowledge of the workshop environment, tools, and process memorisation. She is recognized as useful for discovering the workshop before a first experience, but no longer seems useful afterwards for learning gestures.

'I think so, what's great are the little explanatory notes and the opportunity to experiment'

'For now, I don't think it will be useful to me, for someone who knows nothing about glassblowing, this may help them understand the principle.'

EVR-1, User interface

With 15 occurrences, 11 on Positive point, 2 on points of improvement, 2 on comments, globally the user interface of the application is well received. However, with hight level of expectation and some advises for improvement.

'Moving around in space and the small explanatory cards for each tool.'[is nice]

'Complex to get to grips with at first and then you understand it relatively well as you go along'

'Lacks a bit of detail but good for beginners'

'More developed graphics and more physical supports (cane simulator with sensors)'

PEN-1, learning structure

With 11 occurrences, 4 on Positive point, 1 on points of improvement, 6 on comments, the apprentices feedback for this item is close to the PEN-2 one. Regarding free or guided access to the function, the trend is more towards a guided scenario with an interesting suggestion of having variability in guidance depending on the educational progress.

'Guided for beginners, but more freedom for those who are already experienced.'

FIT-2, reproduction of movements

With 8 occurrences, 1 on Positive point, 7 on points of improvement, This item concerns the most critical point of the application and identifies its lack of technical

maturity compared to the expectations of apprentices regarding gesture acquisition.

'Aiming is quite difficult' [accuracy of the position of the pipe for picking]

'However, when it comes to the movements, I don't think it's relevant.'

'No, the app won't tell us if we know anything, so if we're not being monitored, it's almost counterproductive.'

'No, not really, gestures are difficult to reproduce in VR.'

'It's handy for tools but not at all for gestures.'

8.1.2.2.2 - Overview of the self-assessment questionnaire on tools usage for VR simulator.

The following graphs summarised the results of self-assessment questionnaire on mastering tools, as same principle of e-learningplatform.

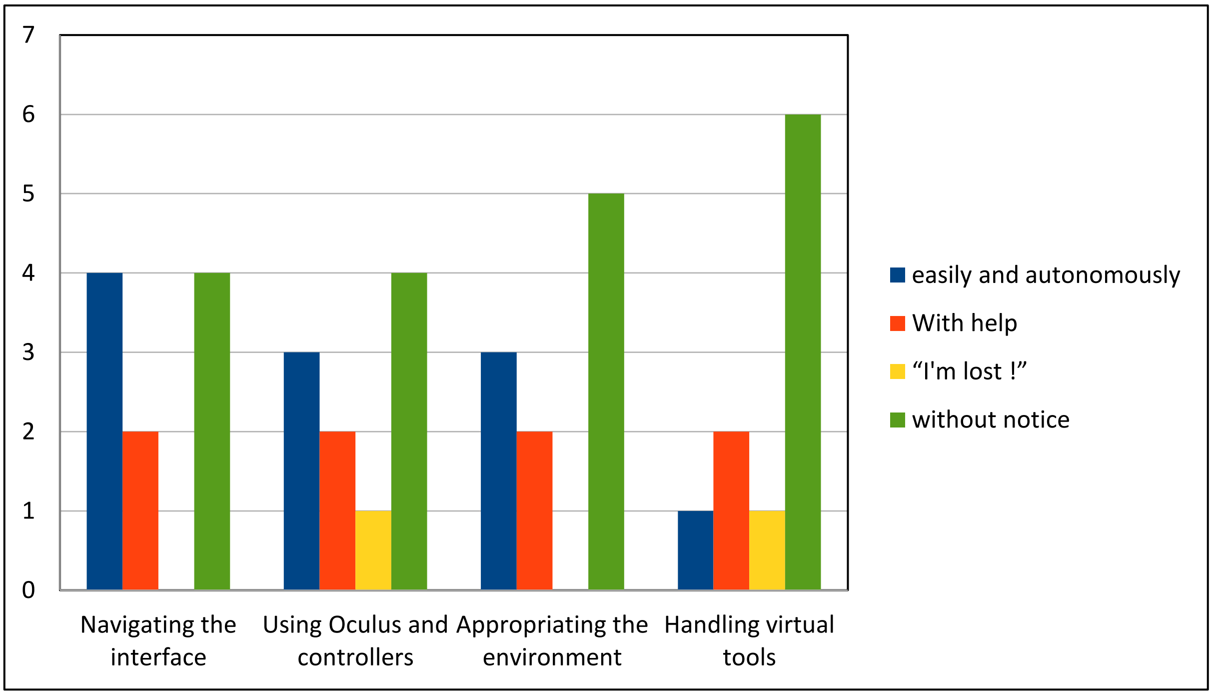


Figure 63- VR application self-assessment questionnaire graph, cluster N°7

Figure 64- VR application usefulness question, cluster N°7

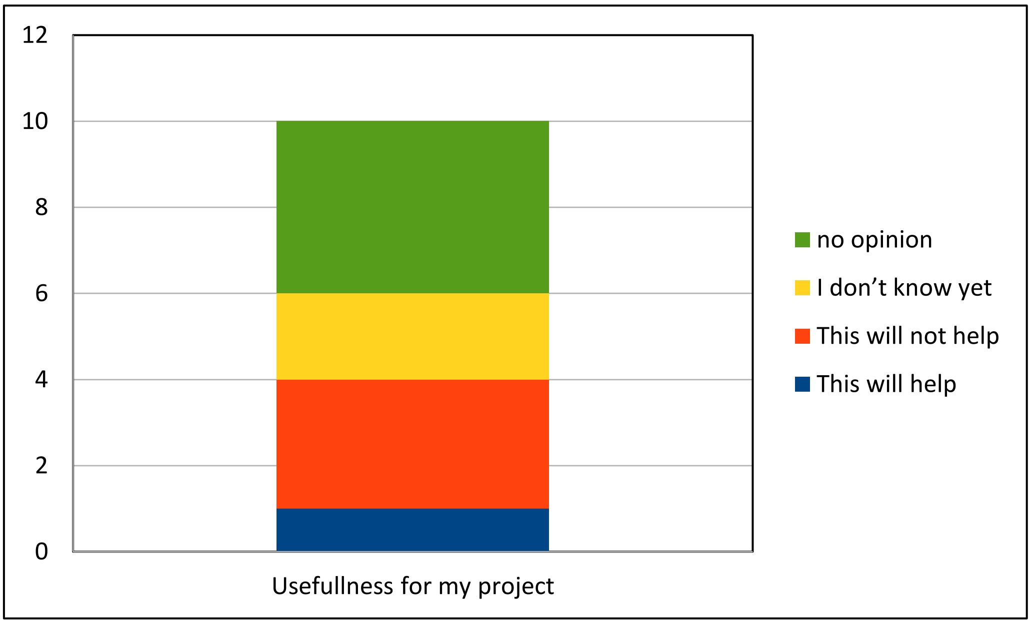
Comments:

For the self-assessment on the mastery of the VR blowing workshop simulator, we see on the graph, for the first three questions, four to three people per theme easily manipulate the VR tool. Two people needing help or one lost in the use of the VR tool. For the manipulation of virtual blowing tools, only one person is comfortable on it, two need help, one is lost. In all the items of the questionnaire, four to six people did not pronounce themselves.

Our interpretation is that we could be observing two axes.

1. Have a previous knowledge and usage of the VR environment
2. Involvement for using VR glassblowing simulator

In effect in the test group, while exchanging with the apprentices, some told us they had already used VR tools for personal use. Moreover, the group is not exclusively composed of glassblowers; for these people, the relevance of the simulator is lower, which can explain a high rate of non-responses and reflect less interest in this tool.



8.1.2.3- community platform

The community platform was tested with apprentices through a presentation followed by time for them to browse and explore the platform. We do not have enough hindsight to know whether the apprentices returned to consult or use this tool.

An oral survey was conducted, in summary, people appreciated being able to find presentations of different crafts on the same site and were interested in discovering these other craft techniques. In addition, there was a desire for more video content showing the techniques, as some felt that the articles were too long and less informative about the craft described or concerned. The platform is appreciated because it offers a level of seriousness and credibility compared to the usual social networks. Such a tool is seen as a way of identifying professionals who can then be contacted directly for help or technical advice. Or for organising events or gatherings of craftspeople, such as communal firing sessions for potters. In conclusion, the principle of an inter-artisan platform is greatly appreciated by young apprentices. The use of the platform still needs to be established in consultation practices as a reference site, with the expectation that it will help to break down language barriers.

8.1.2.4- Project follow-ups results

The methodology for conducting project follow-up interviews is the same as for grouping apprentices No. 7, see §1.3.3.5

The project follow-ups was done through individual interviews with the apprentices.

Project follow-ups allow for a qualitative assessment of the context, place and use of digital tools by apprentices, beyond just Craeft tools. This provides an overview of acceptance, practices, integration and also any difficulties encountered when using digital tools.

- The question framework is the same as that used for the first phase of the experiment in first phase, see Annex 2.

The more occurred thematics are:

thematics	TA group occurrences	T group occurrences
Mixed and pragmatic Use – [MXU]	13	11
Opportunities and limitation of digital tools – [OLD]	12	15
Relationship to the material – [RTM]	6	6

Figure 65 - table of the more occurred thematics for N7 cluster

Following by digital tools learning needs and subcontracting digital tools usage themes.

As in the first phase of experiment, apprentices take a pragmatic and mature approach and use digital tools like any other tool in their toolbox, when they deem it relevant.

They do not necessarily have in-depth knowledge of the tools, but they have a clear idea of how they can be used and do not hesitate to call on subcontractors [FabLab/mechanical trainer] or collaborate with peers when they are not familiar with a tool.

8.1.3 – Group No. 8 – Second phase, second-year apprentices – analysis and results of the evaluation of Craeft digital tools

The cluster N°8 is second one of second year of CPC curricula for apprentice in glassblowing, blowtorch, stained glass and glass decoration.

8.1.3.1- VR glassblowing workshop simulator - results of project assessment documents

The second session of experiment of glassblowing workshop simulator was done only with the glassblowers of the TA group. Four of the six were present. They try the last version of VR simulation provided by Khora who have done improvement and fixed bug from September tested version.

Due to the close dates of between the sessions of cluster N°7 and cluster N°8, mid-September to end of October, we didn't do again the satisfaction and mastery of tools surveys. We have done an interview of glassblower apprentices. This interview was recorded, transcribe and analysed and translated from French to English via AI. See coding structure in annex 3. In parallel a note was done and used to verify the coherence of interview return summary.

the main points emerging:

- General interest for this tool
- A discovery potential for none practitioner, of people fear by the fire
- Recognised added value for discovering workshop and tool
- Too limited sensorial feedback and precision of physics for using like a training tool for already experiment apprentices.
- Adaptation needed to the VR environment.

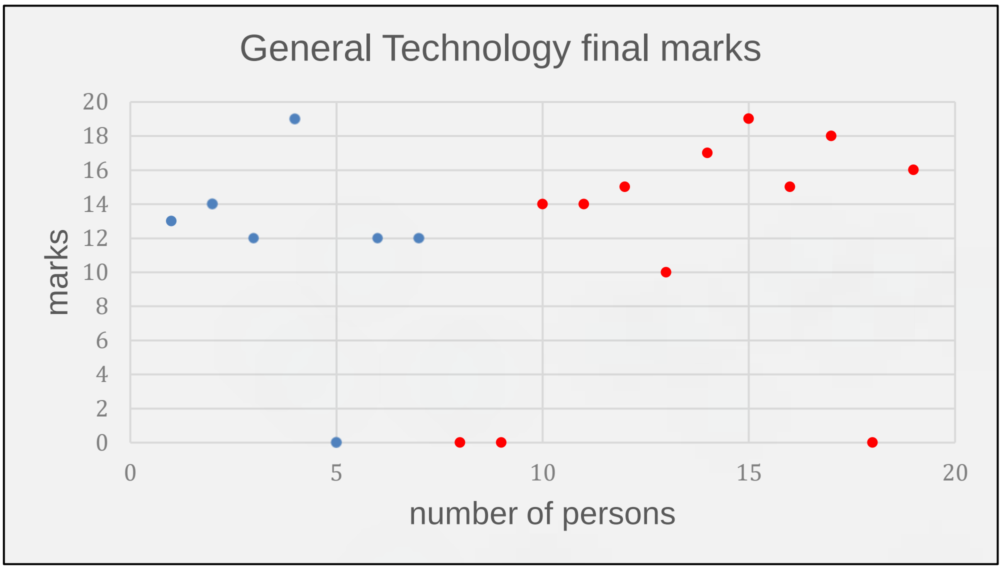
8.1.3.2- Comparative results of formative assessment in cross-cutting matters

At this stage of the school year only one formative assessment was done on the general technology. The analysis covers the TA test group, T control group and the remaining of the promotion of the apprentices.

Some of apprentices have already pass another CPC in one other speciality of glass and they have been absent for the assessment; it is why we have some zero marks on graphics. We don't take account of these zero marks in the mean and standard deviation calculation.

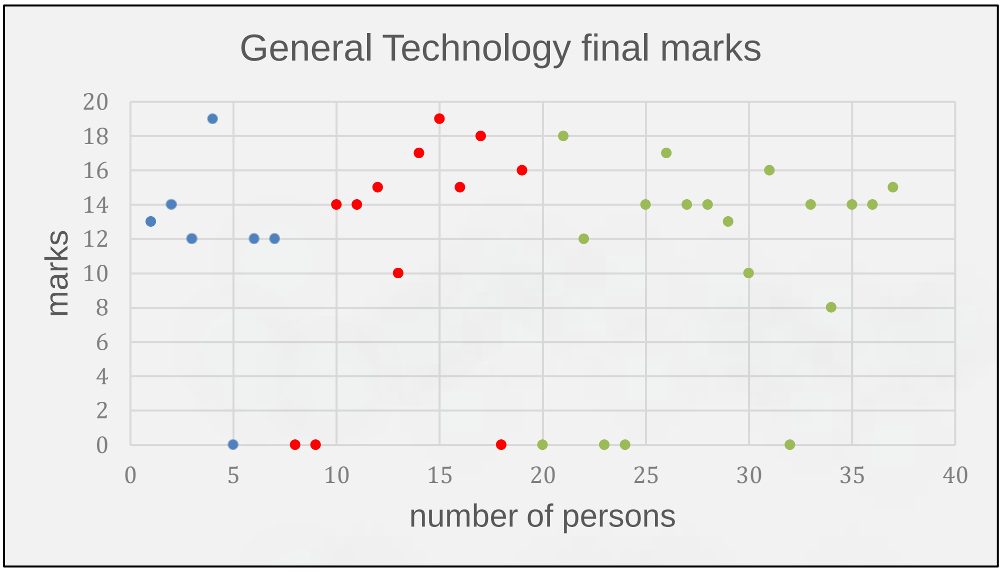
8.1.3.2.1 – results on general technology assessment

Mean T group	13,67	Standard deviation T group	2,73
Mean TA group	15,33	Standard deviation TA group	2,65
Mean of overall promotion	14,24	Standard deviation of the promotion	2,64



Legend : T group - TA group

Figure 66 - T and TA marks in TG - with absents



Legend : T group - TA group - remaining part of the promotion

Figure 67 - Marks of overall promotion

The TA group has a mean of 15.33, slightly more than the T group, 1.67 higher and 1.09 higher than the promotion average. Furthermore, we can see in the graph, see Figure 66 and Figure 67, a concentration of marks between 12 and 14, more important for T group and the rest of the promotion.

The standard deviations range from 2.64 for all promotion to 2.73 for the T group, with the TA group's standard deviation being 2.65. If we ignore the zero marks for the reason mentioned above, the lowest mark is 8 and the highest is 19. The higher standard deviation for T group could be explained by a less homogeneous repartition of marks compare to TA group or remaining of the promotion, see Figure 67.

Finaly the TA group has better rate of marks over 14, see Figure 69.

Nb of marks >10 & 15< T group	5	71%
Nb of marks >10 & 15< TA group	2	17%
Nb of marks >10 & 15< remaining part of promotion	8	44%

Figure 68 - Numbers of marks from 10 to 15 for each group

Nb of marks >14 T group	1	14%
Nb of marks >14TA group	6	50%
Nb of marks >14 remaining part of the promotion	4	22%

Figure 69 - Number of marks over 14 for each group

To conclude the TA Group had slightly better results than the control group, better mean, better proportion of marks over 14. However, the small number of participants for each group and the fact we have done this analysis only on one assessment, can give at most a positive trend of digital e-learning tool impact.

A possible bias is a general lever of implication of apprentices who have chosen to participate at the Craeft experiment in TA group.

8.1.3.3- Project follow-ups results

The methodology for conducting project follow-up interviews is the same as for grouping apprentices No. 7, see - §1.3.3.5

The more occurred thematics are:

thematics	TA group occurrences	T group occurrences
Mixed and pragmatic Use	15	11
Relationship to the material	15	8
Opportunities and limitation of digital tools	14	8

Figure 70 - table of the more occurred thematics for N8 cluster

Following by digital tools learning needs and complexity of digital tools usage themes.

The trend seen in the previous groups from first and second phases is confirmed, with a pragmatic approach and a strong desire to maintain links with the subject matter and workshop activities.

To conclude, we could write that pedagogical environment appears to foster selective digital integration where students adopt tools strategically based on project needs, maintain strong material connections, and demonstrate critical awareness of both affordances and constraints.

8.1.4- Conclusion

Experiments conducted in second phase with groups of second-year apprentices, No. 7 and No. 8, confirm the targeted usefulness of digital tools (e-learning, VR, community platform) in glassmaking training, while highlighting the limits of their scope and their complementarity with traditional methods.

E-learning is highly praised for its clear structure (‘well organised, opportunity to discover other content’), the quality of the materials (videos, diagrams) and its role in revision. However, improvements are expected in terms of technical explanations (‘not detailed enough’) and ergonomics (Moodle navigation logic).

VR is appreciated for its introduction to the workshop (‘useful for beginners’), but its lack of sensory fidelity (‘difficult to reproduce movements’) and physical precision limits its use to an introductory tool.

The results of the formative assessments show a slight superiority of the TA group (average of 15.33 compared to 13.67 for the control group), suggesting a positive impact of digital tools, although the small sample size and self-selection bias of participants temper this observation.

Learners take a pragmatic approach: they use digital tools in a targeted manner, according to their needs, while maintaining a strong link with the subject matter and the workshop. The community platform is perceived as a credible space for discovering other trades and exchanging ideas with peers, but its use has yet to be firmly established.

Challenge: Integrate these tools strategically, adapting them to educational needs and training trainers in their optimal use, to enrich — without replacing — craft learning.

8.2- Informal experiment

As we saw in paragraph 7.2.2.2, the hybrid modality was experimented thought an informal experiment on parallel of the formal one conducted with second year apprentices. This approach allows us to adapt the experience with agility in the face of organizational constraints. This experience is qualitative, but it enriches the formal experience by providing new avenues for improvement in digital tools and the educational scenario for implementing them.

8.2.1 – Video elicitation

8.2.1.1– Video, an existing practice among students and trainers

During our initial discussions with the trainers, particularly Jean-Pierre, trainer of glassblowing with a pipe, we realised that an ‘underground’ video practice already exists in the workshops.

We then interviewed Justine, one of the students using it, and this is what emerged:

- Justine uses her mobile phone to film the trainer's demonstrations.
- She prefers to shoot videos handheld (a more flexible approach) rather than using a tripod, as this allows her to frame the important elements of the work, which vary in space depending on the stages of production for a particular piece. For example, when the glassmaker moves from the workbench to the reheating furnace.
- The aim is to build up a collection of documentation that can be reviewed later to refresh her memory of the technique when she needs to put it into practice.
- Justine plans to sort and name her videos by technique for better organisation.
- The videos are sometimes shared informally via a WhatsApp group with other students. They exchange videos and advice, although this is not structured or systematic.
- Justine uses the videos to prepare herself mentally before making a piece. She watches the videos just before she starts to refresh her memory, and sometimes the day before, which helps her to better understand the steps involved. However, she also has a workshop notebook where she sketches the steps involved in making a piece.

Discussions with other students reveal various objectives and techniques in the use of video:

- As a reflective tool, students film each other during training/learning, for example when blow moulding the different shapes of cups required for the CAP. (Marie Cécile and Alexandre)
- As a communication tool, particularly in the context of their project portfolio. (Jason)
- The shots are taken freehand or with clamp supports that allow them to be attached to the shoulder or to fixed equipment, giving them autonomy in shooting.

In conclusion, our approach to co-constructing video elicitation can build on existing practices, with the aim of developing elicitation and "systematising" its use

8.2.1.2 - Narratives

8.2.1.2.1 – Video elicitation on, glass blowing – first implementation

Context: One expert trainer on glassblowing, Jean Pierre, four learners (CV1-33 & AP1-24). The learners were blowing moulded cups, similar to orangeade glasses, with the aim of mastering the techniques required for the CAP qualification.

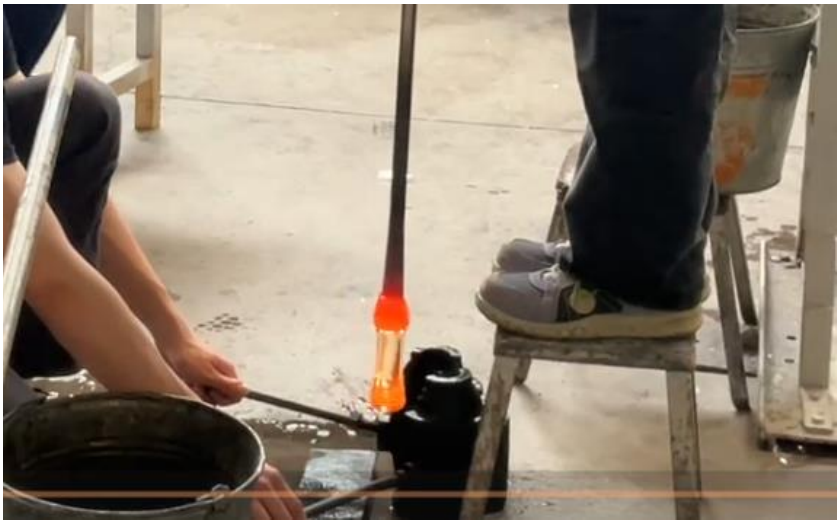


Figure 71 – Detail of video capture of 22-3-2025

8.2.1.2.1.1 - Implementation

8.2.1.2.1.1.1 - Preparatory work (methodology)

- **Recording methodology (equipment & angle of view)**
  - Two different contextual angles were used for recording
- **Interview modality**
  - Group elicitation session conducted outside the workshop
  - Room equipped with a large screen for showing videos
  - Elicitation interview was recorded

8.2.1.2.1.1.2 - Implementation activities (participants & narrative)

- **Subject & matter covered by recording**
  - Blowing moulded cups (orangeade glass style)
  - CAP qualification technique mastery
- **Participants, number & status**
  - One expert trainer: Jean Pierre
  - Four learners: CV1-33 & AP1-24
  - One Craeft project members

8.2.1.2.1.2 -- Evaluation / Results

8.2.1.2.1.2.1 - Preparatory work (methodology)

- Elicitation interview transcribed and analysed using AI tools

8.2.1.2.1.2.2 - Results

This exchange highlighted:

- The main techniques to be improved
- The importance of communication between glassmakers
- The value of observing others and watching videos to improve
- Video is seen as an important tool for self-assessment and peer communication

Limitations identified:

- While analysing and watching videos gives participants better understanding of movements, the written report remains general
- Does not provide specific tips for learners who only have this medium at their disposal

- Exchange between peers (junior and senior) already takes place partly implicitly

Notes:

- Two stages or levels of elicitation identified:
    1. Group elicitation for implementation of reflective approach/practice
    2. Elicitation with trainer or small group of students (with "the best") to elicit and name implicit gestures

8.2.1.2.2 – Video elicitation of, blowtorch – first implementation

Context: The experiment was conducted during a scientific blowtorch course, while training students to produce complex, refrigerant parts required for the CPC qualification. The aim of this recording/elicitation was to enable trainees to identify areas for improvement.

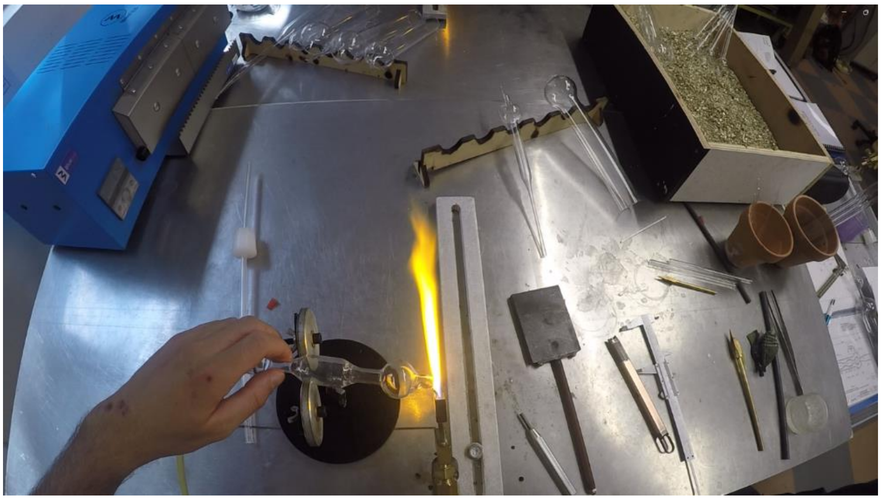


Figure 72 – egocentric view, blowtorch capture of 9-4-2025

8.2.1.2.2.1 -- Implementation

8.2.1.2.2.1.1 - Preparatory work (methodology)

- **Recording methodology (equipment & angle of view)**
  - **First recording (9 April):** Basic part made by trainer
    - Three cameras: one egocentric view, two "contextual" views
  - **Second recording:** Complex part (refrigerant training unit for CAP) by student
    - Two cameras: one egocentric view, one "contextual" view
- **Interview modality**
  - Elicitation carried out on 5 May 2025
  - Collective session

8.2.1.2.2.1.2 - Implementation activities (participants & narrative)

- **Subject & matter covered by recording**
  - Basic part production (trainer demonstration)
  - Complex part: refrigerant training unit for CAP (student)
- **Participants, number & status**
  - One expert trainer: Johanna
  - Two students: CV1-33
  - Two Craeft project members

8.2.1.2.2.2 -- Evaluation / Results

8.2.1.2.2.2.1 - Preparatory work (methodology)

- In parallel of manual notations, the interview is Recorded, transcripted and analyzed via AI artificial intelligence.

8.2.1.2.2.2.2 - Results

Technical adjustments identified:

- Framing issues
- Shooting times
- Addition of filter needed to film glass through flame
- Question raised about using 56-minute video during elicitation

Engagement:

- Strong participation and engagement in video analysis

Type of analysis observed:

- Analysis focuses on desired state of piece (thickness, heat, axis) rather than gestures used to achieve it

- Analysis of method rather than gesture, of technique (in sense of B. Brill)

- Initial analysis, to be confirmed with transcript analysis

Excerpt from AI analysis:

Techniques and know-how:

- Interview identifies key concepts/moments in manufacturing process
- Expert's solutions/suggestions for specific issues

- Preliminary list of points to integrate into practice

Learning dynamics:

- Collective learning process demonstrated
- Experts explain tacit knowledge
- Apprentices acknowledge past mistakes
- Different approaches shared for solving same problem
- Video analysis allows precise identification of problem origins
- Illustrates importance of observation and reflective analysis in learning complex craft

- Know-how passed through demonstration, verbal explanation, gradual correction

Limitations of current video recording:

- Lack of special filter preventing observation of glass behavior in flame
- Suggested improvement: fixed cameras above workstations with suitable filters
- Agreement that video is useful teaching tool but cannot replace direct experience: "It's not the most comprehensive medium. You need the real thing. The two complement each other."

8.2.1.2.3 – Video elicitation on, Finishing touches – initial implementation

Context: Recording with expert finishing trainer (Loïc). This video elicitation session focused on the straight and oblique bevelling of a cup, then the creation of a chamfered plate from 6 mm float glass, which are delicate operations to show students from a first-person perspective and are often points that require redundant explanation.

<u>8.2.1.2.3.1 -- Implementation</u>

8.2.1.2.3.1.1 - Preparatory work (methodology)

- Recording methodology (equipment & angle of view)

    - Egocentric perspective recording

- Interview modality

    - Two explanatory interviews conducted
    - Initially face-to-face with trainer only

8.2.1.2.3.1.2 - Implementation activities (participants & narrative)

- **Subject & matter covered by recording**
  - Straight and oblique bevelling of a cup
  - Creation of chamfered plate from 6mm float glass
- **Participants, number & status**
  - One expert trainer: Loïc
  - One Craeft project member

8.2.1.2.3.2 -- Evaluation / Results

8.2.1.2.3.2.1 - Preparatory work (methodology)

- In parallel of manual notations, the interview is Recorded, transcripted and analyzed via AI artificial intelligence.

8.2.1.2.3.2.2 - Results

Possible scenarios for video use:

- Support for group elicitation
- Integration into e-learning site with subtitles as reference video

Key points of video elicitation added value emerging from interview transcripts:

- The process
- Recommendations
- Advice
- Points to watch out for

8.2.1.2.4 – Video elicitation on, Finishing and decoration, trainer and CV1

Context: Three recordings made with finishing expert trainer (Loïc) and first-year "Glass Designer" students (CV1-33). The video elicitation topics were chosen with a view to working with students on areas that are usually difficult to learn, in consultation with the trainer.

8.2.1.2.4.1 -- Implementation

8.2.1.2.4.1.1 - Preparatory work (methodology)

- **Recording methodology (equipment & angle of view)**
  - Three separate recordings made on 15 and 16 May 2025
  - Workshop setting
- **Interview modality**
  - Group elicitation with trainer and students
  - Outside workshop in room equipped with large screen

8.2.1.2.4.1.2 - Implementation activities (participants & narrative)

- **Subject & matter covered by recording**
    - Removing mould from cups
    - Flattening base (perfectly flat) and rectifying/chamfering rims of cups
    - Cutting curve in 6mm thick flat glass

    - Topics chosen by trainer based on relevant technical points
- **Participants, number & status**
    - One finishing expert trainer: Loïc
    - Two students studying glassblowing with rod (recordings 1 and 2)
    - Three students studying decoration (recording 3)

    - One Craeft project member (support for video captures and interview)

8.2.1.2.4.2 - Evaluation / Results

8.2.1.2.4.2.1 - Preparatory work (methodology)

- In parallel of manual notations, the interview is Recorded, transcripted and analyzed via AI artificial intelligence.

8.2.1.2.4.2.2 - Results

What emerged from elicitation:

- Opportunity for trainer to clarify concepts and advice
- Trainer re-explained techniques with help of videos
- Students saw themselves in action
- Students analyzed, compared, and questioned their approach

AI extraction:

- Drafts of potential process sheets
- Accompanied by advice/recommendations (technical, ergonomic, safety-related)

Educational observations (from Claude AI):

- Importance of concentration and pace in work
- Different methods taught by different trainers
- Value of video for self-analysis of technical movements
- Educational potential of using cameras (GoPro or glasses)
- Document illustrates how video analysis identifies technical differences between craftsmen
- Helps explain tacit knowledge
- Aids in improving learning and transmission of skills

8.2.1.2.5 –Video elicitation, Stained glass, expert artisan

Context: A video recording followed by an explanatory interview was conducted with Sarah, an expert stained glass artisan and trainer. The interview was based on videos of Sarah performing various glass cutting operations.

8.2.1.2.5.1 -- Implementation

8.2.1.2.5.1.1 - Preparatory work (methodology)

- **Recording methodology (equipment & angle of view)**
  - Two complementary angles:
    - General view of Sarah's upper body
    - View focused on hands and technical movements
  - Videos used as discussion basis to access observable aspects of lived experience
- **Interview modality**
  - Explanatory interview based on video recordings
  - Interview in presence of Sarah and David
  - Setting allowed viewing of workshop recordings

8.2.1.2.5.1.2 - Implementation activities (participants & narrative)

- **Subject & matter covered by recording**
  1. Technique for cutting glass with glass cutter (gesture, pressure, trajectory)
  2. Sensory indicators of quality: "singing" of glass and "white cut"
  3. Process of detaching pieces (by hand vs. with pliers)
  4. "Spinning glass" phenomenon as success indicator
  5. Management of re-entrant curves and complex shapes
  6. Anticipation strategies when designing lead path
  7. Use of three-bladed scissors for cutting paper templates
  8. Impact of precision of movement on entire production chain
- **Participants, number & status**
  - One expert: Sarah (stained glass artisan/trainer)
  - One interviewer: David

8.2.1.2.5.2 -- Evaluation / Results

8.2.1.2.5.2.1 - Preparatory work (methodology)

- Not specified

8.2.1.2.5.2.2 - Results

Key takeaways:

Verbalisation of tacit knowledge:

- Sarah explains micro-gestures and usually unconscious sensations
- Reveals sensory richness of expertise (vibrations, resistance, pressure adjustments)

Technical chain of causality:

- Each step conditions the next
- From drawing design to final assembly
- Emphasizes importance of precision from first operations

Adaptive strategies:

- Sarah describes tactical choices for different configurations
- Simple vs. re-entrant curves
- Hand vs. pliers usage
- Methods for anticipating difficulties

Methodological qualities:

- Effective anchoring in concrete action via multi-angle video
- Questions focused on "how" rather than "why"
- Relevant follow-up on sensations and concrete indicators
- Productive co-construction allowing tacit knowledge emergence

Areas for improvement:

- Slow down more on decisive micro-moments
- Question sensory indicators more systematically
- Explore failure situations and their indicators
- Break down complex actions moment by moment
- Avoid overly general questions; favor specific actions

Educational observations:

- Importance of sensory indicators in learning technical movements
- Need for systemic approach: each movement impacts entire process
- Value of anticipation and strategy in craftsmanship
- Relevance of specialized tools and their specific techniques
- Potential of explanatory interviews to reveal hidden complexity of "simple" movements
- Document illustrates how explanatory interviews reveal cognitive and sensory dimensions
- Contributes to better understanding of learning/transmitting complex skills

Conclusion

This document illustrates how explanatory interviews can reveal the cognitive and sensory dimensions of craftsmanship, contributing to a better understanding of the processes of learning and transmitting complex skills.

8.2.1.2.6.1 – Video elicitation/explicitation, glass blowing, Jean-Pierre, expert trainer, cive demonstration.

Figure 73 – detail of video capture of expert gesture – 11-6-2025

Context: This video elicitation was produced at the request of the trainer, Jean-Pierre, with the aim of being able to reuse it as part of a training module on the manufacture of glass rods.

- 11 June 2025: a video was made of the production of a glass pipe, with Jean-Pierre and first- and second-year glass design students (CV 1 and CV2)
- 12 June 2025: a collective explanation session was conducted with Jean-Pierre and the CV1 and CV2 students.

<u>8.2.1.2.6.1 - Implementation</u>

8.2.1.2.6.1.1 - Preparatory work (methodology)

- **Recording methodology (equipment & angle of view)**
    - Handheld digital tablet
    - Allowed following expert glassmaker movements
    - Adaptive camera focus on gestures
    - Views included:
        - General plan for movements

        - Focus on hands and piece during bench work
        - Focus on piece during reheating
    - Note: Raises question of viewpoint adaptation according to action phases, requiring "expert" eye different from gesture expertise itself
- **Interview modality**
    - Collective explanation session
    - Following day (for organizational reasons - did not hinder analysis, allowed clear-headed perspective)
    - Outside workshop in classroom with large screen
    - Participants: trainer and CV1/CV2 students

8.2.1.2.6.1.2 - Implementation activities (participants & narrative)

- **Subject & matter covered by recording**
    - Production of glass with a pipe (cive)
- **Participants, number & status**
    - One expert trainer: Jean-Pierre
    - First-year glass design students (CV1)
    - Second-year glass design students (CV2)
    - One Craeft project facilitator

8.2.1.2.6.2 -- Evaluation / Results

8.2.1.2.6.2.1 - Preparatory work (methodology)

- Not specified

8.2.1.2.6.2.2 - Results

Summary of explanation:

Two distinct analysis levels identified:

1. Technical aspects (driven by students' questions/concerns):

- Use of tools
- Blowing techniques
- Heat management
- Pontils and detaching
- Error management

2. Experience of action (emerged through facilitator questions):

- More difficult to identify
- Trainer discusses difficulty of conveying experience
- Emphasizes need for personal experimentation
- Topics covered:
    - Feeling of pressure when blowing
    - Sensitivity of hands
    - Adapting movements in "reflexive" manner
    - Knowledge transfer

- Learners' frustration

Conclusion

The trainer, Jean-Pierre, the CV1 and CV2 students have embraced and mastered the video tool, which is a very positive development.

The focus when using this tool remains the level of explanation achieved. Indeed, the exchange naturally focuses on technical aspects, which are important and essential for learners and experts but remain external to the experience of the action. We believe this is a necessary step, but not a sufficient one. The challenge is to help and teach trainers and students to access this information so that they can describe the action in greater detail and bring out other important knowledge in the transmission process.

8.2.1.2.7 - Glass blowing video elicitation (cup CV2-24)

Context: To create video support materials for e-learning platform, a recording session on goblet fabrication was conducted with glassblowing trainer. Trainer proposed students also be filmed making this piece with elicitation session to follow.

8.2.1.2.7.1 -- Implementation

8.2.1.2.7.1.1 - Preparatory work (methodology)

- **Recording methodology (equipment & angle of view)**
  - Smartphone and/or tablet
  - Exocentric angle of view
  - Camera positioned as close as possible to egocentric view when possible
  - For certain actions: above glassmaker's right shoulder when working at bench
- **Interview modality**
  - Collective elicitation
  - Participants: students, facilitator
  - 5 days after recording
  - Room outside workshop equipped with large screen for group viewing

8.2.1.2.7.1.2 - Implementation activities (participants & narrative)

- **Subject & matter covered by recording**
  - Steps in making goblet in glassblowing workshop
  - Note: Opening and cold finishing not covered
- **Participants, number & status**
  - One expert trainer
  - Two students
  - One facilitator/videographer

8.2.1.2.7.2 -- Evaluation / Results

8.2.1.2.7.2.1 - Preparatory work (methodology)

- Most relevant video sequences selected
- Elicitation recorded

- Transcription using NoScribe 5.0 AI tool
- Transcript analyzed using Claude/Mistral AI without coding to bring out all themes
- Note: At this stage, dominant/redundant themes not yet identified; felt too early to apply coding

8.2.1.2.7.2.2 – Results

Analysis of glassblowing practices

Arthur and Anne-Cécile students analyse their actions and mistakes when glassblowing, revealing some major issues:

- <u>The importance of mental preparation:</u> Taking the time to visualise the steps before starting helps to avoid mistakes (e.g. picking too much or thermal imbalance).
- <u>Temperature management:</u> Incorrectly assessing the heat of the glass (too hot/cold) disrupts the process. Artisans rely on visual cues (colour, size of the block) and tactile cues (weight, resistance of the cane) to make adjustments.
- <u>Experience and automatism:</u> Experts (such as Jean-Pierre) make corrections intuitively, while learners struggle to correct an initial error, which is often fatal.
- <u>Coordination and 'dance':</u> Controlling hot glass requires precise movements (jerks, rotation) to avoid deformations (e.g. 'banana').
- <u>Learning through analysis:</u> Notebooks and videos help break down the steps and anticipate problems.
- <u>Areas for improvement:</u> Incorporate progressive exercises to develop tactile and visual awareness and build confidence in error management.

Benefits of video elicitation

Video elicitation allows artisans to visualise their actions in real time and analyse their mistakes (e.g. picking, temperature, mould). It promotes awareness of automatic movements and verbalisation of sensations (touch, sight), thereby facilitating self-correction and learning through observation. AC emphasises its usefulness for detailing the steps and completing notebooks.

8.2.1.2.8 - Glass blowing video elicitation (initiation CV1-25)

Context: As courses resumed, glassblowing trainer proposed video elicitation session with first-year Glass Designers (CV1-25) during their initiation - their first contact with glassblowing workshop and hot glass.

<u>8.2.1.2.8.1 - Implementation</u>

8.2.1.2.8.1.1 - Preparatory work (methodology)

- **Recording methodology (equipment & angle of view)**
    - Smartphone and/or tablet
    - Exocentric angle of view for safety reasons
    - Rationale: Having students wear GoPro-type camera on forehead can be distracting despite interesting egocentric view; since initial approach to glassblowing workshop already confusing, filming by operator on workshop periphery preferred (exocentric view)
- **Interview modality**

  - Collective elicitation
  - Participants: expert glassmaker (trainer), students, facilitator
  - One day after recording
  - Room outside workshop equipped with large screen for group viewing

8.2.1.2.8.1.2 - Implementation activities (participants & narrative)

- **Subject & matter covered by recording**
  - First gestures of students in glassblowing workshop
  - Especially: gathering
  - How to keep glass on rod with regular rotation
  - Preventing glass from falling while making glass drop
- **Participants, number & status**
  - One expert trainer
  - Ten students
  - One facilitator/videographer

8.2.1.2.8.2 - Evaluation / Results

8.2.1.2.8.2.1 - Preparatory work (methodology)

- Same as global methodology (see § 8.2.1.2.7.2)

8.2.1.2.8.2.2 – Results

Analysis of glassblowing practices

- Rotation of the cane: Essential for mastering the material, but often forgotten during transitions (e.g. moving to the bench). Jean-Pierre emphasises its gradual automation, as in driving a car. A student notices the rotation of the rod is not a finality but a way to control the glass, keep it in the axe etc.
- Recurring errors: Excessive or poorly controlled picking (pulling instead of gathering), thermal imbalance, and loss of control due to haste or clumsiness.
- Sensory awareness: Touch (weight, resistance) and sight guide movements. Jean-Pierre stresses the importance of feeling the material rather than relying solely on sight.
- Adaptation for left-handers: Need for specific tools and correction of reversed reflexes.

Benefits of video elicitation

Video elicitation allows learners to visualise their mistakes (e.g. rotation, picking) and verbalise their feelings. Jean-Pierre uses it to correct and reinforce automatic responses. Learners emphasise its role in completing notebooks and tracking their progress, promoting constructive self-assessment.

Videos and self-assessment: Learners recognise the usefulness of videos in identifying their mistakes and improving.

Teaching methods: Jean-Pierre favours a gradual approach, avoiding shortcuts, and encourages collective analysis of movements.

8.2.1.2.9 - Apprentices cluster of September and October/November (mixed techniques AP2-24)

Context: The video elicitation experiment was conducted with second-year apprentices (AP2-24) from the TA test group during the two group sessions 7 and 8. Four recording sessions were held on 13, 15, 20 and 22 September, with two elicitation sessions on 19 and 23 September for group No. 7; two recordings were made on 31 October and 3 November, with an elicitation session on 6 November for group No. 8. The techniques observed cover different glass specialities, reflecting the different options represented in the TA group and the different subjects that apprentices must study during their course.

Figure 74 - Images extracted from the video recordings of mixed technics - 2025

8.2.1.2.9.1 - Implementation

8.2.1.2.9.1.1 - Preparatory work (methodology)

- **Recording methodology (equipment & angle of view)**
  - The recordings were made using a smartphone and/or tablet.
  - The angle of view is exocentric, for safety and none intrusively reason.
- **Interview modality**
  - All the elicitation are collective, with students and the facilitator as participants.
  - The elicitation of 19 of September additionally have an expert glassblower (Jean-Pierre).
  - The elicitation of 6 of November was done with an expert on finishing (Loïc)
  - The elicitation session takes place one or few days after the recording, in a room outside the workshop equipped with a large screen for group viewing.

8.2.1.2.9.1.2 - Implementation activities (participants & narrative)

- **Subject & matter covered by recording**
  - The matters observed are, glassblowing with a pipe, finishing, glass decoration and stained glass.
- **Participants, number & status**
  - One expert, depending session
  - Twelve students
  - One facilitator/videographer

8.2.1.2.9.2 -- Evaluation / Results

8.2.1.2.9.2.1 - Preparatory work (methodology)

- Same as global methodology (see § 8.2.1.2.7.2)

8.2.1.2.9.2.2 – Results

Analysis of the elicitation document dated 19 September

This document illustrates the collective analysis of technical gestures in glass blowing and glass decoration, using elicitation videos. The learners and the trainer (Jean-Pierre) identify recurring errors:

- Poor heat management (glass too cold/hot, poor cooling control).
- Axis and rotation problems (poorly positioned rod, glass not centred).
- Blowing defects (irregular thicknesses, piercing the bottom).
- Posture and tension (tense movements, excessive force). Trainer emphasises the importance of concentration, precision of movement (e.g. blowing with the thumb, avoiding pulling the rod when picking up glass) and adapting to the tools.

Learners recognise that the video allows them to visualise their mistakes and adjust their practice, despite initial disruption caused by the camera.

Analysis of the 23 September elicitation document

This document focuses on cutting, polishing and platinum working techniques in glass decoration. Discussions reveal:

- Precision difficulties: Managing angles, bevels and facets, with posture issues (ill-suited machines, tension).
- Debates on methods: Use of a gauge vs. freehand cutting, wet/dry polishing, and grinding techniques (e.g., avoiding digging into the grinding wheel).
- Sensory perceptions: Importance of touch (pressure, vibration) and sight (perspective, alignment), with tips such as using oil to facilitate cutting.
- Ergonomic adaptation: Need for fluid movements and suitable tools (e.g. gloves, goggles).
- Videos help to correct movements and understand mistakes, but some parameters (such as pressure) remain difficult to grasp without physical sensation.

Analysis of the elicitation document dated 6 November

This document explores the analysis of technical gestures in bush hammering, vinyl cutting, and finishing, through elicitation videos. The learners (Aude, Rémi, Thomas, Kylian) and the trainer (NC) highlight several issues:

- Angle precision: In chiselling, the angle of the chisel (45°) is crucial to avoid breaking the plate or creating holes. Aude notes that mental representation of the angle is essential.
- Techniques and postures: Tension (hands, arms) and fluid movements are analysed, with individual adaptations (e.g. use of cutters vs. scalpels).
- Profitability vs. learning: Learners mention time pressure and the difficulty of correcting ingrained movements, despite their inefficiency. Thomas and Aurore discuss the paradox between speed and quality.

- Sensory perceptions: Touch (pressure, vibration) and sight (alignment, perspective) guide movements, but remain difficult to convey on video.

Benefits of video elicitation

Video elicitation is a key tool for self-assessment and improvement of technical movements. It allows learners to:

- Visualise their mistakes (axes, postures, precision) and understand the corrections suggested by trainers.
- Verbalise their sensations (touch, sight, tension) and compare their perceptions with reality.
- Improve by identifying details that are invisible in real time (e.g. tension, angles).
- Share tips with peers, reinforcing collaborative learning.

However, it does not capture all sensory parameters (e.g. exact pressure), hence the importance of combining video and practice.

8.2.2- Hybrid mode

8.2.2.1 – Narratives

8.2.2.1.1 – Feedback on the use of the e-learning platform for technical drawing – CV1-33

Figure 75 – Craeft e-learning platform presentation to CV1-33

Context: Experience takes place at end of academic year, focuses on revising basics rather than learning them. The experiment was planned in two times, 1- the students have an autonomous access to the e-learning platform, 2- Reviewing learning through a flipped classroom.

<u>8.2.2.1.1.1 -- Implementation</u>

8.2.2.1.1.1.1 - Preparatory work (methodology)

- **Modality**
    - Two-stage experience:
        1. Before class: students asked to study course on platform independently
        2. Initially planned to review learning; became feedback on platform experience
- **Interview modality**
- Collective with presence of technical drawing trainer and facilitator

- The exchange is recorded so that it can then be transcribed and analysed

8.2.2.1.1.1.2 - Implementation activities (participants & narrative)

- **Subject & matter covered**
  - Technical drawing course via e-learning platform
  - Focus on revising basics
- **Participants, number & status**
  - Trainer
  - Students: CV1-33

8.2.2.1.1.2 -- Evaluation / Results

8.2.2.1.1.2.1 - Preparatory work (methodology)

- Discussion with students

8.2.2.1.1.2.2 - Results

Themes emerging from student discussion:

1. Navigation and ergonomics of platform:

- Complex and sometimes confusing interface
- Issues: "Next" and "Next activities" buttons in quizzes
- Registration required for each course

2. Assessment of quizzes:

- Overall good assessment
- Can be confusing because module begins with quiz
- Comparison of answers and results (already implemented? To be verified)

3. Video assessment:

- Helps with comprehension
- Short videos appreciated
- Suggestion: additional videos on same subject, different situations

4. 3D objects and practical exercises:

- Help make connection between theory and practice

5. Complementarity between face-to-face and e-learning:

- Recognized value

6. Flexibility of platform:

- Permanent access
- Adapts to personal constraints ("whenever you have 5 minutes")

7. Suggestions for improvement:

- Complete certain course chapters (e.g., quotations)
- Wiki mode
- Increase number of situations, examples, exercises
- Include bibliographical references
- Develop explanations for diagrams
- Graphic appearance and appeal: less monotonous, highlight important information

Additional improvement area identified:

- Develop tutorial on module usage
- Cover navigation and construction principles
    - Example: how first quiz works

8.2.2.1.2 – Decorative glass – Trainer and CV2-33

Figure 76 – Trainer explaining negative curvatures – 9-9-2025

Context: on 9 September, an observation was made on the use of demonstrators during a course on moulding as part of learning the 'pâte de verre' technique. 3D-printed demonstrators had been manufactured prior to this class in order to help demonstrate the basic principles of moulding, draft angles, undercuts, two-part moulds, elastomer moulds, etc. It should be noted that the instructor also used real moulds during this class.

8.2.2.1.2.1 – Implementation

8.2.2.1.2.1.1 - Preparatory work (methodology)

- Overall methodology
    - Discussion with the trainer on concepts that are difficult to learn, which could be taught more easily with the aid of demonstrators.
    - Creation and 3D printing of three demonstrators.

- Interview modality

- In two stages:
  - Observation of the class, note-taking and photography
  - Discussion with students, in order to ask them questions and gather their opinions

8.2.2.1.2.1.2 - Implementation activities (participants & narrative)

- Subject & matter covered
  - Negative curvature
  - Elastomer mould
- Participants, number & status
  - Expert trainer
  - Students: CV2-33, 5 participants

8.2.2.1.2.2– Evaluation / Results

8.2.2.1.2.2.1 - Preparatory work (methodology) - Idem as global methodology,see § 8.2.1.2.7.2

8.2.2.1.2.2.2 – Results

Participants emphasise the usefulness of 3D models and actual moulds for visualising moulding principles, particularly parting lines, undercuts, and interlocking keys. Models provide a better understanding of technical constraints (e.g., demoulding, plaster thickness) than 2D diagrams, but their scale and rigidity (3D printing) sometimes limit the accurate representation of materials (e.g., silicone).

Feedback emphasises:

- The importance of colour coding to distinguish between materials (plaster, wax, elastomer).
- The complementary nature of models and actual moulds to avoid visualisation errors.
- The idea of integrating these tools in the first year to familiarise students with 3D software and moulding processes, with progressive exercises.
- The addition of step-by-step diagrams to clarify techniques (e.g. positioning cling film in underlay casting).
- Participants suggest improving the accuracy of the models and expanding the collection (e.g. hot/cold moulds).

8.2.2.1.3 – Technical drawing – Trainer and CV1-34

Contexte : Une expérimentation informelle de l'usage des démonstrateurs 3D a été menée le 15 septembre, avec les étudiantes-ts créateurs verrier de première année (CV1-34) en cours de dessin technique. L'intention étant d'observer si et comment les étudiantes-ts s'appropriaient/s'emparaient des démonstrateurs.

Figure 77 – Technical drawing course using demonstrator – 15-9-2025

8.2.2.1.3.1 – Implementation

8.2.2.1.3.1.1 - Preparatory work (methodology)

- Overall methodology
  - Creation of 3D printed demonstrators linked to exercises, lessons, or video modules from existing e-learning platforms, with the aim of facilitating understanding of the transition from 3D to 2D orthogonal projection, particularly for people who have difficulty with spatial vision.
  - Trial session during the technical drawing course to test the use and impact of the demonstrators.
- Interview modality
  - Collective feedback interview – not done yet.

8.2.2.1.3.1.2 - Implementation activities (participants & narrative)

- Subject & matter covered
  - Technical drawing
- Participants, number & status
  - Trainer
  - Students: CV1-34, 10 participants

8.2.2.1.3.2 – Evaluation / Results

8.2.2.1.3.2.1 - Preparatory work (methodology)

8.2.2.1.3.2.2 - Results

The result is currently purely informal, as it has not yet been possible to conduct a group feedback session with the students. However, trainer regularly reuses the demonstrators, particularly for introductory courses on the basics of technical drawing. His feedback is that the demonstrators help people who find it difficult to make the connection between the real three-dimensional object and the 2D codification of technical drawing. This assistance seems to work both ways: reading and understanding a volume from a plan, or creating a plan from an object.

8.2.2.1.4 – Use of the e-learning platform in HSE – CV1-34

Context: Proposal made to Health, Safety and Environment (HSE) course trainer to experiment with hybrid mode using e-learning platform. Aim: offer teaching scenario combining digital and traditional methods with specific role for each.

8.2.2.1.4.1 -- Implementation

8.2.2.1.4.1.1 - Preparatory work (methodology)

- **System defined with trainer:**
    1. **25/8/2025:** Initial "traditional" session
        - Present course
        - Outline schedule for following session
    2. **31/10/2025:** Trial session
        - Invite learners to work on e-learning platform ahead of face-to-face course
        - Invite learners to take course
        - Trainer completes, corrects, structures, re-explains
        - Demonstrators used
        - Assessment via traditional or digital methods depending on exercise specifics

8.2.2.1.4.1.2 - Implementation activities (participants & narrative)

- **Subject & matter covered**
    - Health, Safety and Environment (HSE) course
- **Participants, number & status**
    - Trainer
    - Students: CV1-34

8.2.2.1.4.2 -- Evaluation / Results

8.2.2.1.4.2.1 - Preparatory work (methodology) [To be completed - narrative started, informal feedback from Philippe, no formal student feedback]

8.2.2.1.4.2.2 – Results

The feedback we have received is from the trainer; we did not have the opportunity to organise a debriefing session with the CV1-34 students. Most of the students studied the HSE course in advance, as requested by the trainer. The trainer drew on the trainees' prior knowledge during the course but did not go so far as to implement a flipped classroom. Comments such as 'oh, we already know that' were reportedly made. According to the trainer, the results of the formative assessment at the end of the course were good. However, it is difficult to measure the impact of the e-learning tool, for example in comparison with the previous year's CV1 course, as the student profiles and course conditions were not controlled.

In summary, the e-learning platform has been well received by students and has had a beneficial effect through the involvement in learning that the use of the e-learning platform entails. Furthermore, while the repetition of concepts promotes memorisation over a short period, it can lead to weariness (see CLT). The implementation of a hybrid mode, apart from the intrinsic performance of the tool, seems to us to require time and support from trainers to adapt and develop their uses and to integrate this digital tool as effectively as possible.

8.2.3 - Conclusion

Experiments conducted between March and November 2025 at Cerfav reveal the significant contribution of digital tools — video, e-learning and 3D demonstrators — in the transmission of craft skills, particularly in glassmaking.

Video elicitation is proving to be a key educational tool: it allows learners to visualise their mistakes (gestures, control over the glass, axis, temperature), verbalise their sensations (touch, resistance) and collectively analyse techniques with trainers. Feedback highlights its usefulness in supplementing workshop notebooks, reinforcing self-assessment, and revealing tacit knowledge (micro-gestures, anticipation). However, video does not replace physical experience, particularly for sensory parameters (pressure, vibrations).

Hybridisation (e-learning + face-to-face) also has benefits: flexibility, independent revision and complementarity between theory and practice. 3D demonstrators facilitate understanding of technical constraints (moulding, projections), but their effectiveness depends on their gradual integration and adaptation to the training curriculum and educational methods.

Finally, these tools stimulate collaboration (video sharing, collective analysis) and systematise learning, while requiring support from trainers to fully exploit their potential. The challenge remains to fully combine, through the hybrid mode, digital innovation and traditional transmission to enrich the training of artisans.

8.3 – feedback from trainers

8.3.1 – Glassblowing workshop simulator VR feedback

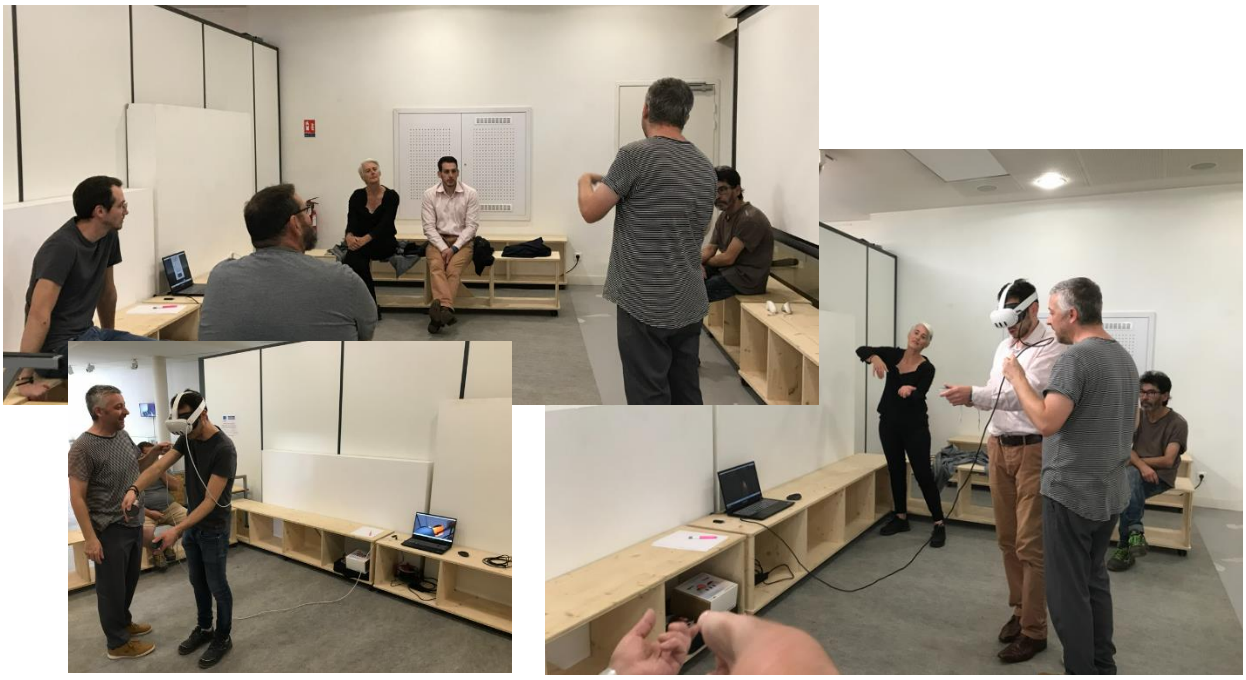


Figure 78 – VR glassblowing simulator Cerfav trainer trial

8.3.1.1 – implementation

The VR glassblowing workshop simulation experiment was conducted on 9 September 2025 with Cerfav trainers teaching various glass specialities, including glass blowing with pipe, pâte de verre and finishing. A demonstration and individual experimentation with the simulation were followed by a question-and-answer session with the trainers to gather their feedback on the experience and the role this tool could play in the learning process.

The discussion with the trainers was recorded and transcribed using the local AI tool NoScribe 5.0. This exchange was analysed using the AI tool Claude with the same coding used for the apprentices' feedback on the VR glassblowing workshop simulation, see Annex 3.

8.3.1.2 – summary

Trainer Consensus

The trainers agree VR has value for:

1. Initial familiarization and reducing fear
2. Isolated practice of specific technical movements (especially kiln picking)
3. Visualization of movements trainers cannot normally observe

However, they strongly caution that:

- VR cannot replace hands-on material confrontation

- Extended VR use without material practice is not educational
- The inability to simulate glass viscosity changes is a fundamental limitation
- Missing weight/haptic feedback severely limits learning transfer

The ideal implementation for trainer would use VR for targeted skill gaps within a primarily workshop-based learning structure.

8.3.2 – E-learning platform feedback

8.3.2.1 – implementation

This interview was done with Hygiene Safety and Health (HSE) trainer, after two experimentations with CV1-34 students (ten students) and AP1-25 apprentices (twenty seven students), during October and November 2025.

He asked learners to study the module on the e-learning platform before the HSE course. The initial idea was to then be able to implement a flipped classroom or to check what had been learned using the questioning method. This was partially achieved, as the HSE trainer had not yet been trained in these methods. The feedback provided by HSE trainer is based on the perception of the digital tool in its current state of integration with other teaching tools.

8.3.2.2 – Summary

This interview reveals a gradual integration of digital tools (e-learning) into his educational methods, while emphasising their complementarity with traditional methods. The e-learning platform is perceived as a revision tool ('They see it more as a revision tool') and a lever for engagement ('it reinforces the fact that it's a real course'), but its use remains limited.

Students show varying degrees of acceptance: some embrace it ('trainees who wanted to get stuck in'), while others cite difficulties in accessing it ('bad faith'). Trainer emphasises the added value of the trainer ('the added value of the trainer, otherwise it's useless'), particularly in simplifying concepts ('very simple words') and guiding analysis ('I was putting all the bits and pieces together').

Hybridisation (digital/face-to-face) seems promising, but requires increased support for students and trainers. Today, in the context of the HSE course, digital tools are seen as a revision aid and a means of diversifying teaching approaches.

8.3.3 – Interview on overall experiment

8.3.3.1 – implementation

Interviews were conducted with Cerfav trainers in various glass specialities, glass blowing, blowtorch and finishing, on the acceptance, integration, use and impact of digital tools in the learning process, in order to gather their experiences of Craeft, what they think they can gain from it and their suggestions.

The interviews were conducted individually, following the questionnaire (see Appendix 4, § A4.c.1), recorded and transcribed using the NoScribe 5.0 tool. A coding system was established based on the questionnaire framework (see Appendix 5, § A5.a.4). An analysis of the transcripts using the coding system was then carried out using the AI tools Mistral and Claude. The coded extracts from the interviews are in Appendix 12, § A12.2.

8.3.3.2 - Summary

The three trainers—Johanna, Jean-Pierre and Loïc—highlight the contribution of digital tools, particularly video, to enriching the transmission of technical skills in glassmaking, while emphasising the need to integrate them with moderation and relevance.

Johanna highlights video elicitation as a lever for decoding one's own techniques (e.g. musical rhythm to explain spinning) and promoting exchanges between peers. She sees educational potential, but insists on the need to regulate its use to avoid digital overload and preserve human contact.

Jean-Pierre, with 50 years of experience, considers video to be a complementary tool to practice, useful for analysing errors (e.g. correcting cives) and accelerating learning. He stresses the importance of combining tradition and innovation by integrating digital tools at key moments (e.g. waiting time in the workshop).

Loïc, who is younger, sees video as a way to overcome difficulties (e.g. traditional pruning) thanks to its immersive perspective. He regrets that its use is not yet natural and calls for better accessibility (e.g. GoPro in the workshop) and educational training to structure feedback.

Common points:

• Video is seen as a tool for reflection and correction, but its integration must remain occasional and targeted.

• Trainers emphasise the importance of learner autonomy (e.g. students filming their actions) and adaptation to individual needs.

• A balance is sought between digital innovation and traditional transmission, with a preference for simple and accessible tools.

Key challenge: Moving from experimental use to established practice by training trainers to lead debriefings and choose the right moments to use these tools.

8.3.4 – conclusion

Experiments conducted in 2025 reveal a nuanced adoption of digital tools (virtual reality, e-learning, video) by glassmaking trainers, who perceive them as useful complements to traditional methods rather than substitutes for them.

Virtual reality (VR) is considered relevant for initiation (reducing apprehension) and the isolated practice of technical gestures (such as glass gathering from the furnace), but its limitations are clear: lack of haptic feedback (weight, viscosity of glass) and inability to replace material experience. Trainers recommend targeted use, either upstream or in support of workshops.

E-learning is seen at this stage as a revision tool and a lever for engagement, but its effectiveness depends on the support of trainers for improve learning methods. Unequal implication of learners and the need to simplify concepts highlight the importance of thoughtful hybridisation.

Video elicitation is widely used to decipher movements (rhythm, errors), encourage self-analysis and peer exchanges. However, its use must be targeted and structured to avoid digital overload and preserve human contact. Trainers emphasise the need to train teachers to lead debriefings and choose key moments for integration.

The challenge: Finding a balance between digital innovation and traditional educational methods, favouring accessible and integrated tools to enrich — rather than replace — practical learning.

9 – RCI 2 – Limoges Porcelain

9.1 - General Context and Pilot Framework

The CNAM research team, in collaboration with ENSAD, the National School of Arts and Design in Limoges, extended the collaboration initiated with the documentation practices through the implementation of the CRAEFT Ethnographic Protocol focusing on a set of operations and their associated technical gestures representative of Limoges porcelain know-how.

After a first exploratory phase based on experimentation with various digital tools designed to analyse and represent the gestures involved in the shaping process known as *tounassage*, the second phase of the *Pilot 1. Education and Training* on Limoges porcelain focused on the in-depth exploration of a single digital tool, developed by FORTH, the *Plaster Turning Simulator.* The overall objective was to evaluate the educational and creative potential of this tool within the specific context of ENSAD Limoges, whose dual focus on art and design, strong historical ties to the porcelain heritage[3], and the orientations of its teaching programme make it a particularly relevant institutional environment for conducting this Pilot. In accordance with the guidelines set out by CERFAV in its *Educational Kit*, the general aim of this Pilot, together with its methodological approach, was to establish a framework for observation and analysis to examine the potential and limitations of a hybrid learning device centred on the use of the *Simulator*. This framework was designed to support the assessment of the development of specific skills associated with a particular stage of the porcelain making process, namely the shaping of the plaster model.

In addition to the team of teachers and designers coordinating the ceramics and porcelain workshop, with whom collaboration had been established since the outset of the project, in the process of organisation of the second workshop, it was decided to involve another instance of the school, the CCE, the *Ceramics as an Experience* Research Laboratory[4]. In the frame of the workshop, this collaboration aimed to actively explore the connections between traditional turning techniques used in the Porcelain Workshop, the different uses of the *Simulator,* and the possibilities offered by 3D Ceramic Printing Technologies. In this context, the Simulator was positioned as a core component of the hybrid pedagogical device, facilitating structured interaction and mutual reinforcement between practices developed in the traditional workshop environment and those implemented in the laboratory through digital approaches. Thus, the workshop design incorporated a range of technical devices, including the traditional plaster turning wheel, the *Plaster Simulator*, 3D modelling software, and 3D ceramic printers. The methodological structure of the workshop was based on a combination of this diversity of porcelain-related tools.

[3] The origins of ENSAD Limoges lie in the Municipal School of Fine Arts Applied to Industry, founded in 1867 by Adrien Dubouché with the support of local porcelain manufacturers.

[4] The CCE research laboratory « Ceramics as an experience » *(La Céramique Comme Expérience)*, was founded in 2015 in order to develop the digital dimension in relation to ceramics, with the aim of exploring the potential contributions of digital technologies and digital fabrication to contemporary ceramic creation.

Figure 79 - Simulator Workshop at CCE Research Laboratory at ENSAD Limoges © Inés Moreno/Cnam

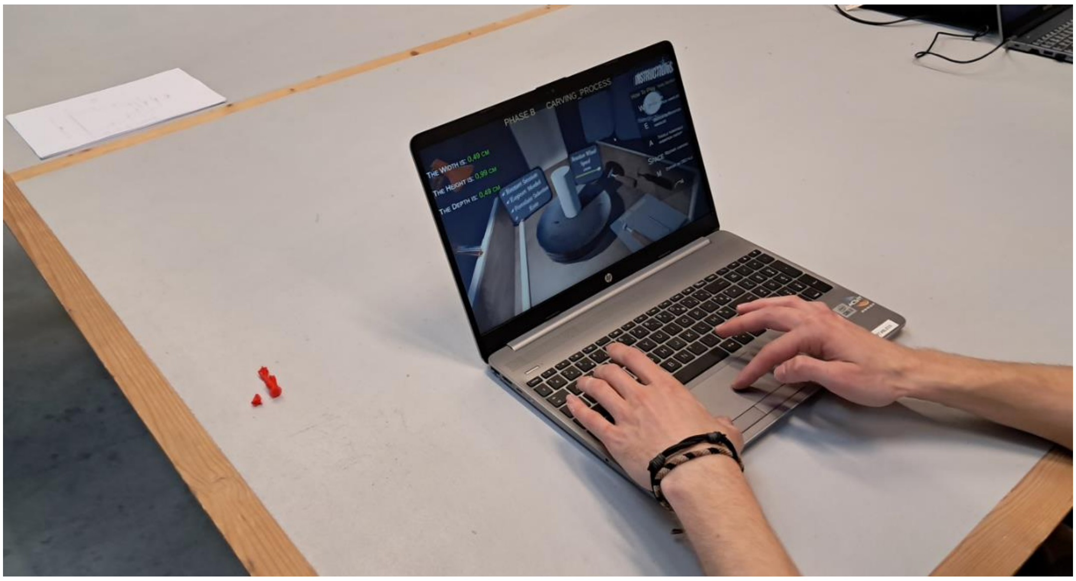


Figure 80 - Simulator Workshop at CCE Research Laboratory at ENSAD Limoges, © Inés Moreno/Cnam

9.1.1 - Pilot Timeline

The second phase of the RCI-2 Pilot on Limoges porcelain took place between February 2025 and January 2026 (M25 and M35.). This second phase was structured into four major stages:

1. **Simulator Development** (February – November 2025)

- Planning and conceptualization of potential extensions and enhancements to further expand the initiative, informed by evaluation outcomes and ongoing dialogue with designers.
- Development of the *Plaster Simulator* digital tool, including continuous iteration and refinement through recursive feedback from porcelain-focused experts and teachers.

2. **Workshop implementation** (12-13 November 2025)

- Two-day workshop in November 2025 at ENSAD Limoges.
- Systematic collection of participant feedback.

3. **Evaluation** (December 2025– January 2026)

- Analysis of feedback from workshop participants.
- Reporting of results.
- Formulation of recommendations on the digital tool.
- Paper writing on the Simulator conceptualisation, technological implementation, improvement process, and first results.

4. **Final recommendations and improvement** (January-February 2026)
   - Final feedback.
   - Adjustments and development of final Simulation prototype.

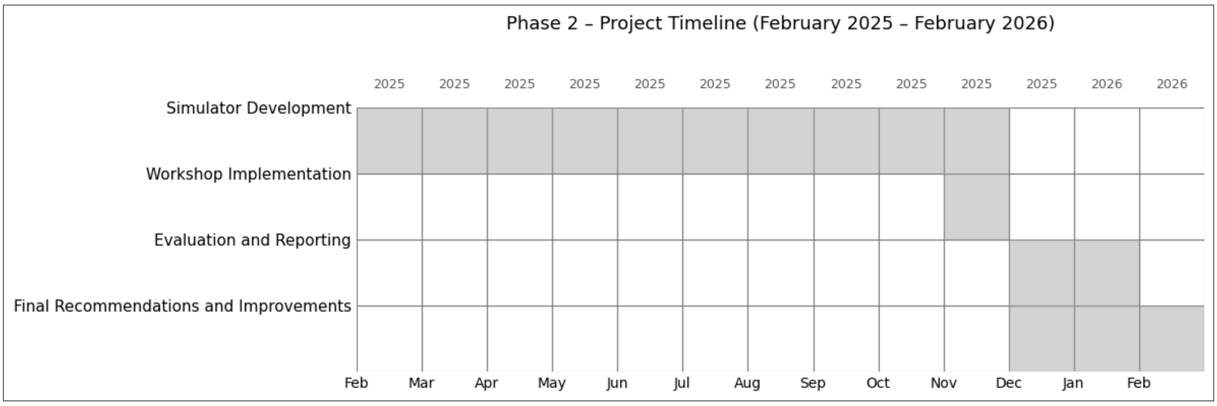


Figure 81 - Timeline of Phase 2 of the RCI.2. Limoges Porcelain Education and Training Pilot (February 2025 - February 2026).

9.1.2 - Digital Materials Development

Plaster Turning Simulator Development Process

During the first phase of the Pilot, an initial version of the simulator was developed by FORTH and introduced at the first workshop, alongside the other digital tools, focused on gestural representation. These first participants had the opportunity to try out this initial simulator, but at that stage the tool was not tested in a systematic way as a teaching tool. With the specific aim of examining the potential of the *Simulator* as a teaching tool in the context of an art and design school, a complex process of improvement and refinement was undertaken. This activity focused on the user-centred design and implementation of an interactive digital simulator dedicated to plaster turning for porcelain slip-casting. Developed in close collaboration with expert porcelain-related practitioners, the *Simulator* reproduces the specific workflow of the ceramic workshop, from the preparation of a plaster blank to the geometric constraints imposed by the turning wheel and tools. This phase was developed through an iterative, user-centric process, resulting in five successive prototypes that were regularly evaluated through expert feedback. Follow-up discussions and semi-structured interviews with expert practitioners were conducted to clarify terminology, decision points, and workshop-specific conventions, ensuring the alignment of simulated actions with actual workshop practices. The digital simulation of the craft action is structured around two main phases of the plaster turning process:

1. *Centring*: liquid plaster is poured into a formwork (mould) and allowed to set into a cylindrical blank on the wheel.

2. *Turning*: The user works with a rotating cylindrical blank, using cutting tools to shape the revolving solid into its final form.

These core crafting action (centring and turning), form the basis of the simulator's interaction model. The simulator allows 3D export (as an .OBJ file) to be used for digital ceramic printing.

In addition to supporting the acquisition of tacit procedural knowledge, the Simulator serves as a digital twin of the crafting process through three objectives. First, it organises craft knowledge in an action-centred way, integrating stimuli from the workspace, the possibilities offered by the tools, and the decision-making of practitioners. Secondly, it offers a more intuitive first-person perspective than conventional third-person documentation, allowing students to experiment safely, make mistakes and rehearse actions without consuming materials. Thirdly, it bridges the gap between craft practice and digital design by generating geometric data compatible with 3D printing practices.

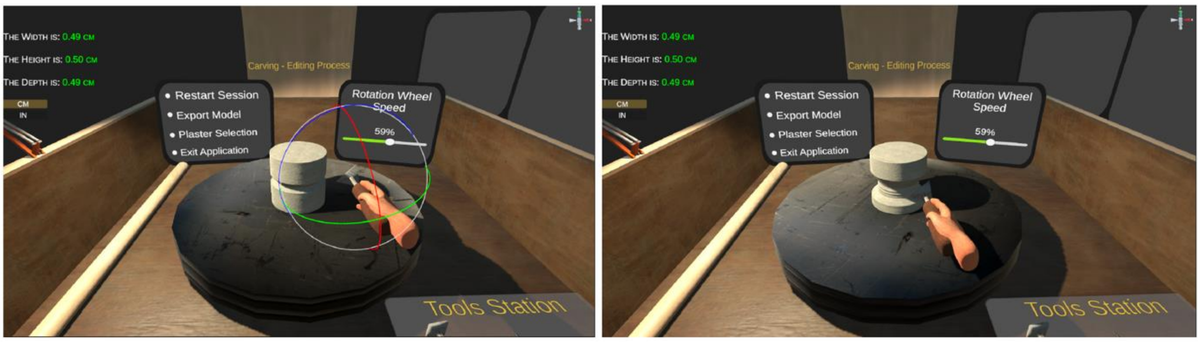


Figure 82 - Simulator Prototype (version 4) depicting tool positioning and Cutting action with the virtual hand / FORTH

Figure 83 - *Simulator* Toolset (pointer and two different turning tools) / FORTH

Ceramic 3D Printing Techniques

In collaboration with the CCE research laboratory, involving training in the Ceramic 3D Printing techniques, making use of 3D printing software to generatel G-code files and Ceramic 3D printers at the school premises, using porcelain paste and, making some printing tests with stoneware paste.

9.1.3 - Workshop Participants

The development and iterative improvement of the Simulator were carried out in close collaboration with the teaching team, including teacher-designers, technicians, and technical teaching assistants working in the workshop. At a later stage, during and following the workshop, this process also involved the participating students.
The group comprised 15 students enrolled in the *Ceramic Studio*[5] educational programme within the ENSAD Limoges curriculum. Participants included second- and third-year students from both the art and design tracks, bringing together a broad range of profiles and educational backgrounds. This diversity was reflected in the intentional composition of mixed groups, regardless of prior experience in plaster turning techniques or digital fabrication, to encourage peer learning, collaboration, and knowledge exchange. In contrast to the previous workshop, which involved exclusively female participants, this second session presented a more balanced gender distribution, with three male students representing 20% of the cohort. It should be noted that two of the students had participated in the first workshop.

The *Ceramics Studio* programme was established by teaching members of the ENSAD Limoges ceramics workshop. It is structured around annual themes that students interpret freely as the basis for developing their individual projects. The programme focused on *Atavism* in 2024–25 and on *Without Hands* in 2025–26. It includes a collaboration with the Adrien Dubouché National Ceramics Museum, enabling artistic and design research based on the museum's collections, associated documentation, and on-site classes addressing techniques represented in the collections. The programme is open to both art and design students.

The school's teaching team, drawn from both the *Ceramic Studio* and the CCE Research Laboratory, was continuously involved throughout the process, from the development and iterative improvement of the Simulator to the design of the workshop's pedagogical framework and its implementation.

Participants profile and initial skills

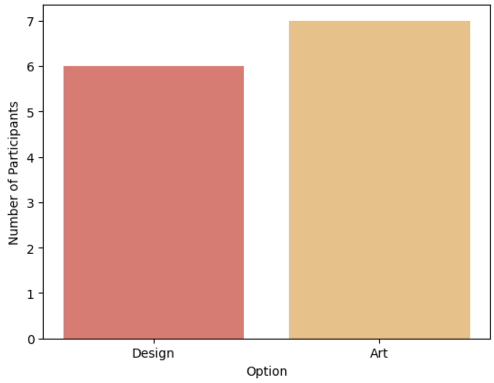


Figure 84 - Distribution of participants by school option.

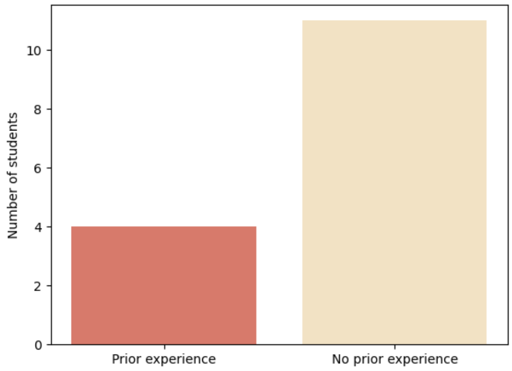
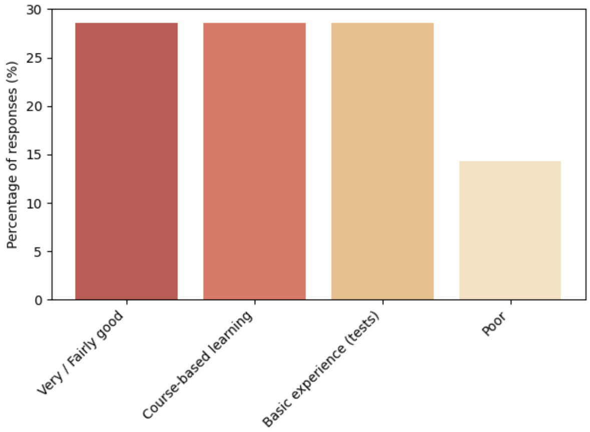


Figure 85 - Distribution of students according to prior experience with the plaster wheel



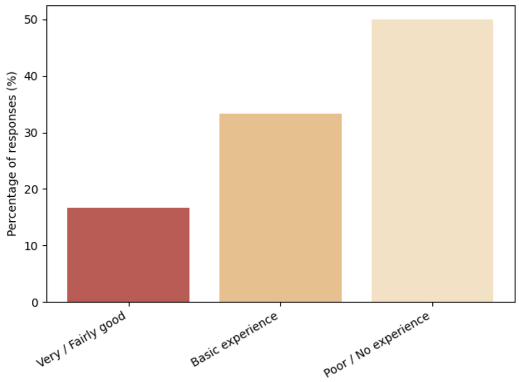


Figure 86 - Participants prior experience in 3D modelling software

Figure 87 - Participants prior experience in 3D printing techniques

Figure 88 - Simulator Workshop at the Porcelain Workshop, ENSAD Limoges © Inés Moreno/Cnam

9.2 - Methodology

9.2.1 - General methodological approach

Following CERFAV's educational methodological guidelines, the second phase of the pilot programme focused on establishing a hybrid mode of educational experimentation. The entire pedagogical device was designed around the *Simulator,* a virtual plaster wheel. The overall objective was to experiment with the interaction between the virtual potter's wheel and the traditional plaster wheel and to study the transitions between these two techniques in terms of learning and skills acquisition. The inclusion of 3D ceramic printing techniques allowed, from the same model, the production of two pieces, one in plaster produced with the wheel in the workshop and the other in porcelain with 3D printing.

In line with the Pilot's general research approach, the workshop was designed and implemented in close collaboration with the school's teaching team[6], taking into account the specific nature of its educational context and the students' profile.

During the workshop, ethnographic documentation included note-taking, extensive photo-taking, and the recording of pedagogical interactions later transcribed and translated.

Preparation of equipment and materials

[6] The designers and teachers, Jessie Dérogy and Anne Xiradakis and Educational Assistant Technicians, Arnaud Borde and Gilles Bonnetat.

- Technical Setup: As the Simulator operates exclusively on PC, enough laptops and desktop computers were provided to allow students to work in pairs.

- 3D printing time constraints: The workshop design considered the relatively long printing times required for 3D-printed pieces.

- Basic Model Exercise: A staircase-shaped model was d by the designer and teacher Jessie Dérogy and provided to participants in printed form. This model served as a common reference for the Simulator modelling exercise, ceramic 3D printing tests, and the plaster wheel turning practice.

9.2.1.1 - Workshop Structure

9.2.1.1.1 - Day 1

1. Project and workshop presentation.
2. Students worked in pairs to familiarise themselves with the digital tool through free exploration.
3. In pairs, students reproduced a spiral staircase based on a reference drawing, without dimensions, requiring them to determine proportions autonomously. The models were exported in .Obj format with the support of the 3D printing instructor, allowing students to extract and document dimensions.
4. As teams completed the first exercise, they were divided into two groups.
    - Group 1 moved to the Porcelain workshop to reproduce the staircase using their dimensioned drawings using the Plaster Wheel.
    - Group 2 remained in the workshop to prepare and carry out the 3D printing of their models.
5. Group debriefing and preparation for Day 2.

9.2.1.1.2 - Day 2

The two groups rotated between workshops to ensure that all participants gained experience with both techniques and fabrication processes.

Group 1 participated in the 3D printing workshop under the supervision of the 3D printing instructor. This session focused on the preparation of digital files for fabrication, an understanding of printing constraints, and the production of staircase models using ceramic 3D printing techniques.

Group 2 worked in the porcelain workshop, where participants translated digital dimensions into physical form by reproducing the staircase drawing in plaster. Through this process, they gained hands-on experience and were introduced to plaster preparation, plaster carving techniques using the plaster wheel, and appropriate material handling procedures.

The workshop concluded with a 1h collective evaluation and exchange of feedback among instructors and participants.

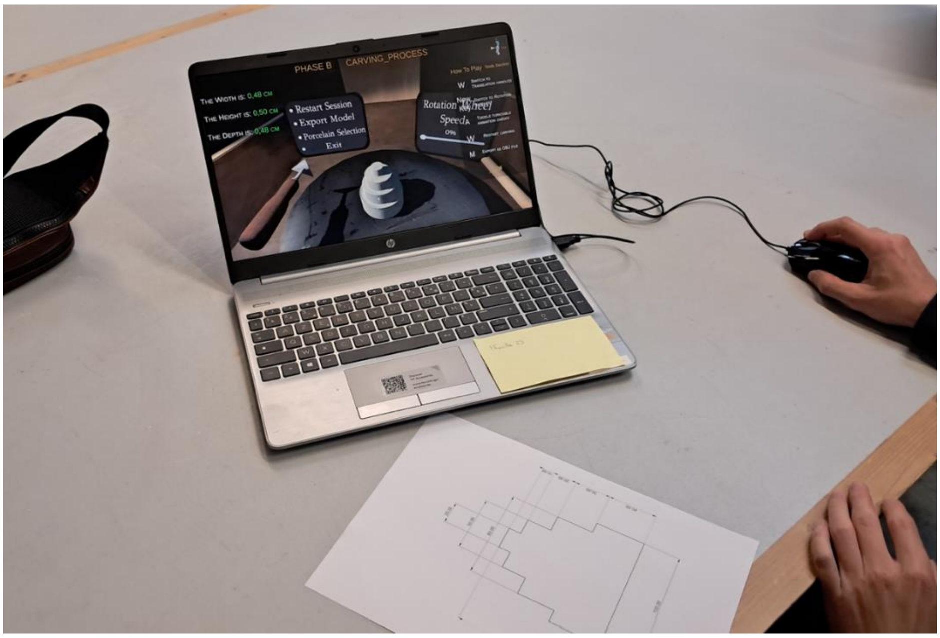


Figure 89 - Simulator 3D modelling exercise, during the Simulator Workshop, CCE Research Lab, ENSAD Limoges - © Inés Moreno /Cnam

Figure 90 - Plaster Wheel turning process during the Simulator Workshop at the Porcelain Workshop, ENSAD Limoges - © Inés Moreno / Cnam

9.3 - Learning outcomes

The workshop combined an introduction to ceramic 3D printing techniques in the laboratory with an initiation to traditional turning techniques on a plaster wheel in the porcelain workshop. The simulator supported the transition between traditional studio practice and 3D printing processes. Printing time was used as an active learning period, enabling project discussions, assessment of technical and material feasibility, observation of printed outcomes and experimentation, thereby fostering autonomy, critical thinking and a strong connection between digital tools and traditional craft practices.

9.3.1 - Learning Content on Ceramic 3D Printing (Laboratory)

1. G-code preparation

Improved understanding of 3D file formats and slicing workflows for printable file preparation.
Configuration of G-code parameters in relation to machine constraints and ceramic material properties.
Capacity to make informed decisions regarding internal filling, wall thickness and structural balance in relation to drying and firing processes.
Awareness of the specific technical constraints of ceramic 3D printing, including overhangs, supports, vibrations, software transfer issues and the fragility of unfired printed pieces.

2. 3D printing machine and adjustments

Understanding the printing machine, its components and its operating principles.
Learning how to select and install appropriate nozzles and to adjust machine parameters (pressure, extrusion rate and speed).
Identify discrepancies between G-code settings and actual printed results.
Awareness of the need for continuous monitoring and in-process defect correction during printing.

3. Material preparation and post-processing

Preparation of ceramic materials (porcelain and stoneware), focusing on appropriate consistency and moisture content for printing, considering drying, firing processes, intermediate sanding steps and post-firing finishing options such as glazing or assembly elements using slip. It is emphasized that the porcelain paste used in 3D printing is the same as in traditional ceramic workshops, with only the forming process being digitized.

9.3.2 - Learning Content on Turning Techniques on a Plaster Wheel (Porcelain Workshop)

Application of basic safety procedures in a workshop environment while working with rotating devices.
Preparation of liquid plaster with appropriate consistency and to eliminate air bubbles.
Preparation and setting up the plaster wheel, including formwork selection, installation and fixation.
Monitoring plaster behaviour during the drying process, including texture changes and temperature rise.

Preparation of turning tools, and an introduction to measurement and centring practices, as well as correct body posture and controlled tool handling.

Learning how to react to common workshop issues such as reattaching detached pieces, rehydrating plaster for reworking.

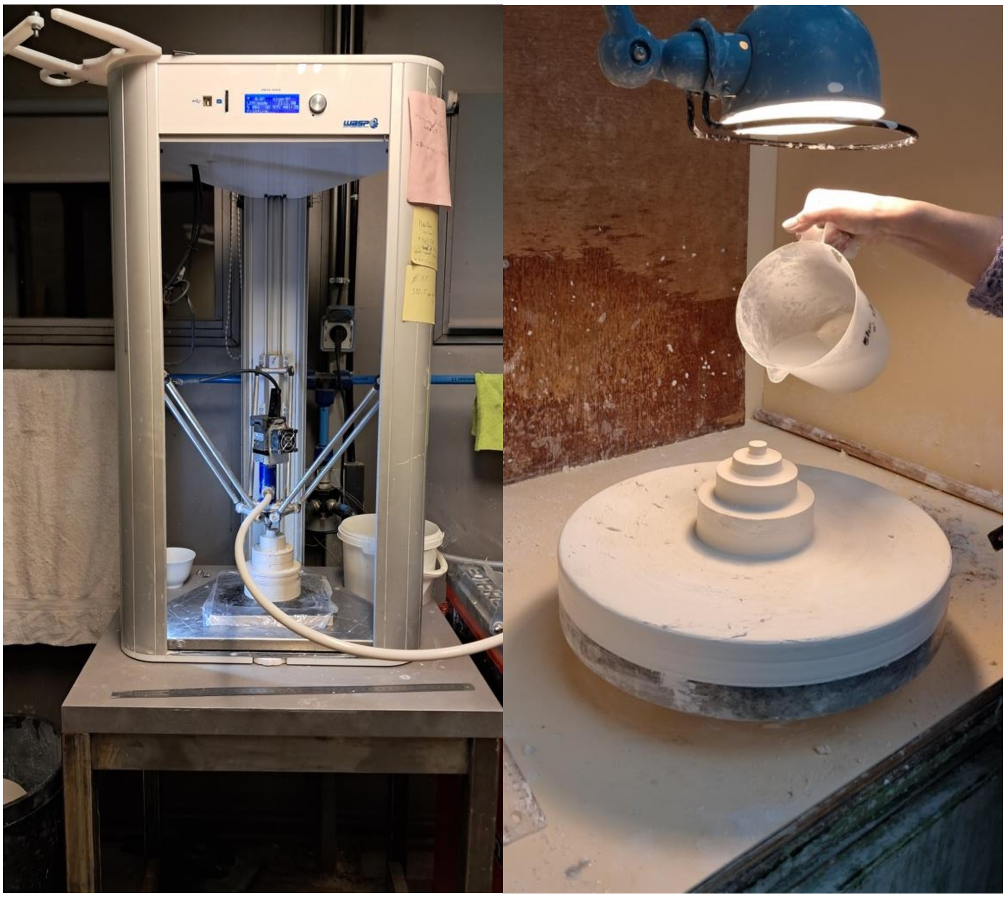


Figure 91 - Ceramic 3D printing process / Turning techniques on Plaster Wheel
© Inés Moreno / Cnam

9.3.3 - Evaluation -Assessment

The evaluation approach mainly focused on the *Simulator* and combined different modalities of data collection:

- On-the-spot feedback.
- Online questionnaire.
- Collective reflective feedback session, serving both as a method for gathering feedback on the digital tool and the workshop dynamics, and as a concluding moment of the workshop.
- Individual interviews with experts in the techniques covered by the Simulator, 3D modelling and the use of the traditional plaster wheel.

9.3.4 - Analysis of Results - Recommendations for the improvement of the *Simulator*

The evaluation focused primarily on the *Simulator*, its potential and its limitations, both pedagogically and creatively. On a more reflective level, the workshop invited participants to think about the possibilities of integrating craft workshop practices, design and artistic practices, and digital tools and digitally induced creative mindsets.

9.3.4.1 - Pedagogical and didactic effectiveness

The *Simulator* showed strong potential as a pedagogical resource, particularly for supporting early understanding of shaping principles, process sequencing, and material logic prior to hands-on workshop practice. Participants recognised its value for visualising objects in advance, experimenting without material constraints, and encouraging a reflective approach to making. These qualities position the *Simulator* as a promising tool within educational contexts related to craft, design, and artistic practices. Pedagogical effectiveness could be further enhanced by making the logic of plaster wheel practice more explicit. Clarifying the pedagogical positioning of the Simulator, whether as an initiation tool, a space for creative experimentation, or a preparatory interface for production, would further strengthen its educational impact. Such clarification would facilitate its integration into formal teaching programmes as well as non-formal educational settings such as museums.

9.3.4.2 - Ergonomics and accessibility

The collected feedback highlighted the need to improve ergonomics and accessibility in ways that would significantly enhance the overall user experience. Participants expressed interest in more fluid tool manipulation, clearer camera behaviour, and more intuitive spatial navigation, all of which are essential for learning through action in digital environments. Introducing core interaction features such as the ability to undo and redo actions, access an action history, and save work would encourage experimentation and reduce hesitation during use. Improvements to visual clarity through lighting, contrast, and depth cues would also contribute to better accessibility, particularly for users who are less familiar with 3D software. The integration of visual guidance systems including grids, reference markers, templates, and measurement tools would help learners better understand spatial relationships and tool positioning. Allowing tools to be pre-positioned directly on the piece profile would further support learning by reducing unnecessary manipulation and reinforcing correct operational gestures. Further improvements could include more flexible tool control, such as the ability to switch between global and local coordinate systems, enabling more precise and intuitive movements. In the longer term, immersive interaction approaches, including virtual reality, represent a promising direction for aligning digital gestures more closely with embodied workshop practices

9.3.4.3 - Organisation of content and workspace

The *Simulator* would benefit from a clearer and more structured organisation of content and the digital workspace to support usability and learning. Reorganising the workspace into clearly identified functional areas for modelling, tool manipulation, and visualisation would improve readability. Simplifying the interface by aligning features with current usage scenarios would further enhance coherence. A more structured and readable workspace would strengthen the *Simulator*'s effectiveness as a pedagogical tool.

9.3.4.4 - Creative potential and exploratory practices

The *Simulator* offers strong potential as a platform for creative exploration, enabling users to experiment with forms beyond the constraints of material practice. By expanding the range of available tools and allowing their adaptation or creation, it could support a wider diversity of formal outcomes and encourage exploratory, iterative design processes. The introduction of predefined shapes and improved interoperability with other digital tools including 3D printing (for example, by including the possibility to generate a G-code file), would further position the *Simulator* as a bridge between conceptual design and material realisation. In this way, the tool could function not only as a preparatory environment but also as a platform for creative research and innovation.

9.4 - Final conclusions

The second phase of Pilot 1. Education and Training has demonstrated the relevance of a hybrid pedagogical approach combining so called traditional craft practices, digital simulation, and additive manufacturing within an art and design education context. The *Plaster Turning Simulator* has proven to be a meaningful intermediary tool, capable of articulating the relationships between gesture, form, material constraints, and digital representation in a way that is accessible to learners with diverse backgrounds. As such, it constitutes both a pedagogical tool for teaching and rehearsing freehand plaster turning.

As a learning device, the *Simulator* offers a sufficiently realistic representation of plaster turning to support preparation for physical workshop practice. It enables users to rehearse key stages of the process, experiment new shapes without material waste, and reflect on decision making in shaping operations. It contributes both to skills acquisition and to the development of analytical capacities, particularly when embedded within a designed pedagogical framework that explicitly put into dialogue virtual and physical environments.

Beyond its immediate educational value, the *Simulator* functions as a form of digital twin of the craft process. By structuring knowledge around actions, material constraints, and tool uses, it opens new possibilities for documenting, analysing, and transmitting intangible craft skills that are traditionally learned through direct observation and embodied practice. The integration of the possibility of export for ceramic 3D printing further extends this logic, allowing learners to observe how digital decisions translate into material outcomes and to compare results across fabrication methods. The workshop experience has highlighted the importance of usability, clarity of purpose, and alignment with workshop realities to fully realise this potential. The didactic effectiveness of such tools depends not only on technological sophistication, but also on ergonomic design, accessibility for non-expert users, and a clear pedagogical positioning. Close collaboration between developers, designers and teachers, practitioners and researchers has proven essential in identifying these dimensions.

Figure 92 - Plaster Wheel turning process during the Simulator Workshop at the Porcelain Workshop, ENSAD Limoges © Inés Moreno / Cnam

Generally, the experience of the Pilot approach on the Limoges Porcelain context confirms the value of hybrid learning devices in craft education when they are conceived not as replacements for traditional practice, but as complementary spaces for experimentation, reflection, and knowledge transmission. The outcomes contribute to broader research objectives on skills preservation, innovation in education and training, and the context-sensitive and sustainable integration of digital technologies within heritage-based practices.

10 – RCI 4 / 6 – Marble carving & Silversmithing

10.1 - Introduction

This report covers the educational activities that PIOP conducted as part of Work Package 6, Pilot 1 – Education & Training. It consists of two sections referring to the second experiments of each RCI, marble carving and silversmithing. Each section contains a methodology part and an experiment and observations section.

10.2 - RCI4 - Marble carving, Tinos

10.2.1 - Methodology

According to CERFAV's updated educational methodological plan, a group of participants is separated into two to form a control and a test group. The test group receives the digital aid developed by CRAEFT, and the control group performs the educational program with traditional means. In the second experiment, the digital aids are integrated into the learning experience rather than added at the end. Furthermore, the educational program focuses on specific areas of the museum exhibition to better accommodate the experiment and the expected learning outcomes of the participants. The targeted areas were the Quarry, Marble carving, and Drawings. The educational aims focused on identifying and naming the process steps of each technique and the tools used in each step, and the connection between drawings and craftsmen.

We developed a Research Sheet (Annex 4-1) to be handed out to the participants before the educational program. The aim is that the participants engage in active learning through research in the museum and the help of the museum professional (control group) or the digital aids (test group). A final quiz (Annex 4-2) for all will evaluate the information acquired through the educational program. A User Experience Questionnaire (UEQ)[7] will also be used to evaluate the interactive educational material. At the end, group discussion and experience exchange will take place. All the material is in Greek.

10.2.2 - Experiment and observations

Due to school constraints regarding their educational yearly duties and their inability to conduct a museum visit, it was decided to conduct the experiment at the school premises. The experiment took place on Monday, 19 May 2025, in a classroom during a teaching hour. Because time was limited, we decided to focus only on the quarrying with wedges technique.

[7] https://www.ueq-online.org/, accessed 29 November 2024.

The participants were the same as in the first experiment (17 pupils). We briefly reminded ourselves of the project and why we are back for a second experiment.

We began by sharing the adapted research sheet including only the technique of quarrying with wedges. The museum professional briefly introduced the technique, its steps, and the tools used in each step. He drew the tools on the interactive board of the classroom and explained their use. To formulate the test group, we randomly chose those sitting in one line of desks. Those were seven pupils in total (five boys and two girls). The pupils sitting at the rest of the desks formed the control group. Those were 10 pupils in total (seven boys and three girls).

We then distributed the six tablets to the test group and asked them to fill in the research paper after they had gone through the interactive learning material. At the same time, the museum professional engaged the rest of the classroom with the same task by further explaining the process and tools.

One thing we did not consider before the experiment is that the interactive video has sound, which is important for the knowledge transmission. The parallel viewing of the video created a noise in the classroom. Furthermore, we realized that, although the tools are mentioned in the interactive video, we did not have a specific interactive quiz regarding the tools and process steps. The work of the museum professional on the interactive board also helped the test group acquire that knowledge.

Due to time constraints, we decided to take advantage of the time we had to allow the pupils to learn about the quarrying with wedges technique. We helped everyone to understand and complete the research sheet and take it home. We did not do the final quiz and a group discussion. As a concluding remark of the second experiment, the museum professional found that the focus on specific techniques and their detailed step breakdown, as well as the combination of speech, real-time demonstration, and digital tools, is a good method to transmit knowledge. He was also eager to use the tools for future workshops at the museum.

10.3 – RCI 6 - Silversmithing, Ioannina

10.3.1 - Methodology

Due to PIOP’s time constraints, it was decided to make a different experiment at Ioannina. Instead of re-designing the first educational experiment, and because the interactive learning materials are also used in the museum application developed for the Valorization pilot (6.3), we came up with a plan to assess both the museum application and its educational outcomes through a joint anonymous evaluation with visitors.

To keep things in order and not confuse the aims and actions of visitors, we developed a specific interactive game to prove if the application’s users have understood the silversmithing techniques on which Craeft focuses, which are sand casting and filigree. The game shows the image of a silver object and provides choices of techniques and tools. A table with two columns, one for techniques and the second for corresponding tools, invites the user to drag and drop the techniques and tools that were used to make the object (Figure 93).

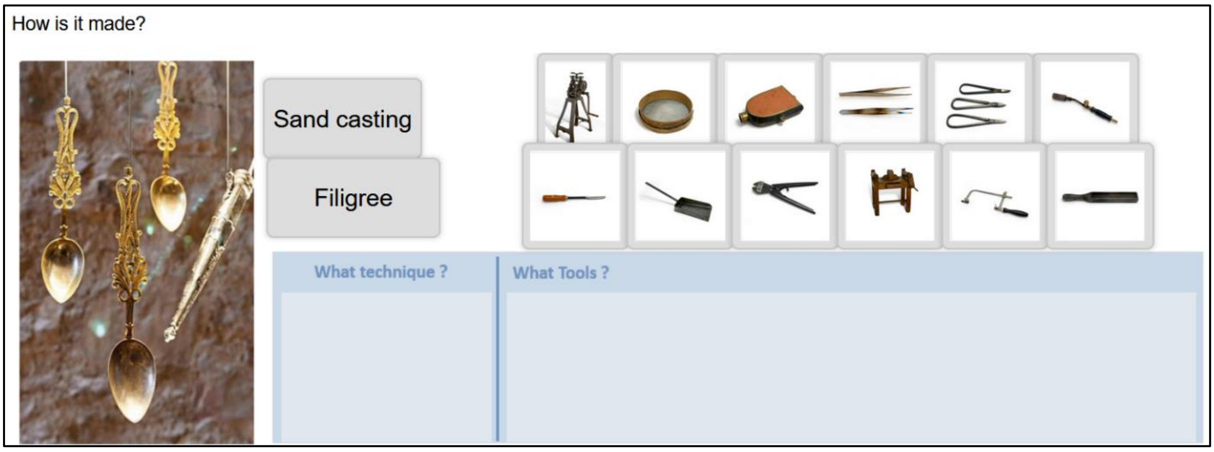


Figure 93. The interactive game "How is it made?"

The plan is that museum visitors receive the application at the beginning of their visit, either by downloading it to their mobile devices or with a tablet that we provide, use the interactive learning material at the designated museum areas as an aid to their physical visit, and at the end of their visit, we ask them to fill out the specific interactive game to assess their knowledge.

10.3.2 - Experiment and observations

The application's evaluation and the adapted educational experiment took place on Thursday, 10 July 2025, at the Silversmithing Museum of Ioannina. Due to the limited timeframe of the evaluation and the choice to work with regular museum visitors, a sampling frame (Bernard 2006) was not prepared. Instead, we asked every visitor for their participation and respected their wishes. Eight museum visitors participated in the extra test for 6.1's adapted experiment.

Two out of the eight participants had 100% accurate responses at the quiz, that is, they completed 7/7 points. Two participants had positive results scoring 86% (6/7 points) and 71% (5/7 points) accuracy, respectively. One participant had only 14% (1/7 points) accuracy, while three of the participants failed to score any points. It should be noted that the participants who had 100% accuracy informed us that they achieved it after three or more attempts. The rest of the participants did not mention any other feedback after completing the test.

It is hard to draw any conclusions regarding the educational outcomes of the application (which combines a physical museum visit with digital aids) with such a small number of participants. Furthermore, because the means of introducing the interactive learning material was through an application that was evaluated for the first time, it can be suggested that the application's UX might have played a role. Overall, from the evaluation survey used for the Valorization pilot's needs, the visitors were enthusiastic about the interactive learning material as a complementary way to understand techniques. Some even emphasized their indicative use to trigger the curiosity of younger generations. More targeted educational uses could be suggested for the future to better assess the educational value of digital aids in a museum visit.

10.4 - References

Bernard, H. R. (2006). Research methods in anthropology: Qualitative and quantitative approaches. Lanham: Altamira Press.

11 – RCI 5 – Woodcarving

11.1 - Implementation

11.1.1 - Preparatory work

11.1.1.1 - Objectives

The main objective of the Education Pilot on woodcarving at CETEM was to design, implement, and evaluate a traditional face-to-face training on woodcarving and an integrated e-learning experience with digital support through an e-learning platform. The initiative sought to explore how interactive videos and digital training materials can enhance the learning process, promote knowledge retention, and encourage future independent practice after face-to-face training or even as independent training. Specifically, the pilot aimed to:

- Introduce participants, professionals, VET trainers, and students, to the **basic principles and techniques of woodcarving**.
- Facilitate the acquisition of **manual and artistic skills** essential for creating simple carved pieces, starting from tool handling and safety to finishing techniques.
- Assess how **blended learning formats** (combining physical workshops and digital materials) support engagement and skill consolidation.
- Promote **cultural appreciation of woodcarving as part of local craft heritage**, with contextual lessons about its tradition in Yecla and its relevance in contemporary design and furniture making.
- Develop a **replicable educational framework** to preserve and promote traditional craftsmanship through modern digital tools

11.1.1.2 - Skills to Be Learned

Participants were expected to acquire technical, artistic and cultural skills related to traditional woodcarving.

➢ Technical and artistic skills

- Identification and use of **hand and power tools** (gouges, mallets, clamps, sharpening tools).
- Knowledge of **appropriate wood types** (pine, linden, birch, cedar, etc.) according to carving difficulty.
- Application of **basic carving operations**: drawing, roughing, shaping, and surface finishing.
- Execution of **tool sharpening and maintenance** procedures.
- Development of **artistic sensitivity and design thinking**, fostering creativity and respect for craft heritage

➢ Cultural and heritage-related skills

- Understanding the **historical evolution of woodcarving in Yecla**, its link to traditional furniture manufacturing, and its role in defining the local craft identity.
- Appreciation of **artisanal values** such as precision, patience, and respect for material integrity.

- Recognition of how **traditional carving techniques** can inspire innovative approaches in modern furniture and interior design.
- Development of **aesthetic sensitivity** and awareness of craftsmanship as an expression of cultural heritage and sustainable design.
- Strengthening of **community-based learning**, reflecting how craft knowledge has historically been transmitted through workshop practice and peer exchange.

11.1.1.3 - Methodology

The process (Figure 94) began with an initial knowledge test, designed to assess participants' baseline understanding of woodcarving concepts, materials, and tools, and know their knowledge and experience in this practice. Based on this initial assessment, learners were divided into three experimental groups, each following a different learning approach:

1. **Group 1 – Face-to-Face Training:** Participants attended traditional, in-person workshops focused on hands-on practice under direct instructor supervision.
2. **Group 2 – Online Training:** Learners completed the course entirely through the **e-learning platform**, using interactive videos, digital materials, and self-guided exercises without physical attendance.
3. **Group 3 – Hybrid Training:** This group combined both methods, first participating in face-to-face sessions and then continuing their learning through the online platform to reinforce skills and review course content.

At the end of the training period, all participants, regardless of their group, completed a final evaluation, consisting of both practical and theoretical tests. This assessment measured skill acquisition, knowledge retention, and overall learning effectiveness, allowing comparison of outcomes across the three teaching formats. An evaluation survey was also completed, to gather the feedback and opinions of students and also the face-to-face trainer.

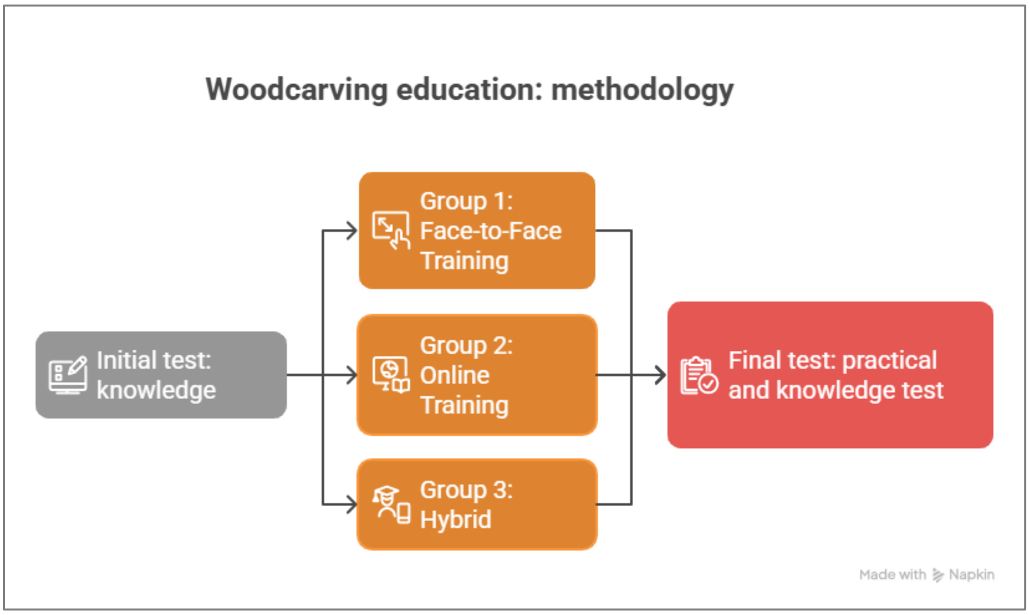


Figure 94 – Woodcarving education methodology

11.1.1.4 - Schedule

The centre planned to complete the entire activity within one year (Figure 95). The process began with the development of training materials for both the face-to-face and online courses. After the in-person sessions, the online content was further enriched with recorded demonstration videos and additional resources based on the classroom experience.

The planning phase also involved the selection of participants, ensuring a diverse group that included VET tutors, sector professionals, and VET students. None of the participants had prior experience or formal training in woodcarving techniques, which ensured a homogeneous starting level across the group.

Once the materials and tools were prepared, the experimental phase was launched. It started with the face-to-face workshop, followed by the online training course. As described in the methodology, participants were divided into three groups: one face-to-face group, one online-only group, and a hybrid group composed of a few students who accessed the online course after completing the face-to-face sessions.

The evaluation process was carried out in parallel with the training activities, combining continuous observation with formal testing. A more detailed analysis of results was conducted once all training sessions were completed and participants' feedback had been collected.

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
Educational pilot												
1. Preparation and planning												
2. Experiment												
2.1 Face-to-face classes												
2.2 Online classes												
3. Evaluation and analysis												

Figure 95 – Woodcarving experiment timeline

11.1.1.5 - Training content

For the training experiment, both face-to-face and online, specific theoretical and practical materials were developed to ensure the acquisition of the proposed knowledge and skills. While the face-to-face format allowed greater flexibility to combine theory and practice organically, the online training required careful structuring of all learning resources to ensure a smooth, coherent, and engaging learning experience that supported progressive knowledge acquisition.

The Introductory Woodcarving Course, with a time learning of 25 hours, is structured into six modules that guide students step by step through the learning process of this traditional craft. During the first four modules, students explore the history and evolution of woodcarving, gain familiarity with the workshop environment, and learn about basic tools such as gouges and chisels, as well as the most commonly used types of wood and their properties. The essential carving techniques are introduced with a strong emphasis on safety measures, which are repeatedly reinforced throughout the practical sessions.

The last two modules focus on practical application and autonomous learning. Students carry out three progressive carving exercises supported by explanatory videos and detailed images, while an additional set of complementary videos reinforces key concepts and encourages continued skill development beyond the course.

The following sections summarize the six modules of the online course, which were also followed during the face-to-face sessions:

Module 1. Introduction to Woodcarving - In this first introductory module, students will discover an ancient craft that combines technique, patience, and creativity. The course provides an overview of the history and evolution of woodcarving, with special attention to the rich artisanal heritage of Yecla, where traditional craftsmanship has evolved into a thriving furniture industry deeply rooted in artistic expression.

Module 2. Tools and Materials for Woodcarving - This module introduces the workshop environment and its organization, focusing on the fundamental tools and equipment used in woodcarving, such as gouges, chisels, and mallets. Students will also learn about the different types of wood most commonly used for carving, their unique properties, and the techniques for selecting and working them properly.

Module 3. Workshop Considerations - This module provides essential knowledge for the maintenance and care of tools, including sharpening techniques to ensure precision and efficiency. It also covers the key safety principles required to work safely in the workshop, fostering good practices that prevent accidents and extend the lifespan of the tools.

Module 4. The Woodcarving Process: Steps and Tool Handling - In this module, students will learn how to design, carve, and finish wooden pieces, mastering each phase of the process. The training emphasizes the correct use of tools, the sequence of carving operations, from drawing and roughing to finishing, and the importance of precision and control in achieving high-quality results.

Module 5. Practical Exercises - This module includes three progressive practical exercises, available in video format, allowing students to apply the knowledge and skills acquired throughout the course. The exercises progress from simple forms to more complex reliefs and culminate in a free-themed personal creation, encouraging creativity and self-expression through carving.

Module 6. Supporting Videos - The final module offers a collection of complementary videos that expand on both theoretical and practical aspects of woodcarving. These resources allow students to deepen their understanding of the craft, revisit specific techniques, and continue improving their skills independently after completing the main course.

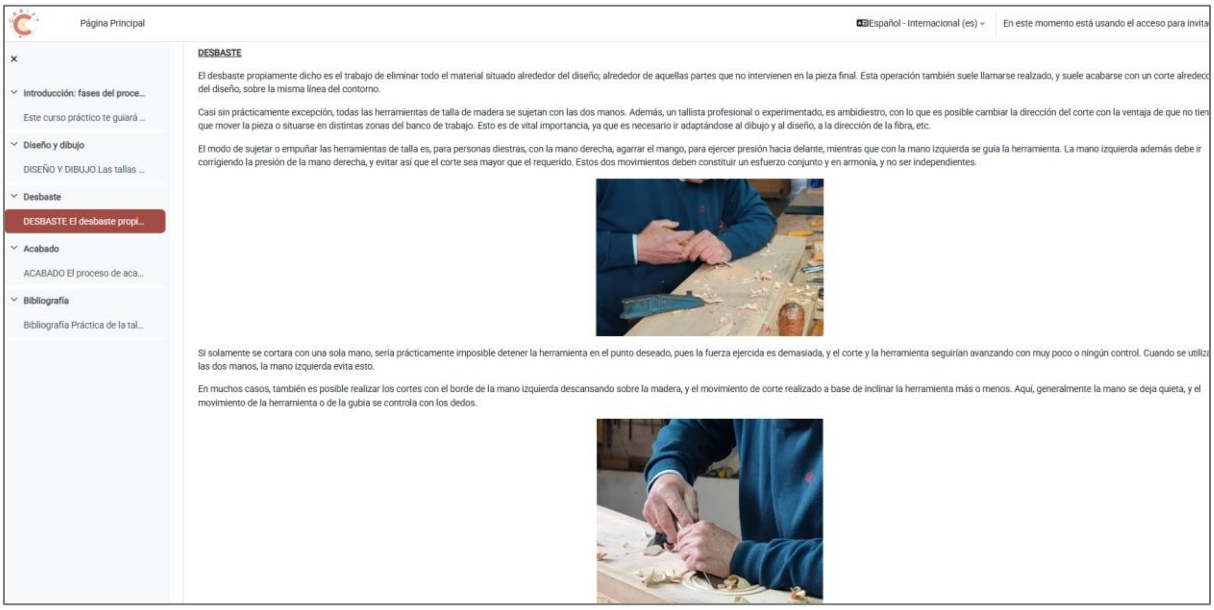


Figure 96 – Woodcarving e-learning example

11.1.1.6 - Tools and materials

A specific selection of tools and materials (Figure 97) was prepared according to the requirements of the planned exercises. Each participant was provided with an individual toolkit consisting of:

- Gouges (4):
  - Flat gouge (5/12)
  - Medium gouge (7/14)
  - Burin or V-gouge (60º, 12/6)
  - Small flat gouge (5/5, optional shared)
- Mallet
- Baseboard (30×40 cm) with wooden strips for securing workpieces
- Two small clamps (or workbench stoppers)
- Wood pieces:
  - One pine piece for initial exercises (15×15×2.5 cm)
  - Three pieces of soft carving wood (linden) for progressive exercises

In addition, common workshop materials were provided for collective use, including:

- Finishing: walnut stain, wax, sandpaper
- Sharpening: stones, oil/water, leather, polishing paste
- Drawing: carbon paper, pencils, erasers, compasses, masking tape

For the online training experiment, all participants were equipped with the necessary tools and materials to ensure the correct completion of the exercises and to maintain consistency with the face-to-face training setup.

Figure 97 – Woodcarving tools

11.1.1.7 - E-learning Platform

The e-learning platform used for the online component of the pilot was those designed to offer a simple and intuitive learning experience in the framework of the CRAEFT project, with tailored training to different crafts: https://www.craeft.eu/elearning. Access to the platform did not require prior registration, allowing participants to enter the course directly and navigate freely through the content.

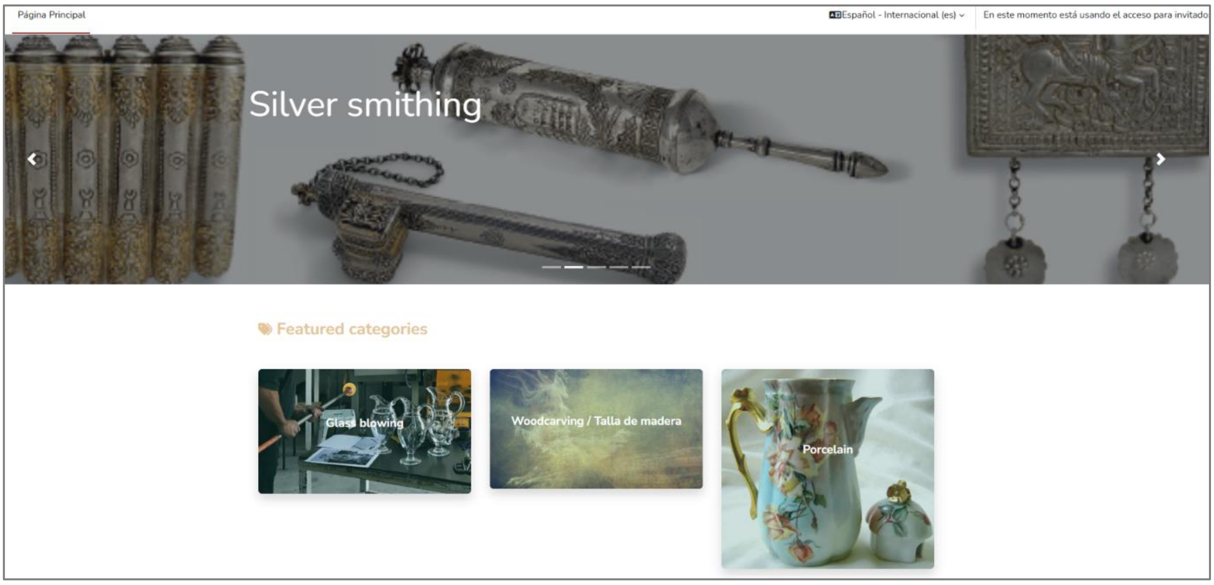


Figure 98 – E-learning home page

The interface was structured to be user-friendly and visually clear, with modules, videos, and supporting materials organized in a logical sequence. Each section guided learners' step by step through the lessons and exercises, enabling autonomous progression while maintaining continuity with the in-person training approach.

This straightforward and open-access design ensured that users of different profiles, such as trainers, professionals, or students, could engage with the course content efficiently, regardless of their previous digital learning experience.

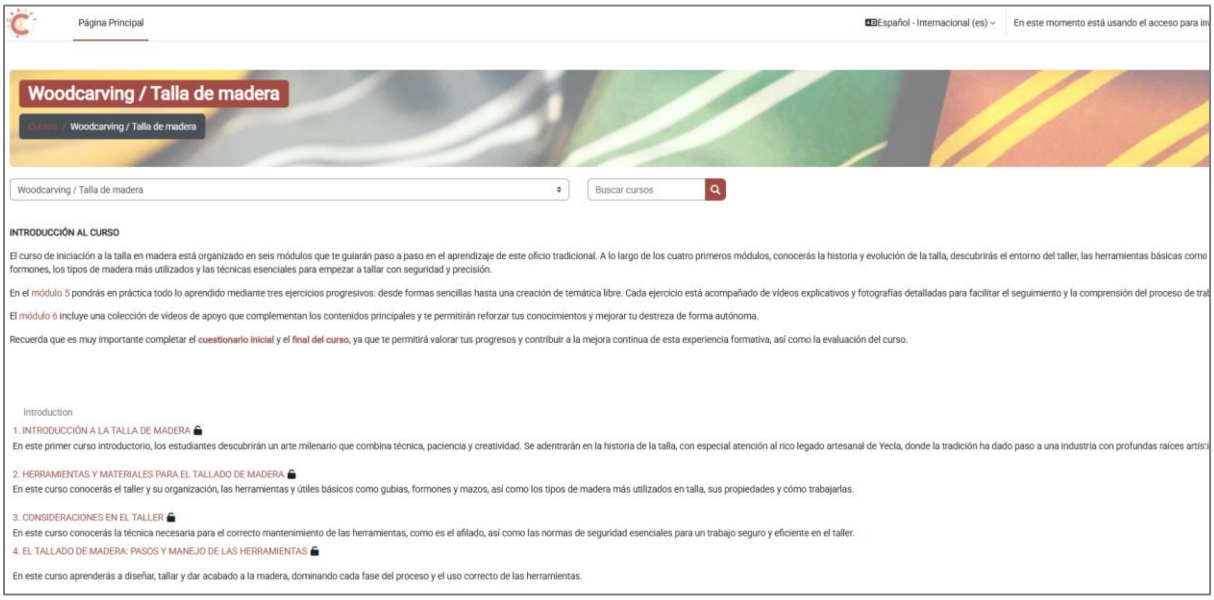


Figure 99 – Access page for online courses on woodcarving

11.1.1.8 – Participants

The pilot involved participants from different backgrounds related to the wood and furniture sector and was promoted among VET teachers, students, and industry professionals, in order to reflect a diverse target audience and assess the suitability of the training formats for different profiles. Participation was entirely voluntary, and all individuals who expressed interest in the pilot were able to take part in the training activities. As a result, no selection or filtering process was required, ensuring equal access to the course for all interested candidates.

- **Face-to-Face Course**

  The face-to-face training was attended by five participants. The final group consisted of two VET teachers from the artistic/woodworking field and three professionals from the sector, including two designers and one engineer. In terms of gender balance, one participant was a woman and four were men, reflecting the existing gender imbalance typical of traditional and manufacturing-oriented sectors such as furniture production and woodcarving.

- **Online and Hybrid Course**

  The complete online course involved a total of six participants. The group consisted of four learners who followed the online course exclusively and two participants who took part in the hybrid format.

  Among those enrolled only in the online course, the final group included three VET students and one industry professional. In terms of gender distribution within this subgroup, one participant was a woman and three were men.

  In addition, the hybrid training format was followed by the two VET teachers who initially participated in the face-to-face course and later continued with the online modules. This group included one woman and one man, allowing them to experience both training modalities and to provide comparative feedback on the use of the online course as a complementary learning tool.

11.1.1.9 - Ethical Aspects

All activities carried out within the framework of the pilot complied with ethical standards and data protection principles. Prior to their participation, all students completed and signed participation and consent forms, ensuring that their involvement in the training and evaluation activities was voluntary and informed (Annex 5-1).

During the face-to-face course, attendance was monitored through attendance records in order to document participation and ensure proper implementation of the training. For the online and hybrid formats, participants signed loan records for the tools and materials provided (Annex II), ensuring traceability and responsible use of the equipment during the training period.

All questionnaires and surveys conducted throughout the pilot were fully anonymous, and no personal or identifiable data were collected or processed. This approach ensured confidentiality, non-discrimination, and unbiased treatment of all responses, guaranteeing that the data collected were used exclusively for evaluation and research purposes within the project.

11.1.2 - Implementation activities

11.1.2.1 - Face-to-face training

A variety group of students, from furniture professionals' designers to art lovers, was involved in a face-to-face training course on woodworking. The course, with a duration of 25 hours, was implemented during a full week, where they discover the tools and materials used in this craft, the woodcarving process and the most common figures that could be created through a very practical way.

Figure 100 – Woodcarving, example of a real-life work situation

The group of five students attending the wood carving workshop presented a diverse range of prior experience, though the majority are complete beginners in the discipline. Students were requested to complete an initial survey on their previous knowledge and interests on this course. Most participants had some familiarity with woodworking: two had worked with wood professionally and another two had experience as hobbyists. Only one student reported no prior experience at all.

Despite this, none of the students had previously taken any wood carving courses, and all five reported having no specific experience in wood carving itself. This was further confirmed by the fact that none of them had more than a year of experience in the craft, most were starting entirely from scratch.

Regarding their technical knowledge, only two students indicated they had basic knowledge about different types of wood suitable for carving. The other three were completely unfamiliar with this aspect.

All five participants joined the course with the intention of learning wood carving from scratch, rather than improving existing skills or pursuing it professionally. In terms of project interests, the group showed a split preference: two students were most interested in wood sculpture, while three leaned toward furniture and decorative items.

Figure 101 – Woodcarving, examples of pieces produced

During the training course students acquired theoretical and practical knowledge and skills on woodcarving, being able to develop different pieces by themselves, starting with initial movements and steps, and finalising with complete pieces.

11.1.2.2 - Online training

The online phase of the pilot involved six participants, including two students who had previously completed the face-to-face training and continued as part of the hybrid group. Similar to the in-person course, none of the participants had prior experience in woodcarving. However, most of them possessed basic to intermediate knowledge of furniture design and manufacturing, which provided a general understanding of materials and workshop practices but not of carving techniques.

Unlike the in-person course, the online version was carried out individually and asynchronously, without direct tutoring. Participants accessed the e-learning platform independently and followed the six-course modules at their own pace. Occasional questions and requests for clarification were addressed by email, and additional advice or feedback was provided when necessary. Images and videos were requested to the students in order to evaluate their work.

Figure 102 – Woodcarving, example of working from home situation

The duration of the online training varied among participants, extending over a period of two to three months, as each student began at different times and progressed according to their personal availability and learning rhythm. This self-paced format contrasted significantly with the intensive and structured nature of the face-to-face course, allowing greater flexibility and autonomy in the learning process.

Figure 103 - Woodcarving, example online courses's student production

11.2 - Evaluation

11.2.1 - Evaluation methodology

The evaluation of the woodcarving training pilot was designed to assess both knowledge acquisition and user experience across the different training formats (face-to-face, online, and hybrid). A combination of quantitative and qualitative methods was used to measure participants' progress and perceptions throughout the learning process.

At the beginning of the course, all participants completed an initial questionnaire designed to assess their prior familiarity with woodworking and carving techniques, technical understanding, and motivations for joining the training (Annex 5-1) This baseline assessment provided a reference point to measure individual and group progress at the end of the training.

During the training phase, instructors continuously monitored participants' performance, providing direct feedback and observing the development of manual and artistic skills. This formative assessment ensured that any learning difficulties were identified and addressed in real time.

After the completion of both the face-to-face and online sessions, participants undertook a final knowledge test (Annex 5-2), which included theoretical and practical questions to evaluate the understanding of techniques, tool handling, and safety procedures. The comparison between pre- and post-course results allowed the evaluation of learning effectiveness and skill acquisition.

Additionally, a satisfaction and usability questionnaires were administered (Annex 5-3), to gather insights on participants' experience with the training course, the clarity of materials, and the perceived usefulness of the videos and exercises as supportive tools.

Following the face-to-face course, participants provided qualitative feedback through open-ended questions and discussions. For the online and hybrid formats, an individual interview was conducted with participants to gain a deeper understanding of their learning experience.

Finally, all quantitative and qualitative data were analysed to determine the usefulness and effectiveness of the online course, both as an independent learning resource and as a complementary tool to reinforce the outcomes of the face-to-face training. The findings provided valuable evidence on how digital learning materials can effectively support the transmission, preservation, and practice of traditional craft skills.

11.2.2 - Face-to-face course evaluation

11.2.2.1 - Initial survey

Before the beginning of the woodcarving course, participants completed an initial questionnaire designed to assess their previous experience, technical understanding, and motivations for joining the training. The survey results provide valuable insight into the students' starting point, enabling a clearer interpretation of the learning outcomes achieved later.

Despite the variety of the group, the majority of respondents had limited or no prior experience in woodcarving. Only a small proportion had previously worked with wood, either professionally or as a hobby. None of the participants had undertaken formal training in woodcarving before the course. The main motivation for enrolling in the course was to learn basic carving techniques from scratch and to understand the craft's creative and technical processes rather than to develop advanced professional skills.

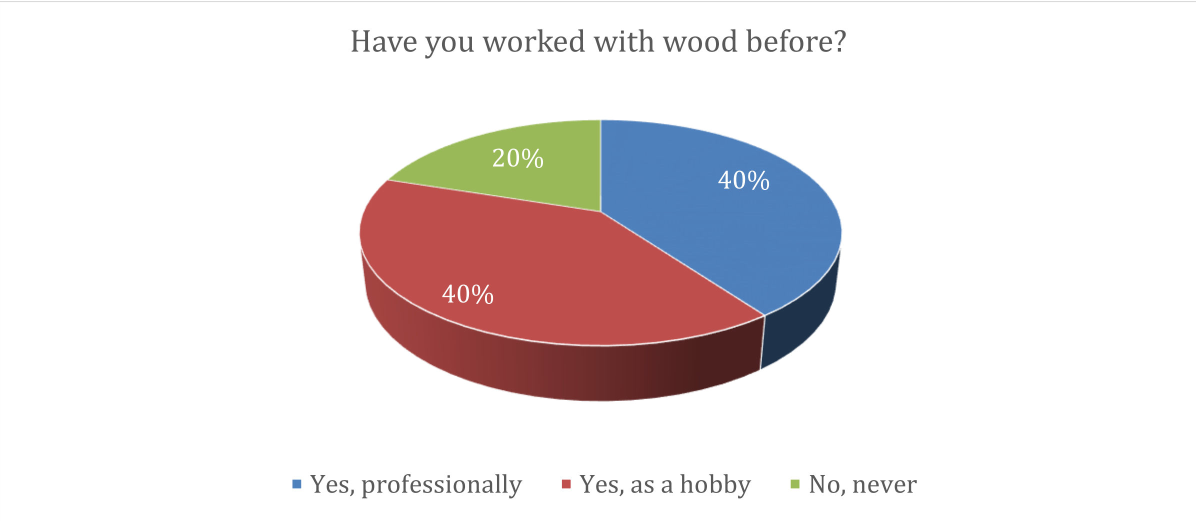


Figure 104 – Face-to- face course initial survey – experience on wood work

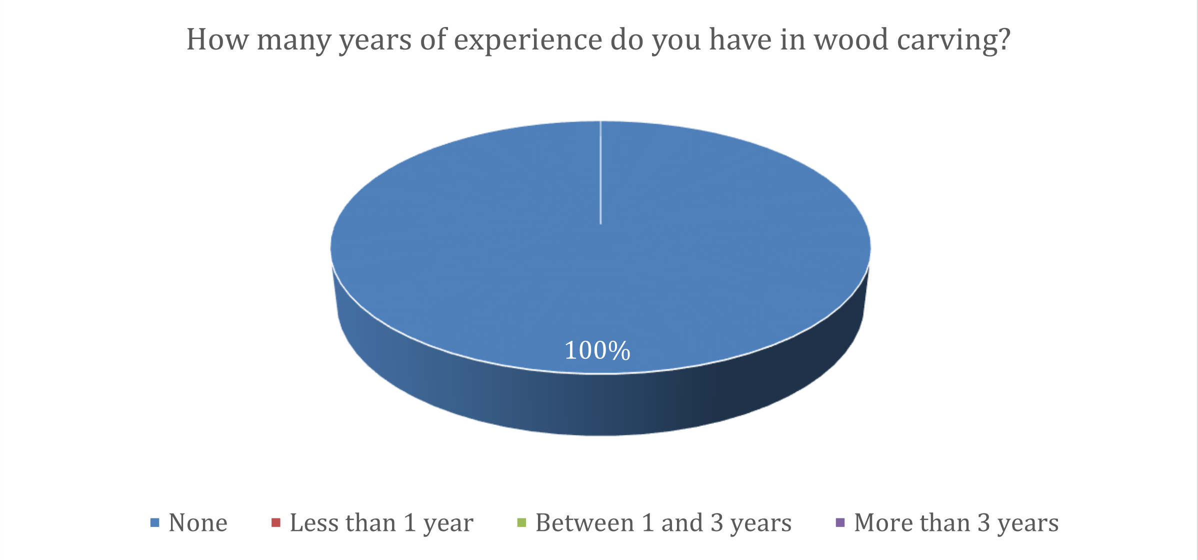


Figure 105 – Face-to- face course initial survey - experience on woodcarving

Survey results indicated low initial familiarity with woodcarving tools and materials. Most participants reported only a general awareness of woodworking tools, while specific knowledge of gouges, chisels, or sharpening techniques was scarce. Likewise, understanding of different wood types suitable for carving was limited: only a few respondents were able to identify softwoods and hardwoods typically used in the craft. When asked about the carving process, such as design transfer, direction of cut, or surface finishing, nearly all respondents recognized their lack of expertise, confirming the need for a highly practical and guided learning approach.

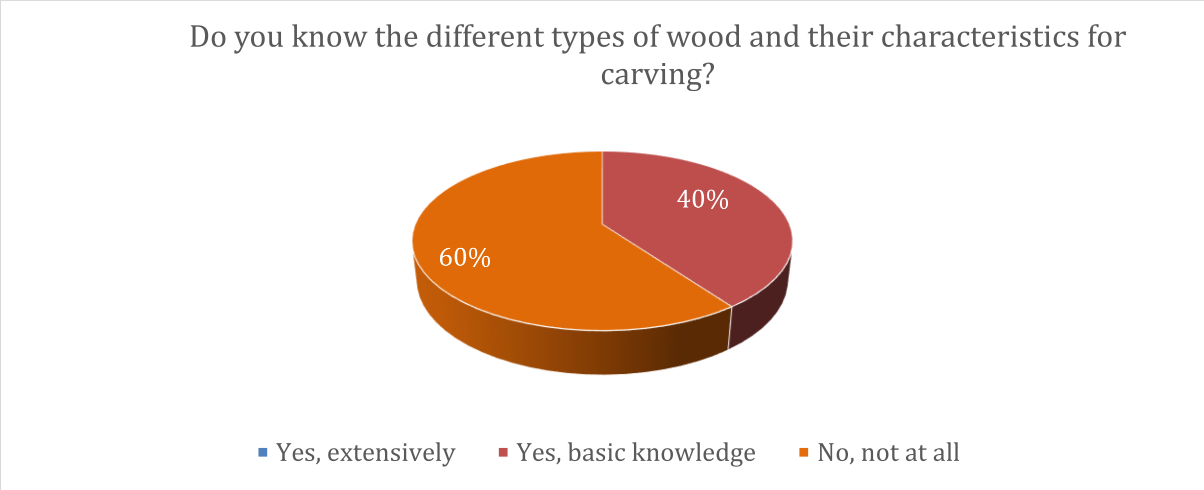


Figure 106 - Face-to- face course initial survey - knowledge of wood species

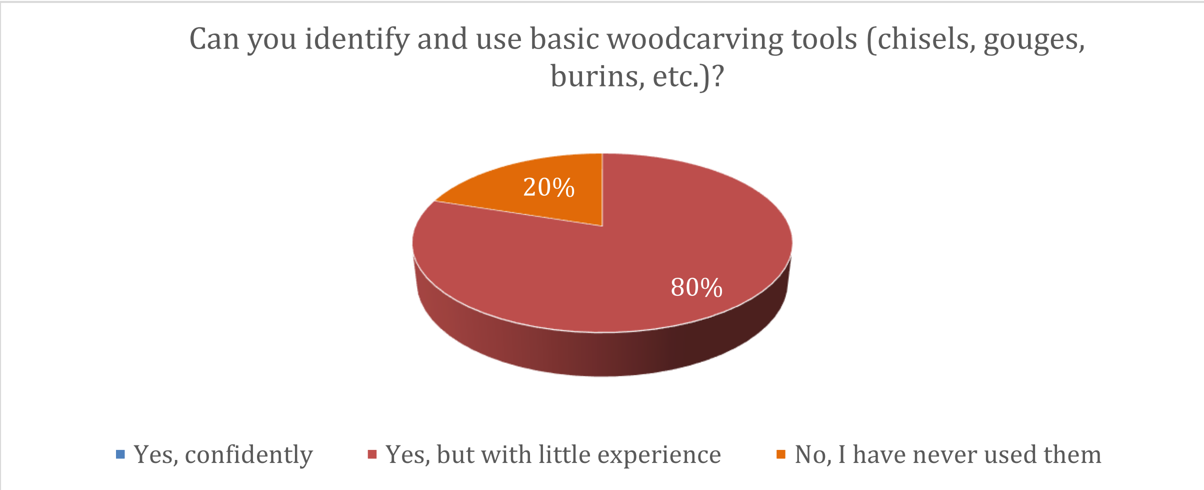


Figure 107 - Face-to- face course initial survey - knowledge of woods' tools

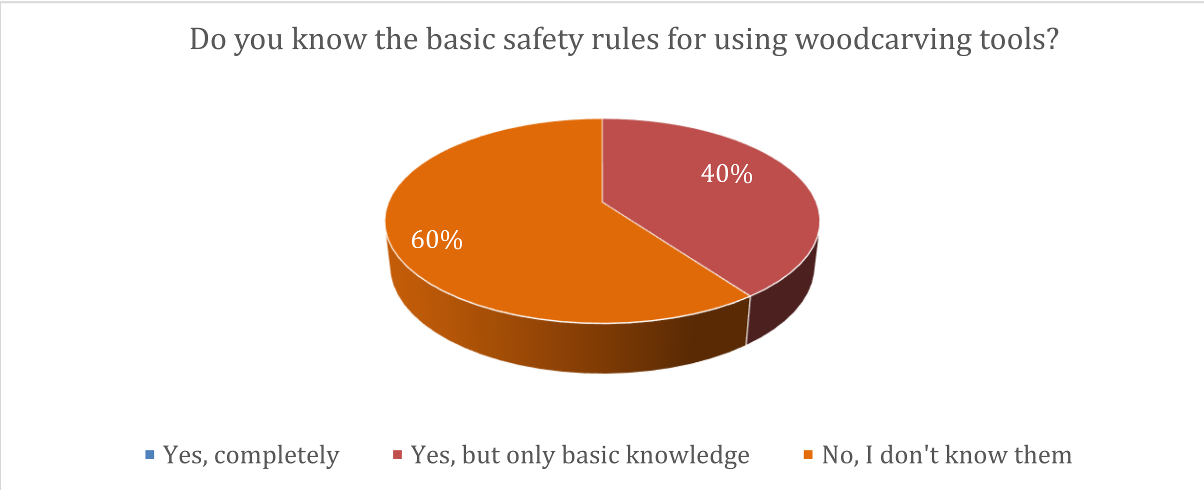


Figure 108 - Face-to- face course initial survey - knowledge of woods' specific safety rules

Participants expressed high expectations for the training, particularly regarding hands-on practice and instructor guidance.

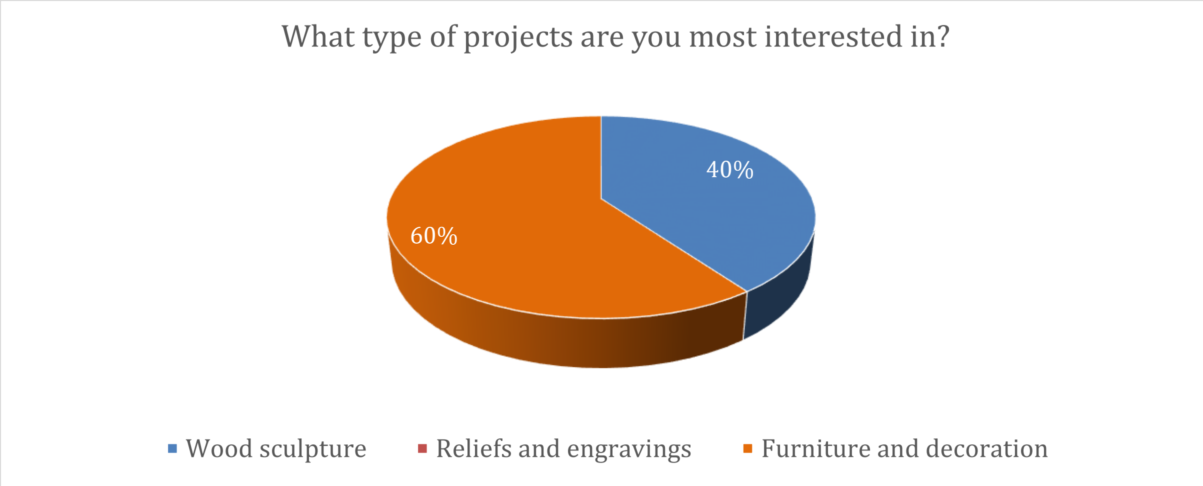


Figure 109 - Face-to- face course initial survey – areas of interest in wood carving

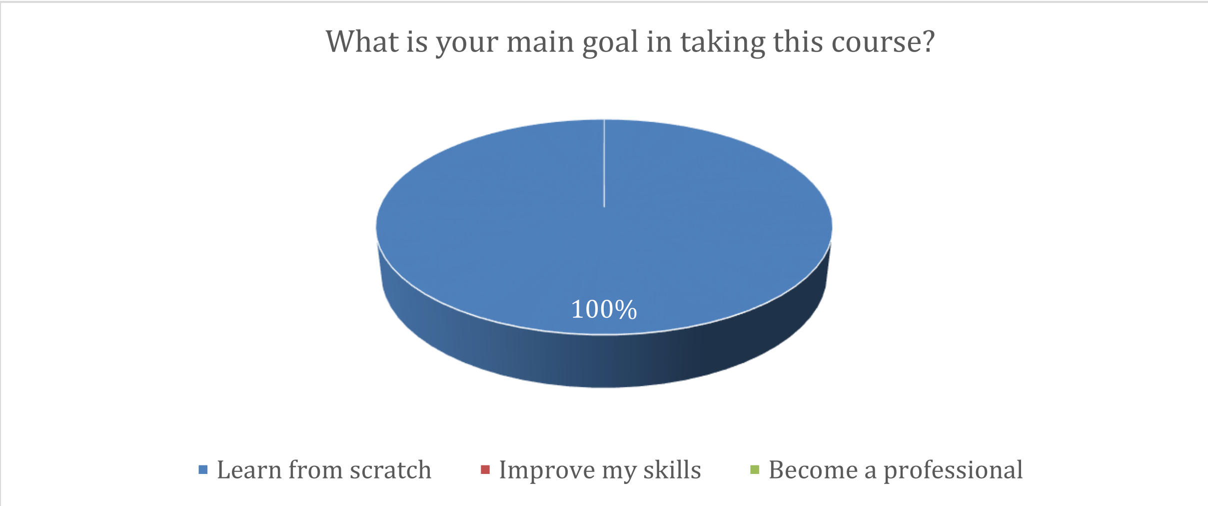


Figure 110 – Face-to- face course initial survey – personal aim for the woodcarving course

11.2.2.2 - Final test and evaluation

11.2.2.2.1 - Final course evaluation

At the end of the face-to-face course, participants completed a final evaluation questionnaire aimed at measuring their satisfaction, perceived learning outcomes, and overall experience with the training. The analysis of these responses provides valuable qualitative and quantitative insights into the effectiveness and impact of the course.

Overall, the results show a high level of satisfaction among all participants. Most respondents rated the course as very useful for their personal and professional development, emphasizing that the combination of theoretical explanations and practical exercises allowed them to acquire basic carving skills and understand the full process, from tool handling to finishing.

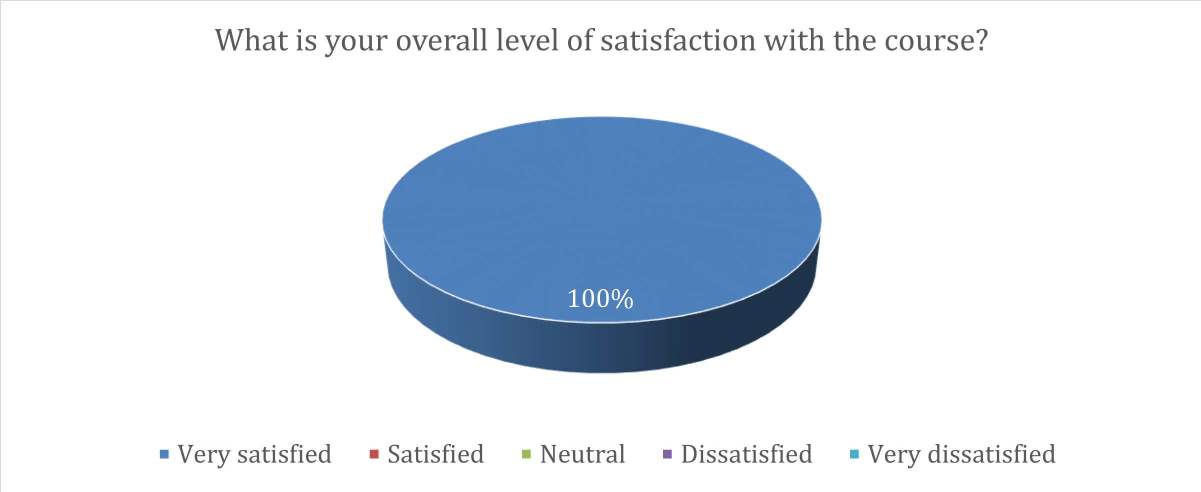


Figure 111 – Face-to- face course final survey – overall satisfavtion

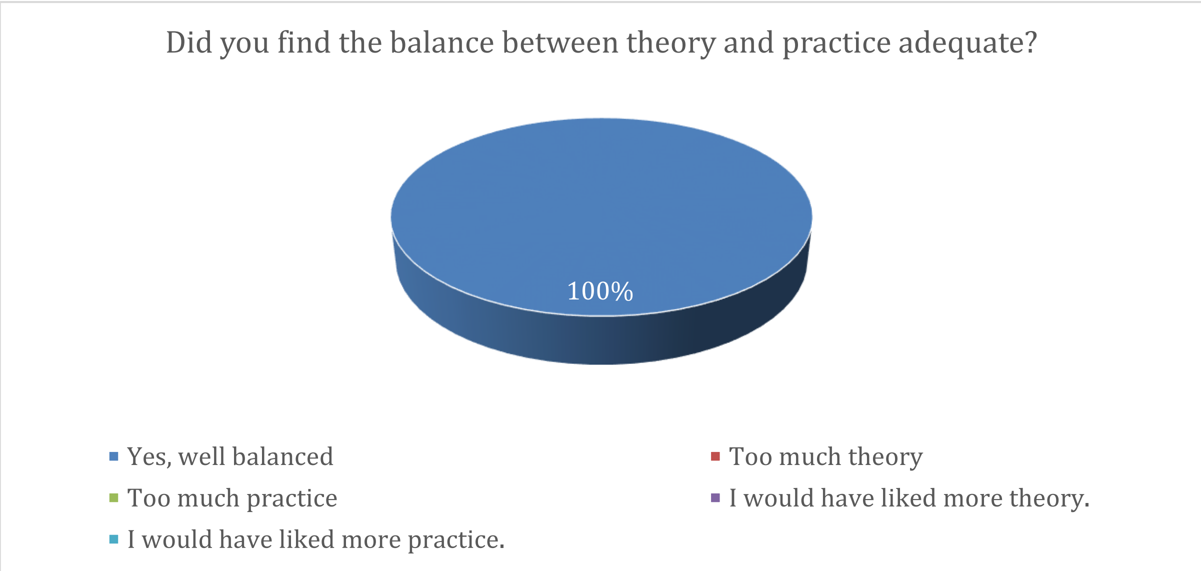


Figure 112 - Face-to- face course final survey – balance

Students particularly appreciated the quality of the learning materials, including the wood, tools, and workspace provided. They described the exercises as clear, progressive, and motivating, highlighting that they were able to complete them successfully and see tangible progress in their manual abilities.

Feedback on the practical exercises and tool supervision was also highly positive. All students reported being *very satisfied* or *satisfied* with the exercises, emphasizing their clarity, progressive difficulty, and the opportunity to apply the techniques learned during the course. No participants expressed dissatisfaction, confirming that the structure and content of the exercises effectively supported skill development.

Regarding the use and supervision of gouges, half of students stated that this aspect was *completely well taught and supervised*, while 25% considered it *generally adequate*. Only 25% of participants mentioned that additional guidance could have been helpful during individual practice. Overall, these responses indicate that the instruction and supervision provided during the hands-on sessions were appropriate and well received, ensuring a safe and effective learning experience.

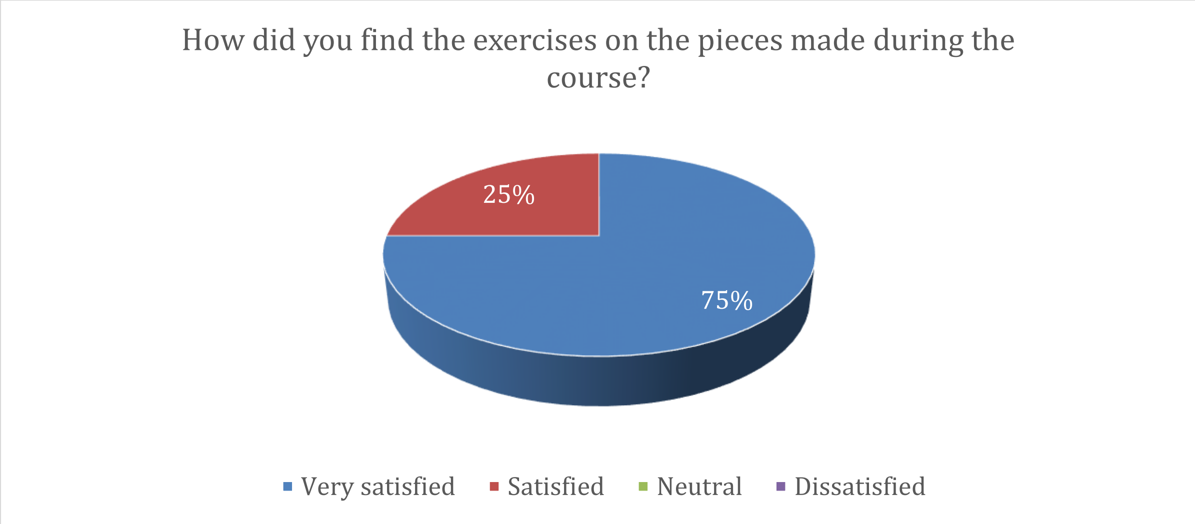


Figure 113 - Face-to- face course final survey – exercices

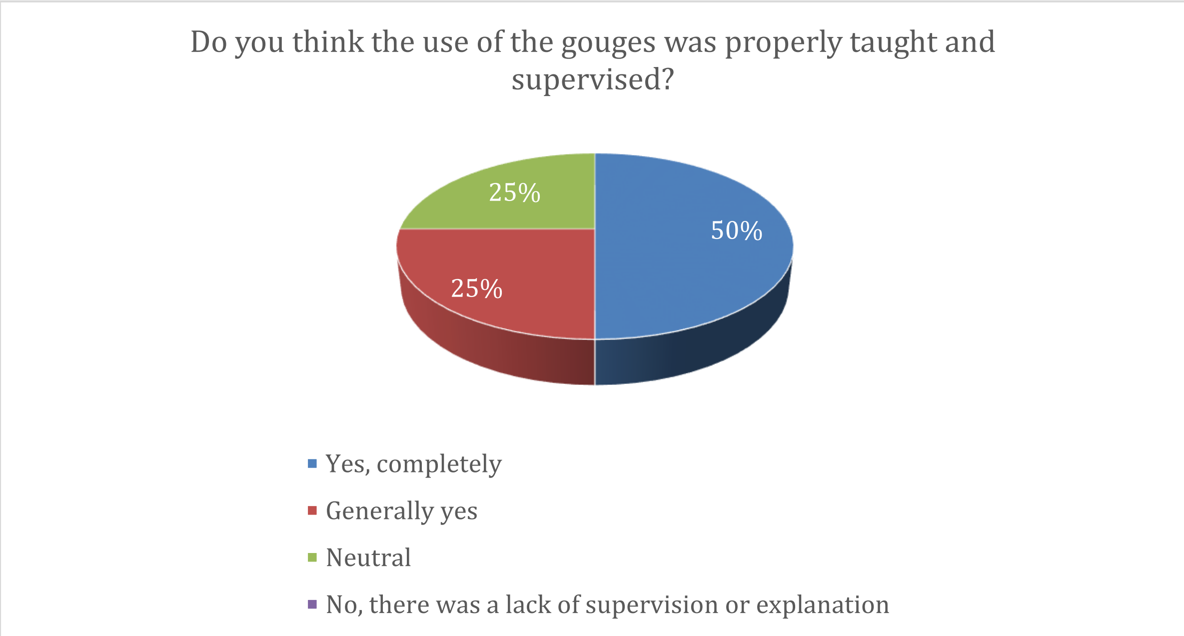


Figure 114 - Face-to- face course final survey – educational

The instructor's guidance and feedback received the highest ratings, with all participants describing the teaching support as excellent. The direct interaction with the trainer and other learners was frequently mentioned as one of the most valuable aspects of the experience, fostering both technical learning and peer motivation.

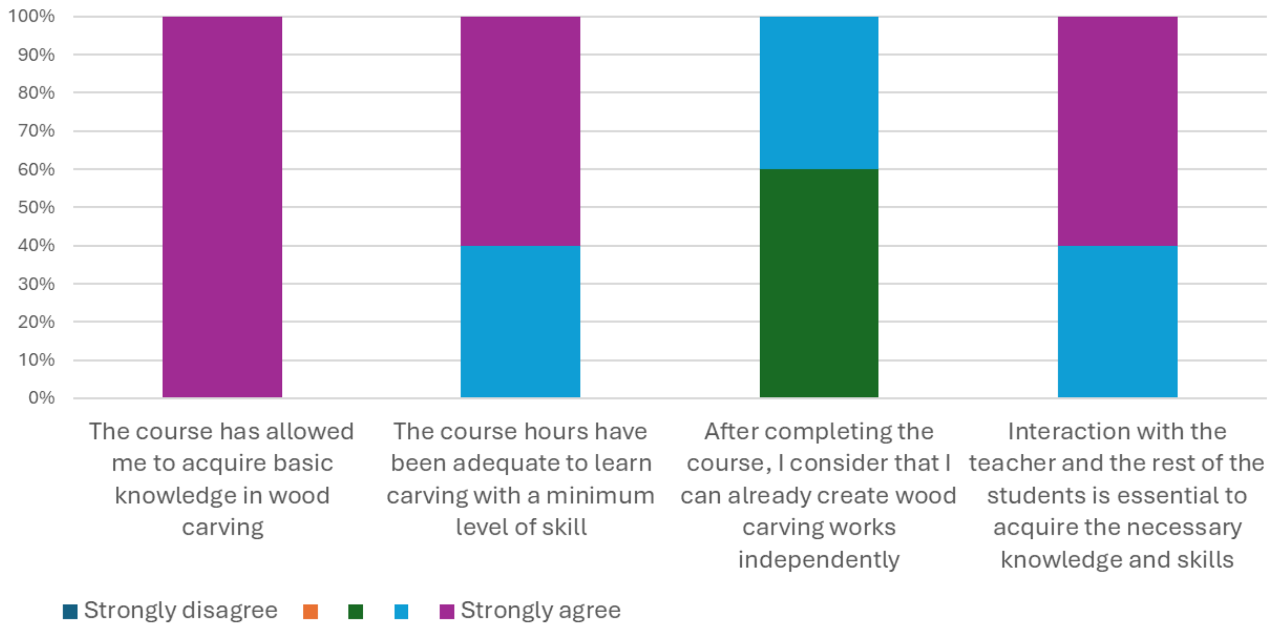


Figure 115 - Face-to- face course final survey - satisfaction

Regarding the difficulty level, most students considered the training well-balanced, noting that the exercises were appropriately challenging for beginners. All participants agreed that the course duration was adequate and that the balance between theory and practice was effectively achieved.

The evaluation survey was complemented through open-ended questions and discussions, highlighting the hands-on learning experience, direct interaction with the instructor, and the opportunity to observe peers as key factors in their skill development. Most participants reported a strong sense of achievement and expressed interest in continuing to practice woodcarving independently and request more trainings on woodcarving to continue improving their skills with more and new elements and techniques.

11.2.2.2.2 - Final knowledge test

At the end of the course, participants completed also a multiple-choice test designed to evaluate their understanding of fundamental woodcarving concepts, including tool use, safety, and material selection. The results demonstrate a high overall level of knowledge acquisition, with most students answering correctly across all questions.

All participants correctly identified the softest and easiest wood species for beginners, confirming their understanding of material properties. Similarly, a large majority correctly answered questions related to cutting direction, fine-detail gouges, and the function of U-shaped gouges, showing solid comprehension of tool handling and carving techniques.

The area showing the greatest room for improvement was bench safety and securing the workpiece, where a higher proportion of incorrect responses suggests that this topic may require further emphasis in future training sessions. Nevertheless, overall results indicate that participants successfully developed essential theoretical and practical knowledge for safe and effective woodcarving practice.

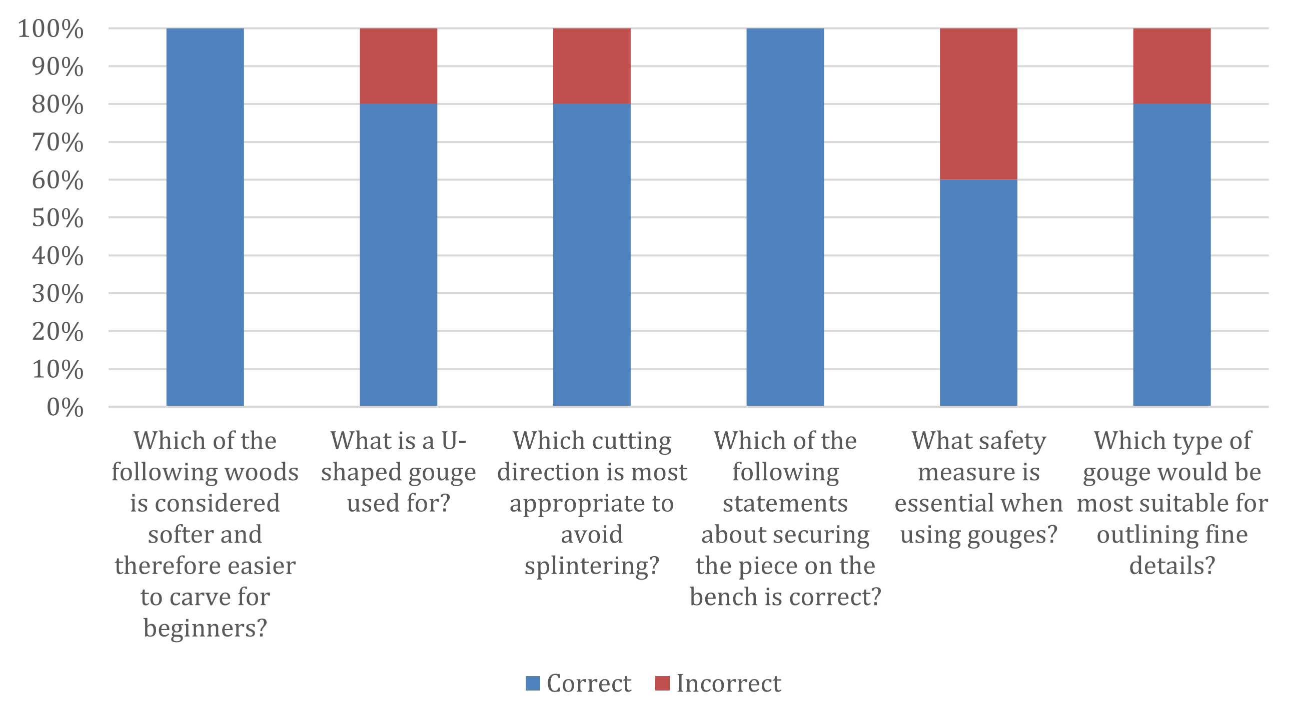


Figure 116 - Face-to- face course – analyse of final assessment of learners

11.2.3 - Online course evaluation

11.2.3.1 - Initial survey

An initial questionnaire designed to gather student´s information about their background, motivation, and previous experience with woodworking is implemented at the very beginning of the course. The results provide a clear overview of the participants' profiles and initial expectations. Note: it should be considered that students that previously did the face-to-face training (hybrid model) didn´t respond to this survey, as they already have answered.

The responses indicate that all students had no prior experience in woodcarving, although several reported having some familiarity as most of them are VET students. This aligns with the objective of the pilot, which targeted beginners interested in exploring traditional craft techniques from a design or technical background.

Figure 117 – Online course initial survey – experience on wood work

Survey results indicated low initial familiarity with woodcarving tools and materials. Most participants reported only a basic awareness of woodworking tools, while no experience of gouges, chisels, or sharpening techniques was scarce. Likewise, understanding of different wood types suitable for carving was limited, as they have previous knowledge on furniture wood, but not woodcarving.

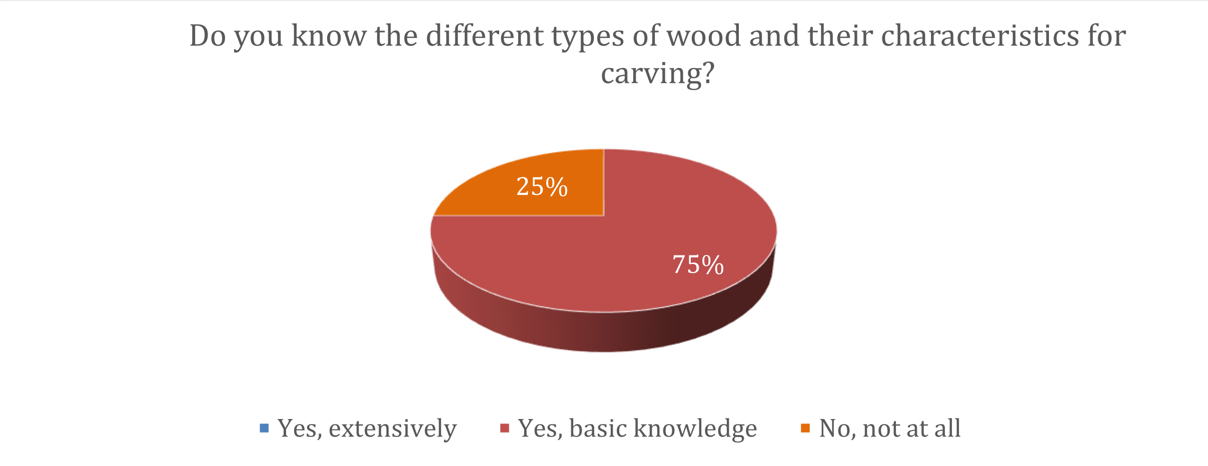


Figure 118 – Online course initial survey - knowledge of wood species

In terms of motivation, participants expressed interest in learning new skills that complement their current furniture/wood VET course. Most are interested in furniture and decoration projects, as should be more align to their current studies and professional expectations, while some of them are interested in wood sculptures, related with artistic part of woodcarving.

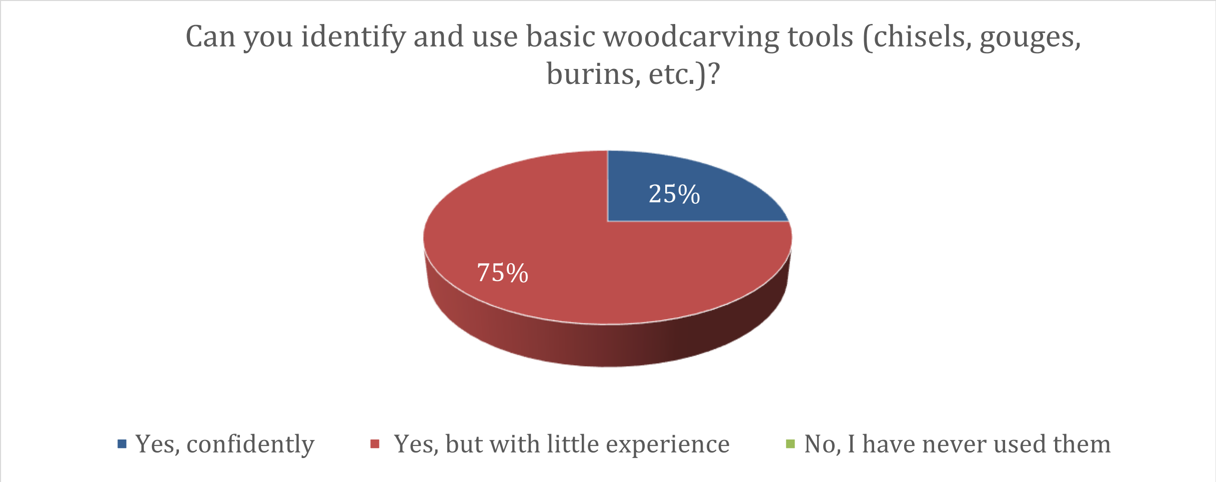


Figure 119 - Online course initial survey - knowledge of woods' tools

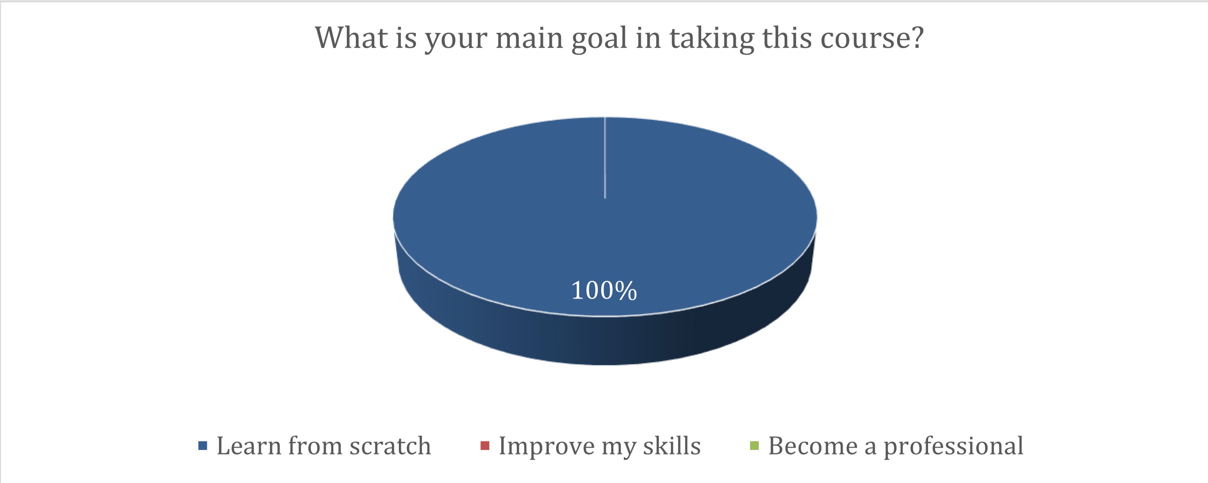


Figure 120 – Online course initial survey – areas of interest in wood carving

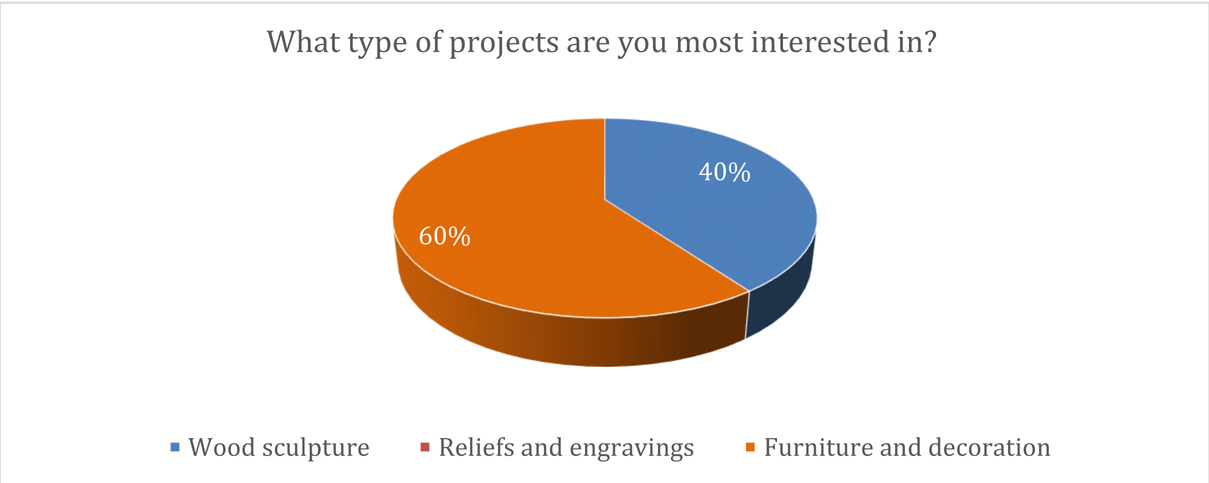


Figure 121 - Online course initial survey – personal aim for the woodcarving course

11.2.3.2 - Final test and evaluation

11.2.3.2.1 - Final course evaluation

At the end of the online course, students are invited to complete a satisfaction questionnaire assessing their perceptions of the learning materials, and the overall quality of the training experience. The analysis of these responses provides insights into how effectively the e-learning format supported knowledge acquisition and learner engagement in the absence of direct, in-person instruction.

Overall, results indicate a high level of satisfaction among students. Most respondents rated the course as useful or very useful for acquiring theoretical understanding of woodcarving, noting that the video demonstrations and explanations were particularly helpful for grasping basic concepts, recognizing tools, and understanding the woodcarving process. Learners emphasized that the clarity and structure of the online materials made it easier to follow the lessons at their own pace.

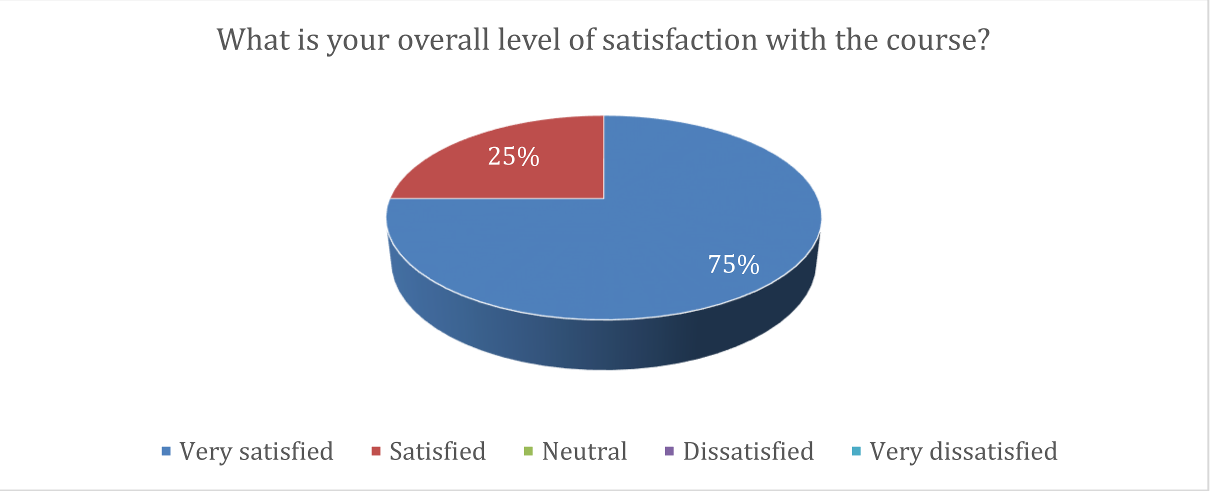


Figure 122 – Online course final survey – overall satisfavtion

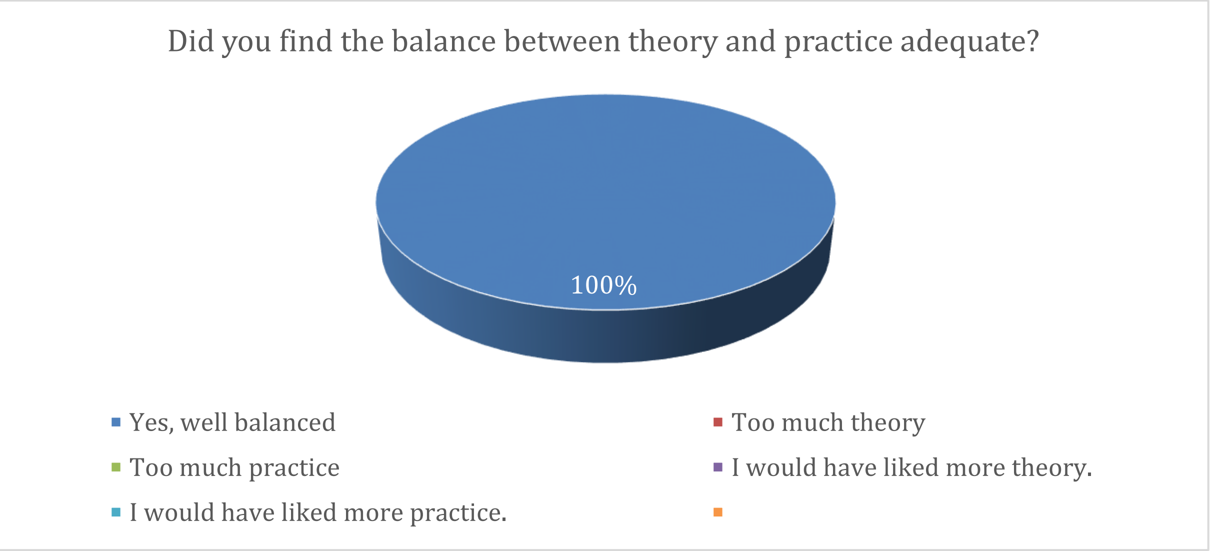


Figure 123 – Online course final survey – balance

In terms of training contents, the combination of theory, exercises, and videos received very positive evaluations. Students highlighted that the inclusion of real demonstration´s videos helped bridge the gap between theory and practice, even though the lack of physical engagement was recognized as a challenge for mastering manual skills. Most learners reported feeling motivated to continue learning and to eventually apply the concepts in a workshop environment.

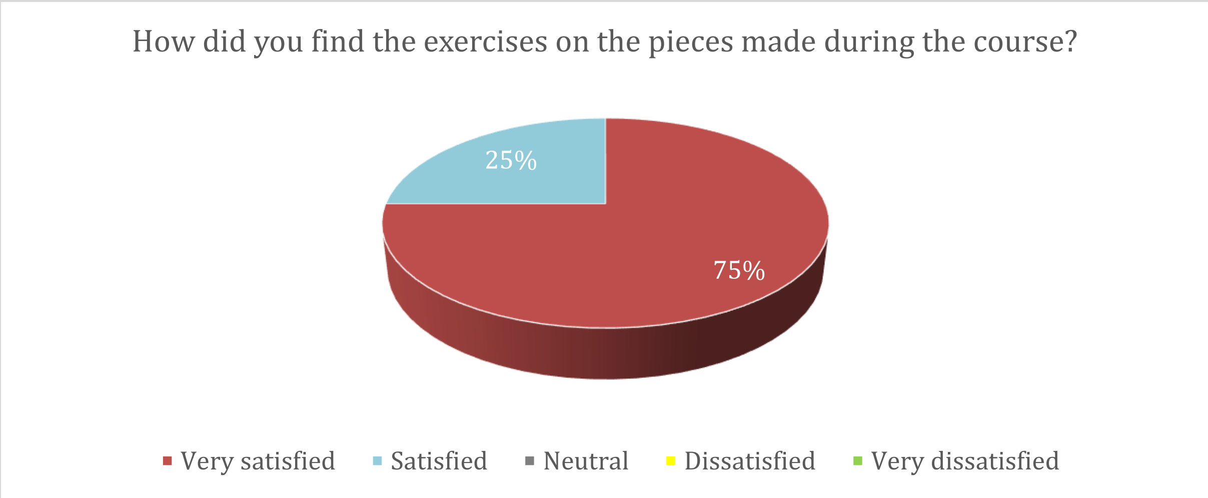


Figure 124 – Online course final survey - exercices

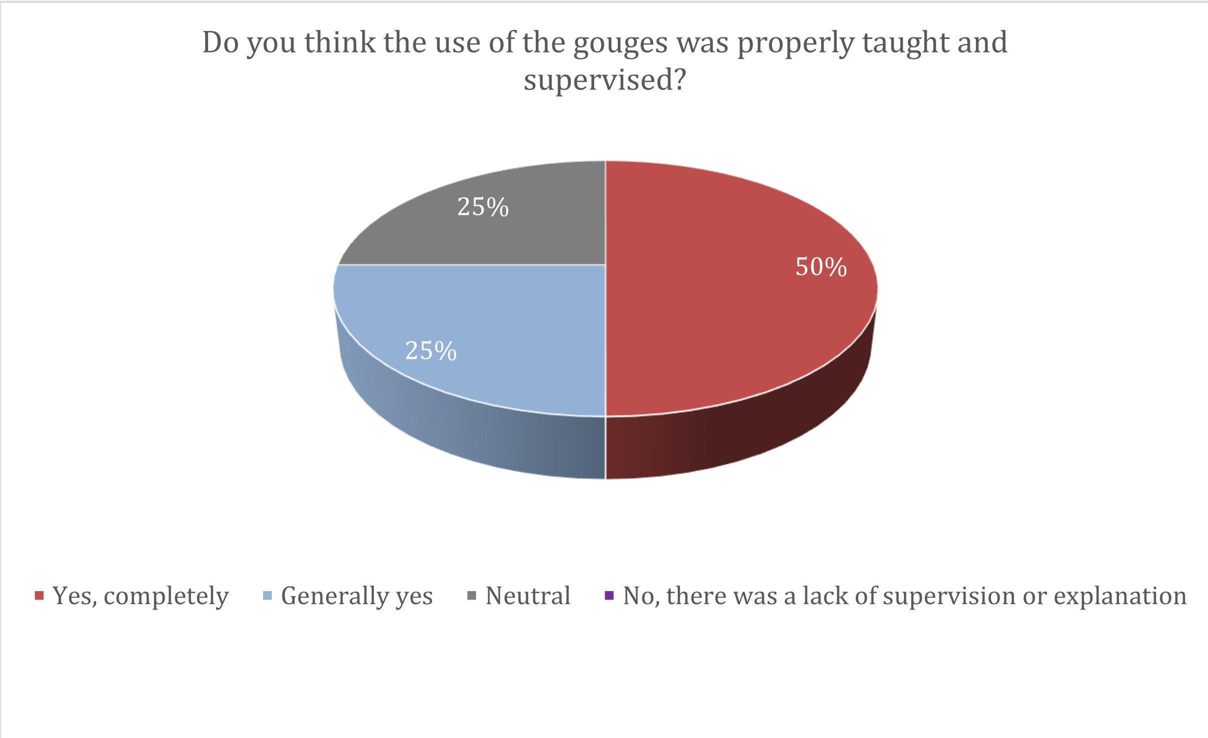


Figure 125 – Online course final survey – educational

Concerning learning support and usability, the test results and qualitative feedback confirm that the e-learning course functioned effectively as an independently learning resource, although some students highlighted the difficulty of such hand-on work without supervision. Overall, the evaluation demonstrates that the online training successfully fulfilled its educational purpose: it provided participants with basic knowledge and skills for woodcarving, as it has been declared by all students.

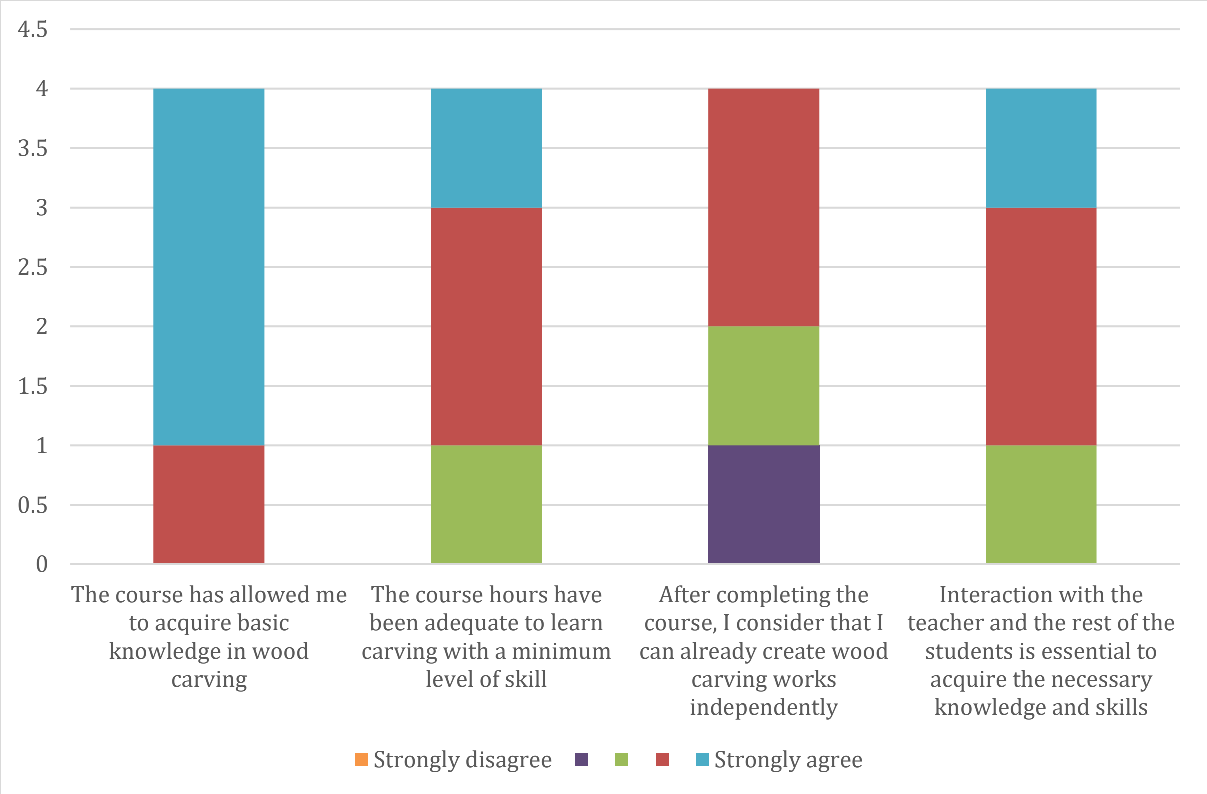


Figure 126 – Online course final survey - satisfaction

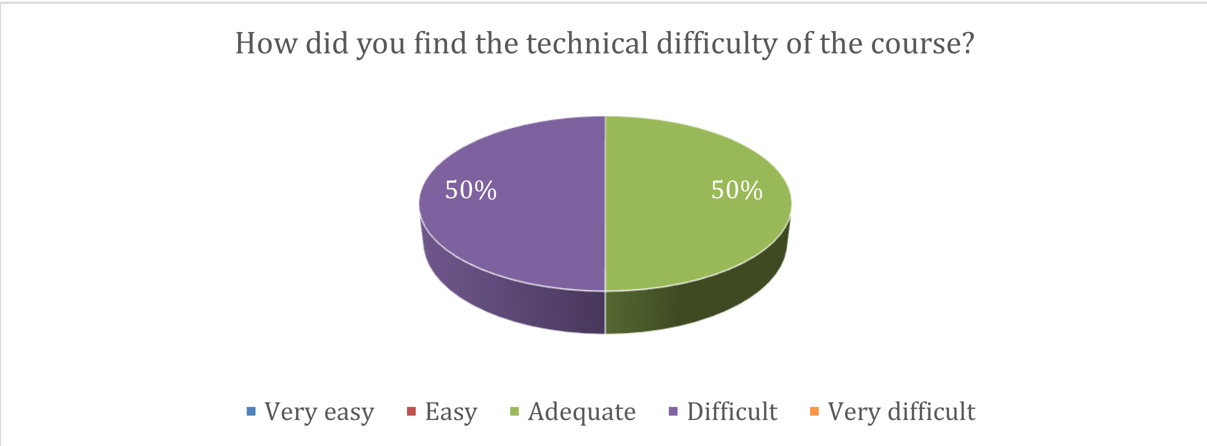


Figure 127 – Online course final survey - difficulty

After the completion of the online training, students were reached for an interview or through email to have general feedback. Although most of students have a satisfactory point of view and declare that "the theory is quite enjoyable and to the point. The most important parts are the videos and the practice. The videos are good, and watching classmates being corrected also helps"; it´s true that it has also received negative feedback, highlighting "Important limitations, especially if it is intended to be useful autonomously".

11.2.3.2.2 - Final knowledge test

The online course concluded with a multiple-choice knowledge test designed to assess participants' understanding of woodcarving fundamentals, including tool identification, safety procedures, carving techniques, and material selection. The analysis of the test results provides an overview of the effectiveness of the online learning content in promoting theoretical comprehension and visual recognition of key concepts.

Overall, students demonstrated a solid grasp of theoretical principles, with the majority answering correctly across most categories. Results show particularly strong performance in areas related to tool identification and material properties, where nearly all students correctly matched gouge types and recognized suitable woods for beginner carving. These outcomes suggest that the combination of explanatory videos and texts successfully conveyed essential visual and conceptual information.

Performance on cutting direction and finishing techniques was slightly more variable, indicating that some learners found it more challenging to visualize applied movements based solely on video content. This may reflect the limitations of asynchronous online formats, where learners cannot immediately test or validate their understanding through hands-on feedback.

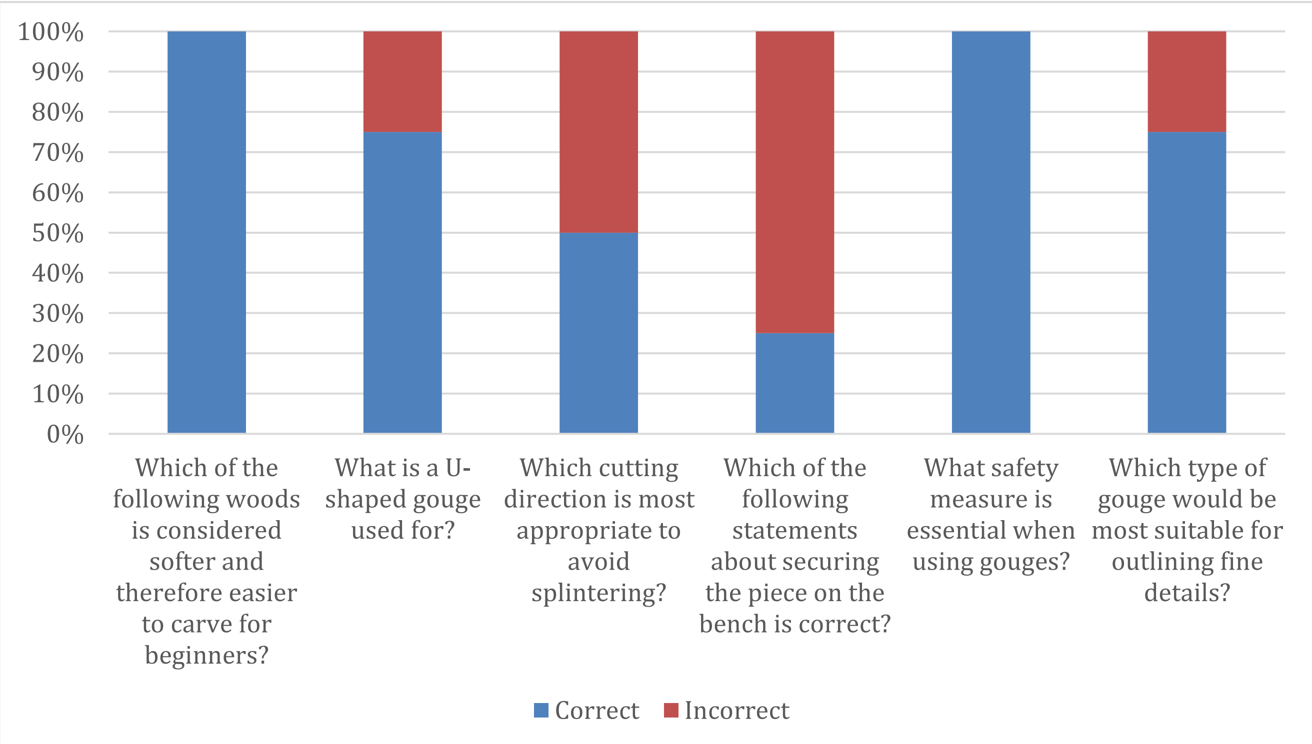


Figure 128 – Online course – analyse of final assessment of learners

The lowest-scoring section involved questions concerning safety procedures and bench organization, where several incorrect answers were recorded. This finding aligns with expectations for a self-paced online course, emphasizing the need for more interactive or scenario-based safety training elements in future iterations.

11.2.4 - Hybrid course evaluation

Regarding the two students that continuous with the online training after the face-to-face training, they expressed very positive overall impressions of the hybrid approach

Students highlighted that the face-to-face sessions provided the essential foundation for understanding tool handling, while the online platform served as an effective tool for consolidating and reviewing concepts after the practical course. Both students especially valued the video demonstrations, which enabled them to revisit techniques and clarify doubts at their own pace. They noted that the visual explanations complemented their practical experience, helping them to better understand movements, cutting directions, and the logic behind each exercise. One learner mentioned that the videos were *"very useful to remember the steps and check details I missed during class."*

The combination of formats was described as *"well balanced and mutually reinforcing"*, allowing them to continue learning autonomously while maintaining the confidence gained during the workshop.

However, both students also pointed out some limitations of the online platform, mainly related to the lack of real-time feedback. They indicated that while the videos and explanations were clear, they would have benefited from an option to upload photos or videos of their own work for instructor review, or from a discussion space to interact with other learners. Such additions, they suggested, would enhance engagement and foster a greater sense of community among participants.

From a pedagogical perspective, both students agreed that the hybrid model significantly improved their understanding of woodcarving as a process, not only as a set of manual exercises. They emphasized that combining in-person guidance with digital follow-up materials helped consolidate theoretical knowledge, encouraged self-reflection, and increased their motivation to continue practicing after the course ended.

11.3 - Conclusions and discussion

The comparative evaluation of the three training modalities (face-to-face, online, and hybrid) provides a comprehensive overview of the pedagogical value, usability, and effectiveness of the CRAEFT woodcarving pilot. By analysing the quantitative results of the surveys and knowledge tests together with the qualitative feedback collected from interviews and open-ended responses, clear patterns emerge regarding the strengths and limitations of each learning approach and their potential combination for future educational strategies in craft-based learning.

11.3.1 - Overall learning effectiveness

Across all formats, participants demonstrated clear progress in their understanding of woodcarving principles, confirming that the training successfully met its learning objectives:

The **face-to-face course** produced the most significant improvement in both technical ability and conceptual understanding. Students developed fundamental carving skills, gained confidence in tool handling, and reported a strong sense of achievement. The presence of a skilled instructor and peer collaboration proved essential for the acquisition of manual dexterity and artistic sensibility, two aspects that are particularly challenging to achieve through remote learning.

The **online course**, while less effective in developing practical competences, performed in theoretical knowledge acquisition and practical skills. It demonstrates that the digital content, especially the video demonstrations and pictures, was effective in transmitting visual and conceptual information. However, limitations emerged in the areas of safety and applied techniques, where students showed a weaker understanding. These outcomes reflect the intrinsic challenges of learning a highly tactile craft without physical interaction or immediate feedback.

The **hybrid model**, tested with two learners who completed both formats, achieved the most balanced results. Students confirmed that the combination of in-person guidance followed by digital reinforcement allowed them to consolidate knowledge, review techniques at their own pace, and continue learning independently. The hybrid approach therefore represents a powerful pedagogical model, combining the experiential depth of traditional apprenticeship with the accessibility and flexibility of digital learning.

11.3.2 - User satisfaction and learning experience

Satisfaction levels were high across all groups, but for different reasons. In the **face-to-face training**, learners valued the immediacy of feedback, the high-quality materials, and the supportive classroom environment. Direct observation of the instructor's technique and peer exchanges were repeatedly mentioned as decisive for comprehension and motivation. Students also appreciated the progressive structure of exercises, which provided a sense of continuity and tangible improvement.

Participants in the **online training** expressed satisfaction with the clarity, structure, and accessibility of the platform. The modular format and concise explanations were well received. The flexibility to learn at one's own pace was also valued. Nevertheless, some students also emphasized the **lack of interaction and guidance**, which they felt limited their ability to translate theory into practice. While the videos were considered engaging and informative, learners highlighted that digital resources could not fully substitute the physical act of carving or the sensory feedback it provides. Moreover, from the interviews it could be suggested that personal aptitude for manual work and previous experience with tools play a decisive role in the effectiveness of online learning. Students with stronger hand–eye coordination or familiarity with workshop practices found it easier to interpret and replicate the techniques demonstrated.

The **hybrid participants** offered a nuanced perspective that bridges both experiences. They described the face-to-face sessions as foundational for understanding the logic of tool movements and safety practices, and the online course as a complementary means for reinforcement and reflection. The possibility to re-watch demonstrations and review procedures was seen as one of the major benefits. At the same time, the students suggested enhancements such as forums for discussion, the option to share their own work for feedback, or direct communication channels with the instructor to deepen engagement. Their reflections underline that hybrid learning not only enhances retention but also fosters autonomy and lifelong learning habits.

11.3.3 - Pedagogical implications

From a pedagogical standpoint, the CRAEFT woodcarving pilot confirms that traditional crafts can be effectively taught and supported through blended models that integrate experiential and digital dimensions. Each format contributes unique educational benefits:

- **Face-to-face** sessions are irreplaceable for developing manual and artistic sensitivity through observation, imitation, and supervised practice.

- **Online materials** excel in providing conceptual foundations and visual references that reinforce understanding. The results also demonstrate that they can effectively support beginners in learning key woodcarving techniques from scratch, enabling them to complete initial and basic figures independently.
- **Hybrid approaches** create continuity between these two dimensions, enabling learners to move fluidly from guided practice to autonomous reflection.

The data also highlight key areas for improvement. First, **safety and bench organization** should receive greater emphasis across all formats, as they consistently emerged as weaker areas in the knowledge tests. Incorporating interactive modules, simulations, or short video scenarios could strengthen this dimension in the online component. Second, **interaction and feedback mechanisms** should be expanded, particularly in the digital environment. Students clearly benefit from the social and collaborative aspects of craft education; hence, discussion spaces, peer feedback tools, or mentor comments could significantly enhance engagement.

The evaluation results demonstrate that students across all modalities reported a strong desire to continue practicing woodcarving, to improve their skills, and to explore more complex projects. This sense of empowerment aligns closely with the objectives of the CRAEFT project: to preserve and revitalise traditional crafts through innovative tools and methods.

Finally, the success of the pilot suggests that integrating digital resources into craft education can play a crucial role in ensuring the sustainability and transmission of tacit knowledge. Moreover, online and hybrid approaches could make craft training more inclusive, reaching new audiences such as vocational students, professionals in related sectors, or individuals with limited geographical access to workshops.

11.4 - Exploitation and future actions

Following the completion of the CRAEFT pilot, the woodcarving training materials have continued to generate tangible educational and institutional impact, due to the good results. The online course, originally developed as part of the project's educational experimentation, has now been formally integrated into CETEM's online training catalogue (elernia[8]), ensuring its long-term accessibility to learners interested in traditional crafts and woodworking.

[8] Elernia: https://www.elernia.cetem.es/elernia/cursos-online/

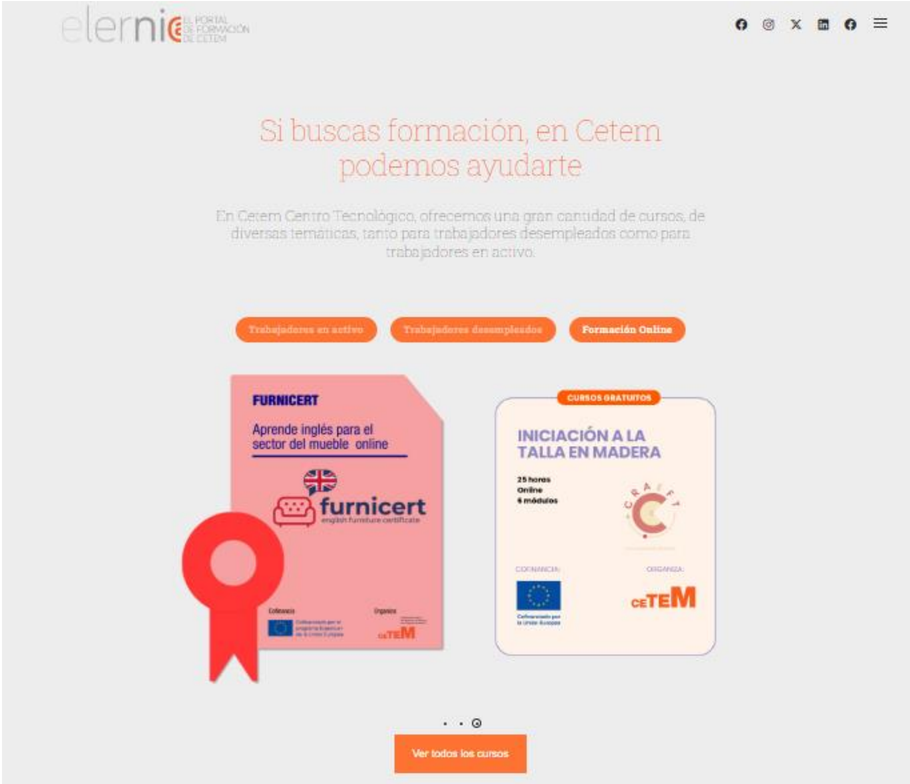


Figure 129 – CETEM certification

Before its inclusion, the course underwent a revision process focusing on workshop safety aspects, with special emphasis placed on reinforcing these principles within the practical module (highlighted in red in the following screenshot-figure). This update ensures compliance students´ feedback and enhances the course's suitability for independent learners who may not initially receive in-person supervision.

Ejercicios prácticos

Este curso contiene tres ejercicios prácticos diseñados para aplicar de forma progresiva los conocimientos y habilidades adquiridos a lo largo de los módulos anteriores. Cada ejercicio está acompañado de un vídeo explicativo en el que el profesor guía paso a paso el proceso de talla, desde la preparación del diseño hasta el acabado final de la pieza. Además, se incluyen fotografías detalladas del resultado final que servirán como referencia visual para los estudiantes.

⚠ **Antes de realizar cualquier práctica, es MUY importante revisar y tener en cuenta todas las consideraciones sobre seguridad incluidas en el Módulo 3.** Estas indicaciones son esenciales para garantizar un entorno de trabajo seguro y prevenir accidentes durante el uso de herramientas de trabajo.

- El primer ejercicio consiste en la **talla de un círculo**, ideal para familiarizarse con el control de la herramienta, la profundidad del corte y la limpieza de las líneas.
- En el segundo ejercicio, se trabaja una **figura floral** sencilla, en la que se introduce el trabajo con curvas, relieves y transiciones suaves entre volúmenes.
- Finalmente, el tercer ejercicio es de **temática libre**, en el que cada alumno podrá aplicar su creatividad y escoger su propio diseño, permitiéndole experimentar con lo aprendido y comenzar a desarrollar su estilo personal.

Figure 130 – E-learning improvement

In parallel, the course has been promoted through the ALLVIEW platform[9], an European Erasmus+ project that promotes excellence in vocational education and training (VET) within the wood and

[9] ALLVIEW platform: https://platform.allview.eu/

furniture sector. This dissemination supports the broader goal of CRAEFT to make traditional craft knowledge more widely accessible through innovative digital tools.

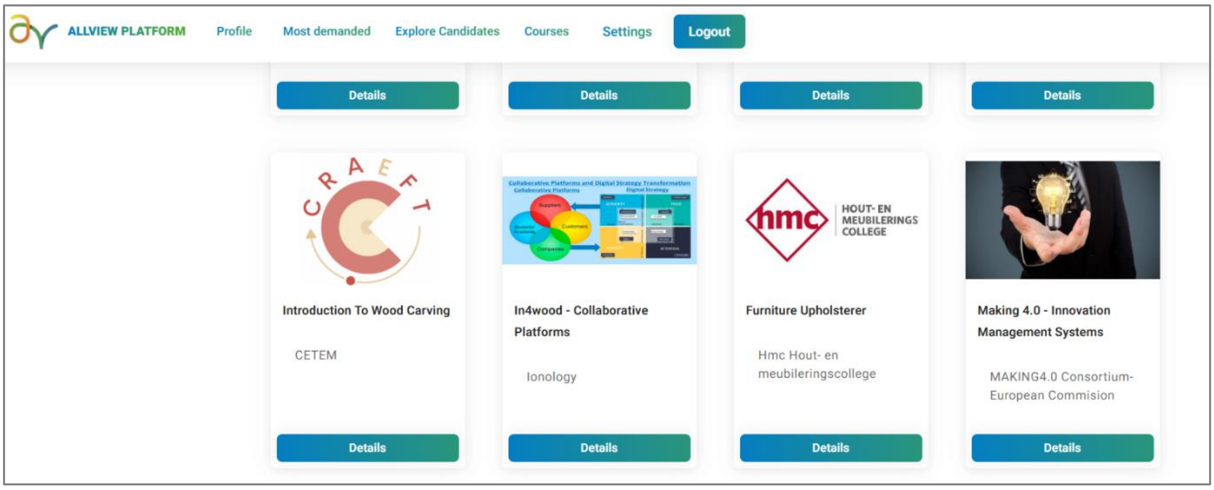


Figure 131 – Collaboration with Yecla Adult Education Center

Furthermore, a collaboration has been established with the Yecla Adult Education Centre, where a face-to-face woodcarving course will be implemented. In this context, the online training has been made available to trainers as a complementary teaching resource and will be promoted among students as follow-up material to support continuous learning

12 – RCI 7 – Aubusson Tapestry

13 – Discussion

The results of Pilot 1 across the various RCIs reveal converging trends and specific characteristics unique to each craft.

- For glass, digital tools (e-learning, VR, elicitation videos) have proven useful for initiation (discovering the workshop, memorising gestures) and revision, but their effectiveness remains limited for the acquisition of sensorimotor skills (precision of movements, heat management). Learners adopt a pragmatic approach, integrating these tools in a targeted manner, without substituting them for workshop practice.
- In marble sculpture, the hybrid experience (physical visit or digital courses and tools) has shown potential for clarifying technical steps, but evaluation remains difficult due to the small sample size and logistical constraints.
- In silversmithing, the interactive application attracted visitors' interest, but the mixed results highlight the need to improve the user experience (UX) and further the educational evaluation.
- For woodcarving, the hybrid model (face-to-face + e-learning) offered the best balance, combining the acquisition of manual skills in the workshop with theoretical consolidation online. The limitations of purely digital formats (lack of sensory feedback, difficulty in assessing safety) confirm that hybridisation is the key to preserving the transmission of craft skills. However, the e-learning tool provides an initial introduction for those wishing to acquire basic knowledge.

Furthermore, it highlights that the added value of digital tools remains dependent on teaching methods that allow them to be integrated effectively into the curriculum. And perhaps even more dependent on the geographical, socio-cultural and economic context, and on the formal or informal mode of transmission, which creates conditions that are more or less favourable to their deployment.

14 - Conclusion

Pilot 1 confirms that digital tools (VR, e-learning, videos, community platforms) effectively complement traditional methods without replacing them.

For glass, their strength lies in initiation and revision, while workshop practice remains essential for mastering complex techniques.

In marble and silversmithing, the results highlight the importance of carefully integrating digital tools, adapted to the constraints of schools or museums, with a need to improve ergonomics and learning assessment.

Woodcarving illustrates the potential of the 100% digital model, which provides a gateway to the first stage of learning, and hybrid models, where digital technology enhances learners' autonomy and the sustainability of the skills acquired.

However, effectiveness depends on training trainers in the use of these tools and their gradual integration into the curriculum.

In the future, it will be crucial to develop and bring interactive content (tactile simulations, real-time feedback) to life and to encourage artisans to embrace it. The challenge of transmission is to broaden access and strengthen the resilience of crafts by combining innovation and artisanal heritage.

Furthermore, taking into account the socio-economic contexts of each place where a craft exists will be essential, as digital tools are not effective on their own but must be integrated into an educational context that is itself rooted in a particular territory.

Annex 1 - Project presentation 24 June 2024

See synthesis document

1 - Goals

- Inform apprentices about the Craeft project
- Gather their ideas, suggestions, expectations, fears and solutions in relation to the project

2 - Phases of the session

- Présentation du projet Craeft
- Présentation des outils Craeft
- Définition des groupes (hors soufflage)
- Atelier créatif / tour de table – (attentes, craintes, idées)

3 - Craeft project's presentation

Presentation of the Craeft project to second-year apprentices, via the Craeft website, preview of digital tools and a powerpoint document.

Figure 1 - Craeft project's presentation

4 - Workshop

4.1 - Framework of questions

- How do you see Craeft's digital tools?
- What are your expectations?
- What you could do with them
- How would you like to use them?
- What are your fears?
- Why do you want to experiment and use these tools?
- What ideas do you have?

4.2 - Boards

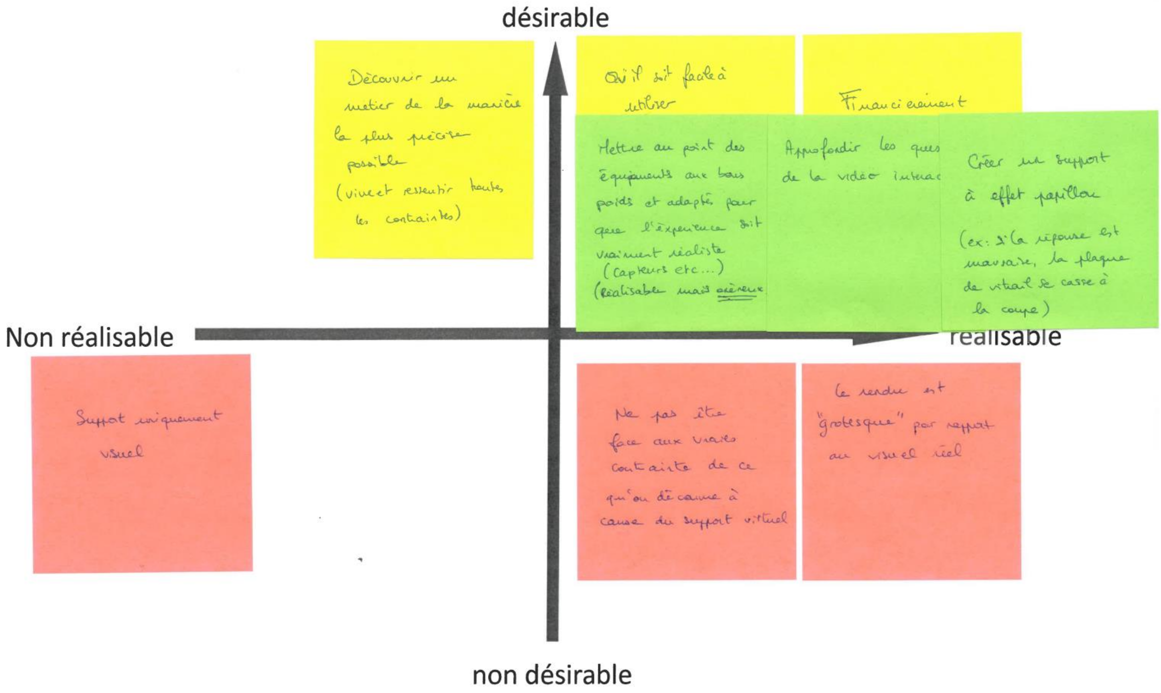


Figure 2 - Craeft workshop - sub group 1

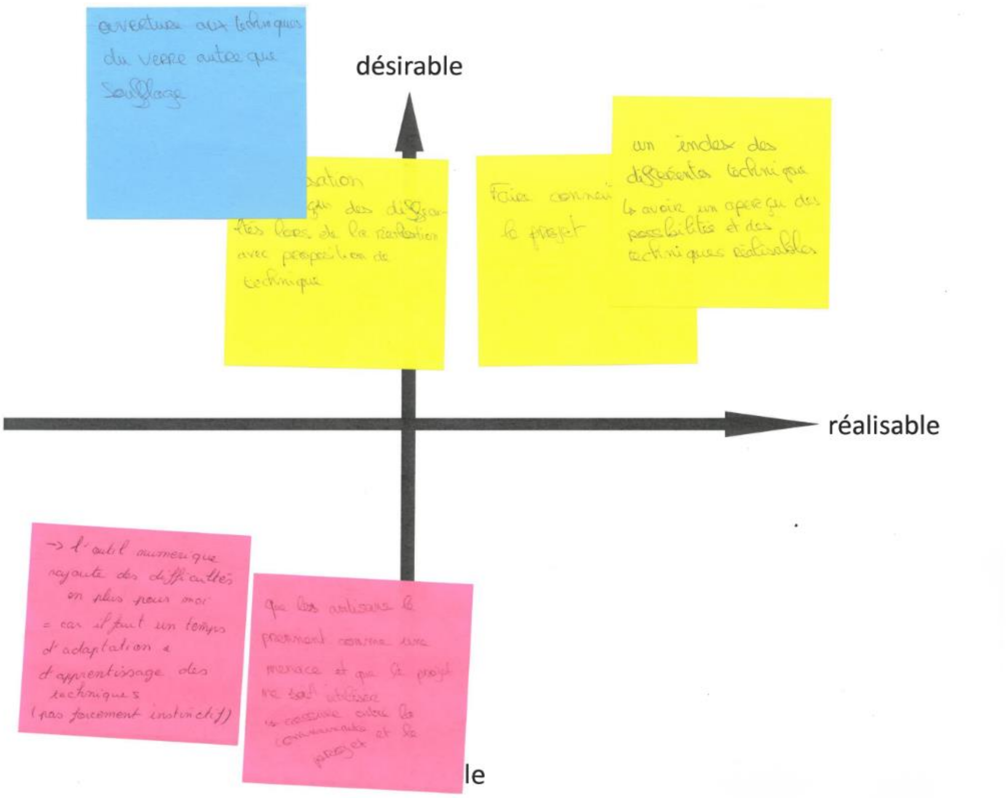


Figure 3 - Craeft workshop - sub group 2

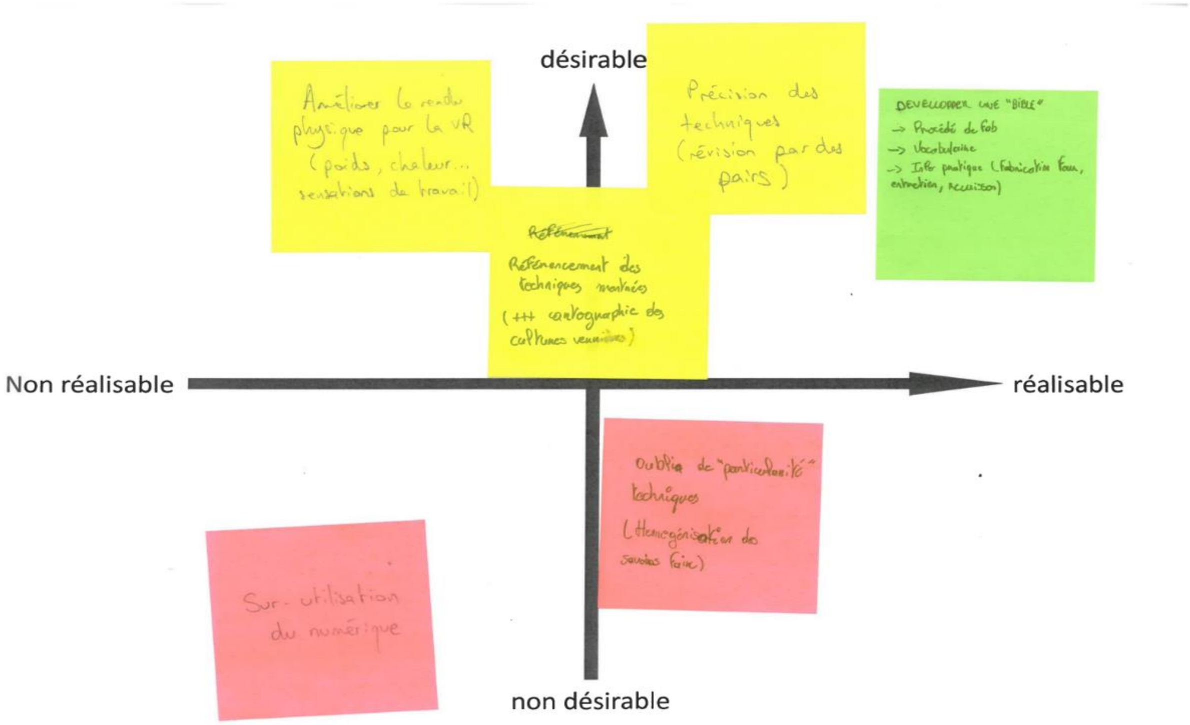


Figure 4 - Craeft workshop - sub group 3

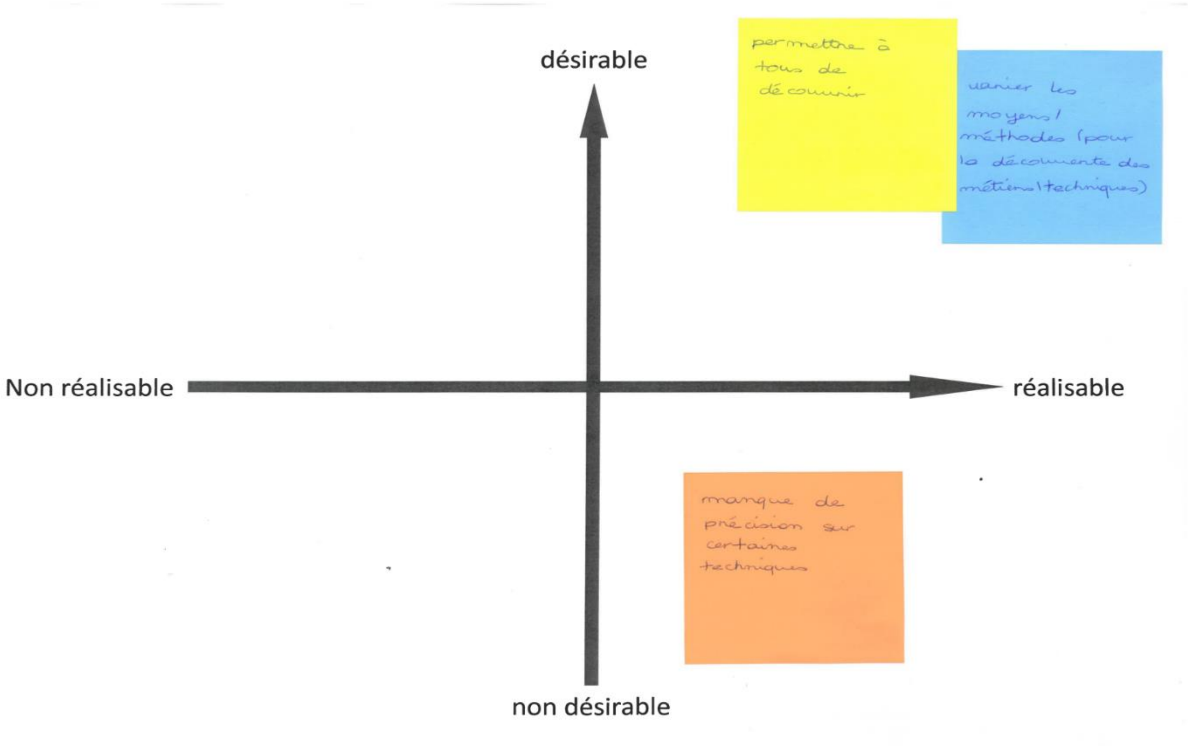


Figure 5 - Craeft workshop - sub group 4

4.3 - Boards transcription

4.3.1 - Sub-group 1

<u>Expectations:</u>

- To discover a profession as precisely as possible (to experience and feel all the constraints)
- That it is easy to use
- Affordable

<u>Fears:</u>

- Only visual support
- Not being faced with the real constraints of what you are discovering because of the virtual medium
- The rendering is 'grotesque' compared with the real visuals

<u>Proposal:</u>

- Develop equipment with the right weight and adapted to make the experience truly realistic (realistic but expensive sensors, etc.).
- Take a closer look at interactive video issues
- Create a support with a butterfly effect (e.g. if the answer is wrong, the stained glass panel will break when cut).

4.3.2 - Sub-group 2

Expectations:

- Modelling, overview of the difficulties involved in carrying out the project and suggested techniques
- To publicise the project
- An index of the different techniques => an overview of the possibilities and feasible techniques.

Fears:

- The digital tool adds extra difficulties for me = because it takes time to adapt and learn the techniques (not necessarily instinctive).
- That the craftspeople will see it as a threat and that the project will not be used, breaking the link between the community and the project.

Proposal:

- Opening up to glass techniques other than glassblowing

4.3.3 - Sub-group 3

Expectations:

- Improve physical rendering for VR (weight, heat, etc.)
- Repository of mounted techniques (+++ mapping of glass crops)
- Accuracy of techniques (peer review)

Fears:

- Overuse of digital technology
- Forgetting technical ‘particularities’ (Heterogeneity of know-how)

Proposal:

- Develop a ‘bible’.
    - Vocabulary
    - Practical information (oven manufacture, maintenance, annealing)

4.3.4 - Sub-group 4

Expectations:

- To enable everyone to discover

Fears:

- Lack of precision on certain techniques

Proposal:

- Vary means and methods (for discovering trades/techniques)

Annex 2 – Glassblowing - Assessment documents

1 – TA group

1.1 - Glassblower with pipe, questionnaire on the initial state of skills -

Questionnaires on the initial state of skills, with apprentices taking part in the T and TA groups, in order to identify or put into perspective any possible bias in the evaluation of the project on the effects of the Craeft tools on the learning path.

Questionnaire:

What is your training pathway?

What is your career path?

Had you ever blown glass with a cane before your apprenticeship?

(for example, an apprenticeship in stained glass after a CAP in glass and crystal art).

Do you already have experience in other areas of glass?

if yes, in which technique(s)?

Do you already have experience of digital tools?

if so, which gaming, for study or work?

What skills from the reference framework do you think you already possess, even partially?

- ☒ Mastering skills
- p ☐ partial mastery of skills

C1 Be informed

- ☐ C1.1 Read the instructions and decode the documents provided (technical file and procedure).
- ☐ C1.2 Identify work materials,
- ☐ C1.3 Identify materials, tools and fluids,
- ☐ C1.4 Identify control tools,
- ☐ C1.5 Take note of health, safety and environmental rules.

C2 Prepare

- ☐ C2.1 Establish the sequence of operations to be carried out according to aesthetic and technical constraints,
- ☐ C2.2 Prepare the raw materials,
- ☐ C2.3 Select and check machines and tools and adjust tools,
- ☐ C2.4 Organise and adapt your workspace.

C3 Implement

- ☐ C3.1 Carry out harvesting with ferret and cane,
- ☐ C3.2 Shape the glass taken for blowing,
- ☐ C3.3 Carry out the blow moulding to produce the required part,
- ☐ C3.4 Carry out the pressing to produce the required part,
- ☐ C3.5 Remove stains and place in the annealing arch,
- ☐ C3.6 Complete the finishing touches (tracing, stripping, slotting, chamfering, sawing, rebraiding, flattening, de-tooling, polishing),
- ☐ C3.7 Carry out the decoration (compaction, roughing, cutting, sanding),
- ☐ C3.8 Stop production.

C4 Ensuring maintenance

- ☐ C4.1 Carry out preventive maintenance (standard: NF 13306 of June 2001),
- ☐ C4.2 Detect any malfunctions,
- ☐ C4.3 Maintain the workstation in working order.

C5 Check

- ☐ C5.1 Adapt gestures and posture to the operation to be carried out
- ☐ and respecting ergonomic rules,
- ☐ C5.2 Check the conformity of products during manufacture,

- ☐ C5.3 Carry out the self-test.

C6 Communicate

- ☐ C6.1 Passing on instructions,
- ☐ C6.2 Participate in problem solving by suggesting improvements or solutions. or solutions.
- ☐ C6.3 Report orally, graphically or in writing, choosing and using appropriate tools, media, techniques, principles and codes.

C7 Comply with health, safety and environmental rules

- ☐ C7.1 Comply with health and safety rules,
- ☐ C7.2 Respect environmental rules.

1.2 - Self-positioning on the appropriation of Craeft tools

E-learning platform:

Connecting to the platform

- ☐ easily and independently
- ☐ with help
- ☐ "I'm lost!"

Comments:

Account customisation

- ☐ easily and independently
- ☐ with help
- ☐ "I'm lost!"

Comments:

Navigating the

- ☐ easily and independently
- ☐ with help
- ☐ "I'm lost!"

Comments:

Download a document

- ☐ easily and independently
- ☐ with help
- ☐ "I'm lost!"

Comments:

Send a document for assessment

- ☐ easily and independently
- ☐ with help
- ☐ "I'm lost!"

Comments:

Understanding the logic of evaluation

- ☐ easily and independently
- ☐ with help
- ☐ "I'm lost!

Comments:

Usefulness for my project / how will I be able to use it?

- ☐ This will help me
- ☐ It's not going to help me
- ☐ I don't know yet

Comments:

Comments and suggestions:

Apprentice Studio (VR):

Navigating the interface

- ☐ easily and independently
- ☐ with help
- ☐ "I'm lost!

Comments:

Using headphones and controllers

- ☐ easily and independently
- ☐ with help
- ☐ "I'm lost!

Comments:

Ownership of the environment

- ☐ easily and independently
- ☐ with help
- ☐ "I'm lost!

Comments:

Handling virtual tools

- ☐ easily and independently
- ☐ with help
- ☐ "I'm lost!

Comments:

Usefulness for my project / how will I be able to use it?

- ☐ This will help me
- ☐ It's not going to help me
- ☐ I don't know yet

Comments:

Comments and suggestions:

1.3 - Satisfaction survey questionnaire on e-learning platforms

Course content:

1. Clarity and organisation of course content

2. Has the course given you an understanding of glassblowing, cross-disciplinary subjects, background, description of machines and tools, presentation of the workshop, etc.?

3. Are the explanations about the machines, tools and workshop clear, detailed and useful?

Course structure and materials:

1. Course structure and organisation of sessions (chapters)

2. Did the course materials (text, images, videos) help you to understand the subject?

E-learning platform:

1. Is the platform user-friendly when it comes to accessing course materials, assessments and taking part in discussions?

2. Are the navigation and instructions provided by the platform clear and useful?

Back to overview:

1. What specific aspects of the course did you find particularly beneficial or stimulating?

2. Do you have any suggestions for improving this training in terms of content or teaching?

Any other comments?

1.4 - Satisfaction survey questionnaire on VR Studio

Interface:

1. Is the VR workshop simulation user-friendly when it comes to accessing the functions and tasks to be carried out?

2. Ease of use of the functions via the controllers (teleportation, entering tools, displaying information, etc.)

3. Ease of use of the interface in general (display of information, movements, actions, 'manage to do what I want')

Knowledge structure:

1. Do you prefer free access to the various functions, or a more guided path?

2. Did the information aids (text, images, videos) help you to discover and understand the understanding of the blow-moulding workshop?

Knowledge:

1. Do I find the application useful for learning and remembering the workshop environment, tools and machines?

2. Do I find the application useful for learning and remembering the manufacturing process?

3. Do I find the application useful for learning and remembering gestures?

General feedback:

1. What specific aspects of the simulation did you find particularly beneficial or stimulating?

2. Do you have any suggestions for improving the simulation in terms of content or interface?

Any other comments?

1.4 - Project follow-up form - TA

project booklet and follow-up sheet

The aim of the project logbook and the follow-up sheets filled in during individual interviews is to assess the impact of the digital tools in the Craeft project that we are offering you to try out.

The aim of this evaluation of the Craeft project during its development is to find out how your project has evolved thanks to the Craeft tools.

We suggest that you write down whatever you like in the notebook! And also to take five minutes at the end of each day to note down your work process throughout the project, during the day when a choice is made, when an unforeseen event occurs, when the result of an experiment is announced.

The project notebook will be used to evaluate the workflow as your project progresses. For example, the time spent creating a mould, the idea and the workflow at each stage of your project (idea =>model =>plan =>mould =>execution =>finished product).

definition: in the following paragraph the term project technique indicates the technique chosen by the person to design and model their project, XR for the TA group, modelling, wax etc. for the T group.

Questions :

Q1 - Which dominant project technique was used for the design,
modelling and project preparation, e.g. drawing, clay, wax, mould, XR, etc.?

Q2 - Did my project require the creation and manufacture of a template, a specific mould, a model, etc.?

Q3 - Time / workflow, facilitation:

- organisation and fluidity of the creative process according to the technique, project chosen for modelling.
- speed of execution slowed or accelerated by the project technique.

Q4 - Opportunities and limitations of project design and modelling tools

- specific problems linked to the project technique
- opportunities and limitations of the project technique
- experience of confronting the tools offered by the project technique in the creative process

Q5 - Opportunities and limitations of the production process

- opportunities and limitations of glass technology (depending on each ROI)
- confrontation with the material in the creation of the project

Q6 - Solutions found using XR tools and other project techniques

Q7 - Result / faithfulness to the initial project

- Are my choices guided by the project design method (XR and others, to be noted as the project progresses)?
- how the project technique influenced my choices => adaptation
- fidelity / loss of meaning / loss of project focus vs technology limitations

Q8 - What skills have been learned or developed as part of the project?

Q9 - Positive points / areas for improvement / suggestions

2 - T group

2.1 - Stained glass, questionnaire on the initial state of skills -

Questionnaires on the initial state of skills, with apprentices taking part in the T and TA groups, in order to be able to identify or put into perspective any possible bias in the evaluation of the project on the effects of the Craeft tools on the learning path.

Questionnaire:

What is your training background?

What is your career path?

Had you ever worked with stained glass, decoration or blowtorches before your apprenticeship?

(for example, an apprenticeship in stained glass after a CAP in glass and crystal art).

Do you already have experience in other areas of glass?
if yes, in which technique(s)?

Do you already have experience of digital tools?
if so, which gaming, for study or work?

What skills from the reference framework do you think you already possess, even partially?

- ☒ Mastering skills
- p ☐ partial mastery of skills

C1 Be informed

- ☐ C1.1 Decode work documents and study proposals.
- ☐ C1.2 Recognise the materials used.
- ☐ C1.3 Identify materials, tools and fluids.
- ☐ Deciphering health and safety rules and ergonomic guidelines.

C2 Prepare

- ☐ C2.1 Analyse the product.
- ☐ C2.2 Prepare the necessary tools and materials.
- ☐ C2.3 Prepare the raw materials.
- ☐ C2.4 Check that the workstations are operational.

C3 Implement

- ☐ C3.1 Produce graphic elements.
- ☐ C3.2 Opening glasses.
- ☐ C3.3 Assemble and fit.
- ☐ C3.4 Apply waterproofing.
- ☐ C3.5 Apply stopping procedures at each stage of the production process.

C4 Ensuring maintenance

- ☐ C4.1 Carry out level I maintenance (Standard NF-X-60010) on equipment and tools.
- ☐ C4.2 Locate the source of faults.

C5 Check and contribute to quality

- ☐ C5.1 Make good use of the equipment, materials and fluids provided.
- ☐ C5.2 Check the conformity of work in progress.
- ☐ C5.3 Check the defined structural, geometric and dimensional characteristics.
- ☐ C5.4 Report any anomalies found during production, relating to: work materials, tools, procedures.
- ☐ C5.5 Keep accurate records of work done and time spent.

2.2 – Decorator on glass, questionnaire on the initial state of skills

Questionnaires on the initial state of skills, with apprentices taking part in the T and TA groups, in order to be able to identify or put into perspective any possible bias in the evaluation of the project on the effects of the Craeft tools on the learning path.

Questionnaire:

What is your training background?

What is your career path?

Had you ever worked with stained glass, decoration or blowtorches before your apprenticeship?
(for example, an apprenticeship in stained glass after a CAP in glass and crystal art).

Do you already have experience in other areas of glass?
if yes, in which technique(s)?

Do you already have experience of digital tools?
if so, which gaming, for study or work?

What skills from the reference framework do you think you already possess, even partially?

- ☒ Mastering skills
- p ☐ partial mastery of skills

C1 Be informed

- ☐ C1.1 Decode working documents and study drawings and/or models.
- ☐ C1.2 Recognise the materials used.
- ☐ C1.3 Identify materials, tools, fluids and consumables.
- ☐ C1.4 Read and/or identify measuring and checking instruments.
- ☐ C1.5 Decode health and safety rules and ergonomic instructions.

C2 Prepare

- ☐ C2.1 Analyse the set and its artistic features.
- ☐ C2.2 Prepare tools, equipment and accessories.
- ☐ C2.3 Prepare raw parts.
- ☐ C2.4 Prepare the workstation.

C3 Implement

- ☐ C3.1 Compaction and tracing.
- ☐ C3.2 Produce: guides, templates, skeletons, colour films, etc.
- ☐ C3.3 Perform cold and hot forming
- ☐ C3.4 Decorate by removing material.
- ☐ C3.5 Decorate by adding material.
- ☐ C3.6 Assemble and glue.
- ☐ C3.7 Shut down the workstation.

C4 Ensuring maintenance

- ☐ C4.1 Carry out level I maintenance (Standard NF-X-60010) on equipment and tools.
- ☐ C4.2 Locate the source of faults.

C5 Control / Quality

- ☐ C5.1 Use materials wisely.
- ☐ C5.2 Check the conformity of work in progress at the end of the job.
- ☐ C5.4 Report any faults found.
- ☐ C5.5 Keep accurate records of work done and time spent.

2.3 - Project follow-up form - T

Follow-up sheet

The aim of the monitoring form and the individual interviews is to evaluate the Craeft project, comparing two groups, one a control group and the other using digital tools.

The aim of this evaluation during the development of your project is to find out how your project has evolved thanks to the tools you have chosen.

This project tracking sheet will be used to assess the workflow as your project progresses. For example, the time spent creating a mould, the idea being to note the workflow at each stage of your project (idea =>model =>plan =>mould =>execution =>finished product).

definition: in the following paragraph the term project technique indicates the technique chosen by the person to design and model their project, XR for the TA group, modelling, wax etc. for the T group.

Questions:

Q1- What is the main technique used for the design,
modelling, preparation of the project e.g. drawing, clay, wax, mould, XR etc.?

Q2- Did my project require the creation and manufacture of a template, a specific mould, a model, etc.?

Q3- Time / workflow, facilitation:

- Organisation and fluidity of the creative process according to the technique, project chosen for modelling.
- speed of execution slowed or accelerated by the project technique.

Q4- Opportunities and limitations of project design and modelling tools

- specific problems linked to the project technique
- opportunities and limitations of the project technique
- experience of confronting the tools offered by the project technique in the creative process

Q5- Opportunities and limitations of the production process

- opportunities and limitations of glass technology (depending on each ROI)
- confrontation with the material in the creation of the project

Q6- Solutions found using XR tools and other project techniques

Q7- Result / faithfulness to the initial project

- Are my choices guided by the project design method (XR and others, to be noted as the project progresses)?
- how the project technique influenced my choices => adaptation
- fidelity / loss of meaning / loss of project focus vs technology limits

Q8- What skills have been learned or developed as part of the project?

Q9- Positive points / areas for improvement / suggestions

3 – Trainer

3.1 – Personal interview questionnaire

1- Context

a. How long have you been teaching students in your discipline?
b. Do you use the web/social media to obtain professional information?
c. Your previous use of digital tools.
d. Your students' previous use of digital tools.
e. Is this the first time you have used digital tools for teaching? Or have you already used digital tools in your teaching?
f. What teaching tools do you usually use (lectures, demonstrations, etc.)?

2- Role in learning

a. What tools did you use (e-learning, VR, video, etc.)?
b. How did you find these digital tools?
c. Ease of use of the tools.
d. How does this tool help you in your teaching process? / How did you use the tool(s) in your lessons?
e. Did you notice any discrepancies between the design of the tool (terminology, process, etc.) and the reality of the workshop?

3- Observation of students

a. What digital tools are used by students?
b. How did students respond to these digital tools?
c. How did students respond to these digital tools?
d. How did your colleagues respond to these tools?
f. Do you think the tools are accessible to students?
g. Did these tools promote understanding?
h. Did these tools promote mastery of the technique in the workshop (transition from digital to practical)?

Annex 3 – Glassblowing - Thematic analysis coding structure

1 - Referencing System for Thematic Analysis Coding structure

1.1 - E-learning platform [EL]

Pedagogical and didactic effectiveness [PDE]

[PDE-1] - Quality of learning materials

[PDE-2] - Educational Progress

[PDE-3] - Assessment of learning

Ergonomics and accessibility [ERA]

[ERA-1] - Navigation and interface

[ERA-2] - Organisation of content

[ERA-3] - Technical accessibility

Exhaustiveness of content [EXC]

[EXC-1] - Core content

[EXC-2] - Specific technical aspects

[EXC-3] - Educational supplements

Linking theory and practice [LTP]

[LTP-1] - Transfer of learning

[LTP-2] - Professional Contextualisation

[LTP-3] - Practical Applications

1.2 - Studio VR [VR]

Pedagogical Engineering [PEN]

[PEN-1] - Learning structure

[PEN-2] - Pedagogical objectives

[PEN-3] - Assessment system

Technical Fidelity [FIT]

[FIT-1] - Physical simulation

[FIT-2] - Reproduction of movements

[FIT-3] - Technical accuracy

VR Ergonomics [EVR]

[EVR-1] - User interface

[EVR-2] - 3D navigation

[EVR-3] - Functionality accessibility

Practical Aspects and security [PAS]

[PAS-1] - Security and best practices

[PAS-2] - Hardware management

[PAS-3] - Organisation of space

1.3 - Personal project follow-ups [PFU]

Mains themes emerging from personal project follow-ups of cluster N°8:

[DTL] - Learning how to use digital tools.
[MXU] - A pragmatic, mixed approach depending on requirements.
[RTM] - A choice based on the pleasure of making, the relationship with the material.
[AXS] - Access for all?
Added themes for analyse personal project follow-ups of cluster N°9

[OLD] – Opportunities and limitations of digital tools, interaction between the choice of tool and the project.
[SCD] – Subcontracting the use of digital tools.
[CDT] – Complexity of digital tools
[CWP] – Collaboration with peers

1.4 - Overall feedback of trainer on digital tools experiment [TFoDT]

Context

[C-PEX] - Context, professional experience

[C-WEX] - Context, web and social network experience

[C-DTPEX] - Context, digital tools personal experience

[C-DTTEX] - Context, digital tools training experience

[C-UTUT] - Context, usual tools used for training

Digital Tools Usage for training

[DT-WDTUT] -Whichdigital tools are used by trainer

[DT-EoU] - Ease of use

[DT-AVfT] - Added value of digital tool for training

[DT-AoDT] - Accuracy of tools in relation to the workshop

[DT-IT] - Digital Tools, Integration and Timing

[DT-TT] - Traditional vs. Technological Teaching

Student monitoring

[ST- WDTUS] - Which digital tools are used by students

[ST- SAoDT] - Students' acceptance of the digital tools

[ST-CAoDT] - Colleague acceptance of the digital tools

[ST-AXSDT] - Accessibility of digital tools

[ST-IDToL] - Impact of digital tool on learning process

[ST-IL] - Student Initiative and Learning Autonomy

Annex 4 – Marble carving – Assessment documents

1 - Tinos experiment – Research sheet

CRAEFT – Work package 6.1 – Training

Research

Instructions: Fill in the tables below with information from your visit to the museum. Identify and record the technical step or design and fill in the adjacent columns with the requested information.

QUARRY

Step	Tool(s)

MARBLE WORK

Step	Tool(s)

DESIGN AND TECHNIQUES

Design	Technique

2 - Tinos experiment – Final quiz

CRAEFT – Work package 6.1 - Training

Quiz

PART A: TECHNIQUES

Instructions: Fill in the missing information in the table. Select the appropriate information from the list for each topic below the table. The suggested information can be used more than once.

Technique	Steps	Tools
Quarry	.... Marble lifting Tuning wedges .... Carving Drilling holes	Falka Jack .... Needle Lever ....
Marblework	Removal .... Marking .... Grinding	.... Needle Disilico .... Ponta ....

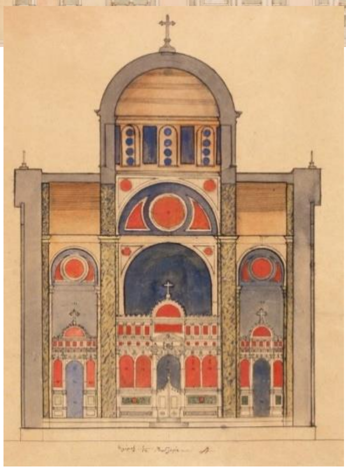
Steps: Design – Rolling – Cutting – Gouging – Lagging – Trimming – Engraving – Cutting

Tools: Wedge – Tongue – Chisel – Compass – Scissors – Masgala – Mandrakas

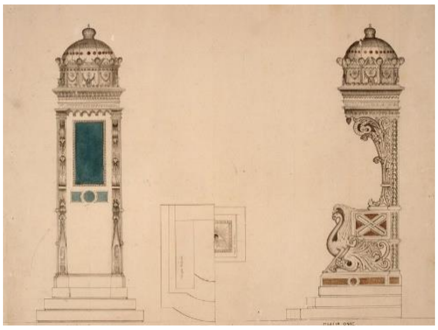
PART B: TECHNIQUES AND DESIGNS

Instructions: Match the designs in the left column with the correct craftsman in the right column. The suggested craftsmen may have made more than one design.

Charalambos Tzavellopoulos



Ioannis Vidalis



Alexandros Tzomakas

Michael Lyritis

Ioannis Halepas

Annex 5 – Woodcarving – Assessment documents

1 - Initial knowledge survey

1. PREVIOUS EXPERIENCE
Have you worked with wood before?
☐ Yes, professionally
☐ Yes, as a hobby
☐ No, never

Have you taken any woodcarving courses before?
☐ Yes, a basic course
☐ Yes, an advanced course
☐ No, never

How many years of experience do you have in woodcarving?
☐ None
☐ Less than 1 year
☐ Between 1 and 3 years
☐ More than 3 years

2. TECHNICAL KNOWLEDGE
Do you know the different types of wood and their characteristics for carving?
☐ Yes, extensively
☐ Yes, basic knowledge
☐ No, not at all

Can you identify and use basic woodcarving tools (chisels, gouges, burins, etc.)?
☐ Yes, confidently
☐ Yes, but with little experience
☐ No, I have never used them

Do you have experience sharpening and maintaining woodcarving tools?
☐ Yes, extensively
☐ Yes, basic knowledge
☐ No, not at all

3. SAFETY AND HANDLING

Do you know the basic safety rules for using woodcarving tools?

☐ Yes, completely
☐ Yes, but only basic knowledge
☐ No, I don't know them

4. MOTIVATION AND INTERESTS

What is your main goal in taking this course?

☐ Learn from scratch
☐ Improve my skills
☐ Become a professional
☐ Other: ____________

What type of projects are you most interested in?

☐ Wood sculpture
☐ Reliefs and engravings
☐ Furniture and decoration
☐ Other: ____________

2 - Final knowledge test

Which of the following woods is considered the softest and therefore easiest for beginners to carve?
☐ Pine
☐ Basswood (Linden)
☐ Oak
☐ Walnut

What is a U-shaped gouge typically used for?
☐ For straight cuts and fine lines
☐ To create rounded or hollowed shapes
☐ To smooth flat surfaces
☐ To mark guidelines

Which cutting direction is best to avoid splintering?
☐ Against the grain
☐ With the grain
☐ Perpendicular to the grain
☐ Zigzag across the grain

Which of the following statements about securing the piece to the workbench is correct?
☐ The piece should be completely loose to allow movement
☐ It should be firmly secured to avoid shifting during carving
☐ The piece's movement should be restricted along some axes for more flexibility
☐ It doesn't matter how it's secured

What is an essential safety measure when using gouges?
☐ Working with thick gloves
☐ Applying a lot of force on each cut
☐ Always carving away from your body
☐ Holding the gouge by the blade for better control

What type of gouge would be most suitable for carving fine details?
☐ Wide and deep gouge
☐ Flat gouge
☐ V-parting tool (V-gouge)
☐ Chisel

3 - Satisfaction and usability survey

What is your overall level of satisfaction with the course?

☐ Very satisfied
☐ Satisfied
☐ Neutral
☐ Dissatisfied
☐ Very dissatisfied

How would you rate the usefulness of the content delivered for your personal or professional development?

☐ Very useful
☐ Useful
☐ Slightly useful
☐ Not useful at all

How was the quality of the materials provided (wood, gouges, workbenches, etc.)?

☐ Excellent
☐ Good
☐ Acceptable
☐ Poor
☐ Very poor

How did you find the technical difficulty of the course?

☐ Very easy
☐ Easy
☐ Adequate
☐ Difficult
☐ Very difficult

Did you find the balance between theory and practice appropriate?

☐ Yes, well balanced
☐ Too much theory
☐ Too much practice
☐ I would have liked more theory
☐ I would have liked more practice

How would you rate the instructor's attention and availability during the course?

☐ Excellent
☐ Good
☐ Acceptable
☐ Could be improved
☐ Poor

What did you think about the exercises and pieces made during the course?
☐ Very interesting and appropriate
☐ Acceptable but could be improved
☐ Not very interesting
☐ Irrelevant for learning

Do you think gouge use was correctly taught and supervised?
☐ Yes, completely
☐ Mostly yes
☐ Average
☐ No, supervision or explanation was lacking

Will you continue to dedicate time and practice to wood carving after the course?
☐ Yes
☐ No
☐ I haven't decided yet

Would you like to participate in future carving courses?
☐ Yes, definitely
☐ Probably yes
☐ I don't know
☐ Probably not
☐ No

Would you recommend this course to colleagues and/or professionals?
☐ Yes
☐ No
☐ I'm not sure

Please rate the following statements from 1 (Strongly Disagree) to 5 (Strongly Agree):

- The course has allowed me to acquire basic knowledge in wood carving.
- The course hours have been sufficient to learn to carve with minimum skill.
- After completing the course, I feel able to create wood carvings independently.
- Interaction with the instructor and other students is essential for acquiring the necessary skills and knowledge.

You may now leave comments about the course:

Annex A
E-learning Portal

care, judgment, dexterity

Abbreviations

Abbreviation	Definition
CLT	e-learning platform linked to Craeft Studio
AS	Apprentice Studio application, virtual workshop learning
DS	Design studio application, design and 3D/XR modelling.
CPC	Certificate of Professional Competence - French level 3 certification.
CS	Craeft Studio application incorporating a virtual training workshop.
CAP	Craeft Authoring Platform, a portal providing access to CLT, DS, AS and Craeft Studio.
HSE	Health, Safety, Environment
MOOC	Massive Open Online Courses
RCI	Representative Craft Instance
XR	extended reality, including virtual reality, mixed reality and augmented reality.

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1 E-Learning portal implementation

Crafts represent a valuable repository of cultural heritage, encapsulating the wisdom and craftsmanship passed down through generations. These crafts encompass a diverse array of artistic, functional, and cultural practices, ranging from woodworking and pottery to textiles and basket weaving [1]. With their intricate techniques, cultural significance, and historical context, crafts stand as a testament to human creativity, innovation, and cultural preservation. In a world marked by rapid technological transformations, the preservation of crafts is of significance for their safeguarding [2].

Training individuals in crafts poses various challenges. It is of paramount importance to understand these challenges when trying to produce digital learning solutions that aim to support such goals [3]. The main challenge lies in preserving the authenticity of these crafts [4] while adapting to contemporary teaching methods. Other challenges are related to the nature of craft concerning the modern globalized environment [5]. These crafts are typically transmitted orally from one generation to the next, lacking a structured, written format that facilitates systematic education [6]. The absence of written records poses a significant risk of knowledge loss [7]. The mastery of crafts is a labor-intensive and time-consuming endeavor, with a dwindling number of individuals showing interest in apprenticeships. This decreasing interest in crafts raises concerns about their preservation [8]. Furthermore, the economic viability of these crafts remains limited, as they generally offer low financial returns [9]. Challenges also include the procurement of appropriate materials, adaptation to cultural changes, and the effective transfer of skills from experienced artisans to younger generations. Ensuring consistency in quality, addressing competition from mass-produced alternatives, and preserving the authenticity of crafts further complicate the training process. Moreover, access to markets, government support, and the revitalization of interest in crafts within communities are critical factors [10]. These multifaceted challenges underscore the need for comprehensive training approaches in crafts, whether technology-assisted or otherwise, to safeguard these invaluable cultural practices.

In this section, a hypothesis is made that embracing eLearning in the realm of crafts can offer significant advantages. First and foremost, it introduces accessibility to craft education, breaking geographical boundaries. Learners from diverse locations can now access instructional materials and interact with instructors and peers, fostering a global exchange of craftsmanship. Moreover, eLearning platforms, such as Moodle, provide a centralized and scalable approach to education. They serve as a repository of knowledge, efficiently organized and cataloged for learners to explore. One of the most compelling benefits of eLearning is its ability to accommodate diverse learning paces [11].

More specifically, concerning craft training, craft apprentices, often constrained by the rigidity of traditional settings, can now tailor their learning experiences to match their unique progress rates. eLearning ensures that learners are not overwhelmed by cognitive overload, offering ample time for the vital process of cognitive processing. This is particularly true when eLearning is designed to reduce intrinsic and extraneous cognitive loads [12]. Incorporating multimedia elements, interactive simulations, and self-assessment tools enhances the learning experience, keeping learners engaged and motivated [13]. A critical issue in eLearning with a special application to craft is the management of cognitive load, a concept deeply rooted in cognitive psychology. Cognitive Load Theory (CLT) offers an intricate framework for understanding how the human cognitive system processes information and how the design of instructional materials [14] can shape the learning experience. eLearning platforms have been proven sufficient for the integration of principles from CLT, ensuring that instructional materials are thoughtfully designed to optimize the cognitive load of learners effectively [15–18].

This research section aims to bridge eLearning on crafts with CLT, serving as a comprehensive guide for applying CLT effects in eLearning settings. eLearning platforms have revolutionized education, offering powerful tools and methods to enhance learning experiences [19,20]. It is argued that craft education can benefit from the principles of CLT. In the use cases described in this research work, the Moodle platform is employed [21] but any other eLearning platform can be suitable for applying the ergonomic knowledge developed by this research work. The rationale for selecting Moodle is the fact that it is an open-source, completely free eLearning platform that is currently used to implement more than 170k eLearning sites and more than 46M. courses. Of course, any other eLearning platform or CMS can be of use as a target system since the provided guidelines are platform-agnostic.

The innovation in providing guidelines to support training on traditional crafts lies in adopting a multifaceted approach that combines an established cognitive theory, such as CLT, with modern eLearning platforms. This fusion allows for a comprehensive understanding of cognitive processes while creating digital content for eLearning environments. These guidelines, rooted in cognitive phenomena, aim to optimize craft learning experiences. Both the guidelines and their application on a widely used eLearning platform are innovative dimensions in craft training. They offer a practical and scalable solution for crafting educational content in traditional crafts. This approach not only acknowledges the unique challenges of traditional craft education but also pioneers a new pathway for integrating cognitive theories into the digital landscape, enhancing the pedagogical strategies employed in training on traditional crafts.

1.1 Background and Related Work

Craft education and training are challenging since they introduce learners to a multifaceted world, where they must acquire skills, knowledge, and appreciation for cultural heritage. Balancing these learning objectives is a cognitive challenge. At the same time, the “low status” and “lack of prestige” of vocational options demotivate young people from following craft training [22]. In this section, we try to address the cognitive challenge building on CLT, as conceptualized by John Sweller [14]. This theory offers guidance on how to structure instructional materials and virtual environments to optimize the learning process. Understanding and addressing the different facets of cognitive load when designing eLearning courses [15] can foster effective learning [16], reduce cognitive overload, and facilitate deep engagement with crafts.

The significance of integrating CLT within the realm of craft eLearning becomes evident as we consider the vast potential to enhance the educational experience. Tailoring eLearning materials and Moodle-based activities to accommodate the complexities of crafts and the distinct needs of learners can empower individuals to engage more deeply with these crafts. The successful application of CLT through Moodle stands as a bridge between tradition and innovation, safeguarding the preservation, appreciation, and continuation of crafts.

This section provides a comprehensive overview of the theoretical foundations and existing research in the domains of CLT, craft education, and eLearning platforms, with a particular focus on Moodle-based learning environments.

1.1.1 Cognitive Load Theory

CLT is a foundational framework in educational psychology that underpins our approach to designing effective eLearning experiences for crafts. CLT delves into the intricacies of how the human cognitive system processes information and how instructional materials’ design influences the learning experience. The framework identifies three distinct types of cognitive load: intrinsic, extraneous, and germane. Intrinsic cognitive load relates to the inherent complexity of the subject matter, extraneous cognitive load pertains to the load imposed by ineffective instructional design, and germane cognitive load concerns the cognitive effort that leads to meaningful learning.

The core effects associated with CLT have a close relevance in eLearning contexts and include the Split-Attention Effect, which underscores the significance of not overloading learners with disparate sources of information [23]. The Modality Effect highlights how presenting information through multiple sensory channels can enhance comprehension and retention [24]. The Redundancy Effect emphasizes the negative impact of presenting the same information redundantly in different modalities [25]. In contrast, the Expertise Reversal Effect reminds us that what is effective for novices may not work for experts [26]. We will also consider the Guidance Fading Effect, which suggests that as learners gain proficiency, guidance should be gradually reduced, and the Imagination Effect which underlines the power of mental imagery in learning [27]. The Self-Explanation Effect advocates for learners to articulate their understanding [28], and the Element Interactivity Effect [29] focuses on handling complex, interactive topics.

1.1.2 Craft Education via Online Social Platforms

Currently, there are several platforms dedicated to teaching crafts. For example, Craftsy is an online platform that offers video courses on a wide range of crafts, including knitting, quilting, sewing, and more [30]. Users can access pre-recorded classes taught by expert instructors. Udemy hosts a variety of online courses on crafts and DIY projects. Instructors from around the world create and offer these courses. While the quality and content can vary, it provides a diverse range of craft-related courses [31]. Skillshare is an eLearning platform that offers a wide range of courses, including those related to crafts and DIY. It is known for its creative and practical courses, with many focused on crafts. The Great Courses offers a selection of video courses, and they have offerings related to crafts. These courses are often taught by experts in their respective fields [32]. While not a dedicated eLearning platform, YouTube has a vast library of craft tutorials. Many artisans and crafters share their knowledge and skills through video tutorials [33]. This offers a wealth of free resources for those interested in crafts. Some craft schools and workshops have adopted eLearning and hybrid learning models. They offer both in-person and online classes, making craft education more accessible to a wider audience.

1.1.3 Moodle as an eLearning Platform

Moodle is a versatile open-source eLearning platform renowned for its rich feature set and widespread adoption in education and training [34]. Educators can seamlessly create and manage online courses, incorporating multimedia content, interactive assignments, and automated assessments. The user-friendly interface promotes easy navigation for instructors and learners alike. Moodle’s flexible design allows for extensive customization with themes and plugins, ensuring it can be tailored to diverse educational needs. Its comprehensive gradebook and analytics tools facilitate learner progress tracking and performance evaluation. Moodle’s robust security measures prioritize data protection, and its mobile accessibility caters to various devices, making it an excellent choice for modern eLearning. With a supportive global community and seamless integration capabilities, Moodle remains a top choice for educational institutions, corporations, and organizations worldwide [35].

1.1.4 Extending Learning Paradigms in Craft Education

In craft education, focusing on digital transformation while preserving the essence of craftsmanship and cultural heritage is important. The landscape of learning paradigms in craft education currently includes or has the potential to include in the future several novel learning approaches such as:

Blended Learning Models: craft education often thrives on hands-on learning, apprenticeships, and the transfer of practical skills from one generation to the next [36]. The fusion of practices with digital tools and platforms, such as Moodle, can create blended learning models that combine the tactile experience of crafting with digital resources.

Microlearning and Skill-Based Learning: As the educational landscape evolves, microlearning has gained prominence [37] in the context of crafts. Delivering skill-based modules in small, easily digestible segments through eLearning platforms is such a paradigm.

Gamification and Interactive Learning: Interactive and game-based learning approaches [38] can engage learners and make the process of acquiring craft skills more enjoyable. Gamified elements can encourage learners to explore the art of crafting while mastering skills in an immersive, enjoyable manner [39].

Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality(MR): New immersive technologies have a good track record in education and training and have been used in the field of Craft training [40–47]. eLearning as a digital form of education has the potential to support or be combined with immersive learning experiences with the benefit of being able to emphasize their ability to simulate real craftwork environments.

Personalized Learning and Adaptive Platforms: Personalized learning experiences tailored to individual learners can be facilitated in contemporary education.

Lifelong Learning and Cultural Preservation: craft education often extends beyond formal schooling, making lifelong learning essential.

1.1.5 Objectives

This section aims to elucidate the principles of CLT and its various effects, highlighting their relevance in the context of craft eLearning and applying these principles as encompassed into instructional design, learning strategies, and assessment methods. To do so, and to provide practical guidance on the implementation of CLT effects, application guidelines are provided for each of the theory's effects. These guidelines are practically implemented for the design of case study eLearning content for the use case of glassblowing.

In this context, it is important to highlight that creating efficient eLearning content is essential for training heritage crafts since the learning subject heavily depends on the interaction of the maker with the material, which cannot be replicated online. As such, it is important to identify the most appropriate ways of transferring some aspects of this knowledge through online courses. The ultimate goal is to prepare the trainee for a mindful interaction with the material at later stages of training. Providing the appropriate background knowledge and problem-solving skills can be essential for each learner's course to craft mastery.

In the subsequent sections, we delve into the theoretical foundations of CLT and provide practical guidelines for implementing CLT effects. Then, the application of the guidelines is illustrated through Moodle-enhanced eLearning experiences for craft education. The main aspiration is that through this research section, educators, eLearning practitioners, and cultural heritage advocates will be equipped with a solid framework to enrich the teaching and learning of crafts in the digital age.

1.2 Effects of CLT Considered in Craeft

This section provides a short introduction to the effects of CLT, before moving forward to the definition of practical guidelines for their implementation in the eLearning context.

The Worked Example Effect refers to providing learners with worked examples or step-by-step solutions to problems before they attempt to solve similar problems. This effect aims to enhance learning and problem-solving skills by allowing learners to see how a task or problem is solved before they try it themselves and is applied by (a) the provision of exemplar solutions or models of how to solve a particular type of problem, (b) Scaffolding Learning by providing learners with guidance and support, and (c) Gradual Release of Responsibility by limiting over time the level of guidance provided.

The Problem-Completion Effect aims to ensure that learners pay sufficient attention to the worked examples to provide learners with completion problems [45]. A completion problem is a partially worked example where the learner has to complete some key solution steps. Sweller [48] asserted that completion problems are effective because they incorporate a problem-solving component, prompting learners to engage with the problem at a sufficient depth to grasp crucial information. This approach avoids overloading working memory by steering clear of complete problem-solving. In completing the problem, learners are required to focus on and process the pre-solved portion before responding to the unfinished steps. Essentially, completion problems represent a hybrid approach, combining aspects of both a worked example and a problem to be solved [49].

The Split-Attention Effect occurs when learners need to divide their focus between at least two sources of information that are intentionally separated either spatially or temporally [50]. Spatial split attention occurs when a learner is required to simultaneously focus on two or more spatially separated sources of information. This occurs when information that is essential for understanding a concept is presented in different locations or on different parts of a display. In such cases, the cognitive load increases as individuals need to split their attention between multiple sources, which can hinder comprehension and learning. Temporal split attention refers to the division of a learner's attention over time due to the presentation of information at separate points in time. It occurs when critical information is presented in a manner that requires individuals to remember and integrate information from an earlier point in time when processing subsequent information.

The Modality Effect refers to the idea that people learn more efficiently when information is presented in multiple modalities (e.g., text and spoken words). The rationale behind the Modality Effect is that by engaging both the visual and auditory processing systems, learners have more opportunities to encode and consolidate the information, resulting in better learning outcomes [51]. This effect is related to the broader field of multimedia learning theory, which explores how the presentation of information in multiple modalities can impact learning and memory.

The Redundancy Effect refers to the principle that presenting the same information through multiple modalities (typically, visual and auditory) can lead to cognitive overload and reduced learning effectiveness. In other words, when learners are presented with redundant information, where the same content is provided in both written text and spoken narration, it can have a negative impact on their ability to comprehend and remember the material [25]. The Redundancy Effect is the opposite of the Modality Effect, which suggests that presenting information in multiple modalities enhances learning. The key distinction is that while the Modality Effect advocates for using different modalities to convey complementary information (e.g., visuals and spoken explanations), the Redundancy Effect warns against presenting the same information in redundant ways (e.g., showing on-screen text and simultaneously reading it aloud). Both Modality and Redundancy Effects are a subject of constant research as new media and learning technologies arise [52–55].

The Expertise-Reversal Effect describes how the impact of instructional methods can change based on the level of expertise or prior knowledge of the learners. In essence, it suggests that what is an effective teaching strategy for novices may not be as effective for experts and vice versa [56].

The Guidance-Fading Effect involves gradually reducing the level of guidance provided to learners as they gain proficiency and expertise in solving problems or completing tasks. The key elements of the Guidance-Fading Effect include: (a) guidance at the beginning of the learning process with detailed step-by-step guidance, such as fully worked examples or explicit instructions [57]; and (b) a gradual reduction in guidance so as for learners to become more familiar with the problem-solving or task-completion process and demonstrate proficiency, the level of guidance is progressively reduced. Independence is the ultimate goal to empower learners to solve problems or complete tasks independently, relying on their own understanding and problem-solving skills.

The Imagination Effect is a cognitive phenomenon in which individuals tend to remember information or concepts more effectively when they actively engage their imagination to visualize or mentally simulate the content they are trying to learn [58]. By mentally creating vivid images or scenarios related to the material, learners can enhance their understanding and retention of the information. This effect suggests that imagination and visualization can be powerful tools for encoding and recalling knowledge.

The Self-Explanation Effect is a learning and cognitive phenomenon that pertains to the practice of self-explanation. It involves learners explaining concepts, problems, or solutions to themselves in their own words as they engage with educational materials. When individuals actively articulate and clarify their understanding, they tend to learn and retain information more effectively [28]. Self-explanation helps learners identify gaps in their comprehension and reinforce their grasp of the subject matter, promoting deeper understanding.

The Element Interactivity Effect refers to the idea that the difficulty of learning and understanding a particular topic or subject is influenced by the degree of interactivity or complexity among the elements or components of that topic. This effect suggests that learning is more challenging when the subject matter is highly interactive or when multiple elements must be understood relative to one another [29]. The complexity and interdependence of these elements can make it more difficult for learners to grasp the material, particularly for novices or learners with limited prior knowledge.

1.3 CLT for Craft Practice Education and Training

Proposing craft-related guidelines for the application of the CLT effects in the eLearning context is the objective of this section. Although the proposed guidelines can be applied to other eLearning contexts too, in the context of this work we are focusing strictly on how to enhance eLearning in traditional craft contexts.

To simplify the understanding and application of these guidelines, we have kept the same structure as in CLT and thus we are providing guidelines per effect. The consolidation of these guidelines resulted in the definition of a small set of guidelines that can be applied horizontally and these are presented in a separate section. The validation of the usage of these guidelines is provided in Section 7 through a use case of implementing eLearning education and training material for a representative craft instance.

1.3.1 Method

The proposed guidelines are the results of working with craft practitioners, craft communities, and craft training organizations in the context of the Horizon2020 project Mingei and the Horizon Europe project Craeft. In Mingei, a protocol for craft representation and presentation has been developed as the outcome of the interdisciplinary effort between heritage scientists, ethnographers, anthropologists, craft practitioners, digitization experts, and experts on modern ICT technology [59]. This protocol sets the foundations for understanding traditional crafts and presenting them for information, education, and training.

Rooted from this protocol, in Craeft, the objective is to propose advanced ethnographic strategies for craft understanding and the application of modern technologies in craft training. Part of the scientific process was the analysis of current craft training curricula in collaboration with craft training institutes in Europe such as the European Center for Research and Training in Glass Arts (CERFAV). CLT was considered since it is well-suited for digital training methods. In collaboration with craft training organizations, we formulated the wireframes of exemplary courses that could bring part of the training process in an eLearning context. These wireframes were then studied in conjunction with the available digital material such as (a) ethnographic recordings from a glass workshop, photographic documentation, (c) 3D models of tools, machines, and the workshop itself, (d) rendered virtual representations of the workshop, (e) visual abstractions of fundamental glassblowing actions in the form of rendered 3D animations, (f) visual abstractions in the form of cartoonized images, and (g) educational material from textbooks regarding the glassblowing craft.

The next step was to study the facilities offered by modern eLearning systems in terms of authoring interactive and multimodal training material. This was important inorder to identify the forms of training experiences that can be supported by the current state of the art in conjunction with the availability of the aforementioned digital material. During this study, the guidelines discussed in this section were authored to optimally bring together digital material and training experiences.

1.3.2 Worked Example Effect

The Worked Example Effect can be applied to the eLearning context through the application of the following guidelines:

- G_WEE1. Provide craft-specific worked examples in the form of step-by-step demonstrations of key techniques and processes;
- G_WEE2. Use high-quality visuals and depict the fine details of the craft and use close-up shots and visualization to help learners see intricate work;
- G_WEE3. Include narration and explanation alongside the visual demonstrations to explain the purpose and significance of each step, the tools and materials used, and any historical or cultural context;
- G_WEE4. Demonstrate variations in techniques and styles that are relevant to the specific craft since different regions and cultures may have their unique approaches;
- G_WEE5. Incorporate hands-on interactive activities that allow learners to practice the techniques they have observed (through imitation) such as virtual workshops and simulations;
- G_WEE6. Provide progressive complexity on the worked examples and interactive activities starting with basic techniques and gradually introducing more complex skills;
- G_WEE7. Offer information on the tools and materials used in the craft to explain their purposes, how to select them, and where to obtain them;
- G_WEE8. Emphasize safety guidelines and best practices, particularly for crafts that involve potentially hazardous tools or materials;
- G_WEE9. Organize field trips (including virtual trips) and invite guest artists and crafts persons to share their experiences and expertise with learners.

1.3.3 Problem Completion Effect

The following guidelines are proposed for applying the Problem-Completion Effect:

- G_PCE1. Introduce learners to craft projects that are partially completed, especially in the case of complex or multi-step tasks;
- G_PCE2. Ensure that the partially completed craft project clearly represents the initial or starting state of the craft to help learners understand the project's context and how to proceed;
- G_PCE3. Accompany the partially completed project with explanations of the techniques and steps taken to reach that point to help learners understand the craft's methodology and thought process;
- G_PCE4. After presenting the partially completed project, encourage learners to actively engage with it. This can include asking them to complete the remaining steps, add intricate details, or identify areas for improvement;
- G_PCE5. Over time, gradually reduce the level of completion provided in the partially finished craft projects to align with learners' increasing proficiency and confidence in completing similar projects independently;
- G_PCE6. Offer constructive feedback on learners' attempts to complete the partially finished craft projects to reinforce correct techniques and address misconceptions;
- G_PCE7. Present a range of craft projects with varying levels of complexity, gradually increasing in difficulty;
- G_PCE8. Encourage metacraftsmanship by motivating learners to think about their craft process and reflect on the techniques and strategies they use, thus helping them develop problem-solving skills specific to crafts;
- G_PCE9. Scaffold craft learning by providing more guidance for novice learners in the early stages of craft training and gradually reducing the level of support;
- G_PCE10. Consider craft context by applying the Problem Completion Effect in a way that aligns with the specific craft context and objectives. Different crafts may require tailored approaches based on the craft's nature and cultural significance;
- G_PCE11. Encourage collaborative craftsmanship. Learners can work in pairs or groups to complete partially finished craft projects, fostering discussion, sharing traditional techniques, and peer learning within the craft community.

1.3.4 The Split-Attention Effect

When considering spatial split attention, the following guidelines come into use:

- G_SAE1. Organize eLearning content effectively to reduce the existence of spatially separated sources;
- G_SAE2. Use visuals such as images or videos that are closely aligned with the accompanying text or explanations to help learners integrate information from a single source more easily;
- G_SAE3. Minimize scrolling that may disrupt the flow of information and lead to spatial split attention. Ensure that content fits within a single screen or provides clear navigational cues;
- G_SAE4. Provide sequential learning by presenting information in a logical sequence and avoiding introducing concepts that depend on earlier content before providing the necessary foundation;
- G_SAE5. Maintain a consistent pace throughout a lesson and provide sufficient time for learners to absorb the content before moving on;
- G_SAE6. Segment instructions by dividing complex instructions into smaller, manageable steps or modules allowing learners to focus on one step at a time and build their skills progressively;

- G_SAE7. Provide redundancy by using multiple formats. Combine text explanations with visuals or demonstrations, allowing learners to access the same information from different sources;
- G_SAE8. Ensure spatial contiguity by placing related information, such as written instructions and visual examples, in close proximity;
- G_SAE9. Ensure temporal contiguity by presenting sequentially information in a logical order, allowing learners to integrate it as they encounter it. Avoid jumping between past and present information;
- G_SAE10. Segment complex craft projects or techniques into smaller, manageable sections or modules to assist in the step-by-step understanding of crafts;
- G_SAE11. Facilitate signaling by using clear cues or markers to highlight relationships between different pieces of information such as arrows, connectors, or highlighting to indicate connections between text instructions and accompanying visuals;
- G_SAE12. Provide a short summary or an overview before or after presenting information on a specific craft technique to help learners understand the big picture and how different elements are related;
- G_SAE13. Incorporate interactive elements into the eLearning materials and offer activities that allow learners to actively practice craft techniques, fostering deeper understanding.

1.3.5 The Modality Effect

For the Modality Effect, the following guidelines come into play:

- G_MDE1. Accompany text with narration to enhance comprehension and retention;
- G_MDE2. Use relevant visuals such as images, diagrams, and animations, alongside text and narration, to illustrate craft techniques, materials, and finished products, making the content more engaging and memorable;
- G_MDE3. Maintain consistency and ensure that content is presented similarly across different modalities (text, narration, visuals) to prevent confusion and reinforce learning;
- G_MDE4. Organize information into smaller, manageable sections or modules to allow learners to focus on mastering one aspect of the craft at a time, making it easier to process information in different modalities;
- G_MDE5. Incorporate interactive elements that encourage active engagement with the craft material. Create interactive exercises, simulations, or crafting activities that enable learners to apply what they have learned;
- G_MDE6. Give learners control over the pace of their craft learning and enable them to review and revisit content presented in different modalities as needed;
- G_MDE7. Minimize unnecessary distractions that can interfere with the processing of craft-related information presented in different modalities;
- G_MDE8. Keep eLearning content engaging by using storytelling, real-life examples, and relevant craft scenarios. Create content that captivates learner’s interest, motivating them to engage with multiple modalities;
- G_MDE9. Test on various devices to ensure that the eLearning course is compatible with various devices and screen sizes to accommodate different learning preferences and environments, including those of craft enthusiasts who may access the course on different devices.

1.3.6 The Redundancy Effect

For the appropriate use of redundancy, the following guidelines can be followed:

- G_RDE1. Use redundancy sparingly and avoid presenting the same information in both text and narration unless it is essential for clarity or accessibility reasons. In the craft learning context, redundancy should be used judiciously, such as when explaining complex techniques;
- G_RDE2. Prioritize complementary information and leverage different modalities to present complementary content. For example, use visuals (images or videos) to visually demonstrate craft techniques while the narration provides explanations;
- G_RDE3. Consider the diverse needs and preferences of your craft learners. Some may benefit from redundancy, while others may find it distracting. Consider offering options for learners to choose their preferred modality, such as providing text and audio options;
- G_RDE4. Emphasize key craft points by highlighting key craft techniques, important terminology, or critical information. Emphasize the most vital content rather than reiterating every detail;
- G_RDE5. Allow craft learners to control the pace of content delivery. They should have the option to skip or replay redundant information based on their understanding and needs, promoting a personalized learning experience;
- G_RDE6. Engage craft learners through interactive elements such as quizzes, discussions, and problem-solving exercises. Interactivity can reinforce learning without relying solely on redundancy, making the learning experience more engaging.

1.3.7 The Expertise Reversal Effect

To ensure that all learners get content that is sufficient for their level of learning and expertise, the following guidelines are suitable:

- G_ERE1. Begin by assessing the learners' prior knowledge and expertise in crafts. Use pre-assessments, quizzes, or self-assessments to understand their current skill level and familiarity with craft techniques;
- G_ERE2. For novice craft learners with little or no prior knowledge, provide explicit and structured instruction. Use clear explanations, step-by-step guidance, and scaffolded learning activities to build a solid foundation in craft techniques. Emphasize foundational concepts, tools, and terminology commonly used in the craft;
- G_ERE3. For learners with moderate expertise in crafts, offer a balanced approach that combines guidance with opportunities for independent thinking and problem-solving. Provide guided problem-solving activities that encourage critical thinking and the application of craft knowledge to practical scenarios. Use real-world craft projects, case studies, and more advanced techniques to deepen their understanding and skills;
- G_ERE4. Highly knowledgeable craft practitioners should engage in open-ended, exploratory, and problem-based learning approaches. Encourage independent exploration, research, and self-directed learning, allowing experts to apply their advanced knowledge to real-world craft challenges and creative projects;
- G_ERE5. Utilize adaptive learning technologies or techniques that can adjust the level of instruction based on learners' responses and demonstrated expertise. This ensures that each craft learner receives content and activities appropriate to their skill level;
- G_ERE6. Provide options to mixed groups of craft learners with varying levels of expertise, consider offering multiple pathways or content modules that cater to different expertise levels within the same course. This allows craft learners to self-select the most suitable learning path.

1.3.8 The Guidance Fading Effect

To ensure that the level of guidance is always optimal while moving forward on a learning path, the following guidelines can be used:

- G_GFE1. Provide explicit and highly guided instruction for novice craft learners such as complete worked examples, detailed step-by-step solutions, or comprehensive instructions for craft projects. Clearly explain the concepts, techniques, and tools involved in crafts to build a strong foundation;
- G_GFE2. Continuously assess and monitor the progress of craft learners as they engage with the materials and complete projects and look for signs of increased proficiency and understanding. Use formative assessments, quizzes, or skill checks to gauge when learners are ready for reduced guidance;
- G_GFE3. Gradually reduce the level of guidance provided as craft learners demonstrate growing competence and familiarity with craft techniques. Begin by omitting some steps, providing fewer hints, or requiring more independent problem-solving;
- G_GFE4. Scaffold the craft learning experience, maintaining a balance between support and independence and adjusting the level of guidance according to the evolving needs of craft learners. Consider individualized learning paths based on each craft learner's skill development;
- G_GFE5. Use prompts and hints instead of providing complete solutions to nudge craft learners in the right direction when they encounter difficulties. These prompts should encourage them to think critically and apply their craft knowledge effectively;
- G_GFE6. Challenge critical thinking for more proficient learners by introducing open-ended or complex craft projects that require critical thinking, analysis, and the synthesis of techniques. Encourage them to explore alternative craft techniques and creative problem-solving strategies;
- G_GFE7. Encourage reflection and metacognition by prompting craft learners to reflect on their craft projects and the techniques they have applied. Encourage metacognition to foster a deeper understanding of their own craft learning process. Ask them to journal their progress and reflect on what they have learned;
- G_GFE8. Be responsive to individual craft learner needs and offer support when needed. If some learners are struggling with particular techniques or projects, be ready to provide additional guidance or support to prevent frustration and ensure successful learning.

1.3.9 The Imagination Effect

To ensure that imagination supports learning, the following guidelines are essential:

- G_IME1. Visualize complex concepts by encouraging learners to visualize intricate craft techniques or artistic processes by providing detailed, descriptive language in the eLearning content. Use analogies or metaphors to simplify complex concepts and stimulate learners' imagination. Complement textual information with visuals, diagrams, and multimedia that help learners create mental images;
- G_IME2. Incorporate storytelling elements in your eLearning materials. Craft narratives and scenarios that depict the historical context or cultural significance of crafts. Engage learners' imagination by creating relatable situations that illustrate the key concepts and the creative journey of craftsmen;
- G_ IME3. Utilize interactive simulations or virtual environments to immerse learners in the world of crafts. This hands-on experience allows them to apply their knowledge in realistic scenarios, making abstract concepts more tangible. Provide opportunities for learners to experiment with craft techniques in a safe, virtual space;
- G_IME4. Develop creative assignments that require learners to produce craftwork, or understand other people's craftwork. These assignments can encourage imaginative thinking, problem-solving, and a deeper connection to the craft.

1.3.10 The Self-Explanation Effect

Developing critical thinking can be facilitated through the following guidelines

- G_SEE1. Incorporate self-questioning by encouraging learners to ask themselves questions as they study, such as "How is this craft technique applied?" or "Why is this design element important?". Self-questioning prompts active engagement and self-explanation, helping learners articulate their understanding;
- G_SEE2. Provide prompts within the eLearning content that guide learners in self-explaining craft concepts. For example, include questions like, "Can you explain the significance of this craft tradition in your own words?". These prompts serve as cues for learners to engage in self-explanation;
- G_SEE3. Reflect and summarize by encouraging learners to periodically pause and reflect on what they have learned in the context of crafts. They can create summaries, mind maps, or written reflections to consolidate their understanding and explore how craft techniques connect with cultural heritage;
- G_SEE4. Incorporate opportunities for peer review and feedback on craft projects and explanations. When learners explain craft concepts to their peers, it reinforces their understanding and allows them to learn from one another;
- G_SEE5. Provide feedback on learners' self-explanations to reinforce correct explanations and offer guidance in areas where learners may need further clarification. Feedback promotes self-improvement and the development of nuanced understandings of crafts;
- G_SEE6. Integrate active learning activities that require learners to solve problems, complete craft exercises, and explain their thought processes as they work through the material. Active participation enhances self-explanation and hands-on craft learning;
- G_SEE7. Teach metacognitive skills that help learners monitor their understanding of crafts. Encourage them to reflect on their learning strategies and adjust their approaches as needed. Metacognition is closely tied to the self-explanation effect and can lead to more effective self-regulated learning.

1.3.11 The Element Interactivity Effect

For the Element Interactivity Effect, the following guidelines can be considered

- G_EIE1. Assess the learner's prior knowledge before designing your eLearning course on crafts. Gauge the appropriate level of complexity and interactivity based on the learners' expertise;
- G_EIE2. Break down complex topics related to crafts into smaller, manageable chunks of information. Present these chunks in a logical sequence or order, ensuring that learners grasp one concept before moving on to the next;
- G_EIE3. Use visual aids, diagrams, charts, and graphs to represent the relationships and interactions between elements of crafts. Visuals can make complex content more accessible and understandable, especially when explaining intricate crafting techniques or designs;
- G_EIE4. Provide explanations and examples that accompany the presentation of complex concepts in crafts. Use real-world examples or scenarios to illustrate how various elements interact within craft processes;
- G_EIE5. Incorporate interactive simulations or scenarios specific to crafts that allow learners to explore the interactivity of complex crafting systems. This hands-on experience can deepen their understanding of crafting techniques and artistic processes;
- G_EIE6. Offer structured guidance and scaffolding as learners work through complex craft topics. Provide hints, prompts, or step-by-step instructions to help them navigate intricate crafting methods and cultural contexts;

- G_EIE7. Encourage peer collaboration and discussion among learners studying crafts. Learners can benefit from sharing their understanding of crafting traditions, artistic interpretations, and techniques, providing different perspectives, and helping each other navigate the interactivity of crafts;
- G_EIE8. Offer opportunities for learners to pause and reflect. Encourage them to think critically about how the various elements of craft-making and cultural significance interact and how their understanding of crafts has evolved;
- G_EIE9. Implement frequent assessments and quizzes that focus on the interactivity of elements within the subject matter of crafts. Assess learners' ability to apply crafting techniques and understand the cultural context of crafts;
- G_EIE10. Provide feedback on assessments and encourage learners to review and revisit complex topics in crafts as needed. Feedback can help clarify misunderstandings about crafting processes and the historical background of crafts;
- G_EIE11. Teach metacognitive skills that help learners monitor and adjust their learning strategies, especially when dealing with highly interactive content related to crafts. Encourage learners to reflect on their learning experiences;
- G_EIE12. Encourage critical thinking and problem-solving skills, especially in the context of crafts. Complex and interactive subjects often require learners to think analytically, creatively interpret crafting techniques, and apply their knowledge in culturally meaningful ways.

1.3.12 Horizontal Guidelines

In general, the following horizontal guidelines can be applied when creating educational material in eLearning contexts:

- G_HG1. Regularly review and revise your eLearning craft content and adapt your eLearning materials on crafts based on learner feedback, performance data, and evolving needs. Keep the course content up-to-date and aligned with best practices in instructional design for craft education;
- G_HG2. Receive and offer feedback.

  - Gather feedback from craft learners to understand their preferences;
  - Provide timely and constructive feedback on learners' craft projects and techniques. Highlight what they did correctly and suggest improvements to enhance their craftsmanship;
  - Encourage learners to critique each other's work constructively, fostering improvement;
  - Encourage learners to take ownership of their craft learning journey.

- G_HG3. Encourage discussion, sharing, and peer learning. Create forums or discussion boards where learners can share their imaginative interpretations and associations related to crafts. Encourage learners to discuss their creative ideas, inspirations, and the emotional connections they form with the craft. Encourage peer collaboration and discussion within the craft learning community. More experienced craft learners can assist those with less expertise, creating a valuable learning experience for all participants;
- G_HG4. Be mindful of accessibility. Make the eLearning course content accessible to individuals with various learning needs, including those who may rely more on one modality than another. In certain cases, redundancy may be necessary to accommodate individuals with different learning needs, such as those with visual or auditory impairments. Ensure your craft eLearning course is accessible to all learners by providing alternative formats and options. Achieving such compatibility would require that web content is authored following the web content accessibility guidelines [60], which, of course, requires expertise, time, and resources. More analysis on adhering to these guidelines is out of the scope of this research work; however, we provide here

some basic guidelines that would enhance the accessibility and usability of eLearning content and are easy to apply and integrate into your eLearning authoring workflow.

- Make sure that standard web-based content complies with basic accessibility guidelines. Use headings, provide alternative texts for all visual elements, avoid using tables for layouts, use simple language, etc. Facilitate accessibility checkers embedded in html editors and check your content before publishing;
- Make sure that your web-based content is easily located within a page. Use a screen reader to evaluate the accessibility of your navigation and whether users can easily locate eLearning content;
- Provide audio-only alternatives for eLearning content by facilitating online text-to-speech facilities;
- Provide descriptions of what is presented in video elements, and author subtitles for videos. Use video transcript tools to simplify authoring and provide access to the text of the transcript;
- Provide users with control over the size of text and contrast settings to enhance visibility for users with reduced visual acuity;
- Support text translations in multiple languages including translations of audio-visual contents, subtitles, alternative texts, and media element descriptions;
- Ensure that eLearning site navigation is seamlessly and consistently presented across different languages;
- Follow the guidelines presented in the previous sections to enhance the usability of web content. This will happen automatically since usability is strongly bound to the reduction of cognitive load.

- G_HG5. Evaluate learning outcomes. Assess the effectiveness of the instructional approach by measuring learning outcomes and learner satisfaction. Use feedback and data to make continuous improvements to the eLearning experience for crafts;
- G_HG6. Do not disregard the context.

  - Include case studies and craft history context to showcase the significance of crafts from a cultural or historical perspective;
  - Highlight the importance of preserving and documenting crafts. Discuss the role of contemporary technology in documenting and promoting these crafts;
  - Promote respect for tradition and cultural sensitivity and encourage learners to appreciate the heritage and significance of crafts.

- G_HG7. Celebrate independence. When craft learners reach the point of completing projects independently and mastering craft techniques, celebrate their achievements and emphasize the value of self-directed craft learning.

1.4 The craeft E-Learning Portal Implementation

This section presents the technical implementation of the CRAEFT e-Learning Portal, which operationalizes the pedagogical and ergonomic principles described in the previous sections. The portal serves as the main digital entry point for structured craft education within the CRAEFT project and supports the delivery of theory-driven, multimedia-rich, and scaffolded learning experiences aligned with Cognitive Load Theory (CLT).

The CRAEFT e-Learning Portal has been implemented using **Moodle**, a mature and widely adopted open-source Learning Management System (LMS). The choice of Moodle was driven by its robustness, extensibility, compliance with accessibility standards, and its ability to support complex instructional designs through modular course structures, activity types, and role-based access control. The deployed platform is publicly accessible and available at:

https://www.craeft.eu/elearning/

1.4.1. System Architecture and Technical Setup

The portal is based on a standard Moodle architecture comprising a web server, a relational database, and a modular plugin ecosystem. Moodle's native functionality is complemented by selected plugins and configuration options to support multimedia delivery, learner interaction, and assessment.

Key characteristics of the technical setup include:

- **Web-based delivery** ensuring cross-platform access through standard browsers, without the need for proprietary software installation.
- **Role-based access control**, supporting different user profiles (e.g., learners, educators, administrators).
- **Modular course organization**, enabling the structuring of educational content into categories, courses, sections, and learning activities.
- **Multimedia support**, allowing the integration of video, audio, high-resolution images, 3D visualizations, and interactive content.
- **Assessment and tracking mechanisms**, including quizzes, assignments, completion tracking, and gradebooks.

This technical foundation enables the scalable deployment of craft-related learning content while remaining flexible enough to accommodate future extensions, additional crafts, and integration with other CRAEFT digital components.

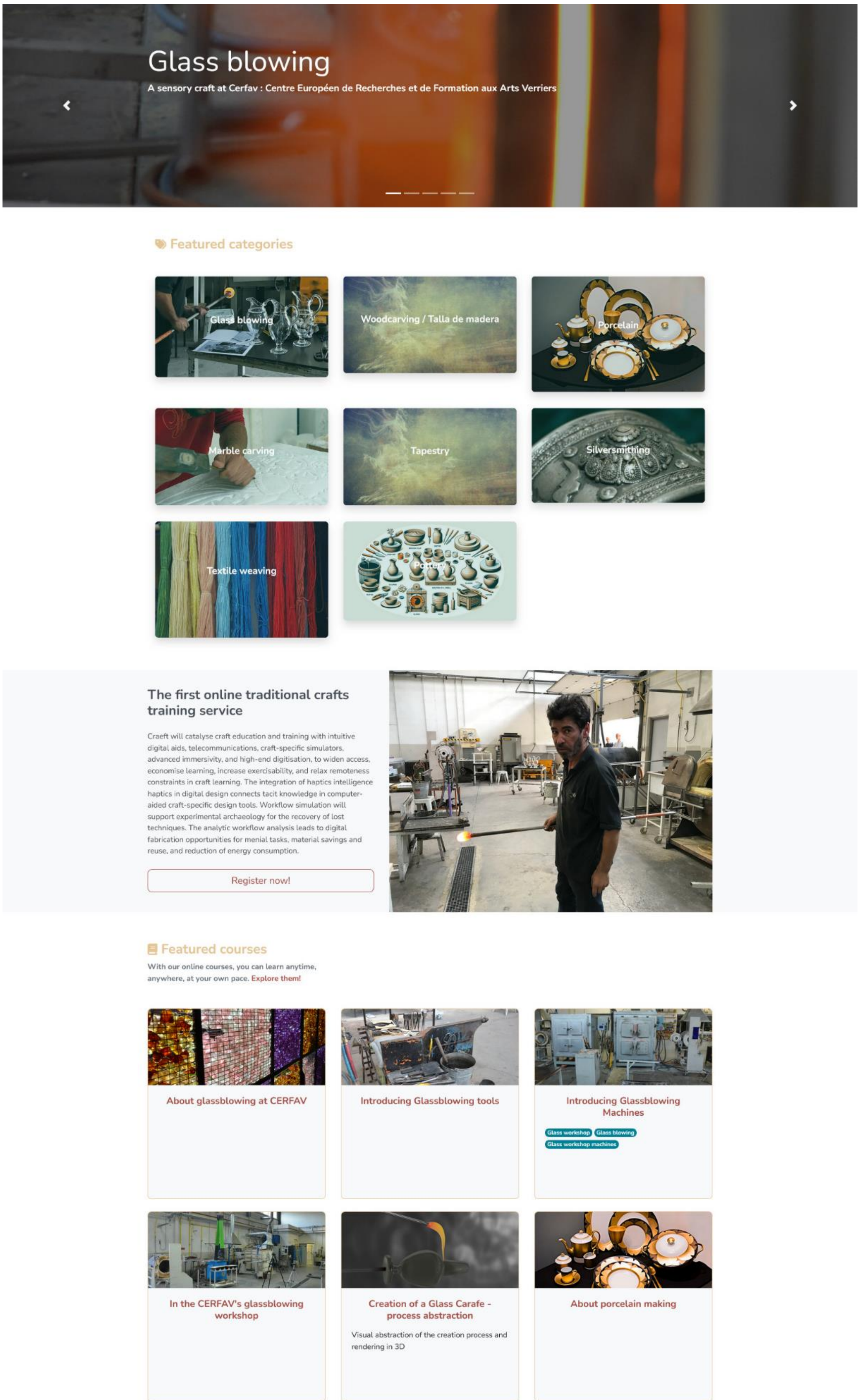

Figure 1. Landing page of the CRAEFT e-Learning Portal, presenting access to available courses and learning pathways (top part).

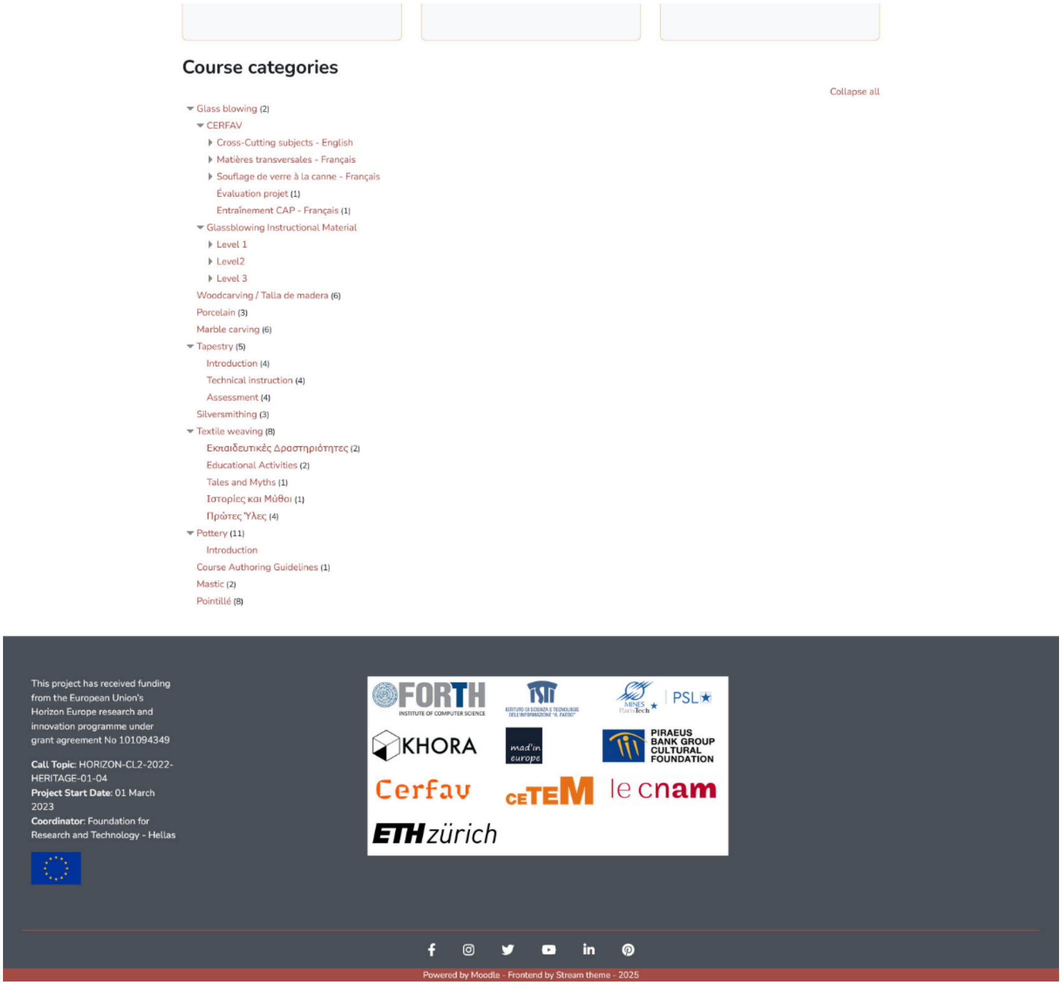

Figure 2. Landing page of the CRAEFT e-Learning Portal, presenting access to available courses and learning pathways (bottom part).

1.4.2. Portal Structure and Navigation Design

The information architecture of the CRAEFT e-Learning Portal has been carefully designed to minimize extraneous cognitive load and support intuitive navigation. The portal follows a hierarchical structure that reflects the scaffolding strategy described earlier in this deliverable.

At the top level, learning content is organized into **course categories**, which correspond to distinct crafts or thematic areas. Each category contains one or more courses, structured according to increasing levels of complexity and learner expertise.

Navigation design principles include:

- **Clear visual hierarchy** using headings, sections, and consistent layouts.
- **Limited on-screen information density**, reducing split-attention effects.
- **Consistent placement of navigation elements**, enabling users to develop familiarity with the interface.
- **Progress indicators**, allowing learners to monitor their advancement within a course.

This structure supports sequential learning while also allowing learners to revisit prior material when needed.

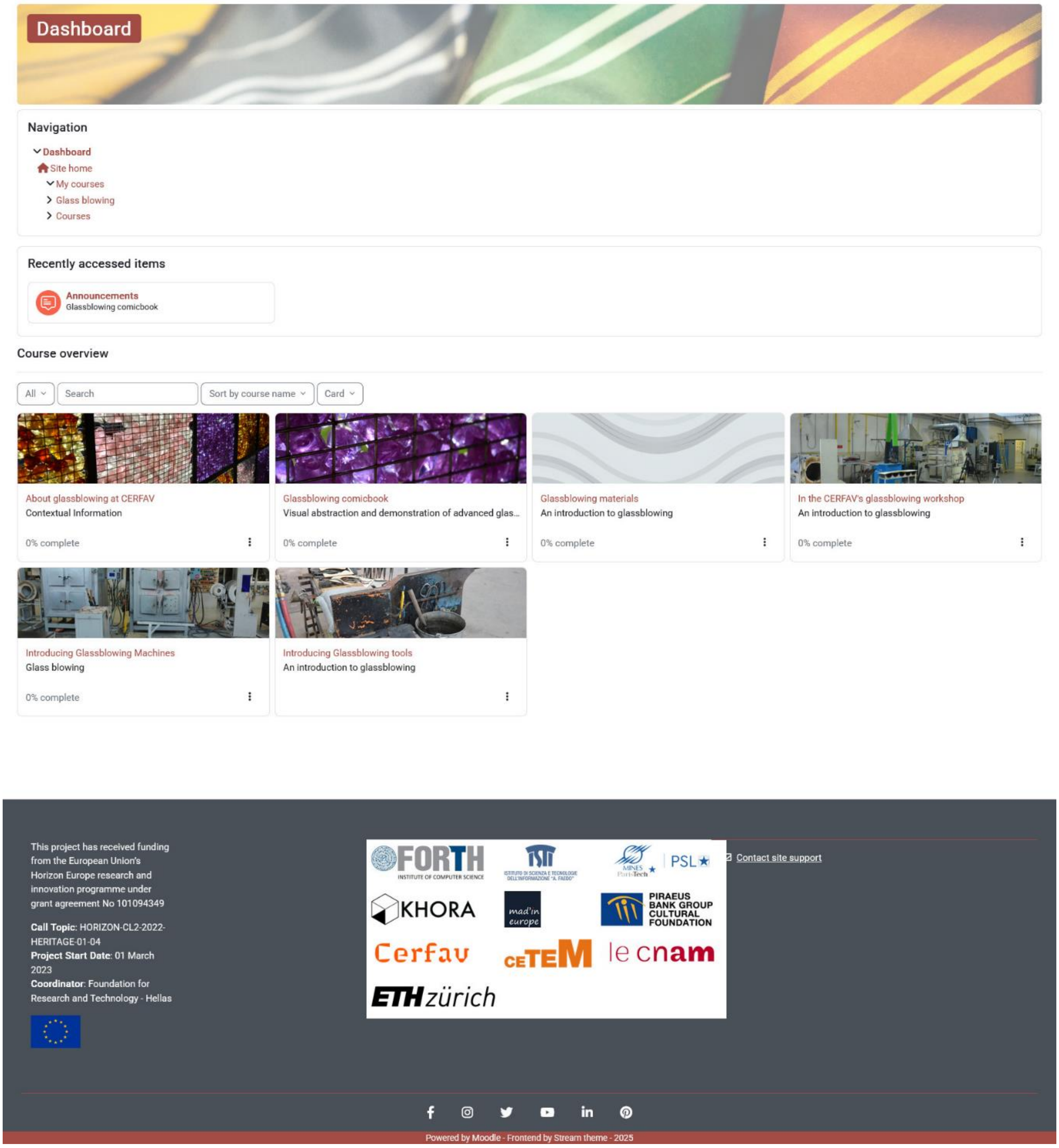

Figure 3. Example of a learner's dashboard.

1.4.3. Course Design and Learning Activities

Courses within the CRAEFT e-Learning Portal are structured into **thematic sections**, each corresponding to a specific learning objective (e.g., cultural context, tools and materials, techniques, safety considerations). This segmentation directly supports the management of intrinsic cognitive load by breaking down complex craft knowledge into manageable units.

A variety of Moodle activity types are employed, including:

- **Content pages** combining text, images, and embedded media.
- **Video-based lessons**, presenting demonstrations of craft techniques with optional narration.
- **Quizzes and self-assessment tests**, supporting formative evaluation and self-reflection.
- **Assignments**, encouraging learners to articulate understanding or document practical exercises.
- **Discussion forums**, enabling peer interaction, reflection, and community-building.

The selection and configuration of activities follow CLT-informed guidelines, ensuring that modalities are complementary rather than redundant and that learners retain control over pacing.

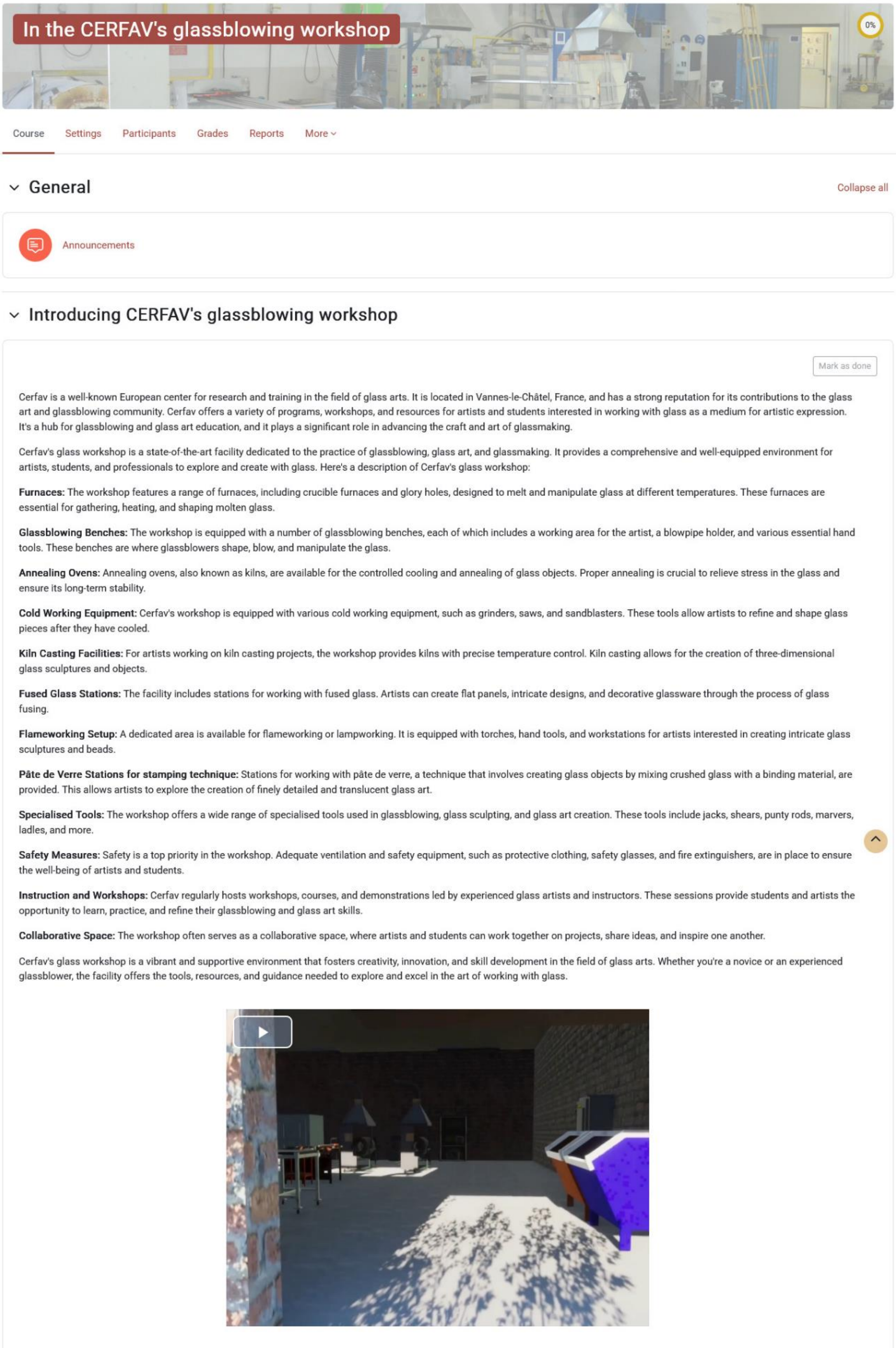

Figure 4. Example of a course section combining multimedia content and self-assessment activities.

1.4.4. Multimedia Integration and Cognitive Load Considerations

The CRAEFT e-Learning Portal extensively leverages multimedia content to support craft education, while explicitly addressing cognitive load management. Visual materials are used not as decorative elements but as integral components of instructional design.

Key design choices include:

- **Close-up visualizations** of tools, materials, and actions to support worked examples.
- **Step-by-step presentation** of techniques, avoiding unnecessary visual clutter.
- **Separation of complementary modalities**, for instance using visuals for procedural information and text for conceptual explanations.
- **Optional audio narration**, allowing learners to choose their preferred modality.

This approach ensures alignment with the Modality Effect while avoiding redundancy that could overload working memory.

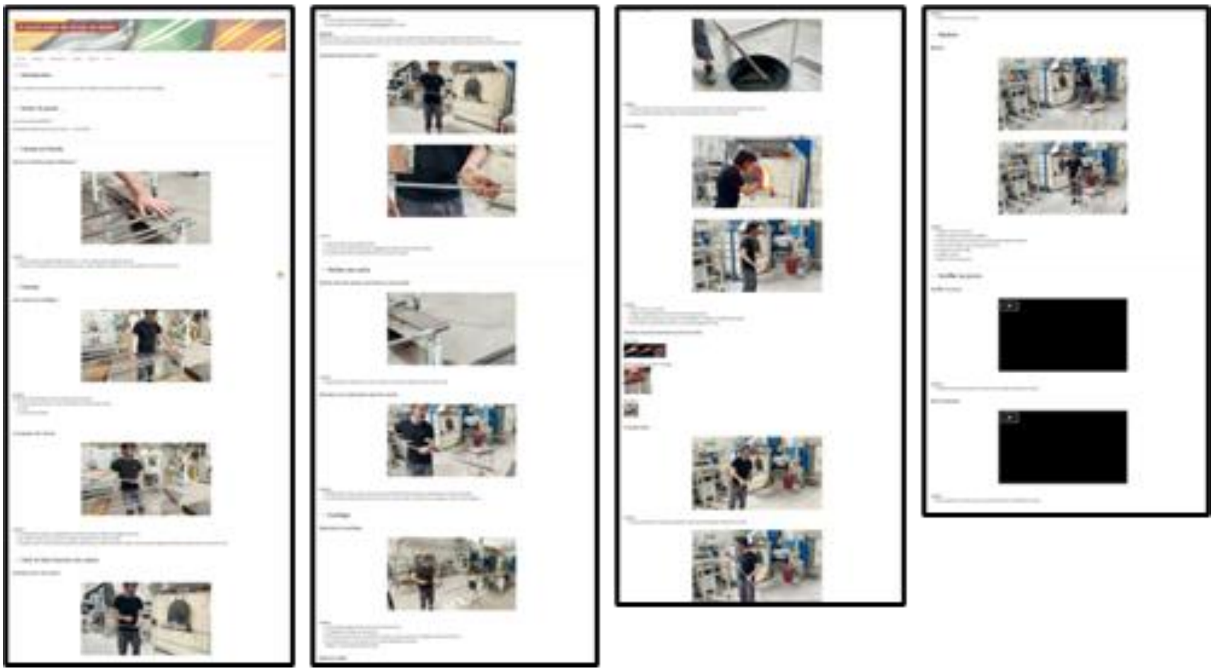

Figure 5. Multimedia learning unit illustrating a craft technique using images and structured explanatory text.

1.4.5. Assessment, Feedback, and Learner Progress Tracking

Moodle’s built-in assessment mechanisms are used to support both learning and evaluation. The CRAEFT e-Learning Portal integrates:

- **Automated quizzes** with immediate feedback.
- **Assignments requiring reflection or analysis**, supporting self-explanation.
- **Completion tracking**, enabling learners to visualize their learning progress.
- **Gradebook functionalities**, allowing educators to monitor engagement and performance.

Feedback is designed to be constructive and timely, reinforcing correct understanding while guiding learners toward improvement. These mechanisms support metacognition and learner autonomy, which are essential in craft education where experiential learning plays a central role.

1.4.6. Accessibility and Future Extensibility

The CRAEFT e-Learning Portal has been implemented with attention to basic accessibility principles, including structured content, consistent navigation, and support for alternative text in visual elements. Moodle's compatibility with assistive technologies provides a foundation for inclusive access, although full compliance with advanced accessibility standards may require further customization.

From a sustainability perspective, the use of an open-source LMS ensures that the portal can be maintained, extended, and reused beyond the project's lifetime. New courses, crafts, and learning scenarios can be added without altering the core system architecture, supporting long-term exploitation of project results.

1.5 Good Practice Guide on Applying the Provided Ergonomic Knowledge

1.5.1 Working with Guidelines

Guidelines, serving as directives for individuals to perform specific tasks effectively and efficiently, can provide a framework guiding designers and developers in making appropriate decisions [61]. For many years, guidelines have constituted an inexpensive and widely used tool. However, despite the indisputable value and importance of such knowledge, several studies investigating the use of guidelines and standards by designers and developers have concluded that they are frequently ignored. This is partly attributed to the challenging exploitability of such knowledge and partly due to the medium of its embodiment, which often gives rise to issues of ineffectiveness and a lack of user-friendliness [62].

To combat this issue, we have followed a dual approach in this research work. The first is to provide in this section a good practice guide that provides the basic principles for reusing these guidelines. The second is to provide use-case examples of their application in actual circumstances, which is the subject of the next section. Use-case examples fall in the category of the Worked Example Effect discussed in the previous section.

1.5.2 Good Practice Guide

1.5.2.1 Familiarization and Preparation

The first step in applying these guidelines would require the designer to achieve a basic understanding of the concepts of the effects of CLT through a one-page introduction, such as the one provided in Section 3. This introduction aims at providing basic orientation and being capable of following the guidelines provided per effect. The second step is to become familiar with the guidelines by simply studying them to understand how each effect should be considered during the design of the eLearning content.

Having achieved a familiarization with the concepts described by the guidelines, the next issue to be considered is the availability of instructional content or the capacity to develop different forms of instructional content. This is essential to define the basic tool set that will be used during authoring instructional content.

The next issue to be considered is the end users of the educational content and how these can be grouped based on their knowledge and expertise. This grouping will support the scaffolding of the training courses.

Next, how progress should be evaluated and the forms of exercises, assignments, and projects that are of interest for the specific eLearning content should be considered. A generic understanding of what is expected to be evaluated is sufficient for this phase of the design.

1.5.2.2 Design of Educational Content

Based on the aforementioned information, the designer of the eLearning course can start by defining an appropriate categorization. For this purpose, the guide provided in Section 6.2. can be of support. The category structure will provide the basic principles of scaffolding, will define the basic educational sections, and will guide the selection of modalities. At the same time, it will support the visualization of the type of assessment that will support the evaluation of the learning outcomes for each category. This will act as a good starting point for the creation of actual educational content.

Regarding the creation of such content, it is highly advised that the examples provided in Section 6.3 are studied. These examples do not cover exhaustively all the types of courses that can be authored by following these guidelines but are considered a good starting point. Studying these examples provides information on how to apply most of the effects presented in the previous section except for the Expertise-Reversal Effect and the Guidance-Fading Effect, which are most efficiently covered through scaffolding learning.

Regarding the evaluation of educational outcomes, studying the examples of Section 6.4 can provide useful ideas on different forms of assignments that can support different effects and achieve various educational goals.

1.5.2.3 Creativity in the Design of Educational Content

Although the application of the aforementioned guidelines is considered important in this research work, it cannot guarantee the success of the authored courses. As in any human activity, creativity plays a significant role in the authoring of craft educational content and can influence both the design and delivery of content. Crafting, by its nature, is a creative endeavor, and incorporating creativity into educational materials aligns with the hands-on and expressive aspects of traditional crafts. Creative authoring involves not only presenting factual information but also engaging learners' imaginations and fostering a deep connection to the craft. By infusing creativity into content creation, educators can employ diverse and innovative teaching methods that resonate with learners, making the educational experience more engaging and memorable. Creative instructional materials, such as visually compelling presentations, interactive simulations, and imaginative scenarios, capture learners' attention and facilitate a deeper understanding of craft concepts. Most of these aspects fall under the Modality Effect and cannot be simply dealt with by adhering to the provided guidelines. In this context, creativity can promote a dynamic and adaptive approach to content delivery, ensuring that educational materials remain vibrant and responsive to the evolving needs of learners.

1.5.2.4 Enhance Acceptability through a User-Centered Design Approach

Incorporating a user-centered design approach, involving a small set of users from all targeted user groups in all stages of the design process, can greatly enhance the effectiveness of educational materials. Seeking feedback in the initial phases becomes a fundamental step in ensuring that the content is not only relevant but also aligns with the preferences and needs of the intended audience. Early involvement of users allows for the identification of potential challenges, misconceptions, or areas that require improvement, promoting a collaborative and learner-centric development process. This iterative feedback loop, integral to user-centered design, ensures that the final educational materials resonate well with users, enhancing engagement and overall effectiveness. By actively involving learners from the outset, educators and instructional designers can create content that is not only accurate and informative but also tailored to the specific requirements and expectations of the target audience.

1.5.3 Use Case: Applying Guidelines in the eLearning Context

This section targets the demonstration of the usage of the aforementioned eLearning guidelines for the implementation of an eLearning course.

1.5.3.1 Description of the Use Case

In the presented use case, the craft of glassblowing will be examined. In this use case, the material used for creating eLearning material is composed of:

- Ethnographic recordings from a glass workshop utilizing various such as mobile phones, cameras mounted on a tripod, and close-up views with handheld cameras;
- Photographic documentation of the workshop tools, machines, and layout including photographic documentation acquired during the creation process to capture key moments of the object's creation;
- 3D models of tools, machines, and the workshop itself;
- Rendered virtual representations of the workshop;
- Visual abstractions of fundamental glassblowing actions in the form of rendered 3D animations;
- Visual abstractions in the form of cartoonized images composed in the form of a comic book presenting the creation process;
- Educational material from textbooks regarding the glassblowing craft.

1.5.3.2 Using Guidelines to Create an Appropriate Category Structure for an eLearning Course

The application of the developed guidelines started by creating an appropriate category structure for structuring the eLearning courses. During this process, several guidelines were followed to provide a clear picture to the learners of what to expect in terms of educational units. The analysis of the category structure and some exemplary course structures per category are presented in Figure 6. Figure 1 also provides a mapping of the guidelines followed to visually demonstrate how an appropriate category structure can act as the point of departure for a successful eLearning course on glassblowing.

Throughout this section, inline codes within the screenshots and textual descriptions are used to provide information on the conformance with specific guidelines.

Figure 6. The proposed category structure.

As shown in Figure 6, for the glassblowing case, we provided a scaffolding strategy decomposed into three levels, each one corresponding to a different expertise level in terms of craft education. The first level is introductory to the craft instance and contains lessons on the social and historical context (contextual information) and also introduces the tools, materials, and glassblowing machines. The knowledge acquired is reinforced through critical thinking and problem-solving assignments. Each level is completed through student evaluation tests and an open round of discussion and feedback that allows the learners to provide feedback on the course and the course editors to provide feedback on the learners based on the performed assignments and evaluation tests. The completion of this level provided a generic yet clear understanding of the craft instance to be studied.

Levels 2 and 3 are consistent in terms of structure and are formulated under the perspective of sequential learning, allowing learners to keep their own pace but at the same time follow a well-defined learning path. This distinction remains throughout the levels, maintaining the same scaffolding strategy. For simplicity, we will analyze level 2 having in mind that the same information stands true for level 3.

Level 2 starts with an introduction to the techniques that will be studied, which in the case of level 2 are the fundamental techniques of glassblowing. Then, the techniques are presented in the form of visual abstraction, which in our case is a 3D representation of the techniques in the form of an animated scene that presents only the tools and their interaction with the material. This form of presentation provides craft-specific worked examples and at the same time minimizes the distractions from the environment. When these visualizations are studied, we continue by presenting the same techniques as executed in the environment through audiovisual recording in a glassblowing workshop in which a glass master is performing the same techniques in the context of creating a glass artifact. These demonstrations enrich the previously studied visual abstractions and complement them through additional sources of information. The course continues with immersive training on basic techniques, which inevitably should happen outside the eLearning platform by using some form of immersion. In the context of the Craeft research project, 3D and VR 3D are to be integrated for immersive training complemented with haptic devices for transferring information from the digital world to the learner and vice versa.

After this first round of training, the course proceeds to combine basic techniques to formulate complete glassblowing examples. These are presented in the form of both visual abstractions and recordings in the same way presented above. Then a second round of immersive training is to take place where the learners are required to imitate what they learned previously in a virtual environment. The level continues with critical thinking and problem-solving exercises. These are both assignments that can be executed offline and assignments that can be integrated with workshop study lessons on-site. In both cases, these result in the submission of assignments by students. The level completes with the evaluation tests and the open two-way feedback round.

Already for the creation of the structure, we have applied or foreseen the application of more than 30 of the aforementioned guidelines. The following example will deep even more into the formulation of specific courses.

1.5.4 Exemplars Courses

1.5.4.1 Course in the Form of a Multimodal Document

In this example, the basic structure of a simple course will be presented and authored in the form of a multimodal document (see Figure 7). The objective of the example is to emphasize key craft points by presenting the basic glassblowing techniques. The course is composed of several topics, each focusing on a single subject—in this case, a fundamental glassblowing technique—minimizing the need for the learners to split their attention in simultaneously presented techniques.

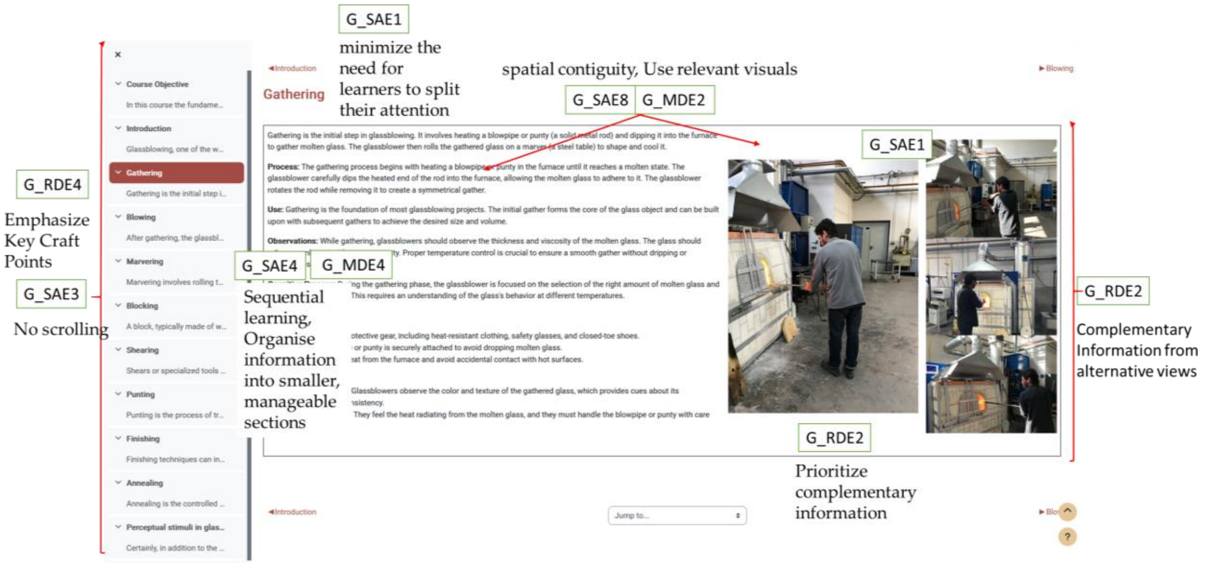

Figure 7. An example of a course authored in the form of a multimodal document.

Furthermore, the course is configured so that only one topic is presented on each page to organize information in small manageable sections and minimize the need for scrolling throughout the content. Following these guidelines, we have achieved the specific course to eliminate the need for scrolling. Navigation between topics is provided both on the left side of the course where the course structure is presented and inline where navigation to the previous and the next topic is provided both on top and after the content of the topic (see Figure 7).

Moving to the content of the course, as seen in Figure 7, the course is a collection of well-defined textual information organized based on their subject (Process, Use, Observations, cognitive processes, etc.). This offers a well-defined sequential flow of information and provides the ability for learners to study each subject separately. Furthermore, by integrating cognitive and perceptual information into the description of techniques, we create mental information that is stored in long-term memory. This information is retrieved in the working memory when actually performing the techniques in a physical setting.

To ensure spatial contiguity, visual information is presented right next to textual information to be studied in parallel. Regarding the use of visuals, complementary information is prioritized. The objective, in this case, is to provide alternative views of the same process from different viewpoints, thus ensuring that the same actions of the practitioner can be studied from complementary views, which is extremely important when studying gestural information.

1.5.4.2 Courses Embedding Audio-Visual Components

In this example, a course that presents visual abstractions of glassblowing processes is studied. A visual abstraction can be thought of as a 3D scene that contains only the tools and material and employs animation to mimic the events of a crafting process. By abstracting the process from the context, we can focus only on its essential parts.

An example of the blocking process in glassblowing is presented in Figure 3. To enhance the understanding of the content to be presented, the techniques and the steps followed are introduced shortly before the presentations of visual abstractions and shortly after to enhance self-questioning on the presented information. To further simplify the presentation of the technique, visual content is split into three steps, each presented individually, and the learner can control playback to study each step again and again. After completion, the student is prompted to confirm whether he has acquired the subject and wishes to move forward to the next subject or whether he wishes to be transferred to the next course in which the same technique is shown as practiced by actual practitioners. In this way, the learners can control the pace of their learning and information provision and define alternative ways of browsing information by navigating between courses. General considerations in eLearning craft courses are maintained in this lesson too by keeping the same course structure and a consistent pace through the presentation of the course content, eliminating whenever possible distractions and scrolling.

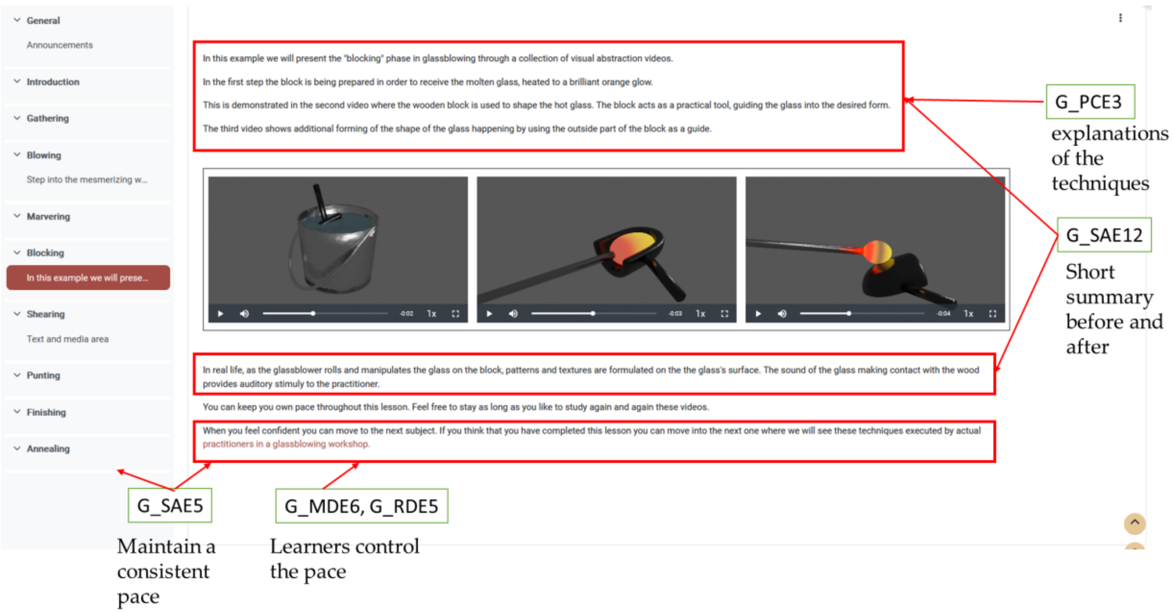

Figure 8. Example of a course embedding audio-visual components.

1.5.4.3 Course in the Form of an Interactive Book

In this example, we are building on the h5p content compatibility of the eLearning platform to create two paradigms of interactive books.

The first paradigm is authored following principles of visual abstraction (see Figure 9). To do so, key frames from a glassblowing process are used as a summary of each action. To make content more interesting, the key frames are simplified using a cartoonification filter. The results are combined to author a comic book. Action sequences are complemented using inline textual descriptions following standard comic book principles. Using the capabilities offered by h5p content, we use the images illustrating each page of the comic to author an interactive book. To ensure that complex concepts are segmented into smaller and more manageable parts, each page of the interactive book has been authored in a way to presents only one step of the process. The placement of images follows the logical sequence of the steps. Inline visual annotations are used to highlight important parts of each action and the interaction between the craftmaster, tools, materials, and workshop. The textual descriptions act as narrations of the visual information. Key locations are also enhanced by linking to the source audiovisual captures of the process to further study important steps.

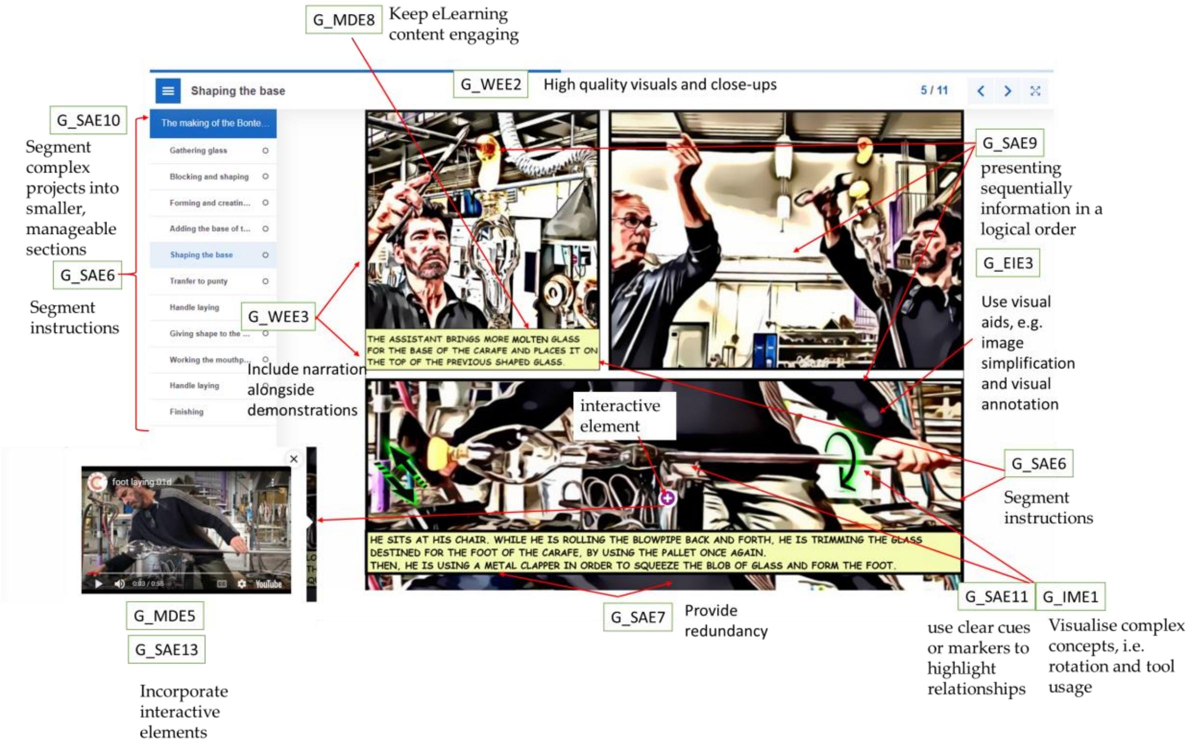

Figure 9. Example of a course in the form of an interactive comic book.

The second example builds on the same visual abstractions used for teaching individual glassblowing techniques now combined in a complete worked example that presents from the beginning to the end the implementation of a complex glass object, which in this use case, is a glass carafe. The same principles of organization in steps and of the provision of information sequentially are maintained in this example too. An indicative screenshot from this interactive book authored in the H5P format [63] is presented in Figure 10.

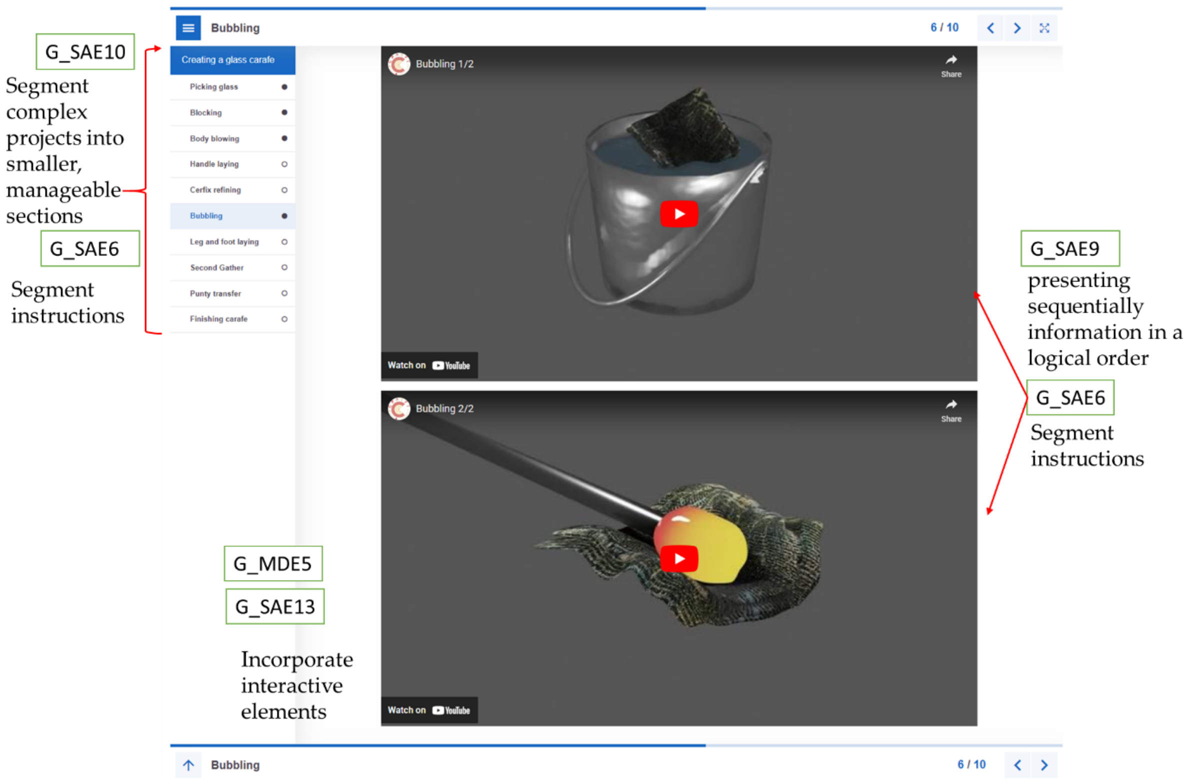

Figure 10. Example of a course that presents a complete worked example as a visual abstraction of steps.

1.5.5 Assignments and Student Evaluation

Student evaluation follows the method of assignments and tests enhanced through digital media to make them more engaging. In this section, examples of alternative evaluation means will be presented starting from plain old-fashioned multiple-choice quizzes and moving to more creative forms such as interactive video quizzes, problem-solving exercises, and creative assignments.

1.5.5.1 Multiple-Choice Quizzes and Interactive Video Quizzes

Multiple-choice quizzes are not the target of this research work and have been thoroughly studied by previous research works (e.g., [64–66]). In this work, we focused on providing through interactive quizzes various levels of feedback during the test to provide real-time information to the learners regarding their selections and thus transform the test into yet another form of learning. Several guidelines are easy to apply here too, such as maintaining a consistent pace in the presentation of questions, ensuring that no scrolling is required, using simple and consistent wording, providing incremental difficulty, etc.

Conversely, interactive video quizzes are considered a more innovative alternative to this research work since much of the craft training depends on observation, understanding, and mimicking. Such tests were created as part of this work using footage from actual practitioners and in our example, the creation of a glass carafe is studied. The footage used regards the demonstration of its creation process in the workshop by a glassmaster and his assistant. The video is interactive, employing pausing to several key frames to allow the student to be prompted with a question that is based on their understanding of the glassblowing process (see Figure 11). Thus, pausing by itself introduces a partially completed problem that allows the learner to exercise knowledge and critical thinking. Questions are formulated in the form of asking for a justification from the learner and questions provide several justifications of a phenomenon. In the case of success, the interactive video continues, while in the case of failure, feedback is provided to the learner to enhance their understanding of the phenomenon under study and the question itself.

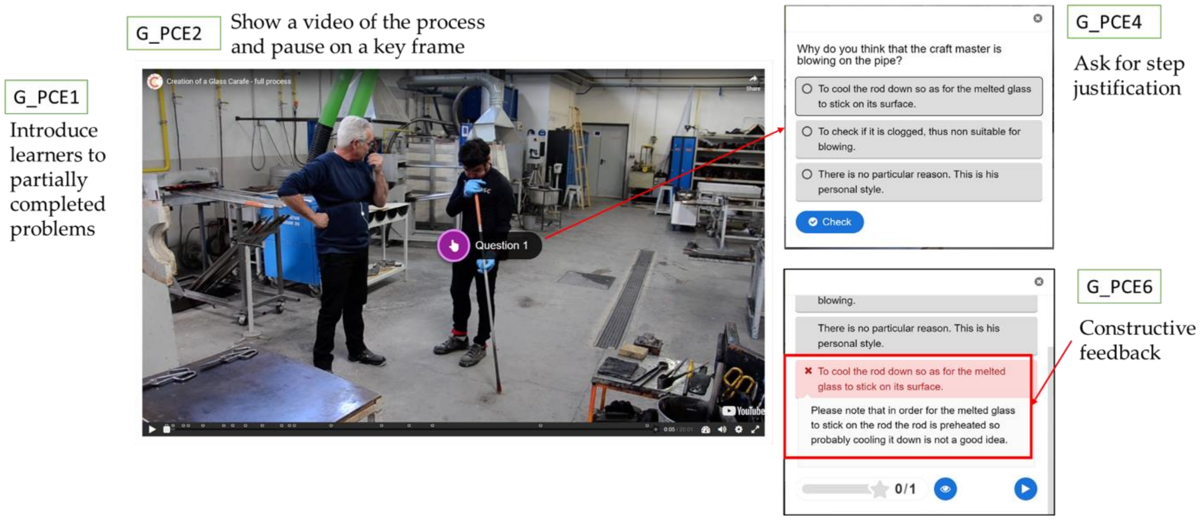

Figure 11. A video quiz and the relevant guidelines conformed to.

1.5.5.2 Problem Completion Assignments

In this example, we mainly study the Problem Completion Effect, in which the learners are introduced to a partially completed problem and prompted to practice their capabilities to fill in the missing pieces of information (see Figure 12). The presentation of the problem starts with a description of the context that the learners should focus on and a short description of the assignment. Then, explicit instructions on how to proceed with the assignment are provided alongside information on how their assignment will be assessed. The partially completed project is provided in the form of a partially filled answer template that the students should use as a starting point for their assignment. Furthermore, learners are strongly advised to work in groups to practice interpersonal collaboration and problem-solving skills. The structure of the aforementioned assignment is designed to support scaffolding learning by deactivating parts of the assignment based on the learner's level. Thus, for novice learners, the assignment has the exact structure and content as shown in Figure 12, while for moderate users only the instructions and an empty template are provided. For experts, only the objective of the assignment and an empty template are provided.

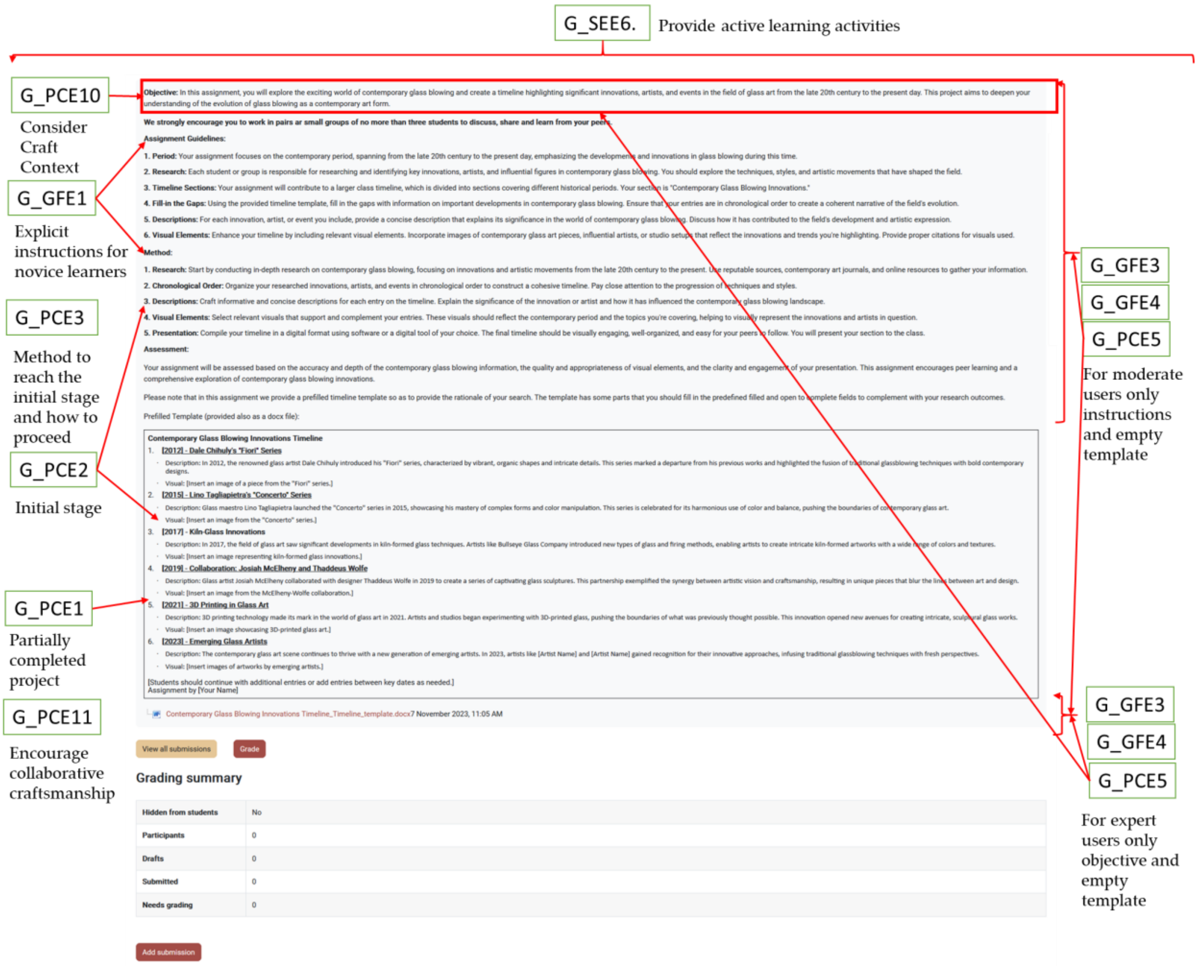

Figure 12. An example of an assignment focusing on the application of the Problem Completion Effect in crafts eLearning.

1.5.5.3 Creative Assignments

In this example, we study the creative assignments that develop critical thinking and analytical skills. The structure of the assignment, as shown in Figure 13, is divided into two sections. The first presents the objective of the assignment, while the second presents instructions in the form of a step-by-step walkthrough of how to execute the assignment. These step-by-step instructions allow the authors of the assignment to integrate strategic sub-tasks that, through their execution, can assist in the development of critical thinking and analytical skills rather than expecting this to magically happen. For example, the assignment provides specific instruction on what should be researched for each art artifact and the research itself is a way of transferring knowledge to the learner not only on this subject but in general on how to establish a new paradigm of collecting and evaluating knowledge from external sources. At the same time, it guides the learner with further instructions to focus on things that are considered essential, such as the artistic intent and the design elements, which can assist in cultivating creative thinking when composing works of art and in general creativity by identifying creative elements and their contribution to the composition. These instructions further provide incentives to the learners to search deeper into artistic creation and provide time for self-questioning since understanding and judging what you see is essential while gathering information on what to see. Combining inner beliefs with external knowledge can become a generator of new ideas, designs, and creative concepts. Of course, the learners are strongly advised to discuss with their peers since through discussion, research, and consolidation, a more holistic understanding can be achieved.

The assessment of such an exercise is a reflective essay in which the learners are asked to summarize their analysis of the selected artefact highlighting key points focused by following the instructions and new creative directions generated throughout their research. The creative essay acts as a form of self-explanation, inviting the learners to explain to themselves while preparing the essay the path, focal points, and decisions made during their research.

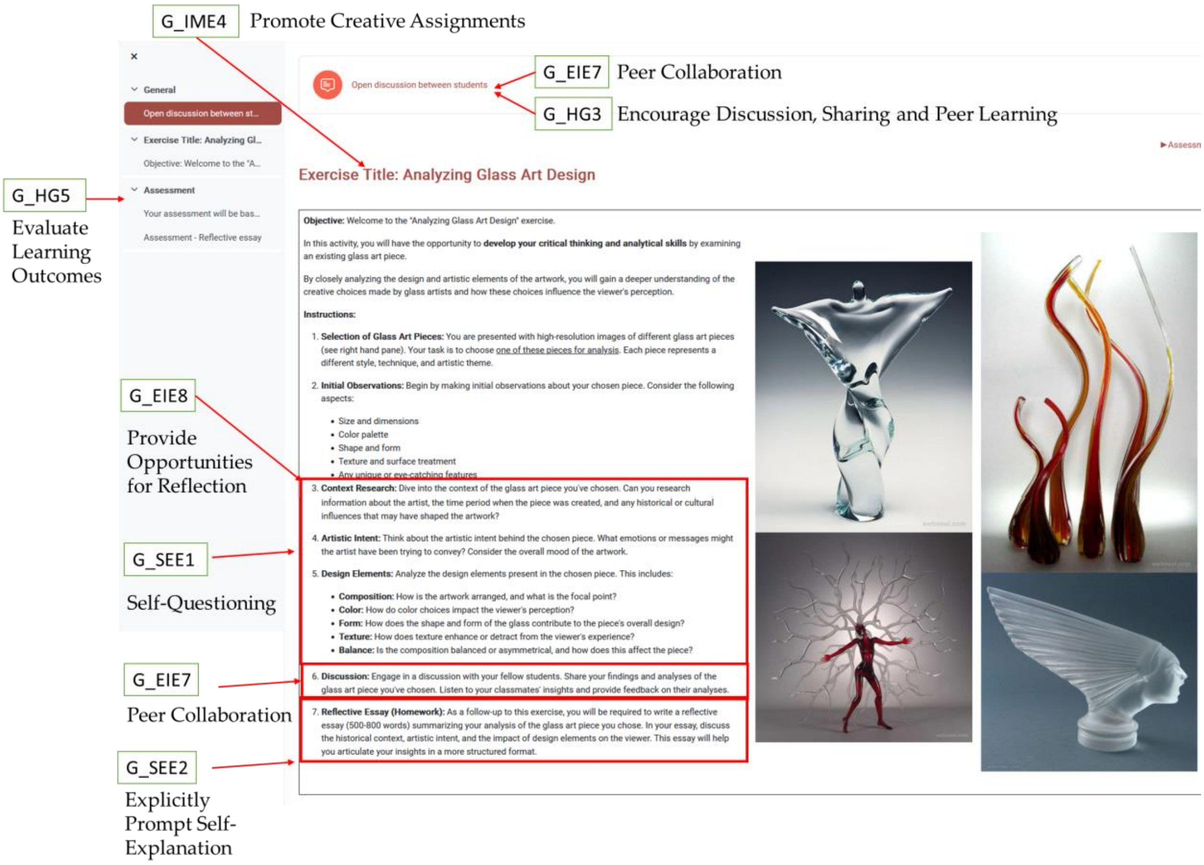

Figure 13. An example of a creative assignment.

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Annex B
Educational kit – First phase

Methodology bases and the usage scenarios of digital tools

CRAEFT

care, judgment, dexterity

Abstract

In the general purpose of preservation & revival Craftship, the aim is codesign and adopting digital aids in knowledge transmission and training and across ways of formal and informal learning.

Educational kit formalises draft digital aids for each RCI curricula program, as well as pedagogical methodology and usage scenario for Craeft digital tools.

The educational kit starts with a reminder of context and demand analysis in order to define the questions it will answer.

- How can Craeft digital tools be implemented in the glassblowing with a pipe CPC curriculum as a pilot?
- How can we assess the impact of digital aids on learning?
- How can a transposable educational model be established for each RCI?

Then, a strategy to combine existing learning methods with digital tools and to select appropriate activities to maximise learning impact has developed through the proposal of a usage scenario and overall methodological approach.

Our concern is to think about the articulation of knowledge and know-how, to create opportunities to go back and forth between digital tools and workshop work in order to create a synergy of learning tools in a synchronous or asynchronous way.

Based on heuristics, educational methods, and Cognitive Load Theory as a validated scientific approach, this document details:

- the context and methods for experimentation of glassblowing pilot 1
- assessment methodology of Craeft digital tools' impact on the learning process
- how to transpose the experimentation to the other RCIs.
- templates of the key training sessions for experimenting.

Contents

Acronyms definition

Abbreviation	Definition
CLT	e-learning platform linked to Craeft Studio
AS	Apprentice Studio application, virtual workshop learning
DS	Design studio application, design and 3D/XR modelling.
CS	Craeft Studio application incorporating a virtual training workshop.
CAP	Craeft Authoring Platform, a portal providing access to CLT, DS, AS and Craeft Studio.
XR	extended reality, including virtual reality, mixed reality and augmented reality.
RCI	Representative Craft Instances
CPC	Certificate of Professional Competence - French level 3 certification.
HSE	Health, Safety, Environment
Groups T and TA	T - Traditional / TA Traditional Augmented
MOOC	Massive Open Online Courses

1 Introduction

1.1 The demand

Grant Agreement, DESCRIPTION OF THE ACTION (PART A)

Work package WP6 – Craft preservation (p12)

Use the Community Platform and the Apprentice Studio, appropriate to the knowledge transfer model of each RCI (formal, industrial, informal, workshops). The objective is to evaluate their efficacy during the first pilot semester and use the results to improve them. Apply findings to improve them for the second pilot semester. Evaluate outcomes with two groups of trainees (one using CRAEFT aids and the other not), for each RCI, and comparatively analyse the progress in developing crafting capacities.

Deliverable D6.1 – P1 - Education & Training (p23)

This deliverable reports the contributions of Craeft to craft education and training. The first version (M24) contained the drafting of the use of digital aids targeted to the training programme of each RCI, as well as the pedagogical methodology and usage scenarios for the Craeft Studio and Apprentice Studio software. It furthermore provided the content collection for the contextualisation of the RCIs. CERFAV will compile the education and training outcomes for the program from the individual RCIs. [...]. The second version (M36) will contain the final version of the curricula and the results of the evaluation of the effectiveness of the education and training aids per RCI. Each version of this deliverable includes: (a) Instructional methodology and software suite usage scenario, (b) Report, and (c) Publication of the education documents will be published on the OpenAIRE communication infrastructure.

1.1.1 Summarise aims

Appropriately apply the Craeft numeric tools to the glassblowing activity as a pilot and deploy them for each RCI.

Defined the modalities and criteria to assess the effectiveness of the education and training aids per RCI and to collect the results.

1.1.2 Strategy

- *“Define a strategy to combine the alternative modes of learning and training in the existing curriculum structure*
- *Select the most appropriate activity with the objective of maximising learning impact*
- *Using heuristic methods and the experience of the organisation of curricula by Cerfav*
- *Maximise the efficiency of each activity through scientifically validated approaches*
- *Evaluate learning outcomes and refine*
- *Integration of a pedagogical engineer at Cerfav for the next two years.”*

1.2- Context

In work frame of the European Craeft project, the aim is the integration of digital tools developed as part of the project in Cerfav glassblowing curricula as a pilot and, in a further step, disseminate this experimentation throughout the other RCIs.

The numerical tools are embedded in Craeft Authoring Platform (CAP). This platform will give access to a Craft e-learning Portal (CLT), to a Design Studio, two training applications, Craeft Studio and an Apprentices Studio.

This experimentation will be implemented with Cerfav apprentices of the first and/or second year, preparing the Certificate of Professional Competence CPC in glass and crystal art.

1.2.1 Conditions of experimentation:

- two groups
    - a control group without the use of Craeft tools
    - a test group using Craeft digital aids and tools
- two times
    - Implementation and assessment of the experimentation, 2nd semester of 2024
    - Improvement, tuning, assessment and report for the final version, 2025 years

1.2.2 Principles of the experiment

- Situational learning (see ppt WP6 p13)

  "In every profession and every activity, there is knowledge that is 'resistant to classical schooling', built up progressively through experience, and which nothing can replace. Situational learning is decisive here and reinforces the training-employment continuum. (Mispelblom et Glée p.46)

- Using the principles of cognitive load theory and testing its operational limits (see annex 1)
- Not to hinder apprentices in their curricula - « primum non nocere »

1.2.3 Aims

- To create an appetite for the tools offered by Craeft.
- To create an attractive, interactive interface.
- To encourage independent learning.

1.3 Analysis of demand

- <u>Why?</u>
    - Craeft will catalyse craft education and training with intuitive digital aids.
- <u>How?</u>

  - Drafting an educational kit for Glass blowing, integrated pedagogical methodology and usages scenario for Craeft Authoring Platform, as a pilot for all the RCIs (Representative Craft Instances)
- Who?
  - Craeft team
  - Cerfav trainers (pilot)
  - Cerfav apprentices (pilot)
  - The people in charge of training for the other RCIs (implementation)
  - RCI learners (implementation)
- Where?
  - Cerfav
- When?
  - From March 2024 to February 2026
- How many?
  - Two groups
    - 2 learners + 1 trainer, traditional group (T)
    - 2 learners + 1 trainer, traditional augmented (TA)
  - Two phases, one drafting of the use of digital aids targeted per the training programme of each RCI, experimentation and assessment, M24. Final version of curricula and results of project assessment of the effectiveness of the education and training aids per RCI, M36.

The issues

How to implement Craeft studio tools in the CPC curricula, glass and lead crystal glass art training courses?

How can we assess the impact of the use of digital technologies, e-learning and extended reality on learning?

How can a transposable educational model be established for each RCI?

2 Proposal scenario for setting up the Craeft education and training experiment

2.1 Craeft tools on offer

- e-learning platform – CLT
- an XR design/modelling platform- Design Studio
- a virtual workshop training platform – Craeft Studio / Apprentices Studio

2.2 Hypothesis

The issue is to implement in an existing curriculum program for learners the Craeft experiment times. (see annex 3 - example of Cerfav CPC glassblowing curricula)

One proposal was to do it during their project time rather than their vocational training time, for several reasons:

- do not hinder:
  - not reduce the time devoted to learning the skills of the trade, gathering glass, mould blowing, etc.
  - on the contrary, allow them to have more time to do it.
- Use a heuristic, active, project-based educational method.

2.3 What can Craeft tools do for them?

- Design their project using a virtual reality tool - Design Studio
- Practice making parts - Apprentices Studio
- Test their knowledge - CLT
  - about the workshop
  - environment
  - machinery and equipment
  - tools
  - process
  - knowledge of glass
  - composition
  - operating temperature
- The rules of hygiene, safety, ergonomics and respect for the environment
- Opening up and learning about other techniques
  - other glass techniques, or hot glass, such as filigree
  - other arts and crafts
- Project follow-up, having a virtual project notebook

Note: a questionnaire or creative workshop on the expectations of Craeft tools could be carried out with learners and trainers to reinforce the proposal.

2.4 Scenarios

I'm an apprentice exempted from general subjects at Cerfav and part of the TA group.

2.4.1 Get informed and think about my project

Using Craeft e-learning platform (CLT):

- *I can test my knowledge.*
- *I can review the concepts I haven't mastered. At the start of each module, I will be given advice.*
- *I can discover/deepen my knowledge of the basics of the glassblowing technique (steps involved in blowing a cup) - trade gestures.*
- *I can find out about the workshop environment, technology, HSE, etc.*
- *I can find out about other glass techniques, stained glass, blowpipes, etc.*
- *I can learn about other glassblowing techniques, filigree, incalmo, etc.*
- *I can learn about other arts and crafts.*
- *I can take notes on the progress of my project.*

2.4.2 Modelling my ideas

Using Design Studio:

- *I design and develop the shape of my object.*
- *I can take into account manufacturing constraints.*
- *I can work out my manufacturing process. (C2.1 reference guide)*
- *I prepare the documents and elements necessary for manufacture, e.g. plan, mould, etc.*
- *I can prepare the elements defining the quality criteria for my creation.*
- *I can check method points or the tools I'll need on CLT.*

2.4.3 I practice before producing my piece in the workshop

Using Apprentices Studio:

- I can practice basic movements.
- [train on a sequence of actions].
- I take into account health, safety, the environment, maintenance and quality. For example, I can't access the virtual workshop if I don't pass the quiz beforehand, or there could be 'surprises' during the simulation. => link with CLT.

- I can draw up a checklist of points to check before, during and after manufacturing.
- *I can check method points or the tools I'll need on CLT.*

2.5 Dependent modalities on the scenarios and the digital tools used

Modalities	**Scenarios / digital tools**			**Workshop**
	E-learning platform	Design Studio	Apprentices Studio Craeft Studio	
Connections	On-line	Off-line	Off-line	Off-line[1]
Location	Everywhere	FabLab or workshop	FabLab or workshop	Workshop
Time	Everytime	Project session	Project session	Workshop session
Synchronicity	asynchronous	synchronous / asynchronous[2]	synchronous / asynchronous[2]	synchronous

Figure 2- Digital tools modalities table

Notes:

1. Offline at first, we can imagine an augmented reality application or access to the e-learning platform available on mobile phones in the workshop, for certain concepts to be learned or certain tasks to be carried out.
2. Depending on the session, there may be synchronous times when the whole group works together on the discovery session.

Asynchronous times when people work on different tools depending on the needs of their personal project, during project time, but not necessarily at the same time on the same tool.

3 Overall methodological approach:

3.1 General principles

3.1.1 Foundation:

Document Miro by David Pilot Glassblowing:

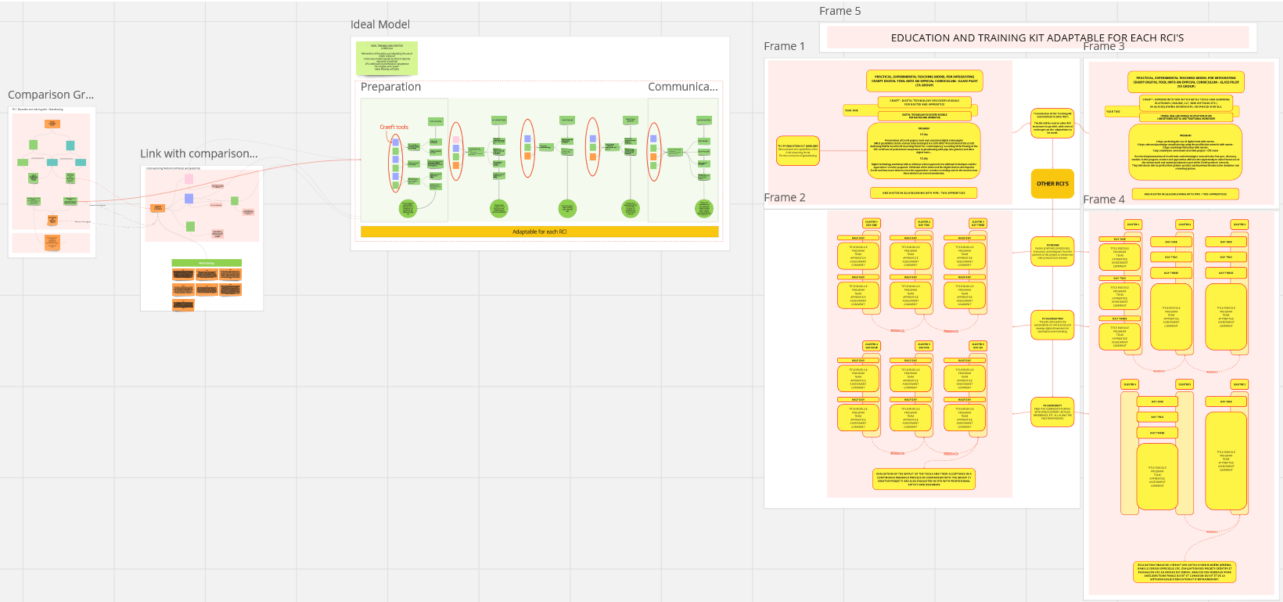


Figure 3 Pilot glassblowing synopsis

See annex 2 and link to the detailed view

3.1.2 Method based on:

- project-based educational and cognitive load theory.
- 2 groups in 2 phases
- 5 activities linked to the CPC curricula, glass and lead crystal glass arts:
    - Prepare
    - Implement
    - Inspection / Quality
    - Maintenance
    - Communication
- 3 learning and project creation phases:
    - I get informed and think about my project
    - I model
    - I practice
- Activities and phases overlap

	Prepare	Impleme nt	Inspect quality	Maintain	Communicate	
I get informed and think about my project”	**O**		**O**	**O**	**O**	Craeft elearning platform
“I model”	**O**		O		**O**	Design Studio
“I practice”	**O**	O	**O**	O	O	Apprentices Studio

Figure 4: Activities and phases overlap diagram.

legend:

O: The learning phase allows you to work on acquiring the skills linked to the activity.

O: The learning phase is indirectly linked to the acquisition of skills related to the activity.

- The three phases of the scenario can be available through all RCIs with their specific modalities of transmission and learning.

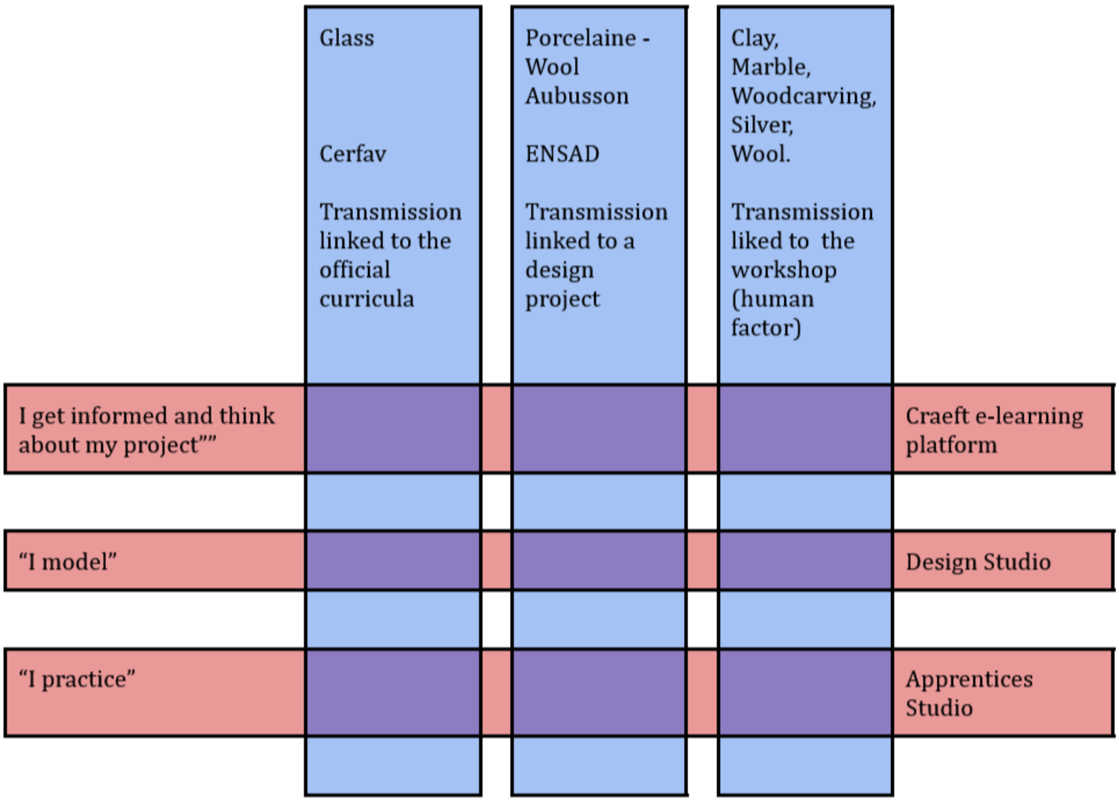


Figure 5: Cross-sectional approach of scenarios for RCIs

- Educational scenarios have the same structure from one RCI to another.
- The sessions are "empty shells" to be completed with the knowledge and know-how of each RCI.

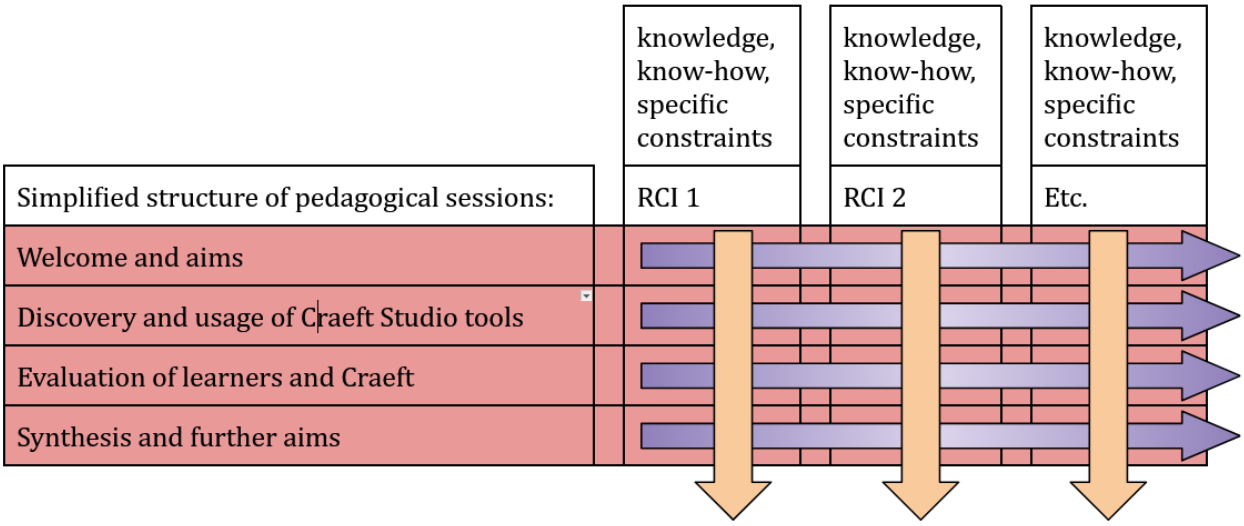


Figure 6: Simplified structure of learning session

- The common points between the different RCIs are the elements (semantic fields) involved, materials, processes and actions. The specificities of each RCI are expressed through the work environment (the workshop), tools and machines, gestures and techniques.
  Added to this is cross-disciplinary knowledge, such as health and safety rules, etc.

- Assessment criteria of learners and Craeft project are transferable directly from one RCI to another (see assessment chapter).

3.2 Educational principles

Which educational approach?

Comparative chart of approaches:

Deductive approach	**Inductive approach**
From general to particular	From particular to general
Linked educational methods: affirmative (teaching) interrogative (training)	Linked educational methods: Active Active experiential Project-based
The learner: “I like learning”	The learner: “I like doing”

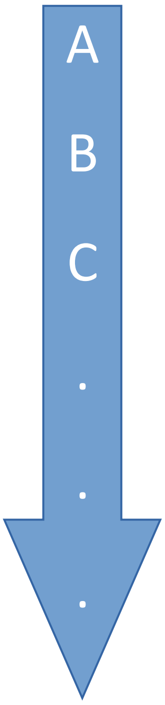
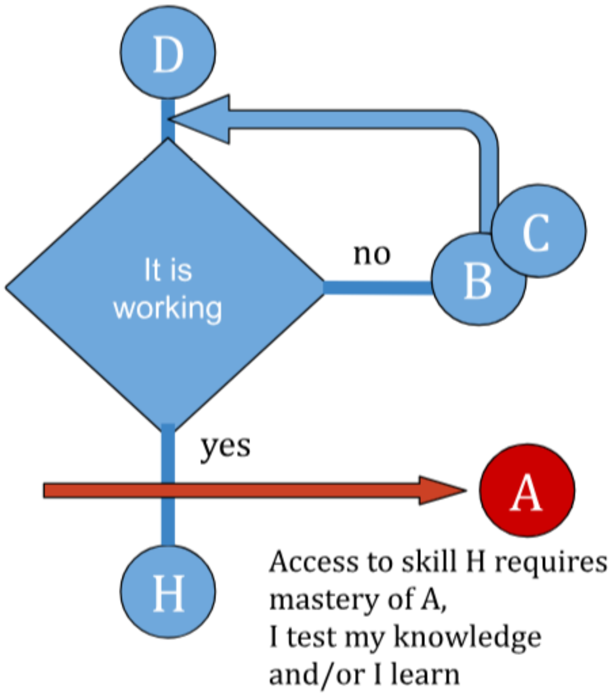
Deductive approach	**Inductive approach**
Knowledge, know-how and skills are accessed via the teacher, in a top-down and sequential manner, one notion after the other.  	*"I have a project; I'm going to learn the knowledge I need to succeed".* *Access to skills is direct from the learner to the knowledge; the trainer is a facilitator. Access to knowledge is discontinuous.* *"I test and start with skill D".* 
Benefits: ● provides a framework that can be reassuring, particularly for less independent learners. ● no gaps in "knowledge" in the learning progression	Benefits: ● learners are responsible for their own learning progress (it is monitored by the trainers) ● motivation
Disadvantages: ● lack of motivation for less 'academic' learners	Disadvantages: ● requires more autonomy from the learner.

Figure 7 Comparison of inductive and deductive approaches

The approach we are proposing as part of the Craeft experiment is an inductive one, more in line with the project's recommendations. Proposing pedagogical, heuristic and heutagogical tools, and an active teaching method.

3.3 Implementation of educational principles

<u>quiz "first"</u>

People following the apprenticeship are likely to already have some knowledge via their apprenticeship master or the courses given at the CERFAV, so creating a challenge with a quiz beforehand is a way of creating an appetite for the tool and motivation.

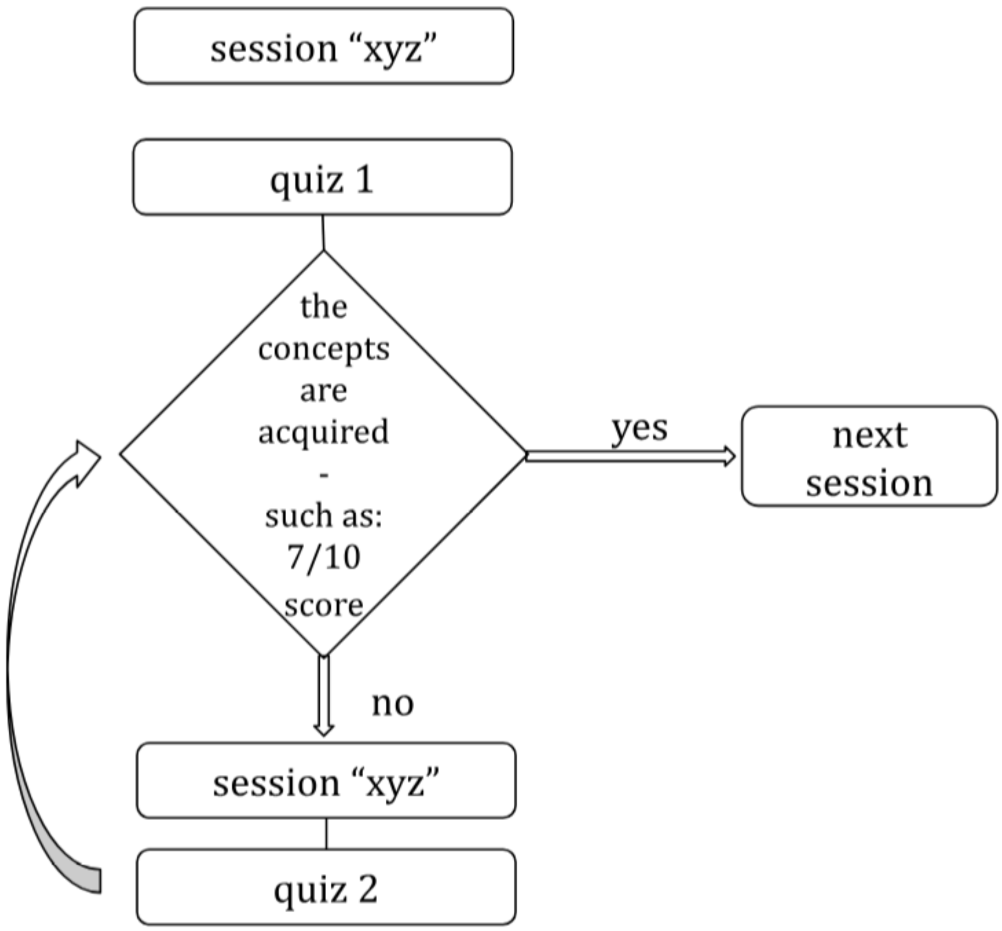


Figure 8 Quiz first principle

Links between the CLT and Apprentices Studio: concepts covered in theory in the CLT are reviewed practically in the Apprentices Studio.

Figure 9 -Knowledge learned as part of the CLT:

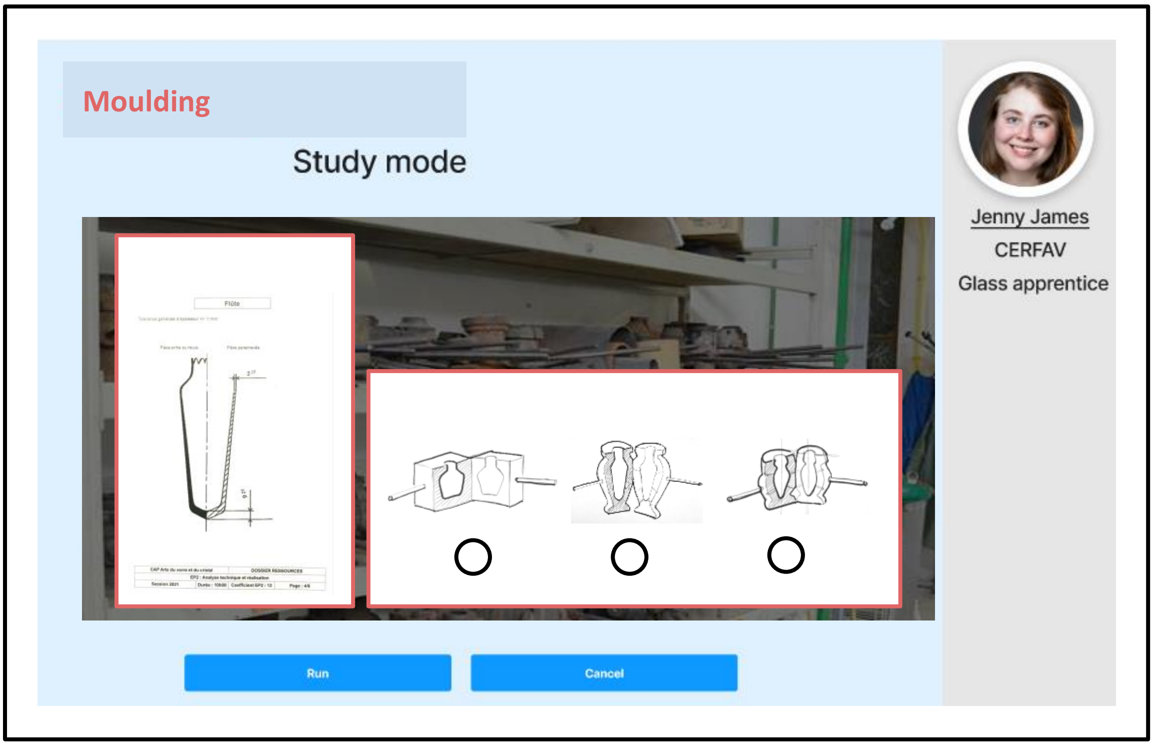


Figure 10 Contextualization in Apprentices Studio:

<u>During the learning process, the three phases of "I get informed", "I model" and "I practice" can loop back on themselves.</u>

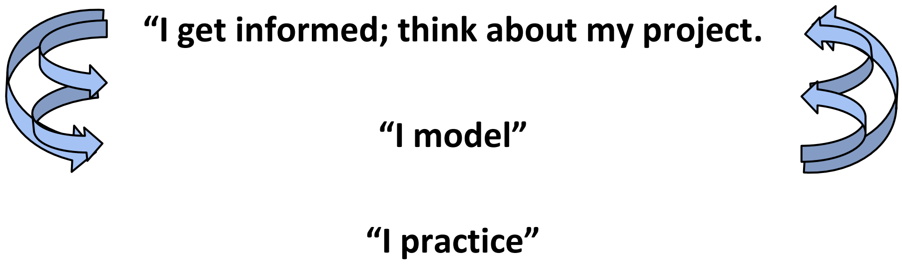


Figure 11 Looping phases diagram

<u>Structuring information into sub-sections and creating categories</u> makes it easier to understand and remember (cognitive load theory).

For example, to showcase hot glass tools and machines:

Action	**Tools**
Gathering glass	
	punty
	blowpipe
Modelling	
	block
	mold
	wet newspaper
	jacks
Detach	
	tweezers
	jacks
	detaching iron
Bringin glass	
	punty
	diamond shears

Figure 12: Knowledge structuring example

Various forms and ways to present concepts: textual, visual, audio-visual

such as:

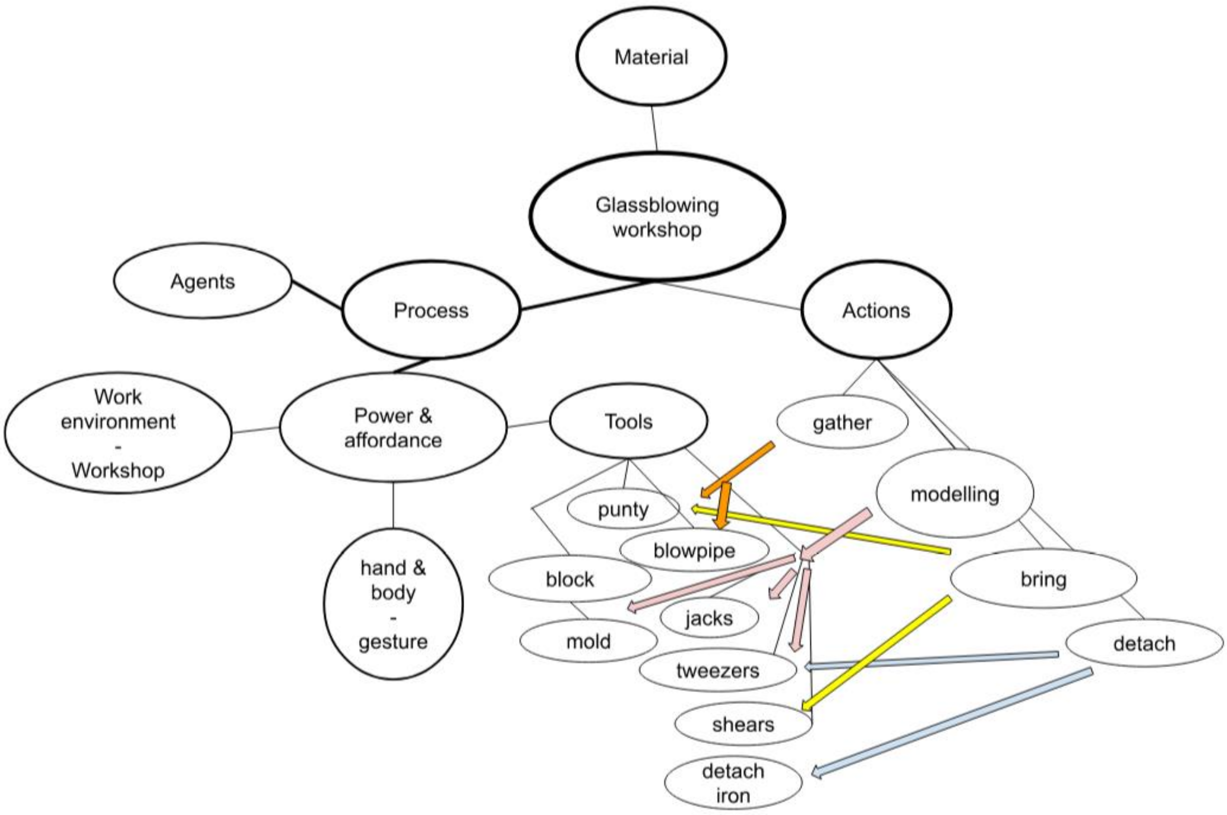


Figure 13 Mind map, mind map

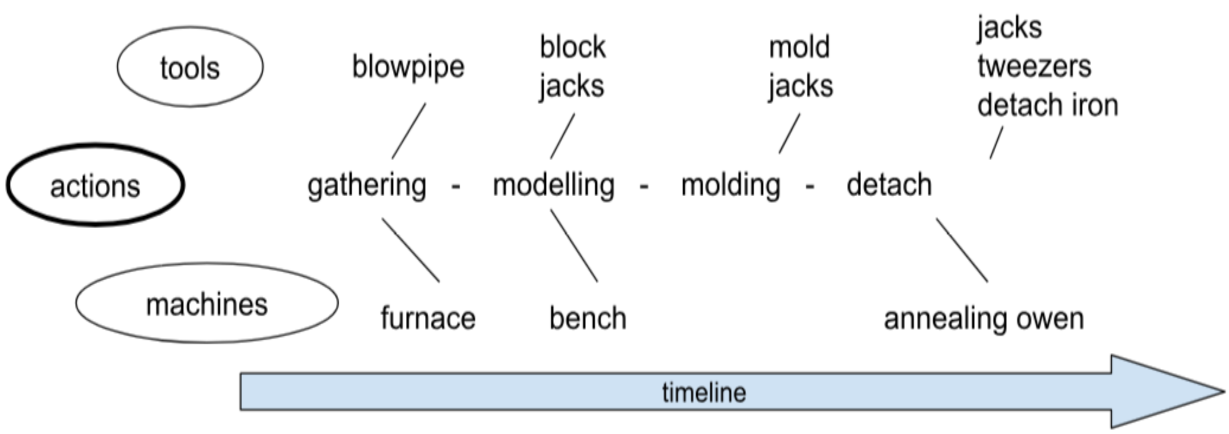


Figure 14 Timeline

4 Assessments

4.1 What is assessed?

4.1.1 Assessment of the learner

- the results of assessments during the curricula (formative assessments, quantitative scores/notes):
  - paper
  - Cerfav e-learning platform
  - Craeft e-learning platform
  - case study.
- the consistency of skills acquired in cross-disciplinary subjects such as technology, HSE and technical drawing with practical implementation in the workshop (qualitative, observation by trainers, self-assessment).
- CPC exam results (summative evaluation)
- the result of the personal project (summative assessment)
- educational progress (time/speed of skills acquisition, maturity of skills mastery at the end of the course, statistical evaluation).

4.1.2 Assessment of Craeft project

- the tools
- effects (impact of Craeft tools on teaching progress)

4.2 Assessment methods - how is it assessed?

4.2.1 Learners:

- theoretical assessment
  - quizzes, tests
  - cases study
  - presentations
- practical assessment
  - simulations
  - practical workshop
  - personal project

4.2.2 Craeft project:

- personal project monitoring (project notebook)
- satisfaction survey
- statistical evaluation, compilation of learners' results

Note: Comparing the results obtained in the assessments between the T and TA groups will make it possible to evaluate the effects of the Craeft tools in the acquisition of skills.

Statistical comparison of the scores obtained in the assessments, tests taken on the CERFAV / CLT platforms or on paper for each person in the T and TA groups.

Qualitative comparison of the assessments made by the trainers on the progress in the workshops and the projects of the apprentices in the T versus TA groups.

4.3 Limitations

- *The small number of people per group may make them unrepresentative.*
- *Depending on the criteria used to assess the situations or the personal project, there may be an increased possibility of subjectivity.*
  An existing evaluation grid should be used and recorded, or created and recorded.

4.4 Learner assessment criteria

See the table showing the relationship between activities and skills on page 31 of this document.

Activity-based assessment is more global and oriented towards situational assessment in a workshop. Skills-based assessment is more oriented towards CLT assessment.

The aim is to cross-reference the results to generate an overall assessment.

4.4.1 Activity-based assessment criteria:

According to the Glass and Crystal Arts referential, pages 7 to 11, the expected results for:

- **Preparation:** "The workstation is ready for use in compliance with procedures and health and safety rules."
- **Implementation:** "The work conforms to the production order and the technical file."
- **Maintenance:** "The workstation is kept clean, safe and in good working order."
- **Inspection / Quality:** "The inspection, which complies with the technical file, is carried out in accordance with the quality procedure and environmental standards".
- **Communication:** "Reports and instructions are given or written within the allotted time, using the appropriate technical vocabulary".

4.4.2 Skills-based assessment criteria:

Skills table, CPC referential of glass and crystal art, see pages 12 to 16.

C1 - Be informed

	Assessment criteria	
Know-how	**Setting the scene**	**Expected results**
C1.1 Read the instructions and	Environmental elements: - The workshop, the workstation.	The determining elements, related to the work, are clearly identified and can be expressed.

	Assessment criteria	
Know-how	**Setting the scene**	**Expected results**
decode the documents provided (technical file and procedure).	Available resources: - Technical file and procedure, - Oral or written instructions, - Model.	
C1.2 Identify the materials used.	Environmental elements: - The workshop, the workstation. Available resources: - Material sheet, - Data sheet.	The materials are identified, and the constraints related to their use are taken into account.
C1.3 Identify materials, tools, and fluids.	Environmental elements: - The workshop, the workstation. Available resources: - Technical file, - Oral information.	Materials, tools and fluids are identified.
C1.4 Identify control tools.	Environmental elements: - The workshop, the workstation. Available resources: - Technical file, - Oral information.	Control tools are identified. They are in working order and available at the workstation.
C1.5 Be aware of health and safety and environmental regulations.	Environmental elements: - The workshop, the workstation. Available resources: - Technical file, - Rules of procedure, - Safety booklet, - Single document, - Environmental sheet, - Product sheet.	Health, safety and environmental rules are identified and understood.

Figure 15- Assessment criteria for activity “be informed”

<u>C2 – Prepare</u>

	Assessment criteria	
Know-how	**Setting the scene**	**Expected results**
C2.1 Establish the chronology of the operations to be carried out according to the aesthetic and technical constraints.	Environmental elements: - The workshop, the workstation. Available resources: - Technical file, - Procedure sheet, - Model.	The choice related to aesthetics and technical constraints are formalised. The chronology of the manufacturing operations is coherent.
C2.2 Prepare the work materials.	Environmental elements: - The workshop, the workstation. Available resources: - Technical file, - Procedure sheet.	The materials are ready to be used.
C2.3 Select and check machines and tools and adjust tools.	Environmental elements: - The workshop, the workstation. Available resources: - Technical file, - Procedure sheet.	The choice of the tool and the machine is adapted to the required realisation. The tool and machine are in working order. In the case of anomalies, the person responsible is informed.
C2.4 Organise and adapt your workspace.	Environmental elements: - The workshop, the workstation. Available resources: - Safety data sheet, - Rules of procedure, - Single document, - Labour Code.	The workspace is operational.

Figure 16 Assessment criteria for activity "prepare"

C3 – Implement

	Assessment criteria	
Know-how	**Setting the scene**	**Expected results**
C3.1 Carry out picking with a ferret and a cane	Environmental elements: - The workshop, the workstation. Available resources: - Procedure sheet.	The quantity of material is necessary and sufficient to produce the part.
C3.2 Shape glass taken	Environmental elements: - The workshop, the workstation.	Mesh and marbling techniques are mastered.

	Assessment criteria	
Know-how	**Setting the scene**	**Expected results**
for blowing	Available resources: - Procedure sheet.	
C3.3 Carry out the blowing process to produce the required part.	Environmental elements: - The workshop, the workstation. Available resources: - Procedure sheet.	The part (cup or single goblet) is in accordance with the procedure sheet. The blowing is clear.
C3.4 Carry out the pressing to produce the required part.	Environmental elements: - The workshop, the workstation. Available resources: - Procedure sheet.	The part (feeder mould, simple shape) is in accordance with the procedure sheet.
C3.5 Perform stain removal and annealing.	Environmental elements: - The workshop, the workstation. Available resources: - Procedure sheet.	The part is detached at the right temperature and carefully placed in the arch.
C3.6 Perform finishing (tracing, beveling, slotting, chamfering, sawing, re-brushing, flatting, de-tooling, polishing).	Environmental elements: - The workshop, the workstation. Available resources: - Data sheet, - Machine file, - Model.	The completion of the part is in In accordance with the data sheet or the model: The bevelling, the slotting and the rebranding are mastered on parts of two to five millimetres of thickness of the mouth; The chamfering is mastered on simple and flat curves. The chamfer does not exceed 5 mm for an angle of 45°; Nursing sawing is mastered. The platinum surface is perpendicular to the vertical axis of a 25 to 100 cm2 part. The de-tooling is mastered for a maximum diameter of 50 mm. Reshaping and deburring are mastered. The mechanical polishing and shining, except for decoration, are mastered.
C3.7 Perform decoration (compaction, roughing, cutting, sanding)	Environmental elements: - The workshop, the workstation. Available resources: - Data sheet, - Machine file, - Model.	For a design composed of straight bevels, cords and slanting bevels: Compassing: The realisation of the Marks conform to the technical drawing. Roughing: The installation conforms with the drawing or the model. Size: The decoration conforms to the design and model. The surface

	Assessment criteria	
Know-how	**Setting the scene**	**Expected results**
		condition does not show any defects incompatible with the continuation of the process. Filleting and small brushwork elements are in accordance with the design. Sandblasting: the installation of covers, protections, and abrasive blasting is in accordance with the drawing.
C3.8 Ensure that production is stopped.	Environmental elements: - The workshop, the workstation. Available resources: - Instructions, procedures.	The workstation and tools are returned in working order, clean and safe.

Figure 17 Assessment criteria for activity "implement"

C4 - Ensure maintenance

	Assessment criteria	
Know-how	**Setting the scene**	**Expected results**
C4.1 Ensure preventive maintenance (standard: NF 13306 of June 2001).	Environmental elements: - The workshop, the workstation. Available resources: - Machine file.	Maintenance is carried out in accordance with the machine file.
C4.2 Detect possible malfunctions.	Environmental elements: - The workshop, the workstation.	The alert is given, and the workstation is made safe.
C4.3 Maintain the station in working order.	Environmental elements: - The workshop, the workstation.	The workstation is kept in working order, tidy, clean and secure.

Figure 18 Assessment criteria for activity "maintaining"

C5 – Control

	Assessment criteria	
Know-how	**Setting the scene**	**Expected results**
C5.1 Adapt gesture and posture according to the operation to be carried out, respecting the rules of ergonomics.	Environmental elements: - The workshop, the workstation. Available resources:	The gesture and the posture are adapted to the operation carried out.

	Assessment criteria	
Know-how	**Setting the scene**	**Expected results**
	- Rules of procedure, - Safety data sheet.	
C5.2 Verify the conformity of the achievements during the manufacturing process.	Environmental elements: - The workshop, the workstation. Available resources: - Data sheet, - Quality sheet, - Template, - Means of control.	Quality requirements are met.
C5.3 Carry out the self-check.	Environmental elements: - The workshop, the workstation.	The process is integrated. Self-control is carried out throughout the manufacturing process.

Figure 19 Assessment criteria for activity "control"

C6 – Communicate

	Assessment criteria	
Know-how	**Setting the scene**	**Expected results**
C6.1 Pass on instructions.	Environmental elements: - The workshop, the workstation. Available resources: - Instruction booklet, - Scoreboard, - Memos.	Instructions are communicated clearly, accurately and on time.
C6.2 Participate in the resolution of problems by suggesting improvements or solutions.	Environmental elements: - The workshop, the workstation.	Proposals for resolution or improvement take into account the context, constraints and are relevant.
C6.3 Report orally, graphically or in writing by choosing and using tools, media, techniques, principles, and codes adapted.	Environmental elements: - The workshop, the workstation. Available resources: - Liaison sheet, - Manufacturing order.	The choice of tools, media, techniques, principles, codes and vocabulary is appropriate and contributes to the clarity and precision of the communication.

Figure 20: Assessment criteria for activity "communicate"

C7 - Respect the rules of hygiene, safety and environment

	Assessment criteria	
Know-how	**Setting the scene**	**Expected results**
C7.1 Respect the rules of hygiene and safety.	Environmental elements: - The workshop, the workstation. Available resources: - Technical file, - Rules of procedure, - Safety booklet, - Single document, - Product sheet.	The rules of hygiene and safety are known and applied.
C7.2 Respect the environmental rules.	Environmental elements: - The workshop, workstation. Available resources: - Technical file, - Rules of procedure, - Environmental sheet, - Product sheet.	The environmental rules are known and applied.

Figure 21: Assessment criteria for activity "HSE"

4.4.3 Personnel project assessment criteria:

Expected results:

1) A completely formatted written dossier including:

- Graphic research
- Cultural references
- Presentation of the project
- Study of technical processes

2) The model or project itself (the piece or pieces)

The assessment criteria take into account the quality of the production.

3) Oral presentation to a jury to explain and defend the project, its concept and its implementation.

Conditions:

Presentation of the work at the exhibition venue, in the presence of a jury made up of professionals and representatives of the teaching team, who may be joined by representatives of institutions and/or exhibition venues.

	None	Insufficient	Satisfactory	Exellent
File	No or very incomplete file	File present but incomplete and/or sloppy	File present and fully compliant with expectations	A very complete dossier, with particular attention paid to content.
Presentation	Disorganised and/or confused presentation. Speaking time was not respected	Unclear presentation. Speaking time respected	Simple yet clear presentation	Clear, thorough and orderly presentation. Respect for speaking time
Piece or model production	Incomplete and sloppy production, showing a lack of commitment to the project	Incomplete or sloppy production, showing a lack of commitment to the project	Complete, meticulous production, in keeping with the stated ambition	Remarkable work, production of high technical quality and incorporating particular difficulties

Figure 22 Assessment criteria personal project

4.5 Project assessment - by learners

4.5.1 The project notebook:

The project notebook aims to assess the learners' experiences - a questionnaire administered to the apprentices throughout the project to find out how the project has evolved thanks to XR and the Craeft tools.

Recording of their working process throughout the project, for example, at the end of each session, or when a choice is made.

Note: the project notebook will be completed by the T and TA groups to be able to draw up a T vs TA comparison of the time spent on the project, e.g. creation of a mould, is the workflow optimised (idea=>model=>plan=> mould =>erected=>finished product), etc.?

4.5.1.1 Craeft tools assessment (specific to the TA group):

- benefits provided
    - What have the CLT/AS/DS tools done for me?
- specific issues relating to XR
- experience

4.5.1.2 Assessing the impact of Craeft tools on the learning process (Groups T + TA):

Definition: In the following paragraph, the term project technique indicates the technique chosen by the person to design and model their project, XR for the TA group, modelling, wax, etc., for the T group.

- Which dominant project technique was chosen for the design, modelling, project preparation, e.g. drawing, clay, wax, mould, XR, etc.
- Did my project require the creation and manufacture of a template, a specific mould, a model, etc.?
- time/workflow and facilitation:
- Organisation and fluidity of the creation process according to the project technique chosen for the modelling.
- speed of execution slowed or accelerated by the project technique.
- opportunities and limitations encountered in relation to the project's design tools / specific issues relating to the project technique.
- opportunities and limits of the project technique
- experience of confronting the tools offered by the project technique in the creative process
- opportunities and limitations encountered in relation to the production process
- opportunities and limitations of glass techniques (depending on each RCI)
- negotiating with the material in the creation of the project
- solutions found using XR tools and other project techniques
- result/faithfulness to the initial project
- Are my choices guided by the project design method (XR and others, to be noted as the project progresses)?
- how project technique has influenced my project choices => adaptation
- fidelity/loss of meaning/loss of project focus vs technology limits.
- What skills have been learned or developed as part of the project?
- positive points/areas for improvement/suggestions

4.5.2 Satisfaction survey:

Craeft tools assessment by learners - their experience of using the various Craeft tools.

Below is the evaluation proposed in CLT - Glassblowing - Feedback level 1.

<u>Course contents:</u>

1. The clarity and organisation of the course content.
2. Did the course provide a comprehensive understanding of glassblowing (or other RCIs), including contextual information, machine and tool descriptions, workshop presentation, and health and safety considerations?
3. Were the explanations and examples provided for glassblowing machines, tools, and workshop details clear and informative?

<u>Course structure and materials:</u>

1. How would you rate the overall structure of the course, including module organisation and order of topics?
2. Did the course materials (text, images, videos) enhance your understanding of the subject matter?

<u>E-learning platform:</u>

1. How user-friendly did you find the e-learning platform for accessing course materials, submitting assignments, and participating in discussions?

2. Were the provided navigation and instructions within the e-learning platform clear and helpful?

General feedback:

1. **Were there any specific aspects of the course that you found particularly beneficial or challenging?**
2. **Do you have any suggestions for improving this course, both in terms of content and delivery?**
3. **Do you have any other comments that you would like to share with us?**

4.6 Project assessment - by the trainers and the apprentice master

4.6.1 Assessing the impact of Craeft tools on the learning process **(Groups T + TA):**

- Personal project assessment
- Time taken to design and model the T vs TA project
- Progress in technical or cross-disciplinary skills

4.6.2 Summary table of assessments:

Assessment media	Documents /reference paragraphs	Groups		What is assessed					Assessment methods - how is it assessed?	
		T	TA	learners			project			
				know	know-how	How to be	tools	effects	quantitative	qualitative
reference skills		O		O				O	paper tests / Platform Cerfav	
			O	O				O	paper tests / Platform Cerfav / CLT	
reference skills		O			O			O	scores (learners' assessment)	workshop/ project
			O		O			O	scores T vs TA (project assessment)	workshop/project / Craeft Studio
reference skills		O				O		O	T vs TA compliance (project assessment)	respect for gestures and posture, HSE rules, etc.
			O			O		O		respect for gestures and posture, HSE rules, etc. / Craeft Studio
Educational progression		O		O	O	O		O	speed of progress, analysis of scores in T vs TA (project assessment)	trainers' assessments/test results

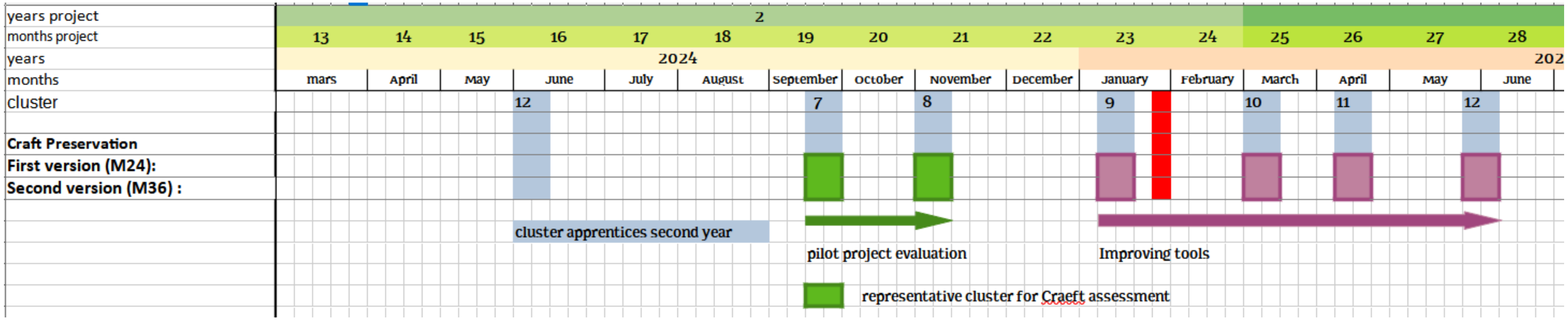
Assessment media	Documents /reference paragraphs	Groups		What is assessed					Assessment methods - how is it assessed?	
		T	TA	learners			project			
				know	know-how	How to be	tools	effects	quantitative	qualitative
Educational progression			O	O	O	O		O		trainers' assessments/test results
Project - project notebook			O	O	O	O		O		rainers' assessments / results T vs TA
Project notebook			O				O			learners' assessment
satisfaction survey			O				O			CLT platform

Figure 23: Summary table of Craeft assessments

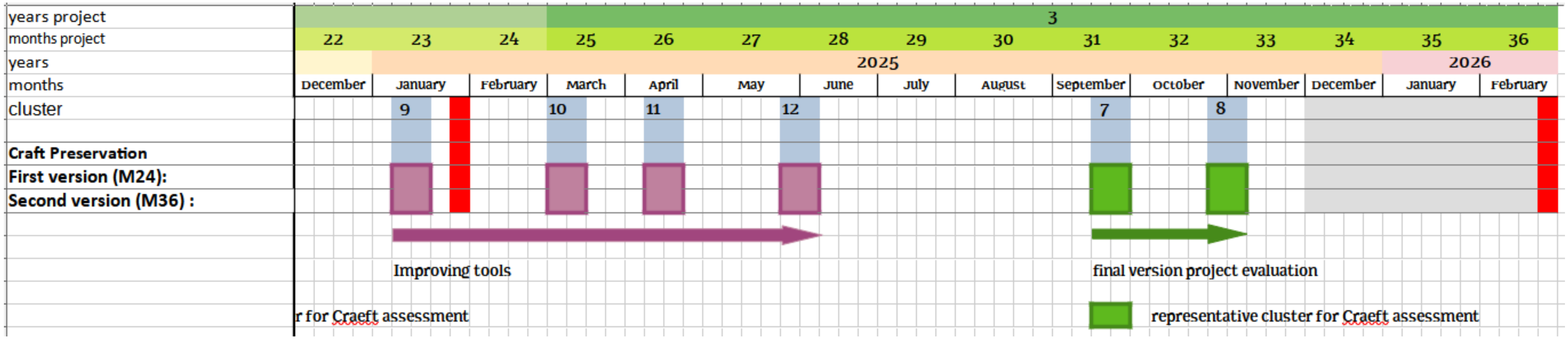
4.6.3 Clusters chosen for project assessment:

In order to avoid creating any bias, the evaluation of the Craeft project will be carried out on clusters 7 and 8, with the same training curriculum but different groups. As Cluster 9 in January 2026 is too late for the end of the project, Cluster 9 has not been retained. Groups 9 to 12 in 2025 were dedicated to perfecting Craeft tools.

Glassblowing pilot 1 (M24):



Final version (M36):



Figures 24 and 25: Organisation of the assessment and improvement phase based on clusters

5 Craeft educational and training module proposal for glassblowing *with steel pipe*:

5.1 Overall aims

To make learning easier using Craeft's digital tools, to support apprentices right through to the CPC in the best possible conditions.

Experiment with and evaluate the tools offered by Craeft Authoring Platform.

5.2 Concerned public and prerequisites

- Concerned public:
    - The apprentices of CPC glass and crystal art
    - age: from 16 to 30 years old, with an average age of 22 years old.
- prerequisites of the sequence:
    - The glassblower apprentices are exempted from general subjects.
    - present the Craeft project to apprentices and select those who wish to be part of one of the two groups
    - presentation and appropriation of Craeft digital aids "use of Craeft tools" to people in the TA group.
- workforce: 4 people
    - 2 apprentices + trainer, group T

Note: In order to secure the evaluation of the project, we can envisage having groups with a higher number of apprentices in the event of illness, setbacks or other circumstances during the project, which make the evaluation difficult if the person has not followed the whole process. Two people per group will be included in the Craeft assessment and report.

5.3 Educational aims

Make learning easier using the digital tools offered by the Craeft Studio portal.

Initially applied to glassblowing, the module proposed and tested should be transposable to other craft sectors (RCIs) at the same time.

5.4 Contents of the course

The contents of the course are based on the French glass and lead crystal glass art CPC referential. At the end, the learner will be able to carry out a project in glassblowing with numerical aids and also be able to blow a cup.

Furthermore, the curricula structure is based on the five activities (main skills) of the glass and crystal art CPC referential and must be able to be transposed to the other RCIs:

- Prepare
- Implement
- Inspection / Quality
- Maintenance
- Communication

To sum up, the Craeft course proposal will use a restrained part of the CPC referential and implement pedagogical tools based on numerical aids.

Its structure will follow the five activities of referential that can be transposed from one craft to another, so that it can be adapted to the eight RCIs. The educational kit, a guide for transposition to each RCI, will have to take into account the diversity of activities and workshop structures.

5.5 Assessments

- of the learner
    - Criteria & indicators
        - From CPC art of glass and crystal referential
        - Personal project assessments
- of Craeft project
    - Criteria:
        - successful acquisition of skills linked to the reference framework
        - successful completion of the CAP
        - anchoring of knowledge
        - level of compliance with and understanding of instructions, processes and technical documents
        - satisfaction, personal experience

Note: particular attention must be paid to the groups representativity and the assessment criteria to ensure the result will be validated

Information is detailed in the assessments section of this document.

5.6 Pedagogical methods

Depending on the skills to be acquired and the context in which they are to be implemented, the method used may vary:

- Experiential
- Active / Heuristic
- Towards self-directed training.

Notes: A survey of the existing methods implemented will have to be carried out for group T. This report will be included in the methodological description and evaluation of WP6.1.

Similarly, a check should be carried out for the TA group, methods planned / methods implemented.

5.7 Support materials

pedagogical follow-up tools:

- assessments
- CLT platform
- Support and interviews for apprentices

Resources

- the tools offered by the Craeft Authoring Platform
- the Craeft project team
- the CERFAV trainer team

Equipment

- Haptic tools from WP4
- CERFAV technical platforms, in particular the hot workshop and the FabLab
- Premises CERFAV

Duration, dates, pace, and organisation (see simplified planning).

6 Sequence

6.1 Formative aims of the sequence

- Propose a new method of learning glassmaking techniques to be mastered as part of a personal project, using Craeft digital tools.
- Appropriation of the use of Craeft digital aids.
- Acquisition of 5/10 essential basic concepts in HSE, TG and DT, which are essential for use in the workshops.

6.2 Duration, dates, organisation

The Craeft project experiment will be carried out during part of the time devoted to personal projects of learners in the second-year apprentices' timetable.

The cluster periods will condition the experimentation times linked to the Craeft project. (see simplified planning).

- June 2024, last grouping of 1st year apprentices, future 2nd year.
- September, October/November 2024, 2nd year of apprenticeship

6.3 Assessment criteria of learners

Information detailed in the assessments section of this document, learners' assessment criteria.

6.4 Overall description of assessment situations

Assessment situations may be based on the assessment of knowledge, know-how or interpersonal skills. These skills can be grouped and assessed within an activity. The assessments may be differentiated according to the T or TA group.

6.4.1 Assessment of knowledge

Group T	Group TA
paper/e-learning CERFAV platform	e-learning Craeft platform (CLT)

Figure 26: Assessment of knowledge items based on groups

6.4.2 Assessment of know-how

Group T	Group TA
Workshop situations	Workshop situations
	Virtual situation in Apprentices Studio

Figure 27 Assessment of know-how items based on groups

6.4.3 Assessment of interpersonal skills

Group T	Group TA
paper/e-learning CERFAV platform	e-learning Craeft platform (CLT)

Workshop situations	Workshop situations
	Virtual situation in Apprentices Studio

Figure 28: Assessment of interpersonal skills items based on groups

6.5 Contents of the sequence

6.5.1 Activities:

- A1 - Prepare
- A2 - Implement
- A3 - Ensure maintenance
- A4 - Inspect and ensure quality
- A5 - communicate

6.5.2 Educational progression table for the "developing a glassblowing craft project" sequence

list of sessions	content of the session	Activities involved
Presentation of the Craeft project / Choice of group cluster N° 6 Apprentices 1st year - 4 hours	Present the Craeft project to apprentices at the end of their first year to identify those interested in the project and to define the T and TA groups.	
Discovery of Craeft Studio platform tools. cluster N° 7 Apprentices 2nd year - 2 days	Information and knowledge required to use the Craeft Studio platform training in the use of Craeft Studio	A1
Create and develop your glassblowing project using the tools on the Craeft Studio platform cluster N°7, N° 8 Apprentices 2nd year - 2 + 2 days	Use of CLT, Design Studio and Apprentices Studio applications to support project and skills development. More focused on the Design Studio.	A1+, A2-, A3, A4, A5
Create and develop your glassblowing project using the tools on the Craeft Studio platform cluster N°8 Apprentices 2nd year - 2.5 days	Use of CLT, Design Studio and Apprentices Studio applications to support project and skills development. More focused on Apprentices Studio.	A1-, A2+, A3, A4, A5
Hygiene, safety, environment (HSE) - 1 hour Student grouping N° 7	Risks and Hazards in a glassblowing workshop. Personal protective equipment Postures Moving around the workshop	A1, A2, A4
Technology - 4 hours Student grouping N° 7, 8, 9	The composition of glass (material) Glassblowing tools (tools) Furnaces (machines)	A1, A2, A3, A4, A5
Technical drawing - from 1 to 2 hours Student grouping N° 7, 9	Know-how to read a technical drawing to be able to carry out the application (CPC technical file)	A1, A2, A4, A5

Figure 29: Educational progression table glassblowing sequence

6.5.3 Table showing the relationship between activities and skills linked to the CPC referential and Craeft tools.

Professional activities	Skills	Craeft Tools

				CLT	DS	AS	W
A1	Preparation	C1	Get informed	■			
		C2	Prepare	■	■	■	■
		C4	Ensuring maintenance	■		■	■
		C6	Communicate	■	■		■
		C7	Comply with health, safety and environmental rules.	■			■
A2	Implementation	C3	Implement		■	■	■
		C5	Inspect	■	■	■	■
		C4	Ensuring maintenance	■		■	■
		C6	Communicate	■	■		■
		C7	Comply with health, safety and environmental rules.	■			■
A3	Maintenance	C4	Ensuring maintenance	■		■	■
		C5	Inspect	■		■	■
		C6	Communicate	■			■
		C7	Comply with health, safety and environmental rules.	■			■
A4	Inspection/quality	C5	Inspect	■	■	■	■
		C6	Communicate	■	■		■
		C7	Comply with health, safety and environmental rules.	■			■
A5	Communication	C6	Communicate	■	■		■

Figure 30 Table of glassblowing skills and Craeft tools

CTL: Craeft e-learning platform
DS: Design Studio
AS: Apprentices Studio
W: Workshop

7 Session 1a: presentation of the Craeft project / Choice of group

cluster N°6 - June 2024

7.1 Educational aims

Present the Craeft project to apprentices at the end of their first year to identify those interested in the project and to define the T and TA groups.

7.2 Operational educational objective

- Observable behaviour: Knowing and understanding the Craeft project
- Implementation conditions: PowerPoint presentation of the Craeft project
- Performance criteria: be able to give back 4 of the 5 key concepts of the project

7.3- Requirements:

Without

7.4 Assessment of apprentices

With a quiz

7.5 Assessment of the project

To justify membership in each of the T or TA groups

8 Session 1b: workshop on Craeft tools - cluster N°6 - June 2024

8.1 Educational aims

Presentation of the learning scenarios to the TA group and discussion of expectations. "What can I do with the Craeft tools? How do I want to use them, make them mine, my proposals?"

8.2 Educational objective

- Observable behaviour: formulate ideas, suggestions, expectations, fears and solutions relating to the Craeft project.
- Implementation conditions: creative workshop, ideation, production of suggestions formalised in a final document.

8.3 Educational method

Active, project-based learning

8.4 Presumed difficulties a priori and learning aids and remedies

Suspected difficulties	**Remedying**
Membership	Highlighting the benefits of the Craeft project
Motivation	Interactive exchange, attention to questions about the project.
Ensuring understanding	Reformulating and getting others to reformulate - quiz

Figure 31: Presumed difficulties for session 1b

8.5 Pedagogical aids (Educational materials)

- PowerPoint presentation
- summary document
- quiz

8.6 Materials

- board and felt
- video projector
- summary documents

8.7 Motivation

- clarity of purpose
- involvement of participants

8.8 Detailed educational scenario for session 1: presentation of the Craeft project and workshop on Craeft tools

sequence	Timing	title of parts	aims	Contents	method and methodology	tools	comments
Morning: 4 hours - start at 8.00 a.m. - presentation of the Craeft project							
	10 min	Launch & contextualisation.	Welcome and confidence-building		Face-to-face group facilitation		
	20 min	Presentation of the Craeft project	Provide the necessary information so that apprentices can choose their group.	• the project, the context • the proposed tools • the proposed experiment	Affirmative teaching method	PowerPoint presentation (video projector)	
	5 min	Quick feedback	Creating a cognitive break and involvement	Questioning the initial perception of the Craeft project	Question-based formative method	Questioning	
	30 min	Discovery of Craeft tools	Discovery of Craeft tools	• CLT • Design Studio • Apprentices Studio	Active method	Demonstrating and testing platforms	
	20 min	Round the table	Discussions about the project, questions, interests, expectations, etc.	Presentation: • personal • of their project • expectation of Craeft tools	Active method	Note-taking in brainstorming mode, mind map, (felts & board)	

sequence	Timing	title of parts	aims	Contents	method and methodology	tools	comments
	10 min	Quiz	Check understanding and representation of the project.	"The five key concepts you remember"	Individual activity	Quiz on paper or online on CLT.	MCQ-type questionnaire or open questions?
	25 min	Choice of groups	Collection of enrolments and non-enrolments, definition of T and TA groups.	• Benefits and commitments • Collecting membership		Powerpoint slide - the commitment (on paper)	
Pause 10 min - Workshop on Craeft tools							
	5 min	Workshop presentation	Define the aims - Involving learners in the Craeft project		Question-based formative method	(board and markers)	
	15 min	What we'll be thinking about	Define the main themes.	• "What can I do with the Craeft tools?" • "How can I use them and make them my own?" • "My suggestions"	Question-based formative method	Suggested ideas + brainstorming, mind map (board, felt)	
	40 min	Brainstorming in a subgroup	Develop the selected themes		Active method	Helping frame for ideation (paper, pencil, felt)	
	30 min	Return to the full group	Select the key ideas that stand out.		Question-based formative method, working group	Display, oral presentation. (scotch tape)	

sequence	Timing	title of parts	aims	Contents	method and methodology	tools	comments
	15 min	Putting ideas into perspective	Present the next sessions - the programme for 2024-2025. (Situate the learner in this curriculum, maintain motivation)		Face-to-face group facilitation		
	5min. Closure						

Figure 32- Detailed educational scenario for session 1b

9 Session 2: discovery of Craft platform tools

cluster N°7 - September (1 or 2 days)

9.1 Educational aims

Discovering together with learners the Craeft Authoring Platform, CLT, Design Studio, Apprentices Studio, Craeft Studio. The aim is for learners to make these tools their own.

9.2 Project aims

Collecting the first feelings and suggestions about the contents and usage of the Craeft platform.

9.3 Operational educational objective

- Observable behaviour: using the Craeft tools autonomously
- Implementation conditions: with the digital tools offered by Craeft Authoring Platform
- Performance criteria: use the tools autonomously. (without major assistance from the trainer(s))

9.4 Requirements:

- to be a member of the TA Group
- have attended the Craeft project presentation session

9.5 Assessment of apprentices:

Self-assessment, co-construction with guidance from the trainer.

Learner assessment criteria:

- "I can navigate the Craeft Authoring Platform tree"
- “I can navigate the CLT tree”
- "I can follow the CLT courses without major intervention from the trainer”
- "I can use the Design Studio modeler"
- "I can export my model for 3d printing/vinyl cutting/wood cutting (blow mould)”
- "I can export a production plan” (technical communication - technical drawing)
- "I can use haptic interfaces with Apprentices Studio”
- "I'm able to navigate Apprentices Studio simulations"

9.6 Assessment of the project:

Information is detailed in the assessments section of this document.

9.7 Educational method

Active, project-based learning

9.8 Presumed difficulties a priori and learning aids and a remedying

Suspected difficulties	Remedying
Ensuring understanding	user guide
Appropriating the tools	doing-with / demonstration

Figure 33: Presumed difficulties for session 2

9.9 Pedagogical aids (Educational materials)

- Craeft Platform
- PowerPoint presentation
- User guide

9.10 Materials

- PC
- VR headsets, haptic and non-haptic controllers
- Video projector
- Fab Lab

9.11 Motivation (create, maintain, develop)

- Knowledge of upstream tools
- Involvement of participants

9.11 Detailed educational scenario for session 2: discovery of Craeft platform tools

sequence	Timing	title of parts	aims	Contents	method and methodology	tools	comments
Day 7h - start at 8.00 a.m.							
Discovery of Craeft e-Learning Platform (CLT)							
	10 min	Launch & contextualisation.	Welcome and confidence-building		Face-to-face group facilitation		ensure cohesion
	20 min	Presentation of CLT	Provide essential guidelines for the use of CLT	• CLT interface • logic of use • sample of courses	Presentation and demo	Video projector + PC + Craeft Studio	
	1h 20 min	Experimenting with CLT	Experimenting with and adopting the tool	CLT courses	Independent use by learners + instructor presence	PC + Craeft Studio	
	10 min	CLT assessment learner and project	ensure understanding and adoption. Collect data to evaluate the project.	evaluation survey	self-assessment co-construction with guidance from the trainer	assessment questionnaires (paper or electronic)	On-the-spot evaluation of the tools during the session and evaluation at the end of the day.
break - 10 min							
Discovery of Design Studio (DS)							

sequence	Timing	title of parts	aims	Contents	method and methodology	tools	comments
	20 min	DS presentation	Provide essential guidelines for the use of DS	• Interface • logic of use • tools	Presentation and demo	Video projector + PC + Craeft Studio + VR devices	
	1h20	Experimenting with DS	Experimenting with and adopting the tool	DS tools	Independent use by learners + instructor presence	Video projector + PC + Craeft Studio + VR devices	
	10 min	Evaluation DS apprenant & dispositif	ensure understanding and adoption. Collect data to evaluate the project.	evaluation survey	self-assessment co-construction with guidance from the trainer	assessment questionnaires (paper or electronic)	On-the-spot evaluation of the tools during the session and evaluation at the end of the day.
Lunch break - 12.00 noon to 1.00 p.m.							
	5 min	Launch					
	10 min	Round of the table	First impressions of CLT, DS et AS	learners' contribution	Question-based formative method	Mind map - (Felt, board)	informal assessment, taking notes on learners' feedback
Discovery of Apprentices Studio (AS)							
	20 min	AS presentation	Provide essential guidelines for the use of AS	• Interface • logic of use • tools	Presentation and demo	Video projector + PC + Craeft Studio + VR devices	
	1h30	Experimentation AS	Expérimentation et appropriation de l'outil	les outils AS	Usage en autonomie des apprenants + présence formateur/trice	Vidéoprojecteur + PC + Craeft Studio + VR devices	

sequence	Timing	title of parts	aims	Contents	method and methodology	tools	comments
break - 10 min							
	20 min	Assessment of Craeft Studio and global, learners and projects.	ensure understanding and adoption. Collect data to evaluate the project.	evaluation survey	self-assessment co-construction with guidance from the trainer	• assessment questionnaires (paper or electronic)	
	10 min	round of the table	First impression of Craeft tools. Evolution of Craeft Studio image after experimentation.	learners' contribution	Question-based formative method	Mind map - (Felts Board)	informal assessment, taking notes on learners' feedback
	15 min	Putting ideas and concepts into perspective & Closure.	Putting the cluster N°7 and 8 programme into perspective, setting objectives.	• Programme of cluster N° 7 & 8 • set objectives	Face-to-face group facilitation - Question-based formative method	(Felts board)	report on the objectives and survey formulated by the learners.
end of day - 4.00 p.m.							

Figure 34: Detailed educational scenario for session 2

10 Session 3 and 4: create and develop your glassblowing project using the tools on the Craeft Studio platform

cluster N° 7 and 8 - September and November (2 to 4 days)

10.1 Educational aims

Using digital tools to develop a craft project (glassblowing),

through three phases: “get informed”, “modelling my ideas”, “I practice”.

10.2 Operational educational objective

- Observable behaviour: Use the Craeft tools to develop the project.
- Implementation conditions: with the digital tools offered by Craeft Studio.
- Performance criteria: independent use of tools, level of interaction, use and integration of tools in project development.

10.3 Requirements:

- to be a member of the TA Group
- have taken part in the Craeft tools discovery session.

10.4 Assessment of apprentices:

Self-assessment, co-construction with guidance from the trainer.

Learner assessment criteria:

- Choosing the right CLT, DS and AS tools according to the development phases and project development needs.
- Use the CLT, DS and AS tools independently (with assistance and then the presence of the trainer - take into account the level of mastery).

10.5 Assessment of the project:

Information is detailed in the assessments section of this document.

Note: to facilitate the assessment of learners and the project, we will suggest that learners use a project notebook as an educational and assessment aid.

10.6 Educational method:

Active, project-based learning

10.7 Presumed difficulties a priori and learning aids and remedies

Suspected difficulties	Remedying
Ensuring understanding	user guide
Appropriating the tools	doing-with / demonstration
problem solving	listening / thinking-with / doing-with

Figure 35: Presumed difficulties for sessions 3 and 4

10.8 Pedagogical aids (Educational materials)

- Craeft platform
- user guide

10.9 Materials

- PC
- VR headsets, haptic and non-haptic controllers
- video projector
- Fab Lab

10.10 Motivation (create, maintain, develop)

- involvement of participants
- provide support in the event of difficulties in using the tools.

10.11 Detailed educational scenario for sessions 3 and 4: Create and develop your glassblowing project using the tools on the Craeft platform

sequence	Timing	title of parts	aims	Contents	method and methodology	tools	comments
Day 7h - start at 8.00 a.m.							
	5 min	Launch & contextualisation.	• Welcome and confidence-building • Remember the objectives set in the previous session	Objectives set during the previous session	Face-to-face group facilitation	notes/minutes "discovering the tools on the Craeft platform" session project notebook	ensure cohesion
	20 min	Project status	• Discussing and sharing projects • Identifying and addressing issues • Presentation of individual objectives	Learners' contribution	Question-based formative method	round of the table	maintain motivation
	3h30	**Work on the project using Craft tools.**	• **Experimenting with and adopting tools** • **Developing a personal project using Craeft tools.**	• **Mainly centred on DS and AS** • **Minus on CLT**	**Project mode. Independent use by learners + instructor presence**	**Video projector + PC + Craeft Studio + VR devices**	
	5 min	Closure					
Lunch break - 12.00 noon to 1.00 p.m.							
	2h20	**Work on the project using Craft tools.**	• **Experimenting with and adopting tools**	• **Mainly centred on DS and AS** • **Minus on CLT**	**Project mode** -	**Video projector + PC + Craeft Studio + VR devices**	

sequence	Timing	title of parts	aims	Contents	method and methodology	tools	comments
			• **Developing a personal project using Craeft tools.**		Independent use by learners + instructor presence		
	10 min	Round of the table	Experience and representation of learners for craft tools.	learners' contribution	question-based formative method	Mind map - (Felts Board)	informal assessment, taking notes on learners' feedback
	15min.	Assessment of Craeft Studio and global, learners and projects.	Ensure that the tools are appropriate and understand how they interact with project development. Collect project evaluation data.	evaluation survey	self-assessment co-construction with guidance from the trainer	• assessment questionnaires (paper or electronic)	
	15 min	Putting ideas and concepts into perspective & Closure.	Putting the cluster N°8 programme into perspective, setting objectives. (cluster N°7) or conclusion (cluster N°8)	• Programme of next cluster • Set objectives • (cluster 7) • Conclude • (cluster 8)	Face-to-face group facilitation - Question-based formative method	(Felts board)	report on the objectives and survey formulated by the learners.
end of day - 4.00 p.m.							

Figure 36: Detailed educational scenario for sessions 3 and 4

11 Cross-cutting sessions

11.1 Technology, HSE, technical communication (technical drawing)

11.1.1 Note on sessions' organisation:

Since learner project time is more about modelling and training, the problem is to "find" time for the Craeft e-learning platform (CLT).

The idea is to be able to use the time of the Technology, Health / Safety / Environment and Technical Communication (technical drawing) courses to have a common core for each session with the T and TA groups and an hour at the end of the session where the T group follows the course in the traditional way and the TA group via the CLT.

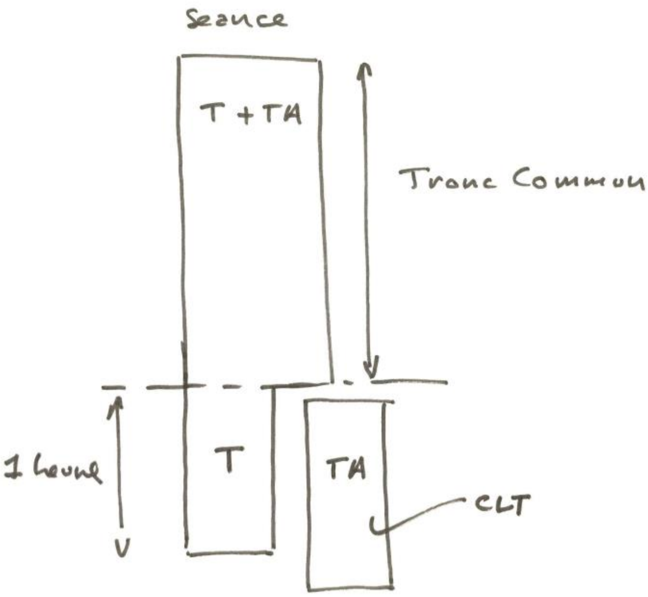


Figure 37 Organisation of sessions on cross-cutting themes

11.1.2 Educational aims

Acquire the basic concepts that are essential and a prerequisite for working in the workshop. The aim is to ensure that those concepts are known and applied.

11.1.3 Operational educational objective

- Observable behaviour: know from 5 to 10 essential concepts for each subject.
- Implementation conditions: using CLT
- Performance criteria: the concepts can be reproduced without error in different contexts (CLT, AS, workshops).

11.1.4 Requirements:

- to be a member of the TA Group

11.1.5 Assessment of apprentices:

Quizzes, video quizzes, case studies, virtual or real-life situations.

11.1.6 Educational method

Semi-active, active

11.1.7 Presumed difficulties a priori and learning aids and remedies

Suspected difficulties	Remedying
• Interest, sense of acquisitions	• Don't relearn a concept you've already learned => preliminary quiz
• ensure the understand	• User guide • Trainer presence
• Maintain motivation	• Exchanges with peers

Figure 38: Presumed difficulties for sessions 3 and 4

11.1.8 Pedagogical aids (Educational materials)

- Craeft e-learning platform
- User guide

11.1.9 Materials

- PC

11.1.10 Motivation (create, maintain, develop)

- Ensuring that learning is meaningful - (avoiding the pitfall of being too academic, learning for learning's sake, linking knowledge to a reality, a need, an obligation in the field)
- Pay attention to the learning method and educational tools (plan adaptations)

11.1.11 Detailed educational scenario: cross-cutting sessions - first session

Detailed educational scenario: **cross-cutting sessions – first session**

sequence	timing	title of parts	aims	contents	method and methodology	tools	comments
1 hour							
cross-cutting session 1							
	5 min	Launch & contextualisation.	confidence-building		Face-to-face group facilitation		
	15 min	reminder of CLT usage	Make sure learners are familiar with the tool	• CLT Interface • logic of use	questioning/demonstration	PC + Craeft Studio	Motivation: to ensure that the tool is easily used
	3 min	Objective	Acquisition of a cross-curricular concept/skill	depending on the subject studied	Self-training on CLT	PC + Craeft Studio	Trainer presence
	15 min	learning session/acquisition of concepts					
	7 min	Learner assessment: quiz, etc. (on CLT)					
	5 min	Assessment of CLT tools	Collect data to evaluate the project.	• evaluation survey		• Assessment questionnaires (paper or electronic)	

sequence	**timing**	**title of parts**	**aims**	**contents**	**method and methodology**	**tools**	**comments**
	5 min	Round of the table	Feeling on the use of CLT	• learners' contribution	Question-based formative method		Taking notes for the project report
	5 min	Putting ideas and concepts into perspective & Closure.	Set objectives for the next session.	programme of the next session	Face-to-face group facilitation	felts and board	

Figure 39: Detailed educational scenario for cross-cutting themes - first session

Detailed educational scenario: **cross-cutting sessions - following sessions**

sequence	**timing**	**title of parts**	**aims**	**contents**	**method and methodology**	**tools**	**comments**
1 hour							
cross-cutting session							
	5 min	Launch & contextualisation.	confidence-building		Face-to-face group facilitation		
	3 min	Objective	Acquisition of a cross-curricular concept/skill	depending on the subject studied	Self-training on CLT	PC + Craeft Studio	Trainer presence
	30 min	learning session/acquisition of concepts					

sequence	timing	title of parts	aims	contents	method and methodology	tools	comments
	5 min	Learner assessment: quiz, etc. (on CLT)					
	7 min	Assessment of CLT tools	Collect data to evaluate the project.	• evaluation survey		• Assessment questionnaires (paper or electronic)	
	5 min	Round of the table	Feeling on the use of CLT	• learners' contribution	Question-based formative method		Taking notes for the project report
	5 min	Putting ideas and concepts into perspective & Closure.	Set objectives for the next session.	program of the next session	Face-to-face group facilitation	felts and board	

Figure 40 Detailed educational scenario for cross-cutting themes - following sessions

12 Glossary

12.1 Educational terms

Term	Definition	Example
activity	A cluster of skills enabling a field of activity related to a trade to be carried out	in sales: • selling and advising customers • managing a sales area
skill	be able to carry out a task with given resources in a given context.	• manage a stock • blowing a cup in a mould
capability	be able to carry out an elementary task forming part of a skill	• gathering glass • prepare a gob • blow into the mould
assessment	A test used to validate the acquisition of an ability, skill or activity.	
formative assessment	is used to validate the learning progression by checking whether or not the ability or skill has been acquired. If the skill has not been acquired, remedial action is taken.	• test at the end of a course • pop quiz
summative assessment	is used to validate the acquisition of skills and the mastery of an activity during or at the end of curricula. In particular, as part of a certification process. no remedial action.	• mid-course exams • final examination • CPC
remediation remedial action	action taken by the trainer and the learner to identify gaps in the acquisition of a skill and to remedy them.	In the skill of blowing a cup, review and practice preparing the gob.
criteria	transposing qualitative data associated with an ability or skill into quantitative data, to assess success and give a score.	the right temperature => 21°C a successful cup: • filling the mould - y/n • surface trace - y/n • bottom thickness 5 mm, +/- 1mm

Term	**Definition**	**Example**
modality	means and conditions for simulations, assessment, etc.	• paper-based test • test on e-learning platform • role-playing in a workshop
module	corresponds to the acquisition of mastery of an activity	
sequence	corresponds to the acquisition of a skill	
session	corresponds to the acquisition of a capability	
referential	reference document linked to a certification defining the skills to be acquired, the assessment criteria and the examination conditions to guarantee the uniformity of the certification.	
educational approach	inductive or deductive, a choice of principle from which the educational methods will derive.	inductive approach, particular to general => active experiential method => project-based teaching.
educational method	affirmative, interrogative, active, active experiential, the method derives from the approach, and is implemented using tools defined by the educational trends.	deductive approach: • affirmative method • interrogative method inductive approach: • active method • active expérimenter
educational trends	Based on university research, they define educational principles, methods and tools.	• behaviorisme 1920 - 1935 Pavlov / Skinner link with the affirmative method • le constructivisme / socio-constructivisme 1925 - 1960 Piaget / Bandura link with the active method
educational aim	defined the general objectives of a sequence	

Term	**Definition**	**Example**
operational educational objective	defined a precise objective linked to the acquisition of a skill for a session. It contains three axes: • Observable behaviour • Achievement condition • Performance criteria involve assessment.	The learner will be able to: • blow a goblet • in a hot workshop using a mould • 10 cups are put in the annealing oven, complying with the quality criteria defined in the technical file, for 12 attempts.
educational objective	defined a precise objective linked to the acquisition of a skill for a session. It contains two axes: • Observable behaviour • Achievement condition no assessment	The learner will be able to: • blow a goblet • in a hot workshop using a mould
learning progression	acquisition of skills by a learner in relation to the training programme. The concepts of level of mastery of skills, time and speed of acquisition come into play. The markers of learning progress are formative assessments.	
heutagogy	self-directed learning.	I'm taking a MOOC course on plants.
synchronous	learners take part in a training session at the same time, in the same place or in different places.	• Training session in a workshop or classroom. • A distance learning session or a session with some of the learners in the same place and others at a distance, but at the same time.
asynchronous	Learners can access the session at any time from any location.	• E-learning platform • Access to an audio/video recording of a session that took place synchronously.

Figure 41 Glossary table

Annex B1 - Cognitive load theory

Cognitive load is a theory developed by John Sweller (en) and Fred Paas that explains the failures or successes of people primarily in learning activities, but also in problem-solving activities. The cognitive load theory involves the capacity to store information in working memory and the integration of new information. It is useful for teachers and educationalists, and provides them with advice that can easily be applied in learning situations.

Working memory: Working memory can only handle a limited amount of information, between five and nine, depending on the individual.

Mental schema: Although working memory can only process three to nine pieces of data simultaneously, there is apparently no limit to the size of these pieces of data.

types of cognitive load:

- Intrinsic - linked to the task itself
- Extrinsic - linked to the way the information is presented
- Essential - enables knowledge to be transferred to long-term memory; mental schemas should be encouraged.

The effects:

- Split attention effect - dissociation of attention
- Modality effect - the modality with which information is presented
- Redundancy effect - too much redundancy of information leading to dissociation of attention.
- Worked examples effect - demonstration by an expert helps to solve a problem
- Expertise reversal effect - putting something into practice is preferable to repeating the same demonstration.
- Guidance fading effect - adapting guidance to the level of learning, guiding the learner more at first, and gradually letting them become more and more autonomous.
- Element interactivity effect - present information by breaking it down into simple 'bricks' which are then assembled into a mental diagram, rather than presenting complex information straight away.

Source, wikipédia: https://fr.wikipedia.org/wiki/Charge_cognitive

see also: https://www.google.com/url?q=https://theses.hal.science/tel-01735371&sa=D&source=docs&ust=1717665255929821&usg=AOvVaw3FBwOK8j0fJakyNM8Idga_

Annex B2 - Pilot glassblowing *with steel pipe*

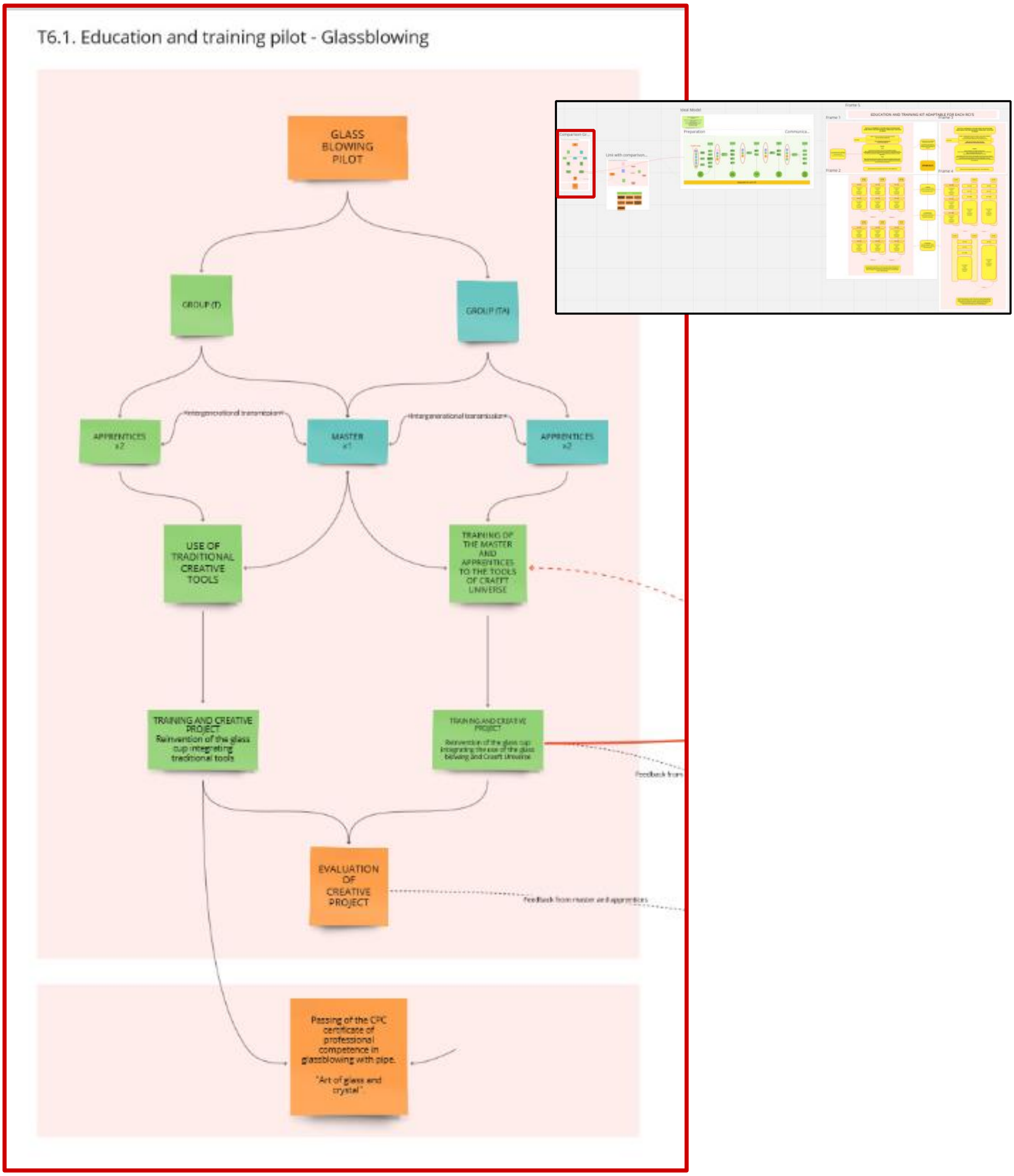


Figure 42 Pilot glassblowing synopsis - board 1

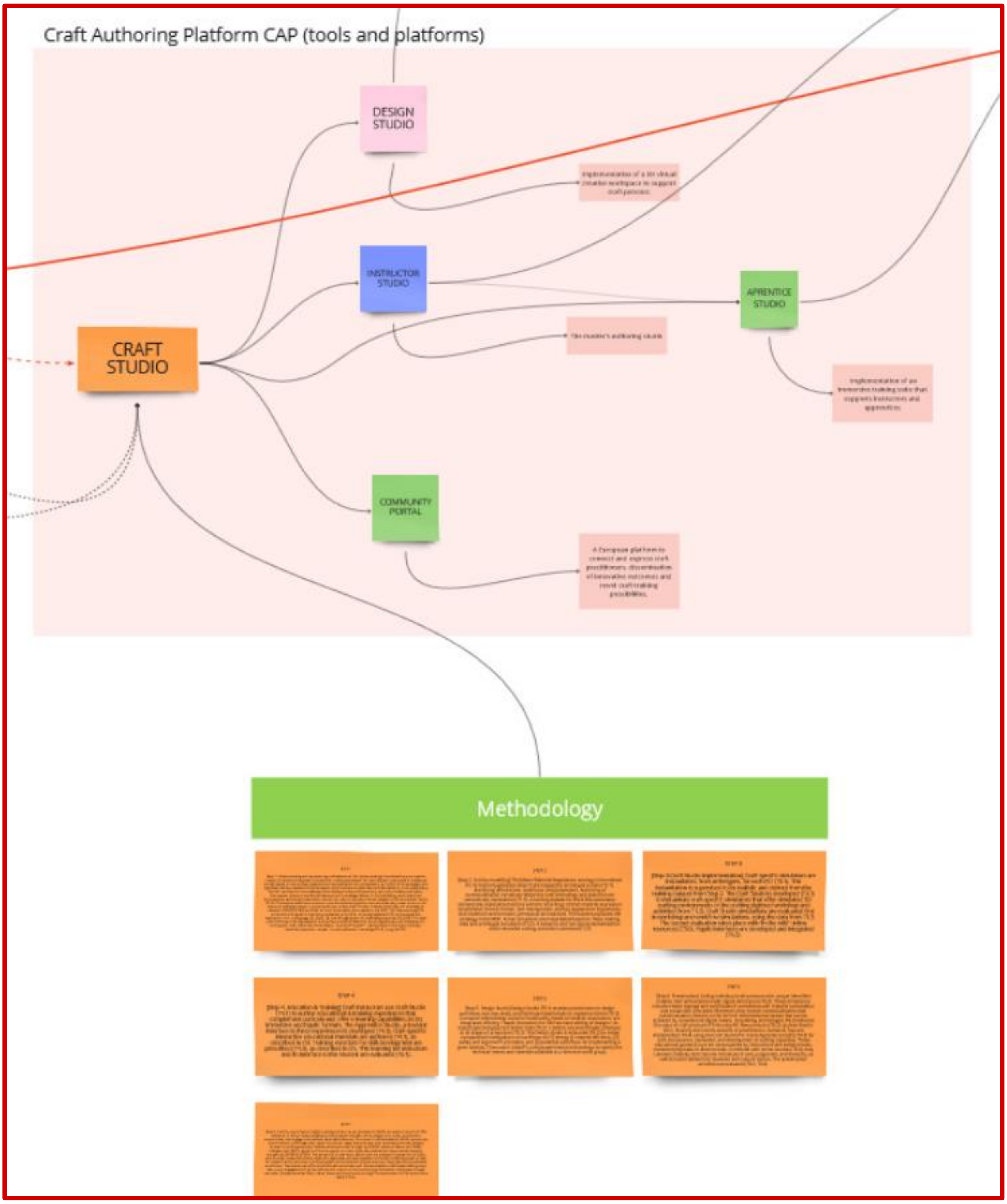
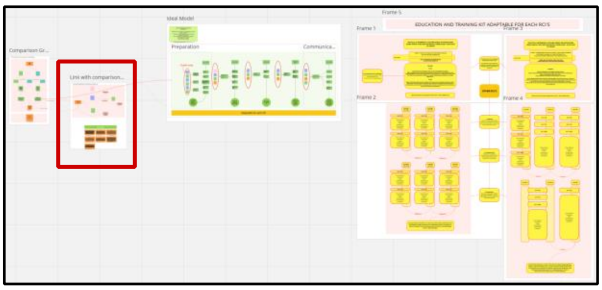
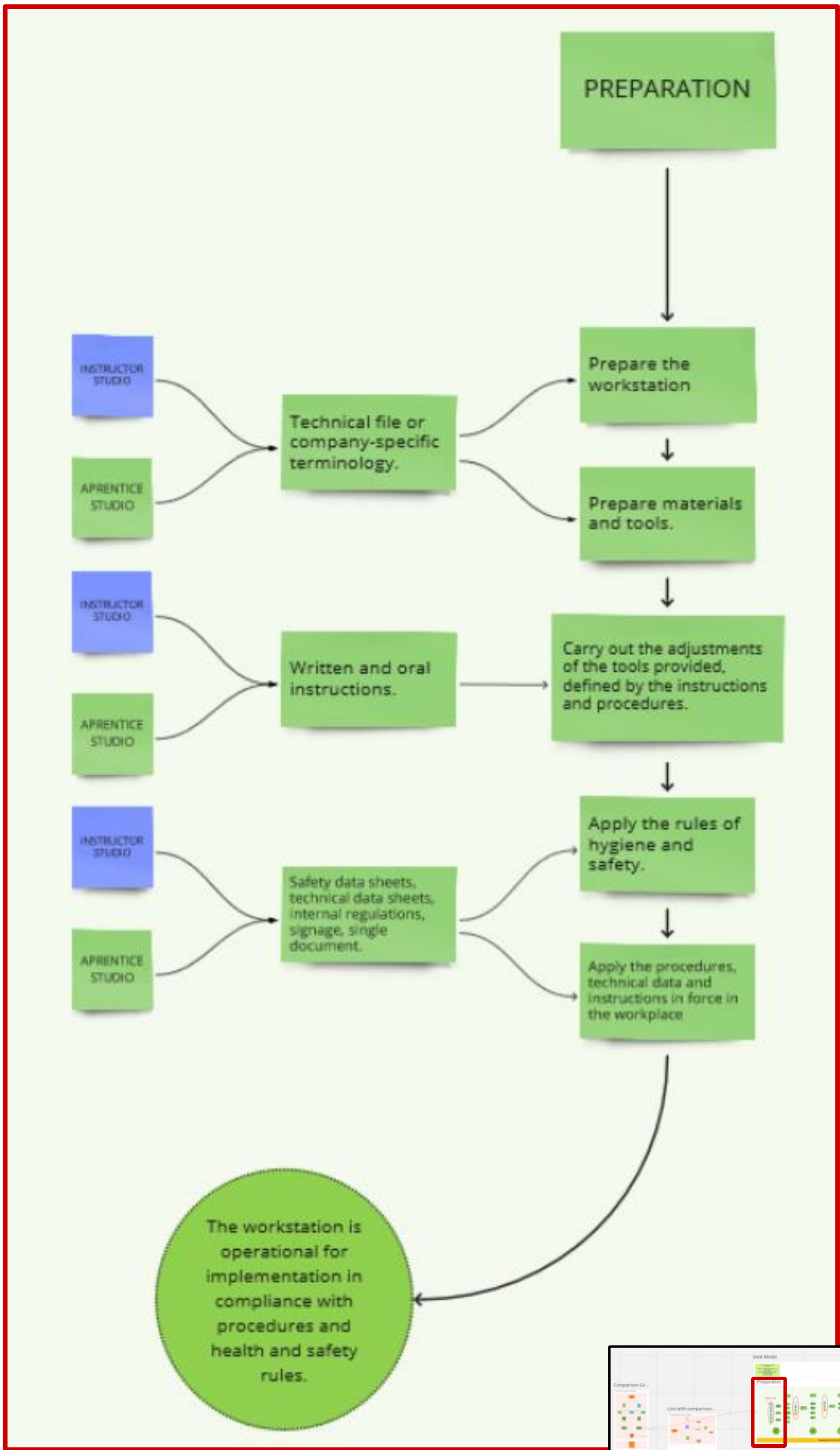


Figure 43 Pilot glassblowing synopsis - board 2





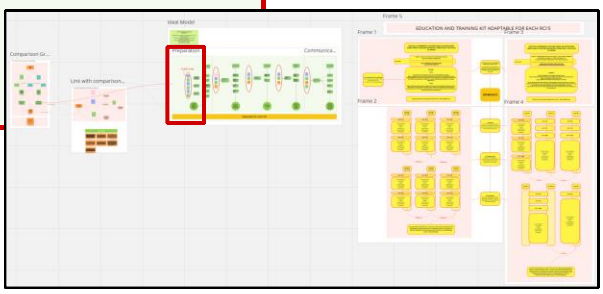


Figure 44 Pilot glassblowing synopsis - board 3

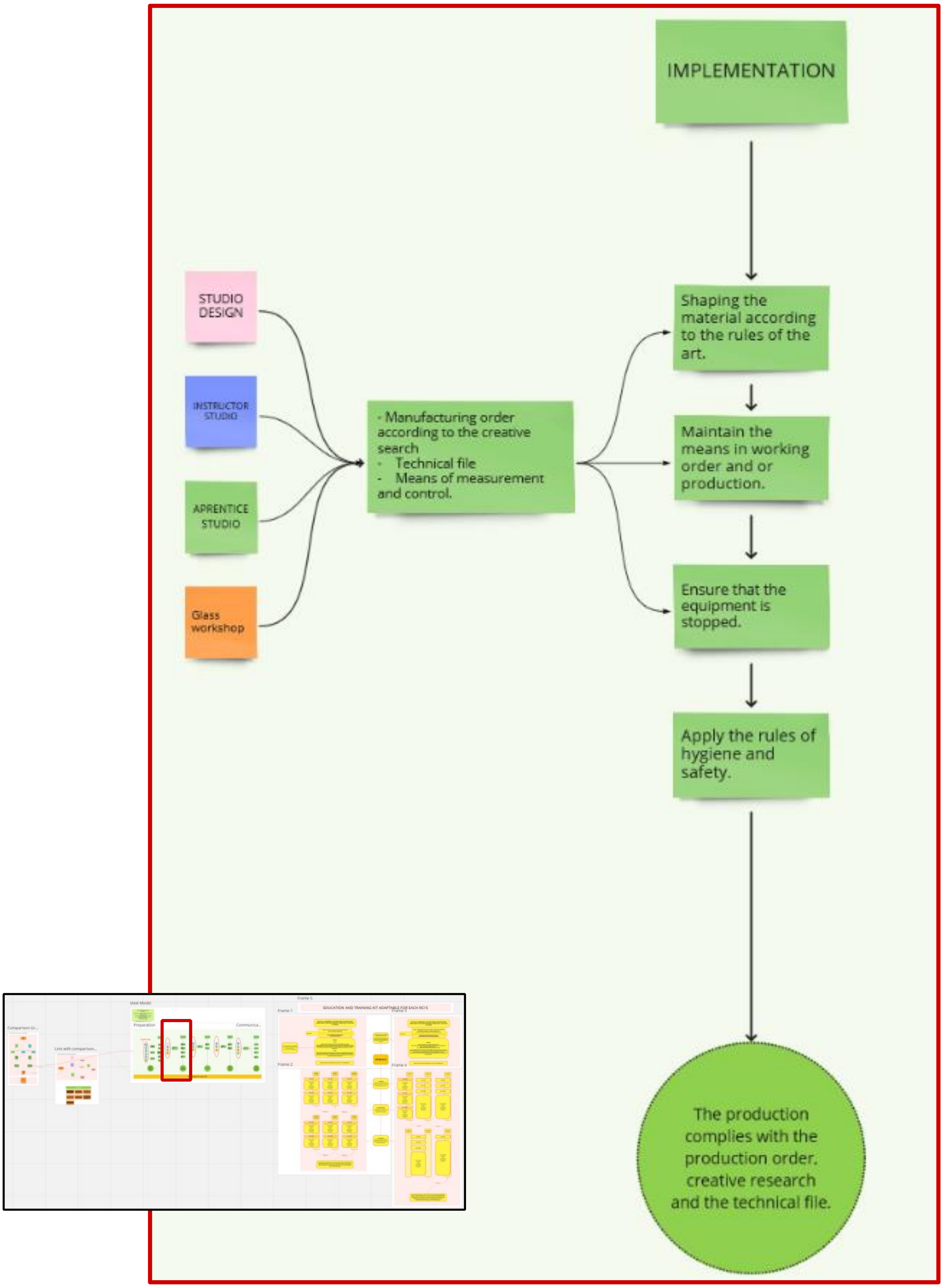


Figure 45 Pilot glassblowing synopsis - board 4

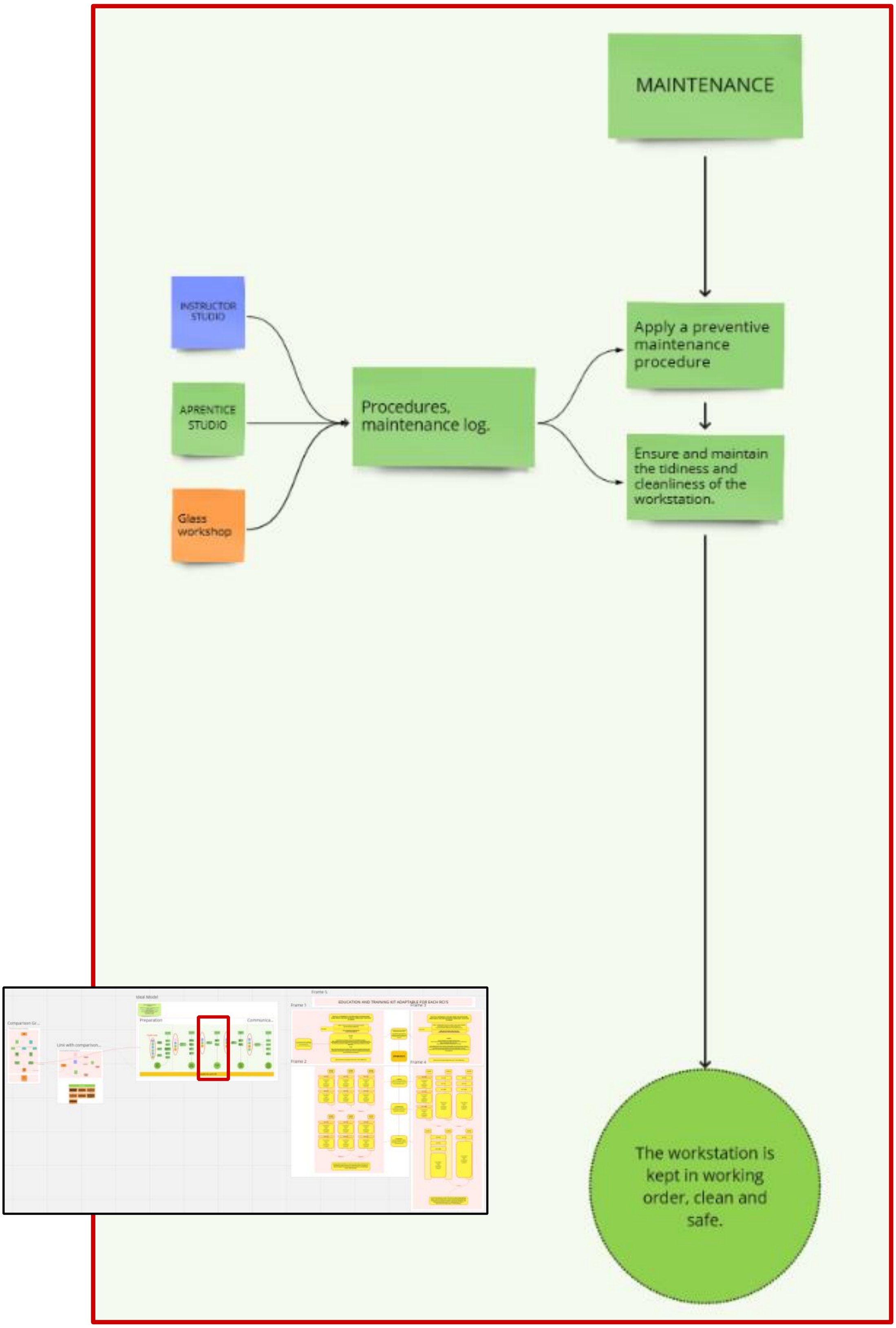


Figure 46 Pilot glassblowing synopsis - board 5

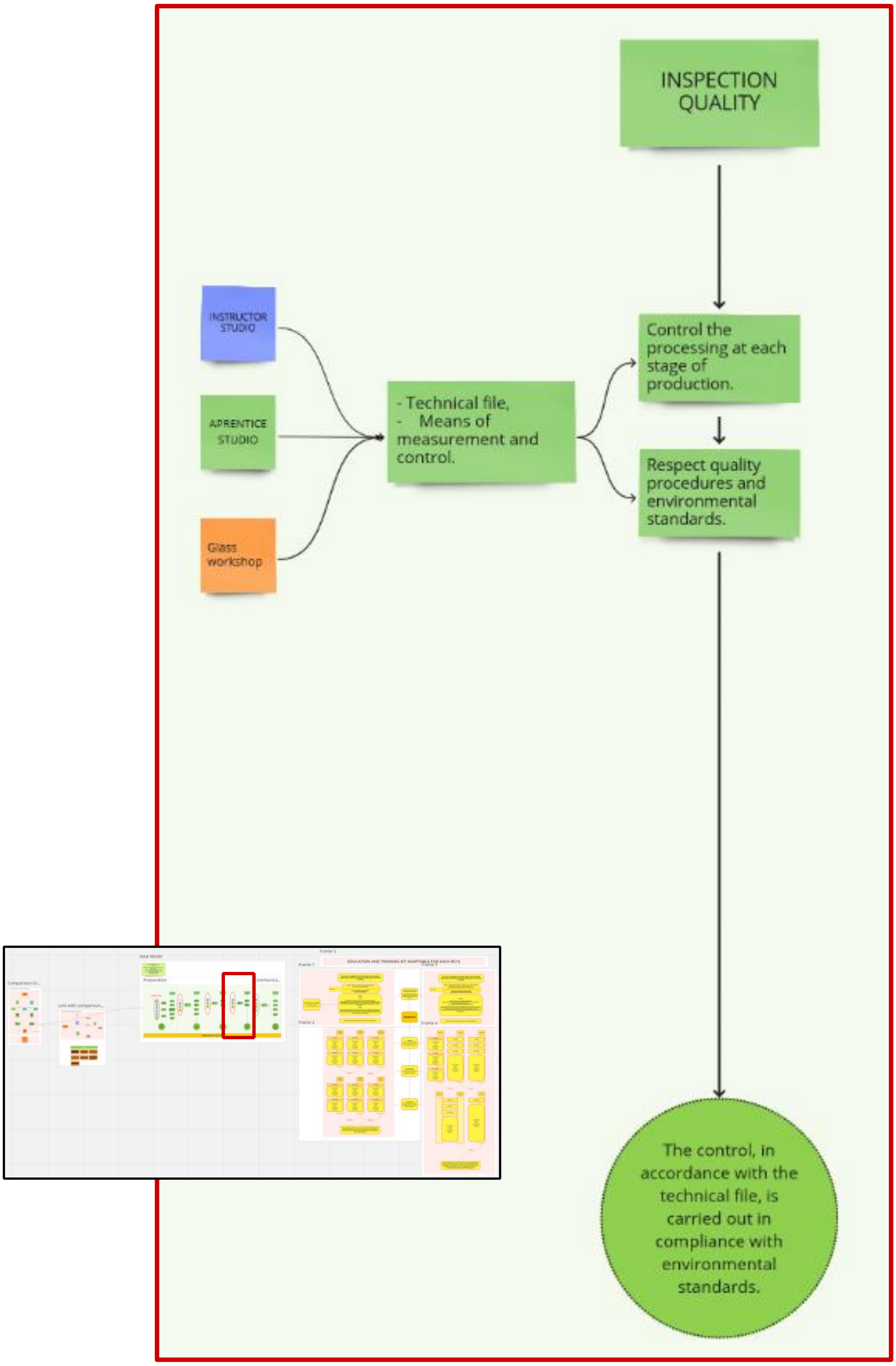


Figure 47 Pilot glassblowing synopsis - board 6

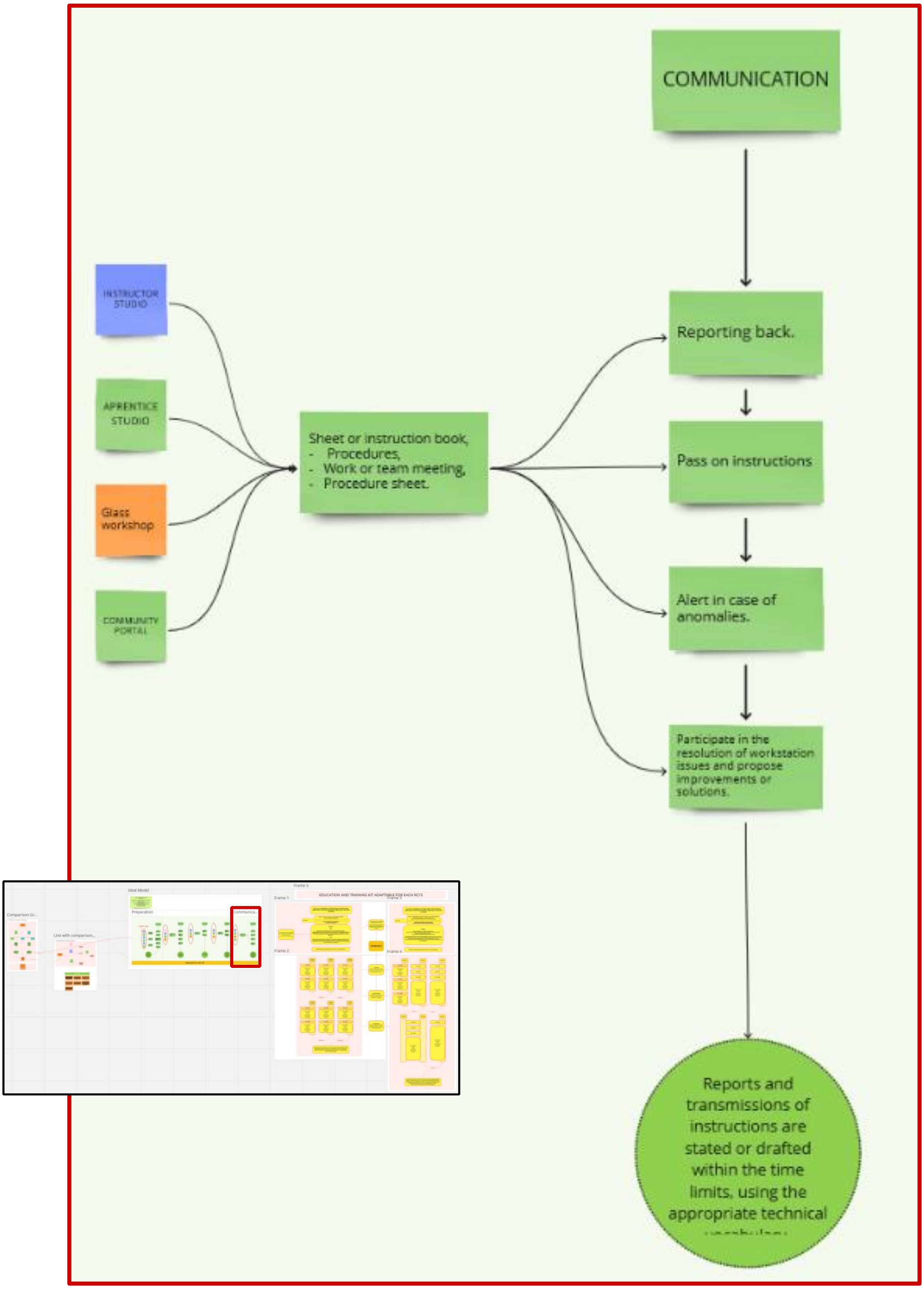
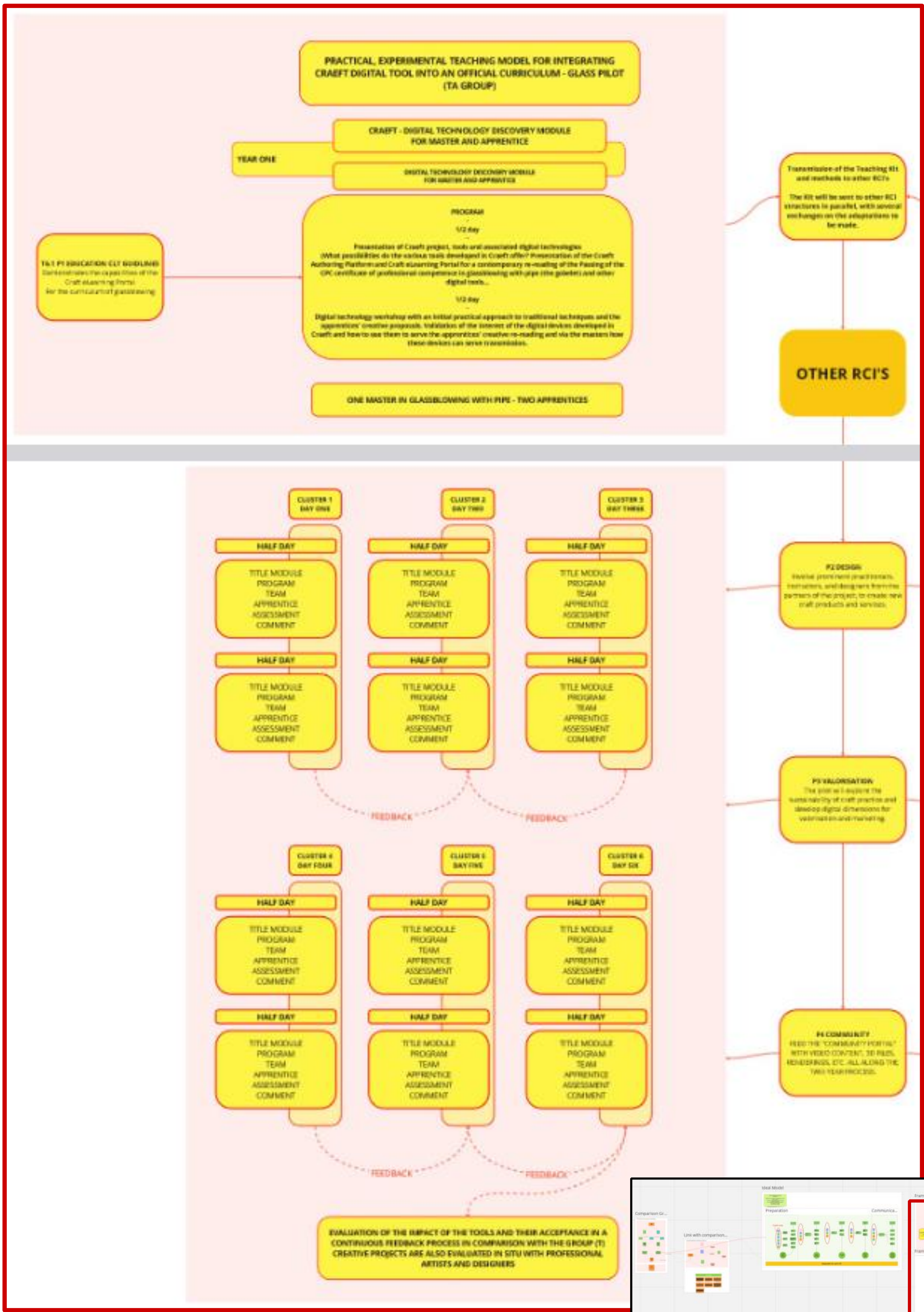


Figure 48 Pilot glassblowing synopsis - board 7



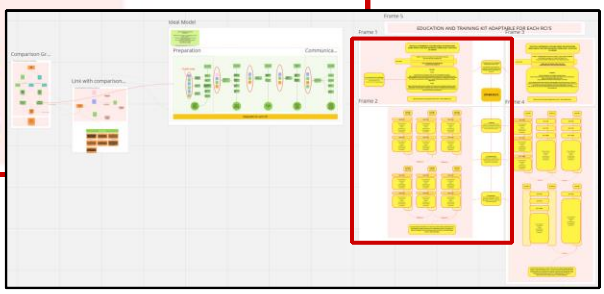


Figure 49 Pilot glassblowing synopsis - board 8

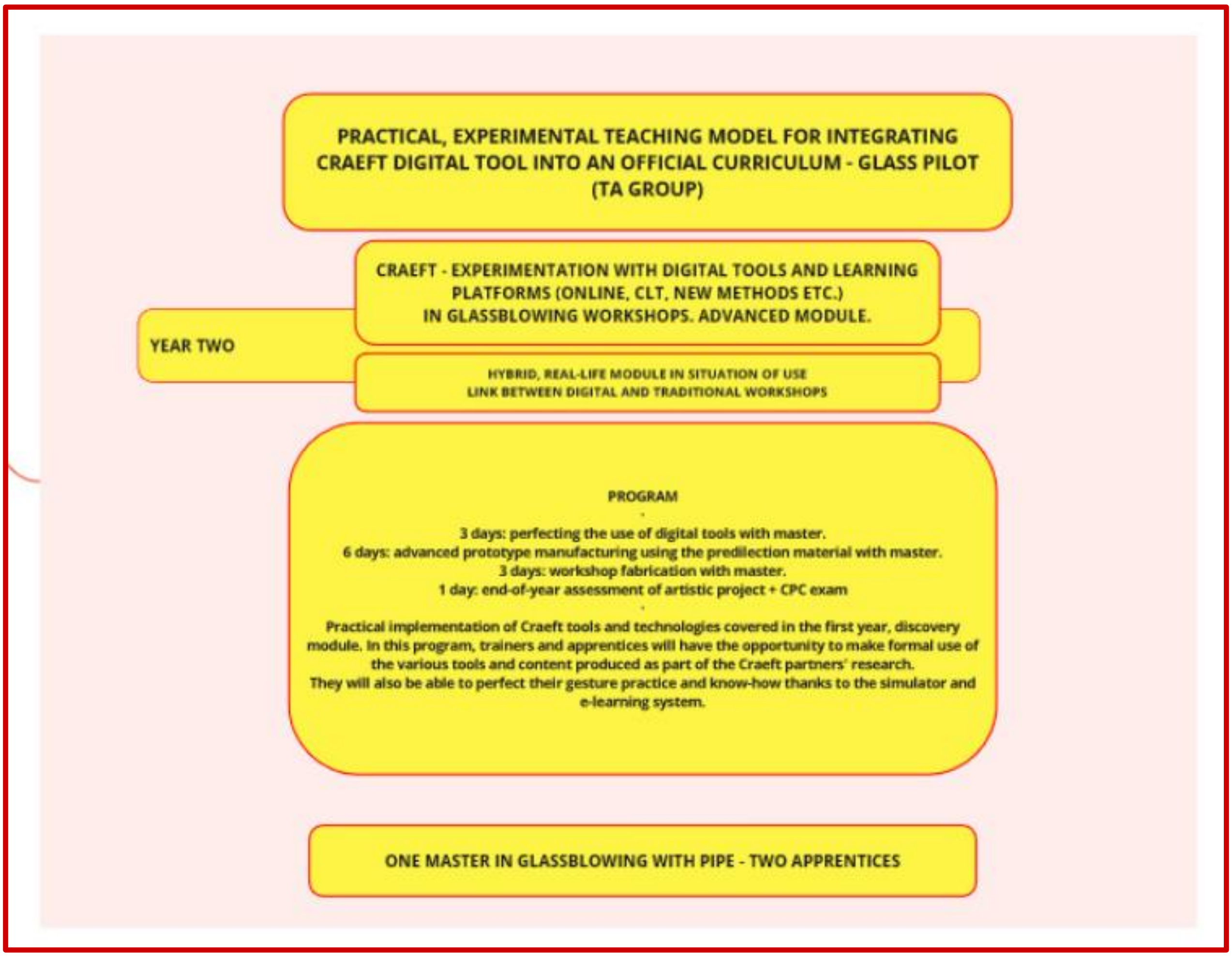
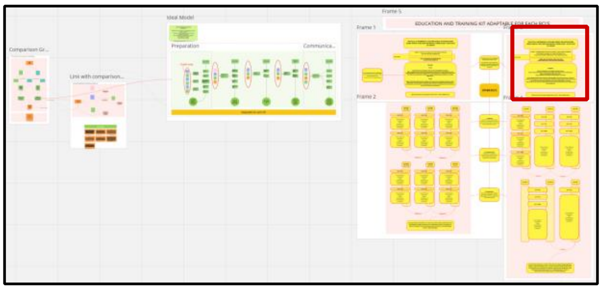


Figure 50 Pilot glassblowing synopsis - board 9



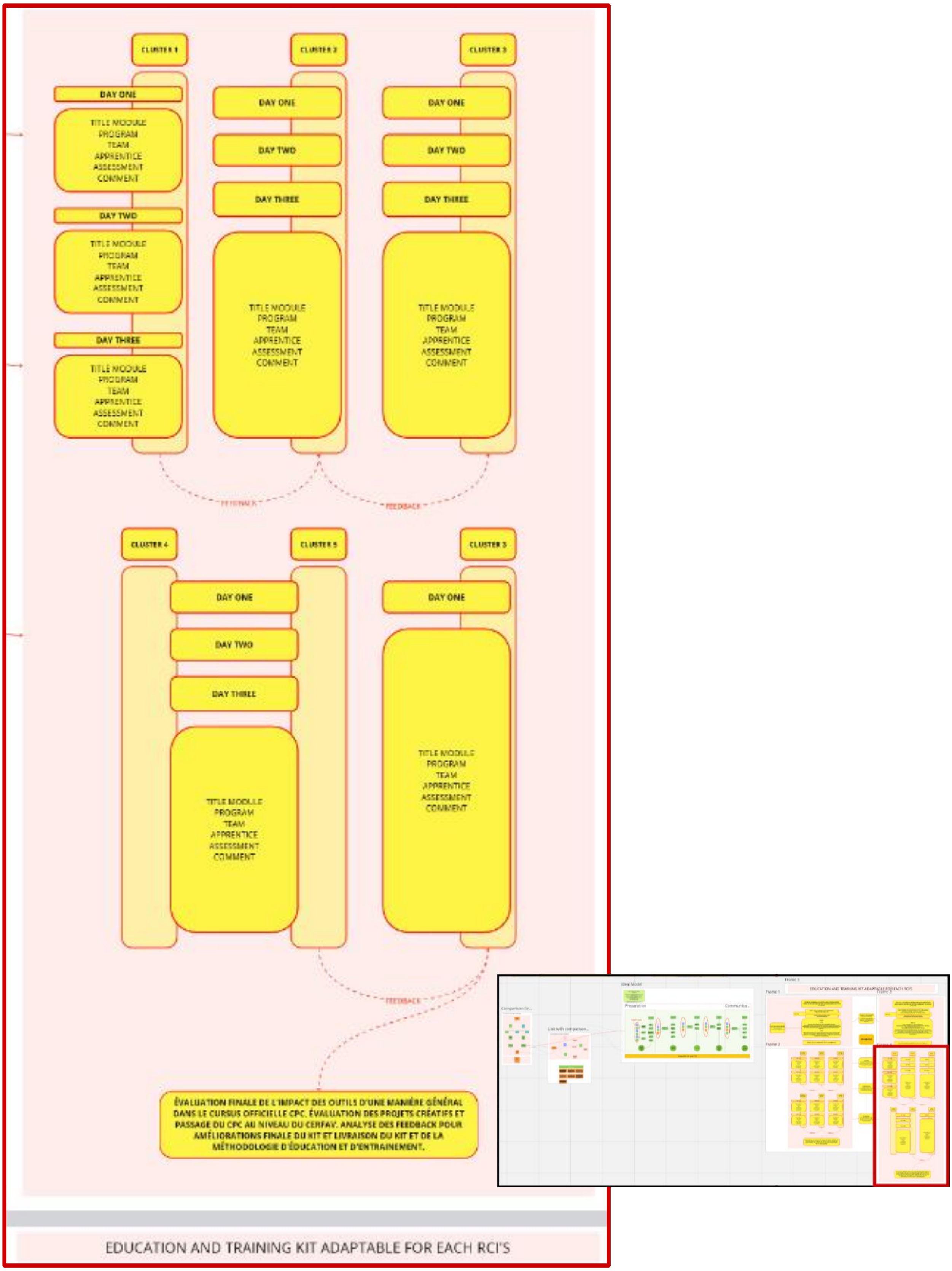


Figure 51 Pilot glassblowing synopsis - board 10

Annex B3 - Glassblower apprentices clusters' programme

first year apprentices

subjects	cluster					
	1	2	3	4	5	6
glass blowing						
Gathering the glass with punty	2 days					
Gathering the glass with blowpipe		2 days				
mold a balloon glass			1+2 days	2 days	2 days	
cross-cutting courses						
HSE	x	x				
Technology		x	x	x	x	
Technical drawing	x	x				
XR discovery		1 day				
FabLab				1,5day		
Project			1 day			1,5 jour

Figure 52 First year apprentices clusters programme

second year apprentices

subjects	clusters					
	7	8	9	10	11	12
glass blowing						
mold a balloon glass	1 day					
mold a gobelet	1 day					
CPC revision		2 days				
CPC revision			1 day		1 day	
CPC revision						x
cross-cutting courses						
HSE	x					
technologie	x	x	x	x		
Dessin technique			x	x		
XR discovery						
FabLab						
Project	4 days	4 days	4 days	4,5 days	3 days	

Figure 53 Second year apprentices clusters programme

Cross-cutting courses

end of project + installation 2 days + project assessment 1

Annex C
Educational kit – Second phase

Methodology to improve the usage scenarios of digital tools

Abstract

This complementary document, to the educational kit in Annex A, covers the basics. It is based on the results 2024 of WP6.1 education and training, and in particular feedback from learners, to propose a methodological approach and optimised usage scenarios with a view to maximising the impact of learning methods combining digital and traditional tools.

Key themes:

- Teaching methodology - a pragmatic, co-constructed approach
- Improved usage scenarios - hybrid mode
- Implementation of the second phase of experimentation

Pragmatic and co-constructed methodology

Pragmatic because the evolution of the initial methodology is based on the experience gained with apprentices and students through the various RCIs. Our proposal capitalises on the strengths while seeking a better response to the expectations of learners and better adaptation to the specific contexts of each RCI.

Co-constructed, because the changes we propose are developed with the trainers and their students. They are also informed by theoretical contributions from research into transmission in general and the technical gesture in particular.

Key themes:

- The importance of the pedagogical objective
- The learning context
- Differentiating between technique and method
- The importance of workshop practice
- The adoption of reflective practice.

The hybrid approach proposes close interaction between traditional and digital teaching tools, decompartmentalisation of methods and precise definition of the roles of the tools to optimise their impact.

Usage scenarios - Hybrid mode

Three typical usage scenarios are described to illustrate the pedagogical path of the hybrid mode, showing how digital tools can be better integrated with traditional methods to enhance learning.

Typical scenarios

- Intermediate educational tools - demonstrators
- Video elicitation
- A museum visit - an example of the interweaving of digital and traditional tools

These typical scenarios form the basis for the development and implementation of each ROI.

Implementation

This section describes the planned deployment of the 2025 experiment for each ROI.

We look at how the impact of digital tools will be assessed. We question the notion of representative samples and their determination, as well as their impact on the results of the evaluation of Craeft digital tools in learning.

These additions aim to refine, strengthen and improve the tools, their uses and the evaluations that will be made of them during the final 2025 experiment for WP6.1 education & training of the Craeft project.

Contents

Table of illustrations

Acronyms definition

CLT	e-learning platform linked to Craeft Studio
AS	Apprentice Studio application, virtual workshop learning
DS	Design studio application, design and 3D/XR modelage.
CS	Craeft Studio application incorporating a virtual training workshop.
CAP	Craeft Authoring Platform, a portal providing access to CLT, DS, AS and Craeft Studio.
XR	extended reality, including virtual reality, mixed reality and augmented reality.
RCI	Representative Craft Instances
CPC	Certificate of Professional Competence - french level 3 certification.
HSE	Health, Safety, Environment
groups T and TA	T - Traditional / TA Traditional Augmented
MOOC	Massive Open Online Courses

Educational Kit - 2025

The 2024 educational kit laid the foundations for experimenting with digital tools in traditional learning, particularly through typical usage scenarios and the method for assessing the impact of digital tools in the transmission of craft trades.

The 2025 educational kit, building on the foundations laid by the 2024 kit, proposes improvements to the scenarios for using digital tools, based on the initial experiment conducted in 2024, in order to optimise the impact and integration of digital tools in traditional learning.

1 Aim reminder

To maximise the impact of learning methods by creating an intelligent hybrid between digital and traditional tools, while preserving the essence of the transmission of knowledge and know-how.

Year two of the 2024 project defined the educational methods and usage scenarios for integrating digital tools into traditional learning.[1] . The final 2025 pilot will build on these foundations and will go further and finer in the integration of digital tools with traditional learning tools through a stronger and closer interweaving between the methods.

This document will present the pedagogical methodology and the scenarios for using digital tools that have been revised in order to achieve this objective.

[1] See version 1 of the teaching pack.

2 A pragmatic methodological approach

Our methodological approach is pragmatic in the sense that we are basing and developing it on the established foundations of the Craeft project and the results of Pilot 1 - 2024, in particular on feedback gathered from learners/students.

2.1 Basis for the construction of the final version of Pilot 1

2.1.1 The Craeft approach

The approach of the Craeft project is to enhance the traditional learning experience by offering multiple learning modes, via digital tools such as e-learning or virtual reality. The alternative modes make it possible to adapt to the specific pedagogical contexts and, in particular, to the constraints and experimental configuration of each RCI.

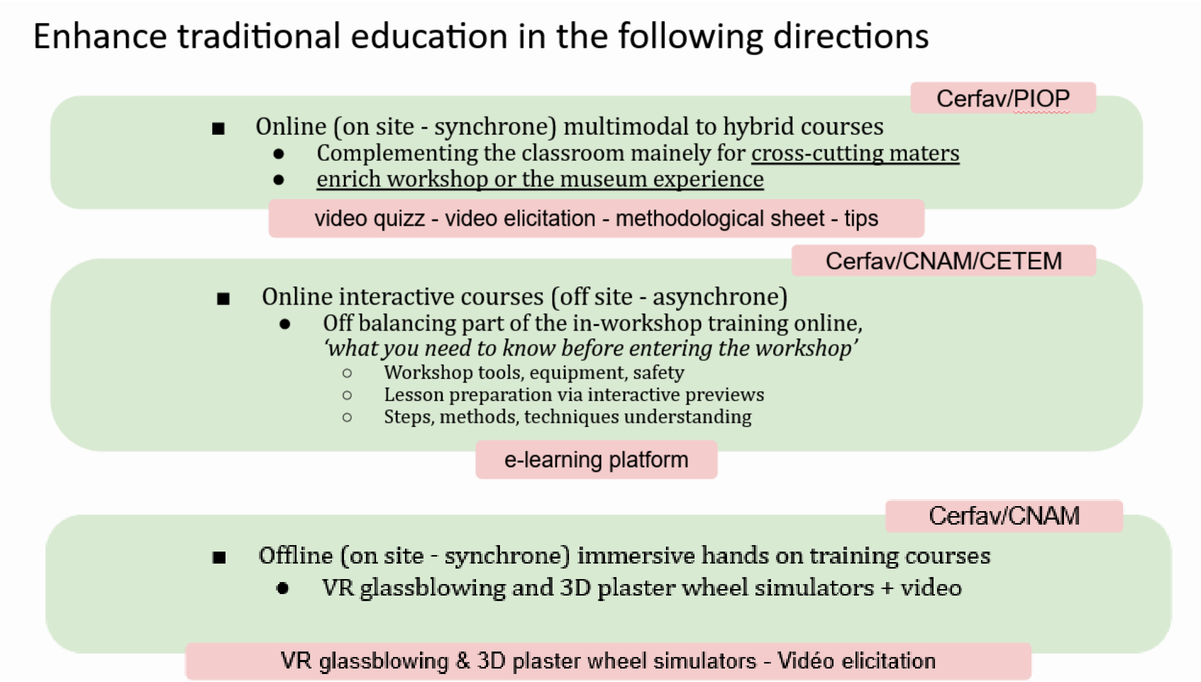


Figure 1 - Craeft approach depending on the context

2.1.2 Results of the Pilot 1 - 2024 experimentation

2.1.2.1 Feedback from apprentices/learners

Four main themes dominate the feedback from the various RCIs:

- Apprentices' pragmatic and mixed approach [and use] of digital and traditional tools
- The desire to maintain a close relationship with the subject matter
- Willingness not to replace workshop practice with digital tools
- Responding to learners' needs

The integration of digital tools into traditional craft learning is viewed positively and offers many opportunities to enrich the learning experience.

> *"However, it is essential to continue to improve and adapt these tools to meet learners' needs and expectations, while maintaining a balance with traditional methods."*[2]

> *"The aim is to develop with learners [and trainers] effective, relevant digital tools that can be integrated into the organisation's learning methods in the long term, to structurally change and sustainably improve the transmission of know-how, through a mixed use of digital tools integrated into workshop practice."*[3]

2.1.2.2 Conclusion from the analysis of learner assessment results

The results of the experimentation in year 2 -2024 of the project lead us to postulate that digital tools do not have any intrinsic impact on learning, and that it is in the methods of implementation that the effectiveness of digital tools lies, in close conjunction with traditional tools and methods.[4]

This brings us closer to the notion of pharmakon[5] , where for each new technology we need to find the right way of using it and the right dose, the right dosage, to make it a remedy and not a poison, through unthinking use.

[2] Extract from D6.1 education & training Y2 - §6 Conclusion - 6.1 General summary
[3] Extract from D6.1 education & training Y2 - §6 Conclusion - 6.2.3 conclusion
[4] (see grouping experimentation report N°10 currently being drafted - analysis of results between groups T and TA for general subjects also presented at the April 2025 plenary session)
[5] Notion taken from Platon and developed by Bernard Stiegler in particular in "*La Technique et le Temps, tome 1: La faute d'Épiméthée*" (1994).

3 Educational Methodology

3.1 Contribution of existing methodological references to the development of the proposed scenarios

In developing the scenarios, we are basing ourselves on the theoretical and methodological contributions of the research cited in the references. This ensures that we build teaching tools based on tried and tested learning mechanisms. It also enables us to check that the scenarios are in line with and mobilise the appropriate acquisition resources.

3.1.1 The importance of the educational aim:

The first thing to remember, and this may seem obvious, is the importance of setting and sharing an educational objective with the learners for each session.

> *"Bernstein saw the human organism as an active system, constantly moving towards a chosen goal".*[6]

This will enable the students to prepare and focus on the movement, the gesture, the action to be learned and acquired.

Although the learning objective can initially be formulated in terms of a general intention, it must then be clarified in terms of an operational learning objective defined in terms of three items:

1. Observable behaviour - being able to + action verb
2. Conditions of achievement - environment, where, with what tools, how long, etc.
3. Performance criteria - what are the qualitative criteria, how are they quantified and at what "score" is the ability/skill considered to have been acquired or mastered. This third item implies an assessment.

Example:

1. Observable behaviour: at the end of the session, the learner will be able to make blow-moulded cups (1 shape).
2. Conditions for carrying out the task: with the help of the technical file, in a hot workshop.
3. Performance criteria:
    a. Choice of tools and equipment - irons, mallets, mould criteria (2 points) :
        i. Adaptation of the shape and dimensions of the tools
    b. Execution of the job - criteria (4 points):
        i. Quantity of glass
        ii. Glass temperature
        iii. Compliance with the axis
        iv. Regularity of thickness
    c. Finished object - criteria (5 points) :

[6] E. Biryukova et B. Bril, *Le geste technique: Réflexions méthodologique et anthropologiques, Bernstein et le geste technique*, Éditions Érès, 2002, p. 51.

   i. Surface finish
   ii. Compliance with thicknesses
   iii. Regularity of the base
   iv. 8 out of 10 cups must be "flawless" according to the previous criteria.

d. The score must be 7/10 to consider the skill acquired.

3.1.2 The learning context:

> *[...] "Any skill acquisition process can be defined as learning to use and master the context, oriented towards achieving a goal."*[7]

3.1.2.1 Why talk about context?

No form of learning can be conceived of as taking place in isolation, detached from the geographical, cultural, social and technological environment in which it takes place; it is the framework, the substrate in which the action can take place, the canvas on which the painted motif can take shape.

Furthermore, the context or environmentThe task to be learned and the learner's body define the constraints, the field of possibilities, and the degrees of freedom with which the learner will have to deal, finding the path to an efficient and economical gesture. See Figure 1 - Craeft approach depending on the context.

This gives rise to the notion of affordance, defined as follows:

> *"An affordance would therefore be an objective relationship between the properties of the subject and those of the environment (Adolph et al. 1993)".*[8]

[7] B. Bril, *Le geste technique: Réflexions méthodologique et anthropologiques, L'apprentissage de gestes techniques: ordre de contraintes et variations culturelles*, Éditions Érès, 2002, p. 121.
[8] B. Bril, *Le geste technique: Réflexions méthodologique et anthropologiques, L'apprentissage de gestes techniques: ordre de contraintes et variations culturelles*, Éditions Érès, 2002, p. 121.

Any A change in the environment will lead to a change in the constraints under which learning takes place. It is therefore important to take this into account, and even to use it to optimise the proposed learning situation.

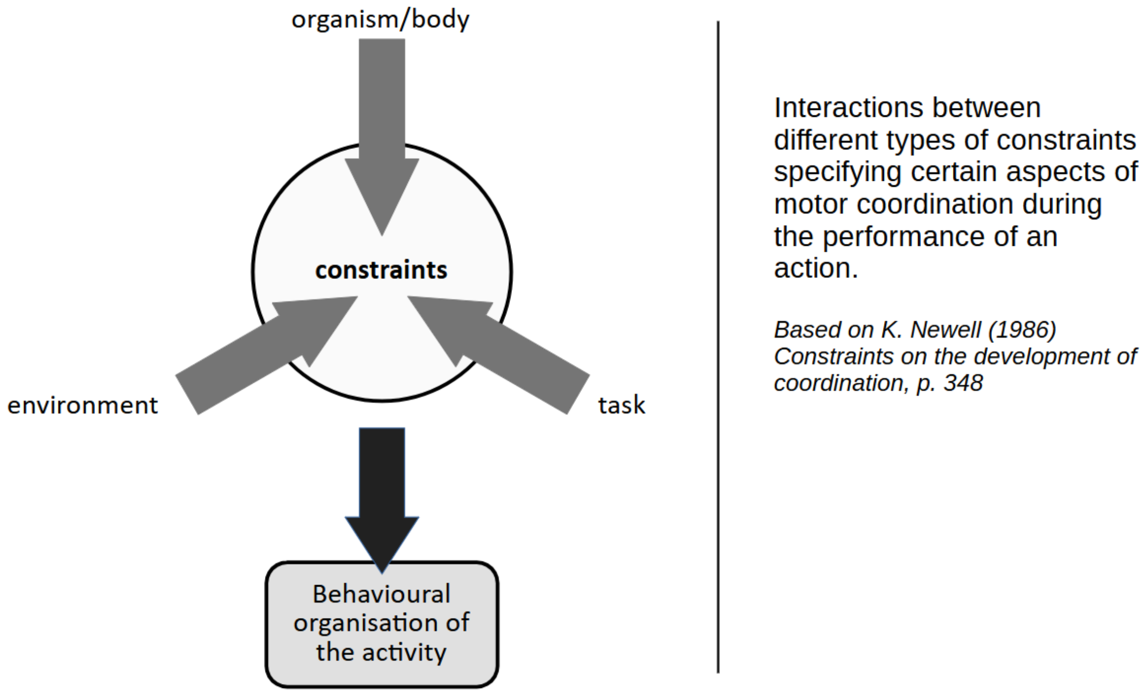


Figure 2 - Constraints in the development of coordination[9]

3.1.2.2 How is it defined?

The context or environment can be defined as the environment in which the training activity takes place. It has several dimensions, including geographical, cultural, social and technological. This environment raises questions such as

- What is the learner's place in society in terms of age, sex, gender, etc.?
- What is the place of learning, particularly economic learning?
- What are the dominant methods of transmission?
- What are the representations of techniques, learners, methods, etc.?
- What are the technologies and tools?
- And so on.

We could also talk about an ecosystem in the sense of a dynamic system that brings together, in an environment (the context), organisations (the training stakeholders) and outputs (the tasks), all governed by physical, biological or social rules and objectives.

[9] B. Bril, *Le geste technique: Réflexions méthodologique et anthropologiques, L'apprentissage de gestes techniques: ordre de contraintes et variations culturelles*, Éditions Érès, 2002, p. 117.

[...] "the notion of a dynamic system, which considers forms of action or coordination of gesture as emergent properties of interactions between the body and the environment (Reed and Brill, 1996; Thelen and Smith, 1994)".[10]

"Van Leeuwen (1992) [...] She suggests the need to receive not only the properties of the object, those of the movement and those of one's own body [...] Analysing the learning process comes down to analysing the nature of the dynamics of the relationship between the person, the environment and the tool in carrying out the task."[11]

3.1.2.3 Creating an augmented context

"Expertise is characterised by flexible behaviour, capable of constantly adapting to the contingencies of the task, whereas the less expert appears to be either more rigid or more variable, with little controlled variability" [12]

It would appear that the expert gesture is more than just the "right" gesture, but a gesture that is adapted to variations in the environment when performing the task at hand. For example, for a glassmaker using a cane, adapting to the temperature of the glass, which can cool more or less quickly depending on the ambient temperature conditions in the workshop, and adapting to the quantity of glass brought in by an assistant. For a cutter working on marble or wood, you need to adapt to the grain of the material. And so on.

According to Bernstein, dexterity is defined by four criteria.[13] :

- Correctly
- Quickly
- Reasonably (minimising effort and energy expenditure)
- With a "spirit of appropriateness

In addition, an experiment carried out by Famose and his colleagues (1977) shows that an enriched environment which emphasises the properties of the ski/slope, task/environment, body/task, body/environment pair, gives better results than "copying" a model.

" The diversity of tasks accomplished and the diversity of unforeseen disturbances overcome in the course of learning are the necessary conditions for success."[14]

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[10] A. Roby-Brami et I. Laffont, *Le geste technique: Réflexions méthodologiques et anthropologiques, Gestes et technologie: la compensation des incapacités motrices,* Éditions Érès, 2002, p. 110.

[11] B. Bril, *Le geste technique: Réflexions méthodologique et anthropologiques, L'apprentissage de gestes techniques: ordre de contraintes et variations culturelles*, Éditions Érès, 2002, p. 121.

[12] B. Bril et V. Roux, *Le geste technique: Réflexions méthodologique et anthropologiques, Observations et expérimentations de terrain: des collaborations fructueuses pour l'analyse de l'expertise technique. Le cas de la taille de pierre en Inde*, Éditions Érès, 2002, p. 42-43.

[13] E. Biryukova et B. Bril, *Le geste technique: Réflexions méthodologique et anthropologiques, Bernstein et le geste technique*, Éditions Érès, 2002, p. 64.

[14] E. Biryukova et B. Bril, *Le geste technique: Réflexions méthodologique et anthropologiques, Bernstein et le geste technique*, Éditions Érès, 2002, p. 66.

In addition, an experiment carried out by Famose and his colleagues (1977) shows that an enriched environment which emphasises the properties of the ski/slope, task/environment, body/task, body/environment pair, gives better results than "copying" a model.

> *"In this experiment, the authors compared the learning of skiing by children in the presence of a "model" or an "enriched environment" [...] The results showed that the children in the second group progressed more rapidly than the others [...] Motor coordination is not learned for its own sake, but is the consequence of mastering the environment to achieve a given goal".*[15]

3.1.2.4 Conclusion on context and environment

These diversions into the notion of context, the learning environment, and even the ecosystem, bring us back and refocus us on the importance of the role of digital tools in augmenting the traditional learning context, helping the learner to understand the properties of the trio. body, environment, task, and also proposing more variations in the environment in order to optimise the learning process.

Understanding the properties of the task/environment pairs can be achieved using intermediate teaching objects (demonstrators) or facilitated by video elicitation (reflective vision). Variation of the environment could be achieved through digital simulations, some of the parameters of which would be variable, and controllable by the trainer.

These reflections on the environment lead us to make the link with the 'guidance fading effect' of cognitive load theory, which recommends having learners perform a variety of tasks rather than repeating the same exercise, adapting the level of guidance to the level of the learners, and empowering them through a reflective vision of their practice.

In conclusion, to quote Bernstein, learning is repetition without repetition.

3.1.3 Differentiation between technique and method:

3.1.3.1 Consider cognitive and bodily understanding

In the publication "Geste technique et apprentissage: une perspective fonctionnelle", Blandine Bril differentiates the notions of methods and techniques in learning. Methods cover the goals and sub-goals of an action (or course of action), which we might liken to the process of making an object, incorporating an overall task broken down into sub-tasks. The techniques, whose order of execution is organised by the sub-goals, are the repertoire of basic gestures to be mastered in negotiation between the body, the environment and the task in hand.

> *[...] "Our approach here refers to the functional component of the action, presented by Leroi-Gourhan [1964] as the technique, i.e. the mode of action on the material as opposed to the method, which gives the way in which the technique is implemented in a particular spatial and temporal organisation in order to achieve the set goal".*[16]

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[15] B. Bril, *Le geste technique: Réflexions méthodologique et anthropologiques, L'apprentissage de gestes techniques: ordre de contraintes et variations culturelles*, Éditions Érès, 2002, p. 122.

[16] B. Brill, *Geste technique et apprentissage: une perspective fonctionnelle, in* Patrick Pion & Nathan Schlanger, *Apprendre : Archéologie de la transmission des savoirs,* La Découverte / Inrap, 2020.

The table below, Figure 3 - Level of action and functional linksillustrates our understanding/interpretation of the functional links between the different levels of an action, as well as a parallel with their taxonomy and their nature.

Action level	Functional links	Taxonomy	Nature of action level
Goal		Intention	Task to be performed
⬇	<= order of sub-goals	Knowledge	Process
Sub-goals		Knowledge/action knowledge.[17]	
⬇	<= order of implementation of techniques		
Techniques		Know-how/knowledge of action.	Gestures

Figure 3 - Level of action and functional links

This approach makes us wonder about the relevance of differentiating between procedural and sensorimotor or bodily learning, insofar as the teaching methods and tools developed will play a different role depending on whether the learning is procedural or bodily.

> *Bernstein: "concentrate your thought and your will on the what of movement, the how will come from itself" [Bernstein, 1996, p. 232].*
>
> *[...] "the starting point is the functional properties of the technical gestures [...], which generally constitute a real challenge for the learner's cognitive-motor system".*[18]

If the how of movement comes from itself, the emergence of understanding and mastery often remains a challenge for the learner. In the following paragraph, we propose to identify the tools that could best help learners at each level of action.

3.1.3.1 Contribution/challenge (?) for the development of Craeft tools

Our proposal is to draw a parallel, see Figure 3 - Level of action and functional links below, between the learning perspective proposed by B. Bril and the pedagogical framework of the Craeft project.

The following table proposes a thematic grouping via the dividing line between knowledge and know-how. However, this dividing line is not an absolute indicator and may be blurred or porous depending on the situation.

Knowledge	**Know-how**
Theory	Practice
Methods*	Technics*
E-learning / Courses	Situational learning
Demonstrators - Intermediate learning object	

[17] B. Bril distinguishes knowledge of action from know-how: *"We will use the expression 'knowledge of action' rather than 'know-how' here, as these terms better reflect the possible variations in action strategies, whereas know-how often locks the actor into fixed, stereotyped action procedures".* For the sake of simplicity and clarity, we will hereafter assimilate these two closely related concepts, assuming that know-how, if it is to be effective, is also dynamic and adaptive.

[18] B. Brill, *Geste technique et apprentissage: une perspective fonctionnelle, in* Patrick Pion & Nathan Schlanger, *Apprendre : Archéologie de la transmission des savoirs,* La Découverte / Inrap, 2020.

Video elicitation
VR workshop simulation

Figure 4 - Thematic grouping of knowledge and know-how

* - in the sense of B. Bril

This approach enables us to examine the role of each teaching tool, whether digital or traditional, depending on the learning stage. In particular, it allows us to identify the tools that can potentially bridge the gap and facilitate understanding between methods and techniques, between theory and practice.

And making the link with the next paragraph, the techniques, the mastery of gestures, the mastery of basic gestures, remain within the scope of the situation, of real practice in the workshop.

3.1.4 Workshop practice, an irreducible part of learning:

> *'We assume that mastery of technique is essential whatever the method used'.*[19]

One important point to emphasise is that the development of digital aids for learning craft trades does not replace the physical experience of the workshop. These tools can optimise procedural understanding and memorisation and make the link between methods and techniques or between knowledge and know-how. They can enable a reflective vision, a back-and-forth between experimentation and conceptualisation (as we will see in the following paragraph). However, given the current state of technology, concrete experience, confrontation and negotiation with the material and the environment remain essential in the acquisition of sensory-motor and physical know-how.

For N. A. Bernstein, who has worked on motor control, seeing movement is different from producing movement.

> *'The only way to learn a movement is to actually produce it and feel all the sensations that will enable sensory corrections.'*[20]

This dimension of learning in context is consistent with Cognitive Load Theory, particularly through the 'expertise reversal effect', putting into practice and is preferable to repeating the same demonstration.

The notion of sensations enabling sensory corrections, as mentioned by Nicolai A. Bernstein, echoes the explicitation interview, Pierre Vermersch (2019), which aims to verbalise the action and proposes, in particular, an exploration of non-formalised motor sensations in order to become aware of them, to be able to transmit them or question them in a learning situation. This resonance between the research of A. Bernstein and P. Vermersch lead us to the notion of reflective practice in learning.

[19] B. Brill, *Geste technique et apprentissage: une perspective fonctionnelle, in* Patrick Pion & Nathan Schlanger, *Apprendre : Archéologie de la transmission des savoirs,* La Découverte / Inrap, 2020.
[20] E. Biryukova et B. Bril, *Le geste technique: Réflexions méthodologique et anthropologiques, Bernstein et le geste technique*, Éditions Érès, 2002, p. 60.

3.1.5 Towards reflective practice:

3.1.5.1 Responding to an implicit need?

> *"Following in the footsteps of the prehistorian André Leroi Gourhan [1964] and the neurophysiologist Nicolai A. Bernstein [1996], we hypothesise that what lies at the root of learning is an understanding, not necessarily verbalised, of the ways in which matter acts and is transformed.*[21]

This quote from B. Bril raises questions about " *understanding, not necessarily verbalised* ". Is it an obstacle to learning?

If the skills required to complete a task are acquired without difficulty, the question does not arise. On the other hand, if learning difficulties arise, for all or part of a group of learners, it will be necessary to understand the causes, to be able to propose remedial measures and to identify the factors contributing to errors or success.

> *"In all activities involving tasks to be carried out [...] knowledge of the final result alone is insufficient to diagnose the nature and cause of a difficulty or exceptional success.*[22] *"*

Our aim is to provide trainers and learners with a tool that gives them better feedback. A tool that will enable them to gain a more detailed understanding and analysis, and to reappropriate their actions. This tool must be co-constructed, easy to use and assimilable into existing teaching methods and tools.

<u>We are also working on the assumption that, even before difficulties arise, understanding, becoming aware of and taking a reflective look at one's own practice helps and makes learning more fluid.</u>

What's more, when it comes to understanding and preserving craft skills, the finished object or the intermediate elements used in its production are not enough to grasp all the dimensions involved in making it.

This perspective leads us to propose experimentation with video. elicitation /explicitation, with as a methodological support the research on the explicitation interview, initiated by Pierre Vermersch, Catherine Hir and pursued by the GREX[23] (Groupe de Recherche sur l'EXplicitation.)

> *"If by action I mean the performance of a task, the aim of the explicitation interview is to describe the unfolding of this action, as it was actually implemented in a real task.*[24] *"*

This methodological support will be invaluable, in particular for finding out about the process of carrying out a know-how action, identifying the levels of exploration and deciphering the tasks analysed, and having a framework for conducting the interviews.

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[21] B. Brill, *Geste technique et apprentissage: une perspective fonctionnelle, in* Patrick Pion & Nathan Schlanger, *Apprendre : Archéologie de la transmission des savoirs,* La Découverte / Inrap, 2020.
[22] P. Vermersch, *L'entretien d'explicitation*, ESF Sciences humaines, 2019.
[23] source website: https://www.expliciter.org/
[24] P. Vermersch, *L'entretien d'explicitation*, ESF Sciences humaines, 2019.

3.1.5.2 explicitation and/or elicitation?

Definitions

Explain (Expliciter): from the Latin *explicitus,* explained, clear, past participle of *explicare, to* unfold, unroll.

Explicitation[25] :

1. The act of identifying, describing, explaining and listing in as much detail as possible the steps taken to accomplish a task. This is the process of making explicit what is implicit.
2. The act of developing and clearly stating something implicit.

Elicitation[26] : (21st century) Borrowed, via the English word *elicitation*, from the Latin *ēlĭcĭtus*, participle of the verb *ēlĭcĭo* ("to draw out; to attract; to draw out, to tear out, to excite, to provoke, to obtain").

3. (Knowledge management) Action of helping an expert to formalise their knowledge to enable it to be saved or shared.

7. (Psychology, Intelligence) The use of conversation to extract information from a person or group without giving the impression of being questioned.

To sum up

- Explicitation aims to make explicit what is implicit.
- Elicitation aims to bring out what is implicit, to encourage the speaker to bring out what he or she knows.

Explanatory interviewing aims to make explicit implicit knowledge about the task at hand. And the principle of video elicitation aimed, from a general point of view, at collecting information. We will keep the contiguous use of these two terms.

3.1.5.3 Why the video elicitation /collective explicitation?

When we interviewed Cerfav trainers, students and apprentices, we realised that the practice of video-recording gestures. had been going on for a long time. However, the use of these recordings seemed to us to be rather unstructured. Stored in bundles on USB sticks or hard disks without classification, reviewed to recall a process and often untraceable at a later datealways well , made and put aside "for later", etc., the video recordings are not organised.

During an individual interview or a group session, the video will be a support, a lever to facilitate the verbalisation, the explicitation of the experience of the action. This re-visualisation can address several levels of experience: the environment, the emotional state, and the sensory state of the action experienced. The video allows iterations. , collectively with control of temporalities (acceleration, pause, slow motion) to explore corrective strategies for gestures and postures.

We experimented with a few attempts at explicating collective and individual during sessions, elicitation video. The information gathered on the experience of the action was difficult to obtain

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[25] source: Wiktionnaire - https://fr.wiktionary.org/wiki/expliciter - https://fr.wiktionary.org/wiki/explicitation
[26] source: Wiktionnaire - https://fr.wiktionary.org/wiki/%C3%A9licitation

because of the difficulty of placing the learners individually or collectively in a position of embodied speech. Nevertheless, we hypothesise from the exchanges with the trainers and learners interviewed that the exploration of these two methods of interviews, combined with the support of video devices, could constitute better documentation for the transmission of knowledge and know-how of actions.

To sum up, the choice of video as a support for the elicitation/explitication An interview is justified because it is possible to:

- Build on pre-existing practice to make it easier to appropriate
- Produce an observable support for the development of interviews of explicitation
- Produce observables for documenting and safeguarding craft manufacturing processes
- Design an innovative teaching tool based on the sensoriality of the experience of action
- Explore several levels of the experience of action.

The challenge :

- Formalise a practical methodology.
- Measuring the impact
- Integrate this tool into learning

3.1.5.3 Complementary Contribution of Experiential Learning[27]

The Experiential Learning model proposed by David A. Kolb (1984) defines learning as "the process by which knowledge is created through the transformation of experience.[28] "

The acquisition of knowledge is constructed along two dialectical axes, "the grasping of experience," which can be done in a concrete or abstract way and "the transformation of experience", which can be approached through action or reflection, see

Knowledge	**Know-how**
Theory	Practice
Methods*	Technics*
E-learning / Courses	Situational learning
Demonstrators - Intermediate learning object	
Video elicitation	
VR workshop simulation	

Figure 4 - Thematic grouping of knowledge and know-how.

We suggest you take a diversion towards this approach because it echoes the hybrid mode, and in particular video elicitation, in the back-and-forth between experience and knowledge, one serving to nourish the other in a cyclical fashion.

[27] (1984) David A. Kolb

[28] David A. Kolb, Richard E. Boyatzis, Charalampos Mainemelis, *Experiential Learning Theory: Previous Research and New Directions, 1999 in* R. J. Sternberg and L. F. Zhang (Eds.), *Perspectives on cognitive, learning, and thinking styles*, NJ: Lawrence Erlbaum, 2000.

Kolb's theory seems to be able to enlighten us on the process used in video elicitation at a macro level, the micro level being the domain of the explanatory interview.

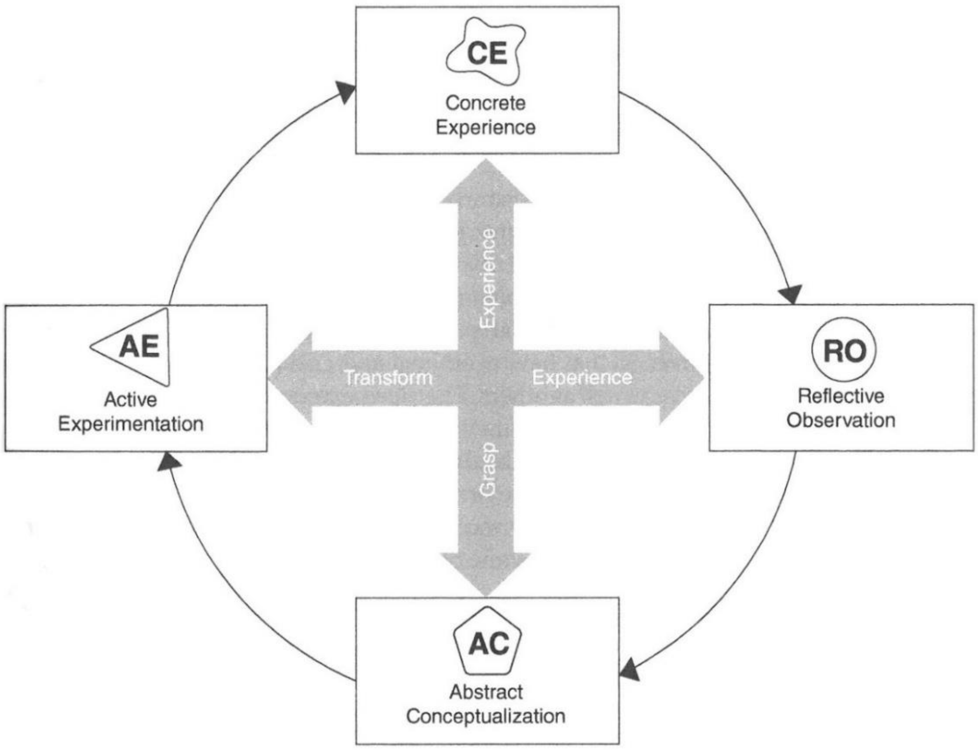


Figure 5 - The Experiential Learning Cycle[29]

The macro level: experiential learning proposes a cycle which starts with experimentation and which is questioned by reflection in order to lead to its conceptualisation. This conceptualisation is then questioned by action, re-questioned by new experimentation, which allows the initial experience to evolve. Kolb's cycle corresponds to a spiral of pedagogical progression that could be applied to video elicitation, where the action produced is filmed and questioned through the explanatory interview, which helps to extract information. An "evolved" action can then be reproduced differently (reproduced without reproduction) with the light of the information made explicit.

[29] D. A. Kolb, *Experiential Learning: Experience as the source of learning and development*, Pearson, 2015, p. 51.

The micro level: this takes place during the explanatory interview, and is the domain of "intimate" exploration of the action, what Pierre Vermersch calls the experience of the actual action.

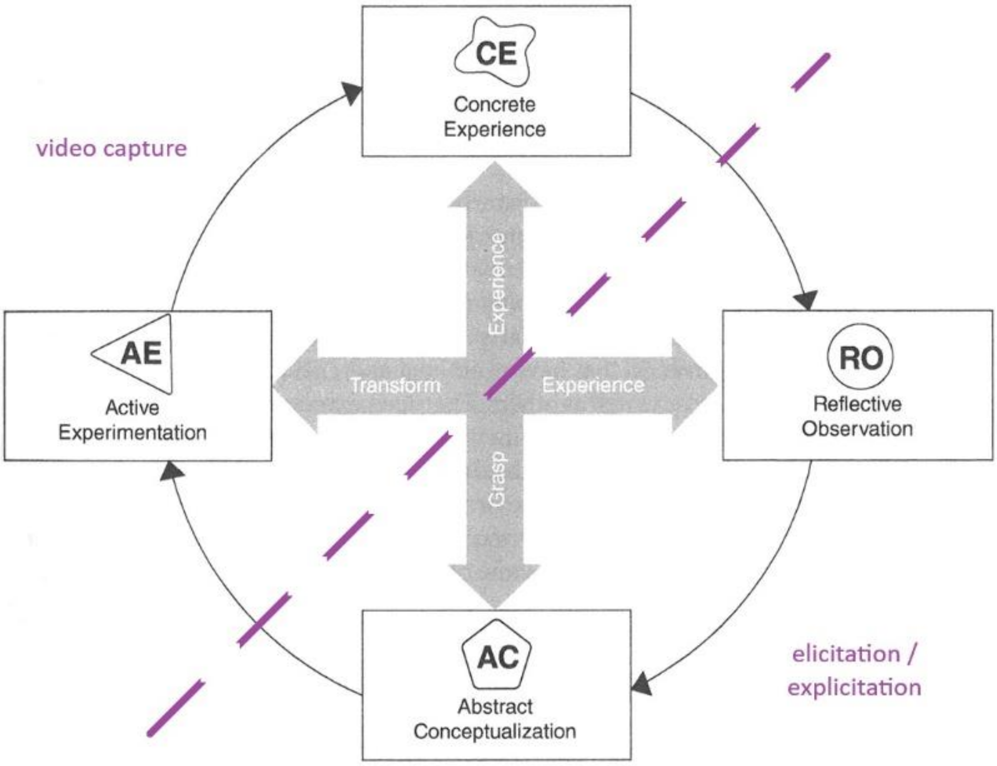


Figure 6 - The parallel between Kolb's cycle and Video elicitation

In Figure 5 - The Experiential Learning CycleWe propose a parallel between the Kolb cycle and the phases of video elicitation, with the video capture of the action corresponding to concrete experience and active experimentation, and the explicitation phase to reflective observation and abstract conceptualisation (the discovery and production of knowledge).

Experiential learning theory also *suggests that learning requires abilities that are opposed and that the learner must continually choose the set of learning abilities that will be used in a specific learning situation.*[30] " Experiential Learning Theory deduces learning styles based on the four axes of Kolb's cycle, with learners adopting a preferred style according to their personality. They may be oriented towards concrete experience, reflective observation, abstract conceptualisation or active experimentation. The "choice" of a preferential style does not mean that learners do not switch from one style to another during the learning process, but that it corresponds better to their way of functioning; we could say that it is dominant.

[30] David A. Kolb, Richard E. Boyatzis, Charalampos Mainemelis, *Experiential Learning Theory: Previous Research and New Directions, 1999 in* R. J. Sternberg and L. F. Zhang (Eds.), *Perspectives on cognitive, learning, and thinking styles*, NJ: Lawrence Erlbaum, 2000.

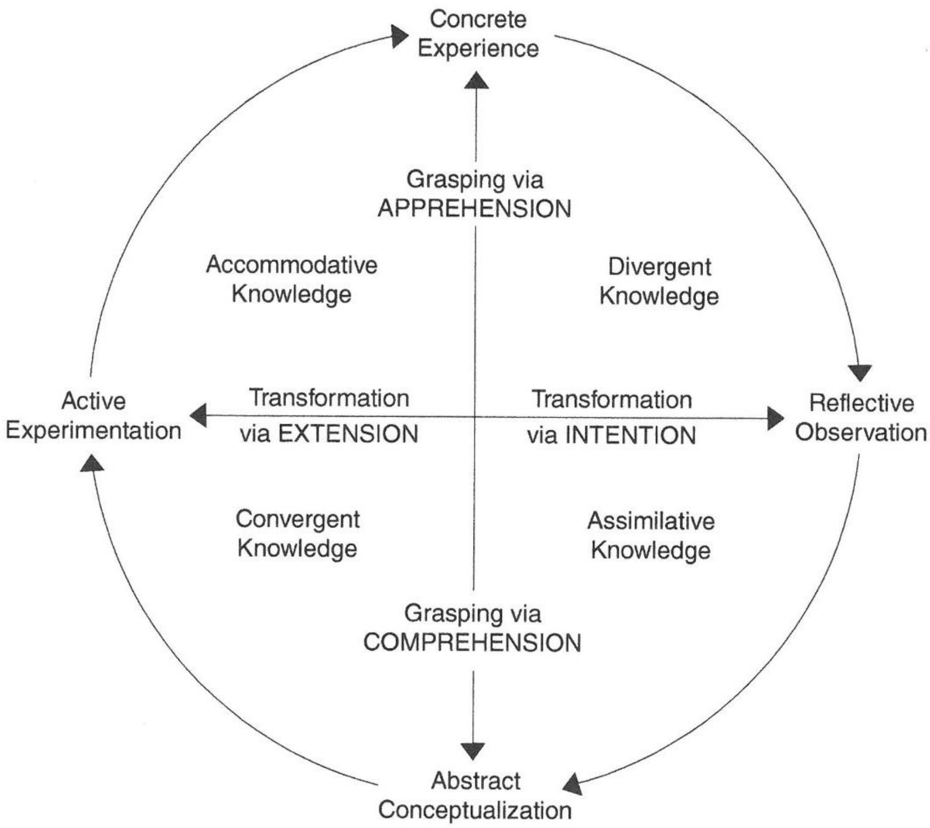


Figure 7 Structural dimension underlying the process of experiential learning and the resulting basic knowledge forms[31]

<u>This notion of learning style reinforces our belief in the value of the hybrid mode, which makes it possible to offer learners several access routes and to vary the times and teaching tools while ensuring that they address different styles for the same subject.</u>

For the acquisition of gestures in the workshop, the temptation is to focus solely on concrete experience, although this is naturally the dominant learning style for this type of learning. For example, the contribution of video elicitation opens up the learning of gestures to other learning styles, in particular reflective observation and abstract conceptualisation.

In the same way, for general subjects (knowledge), such as technology, the use of intermediary objects from pedagogy/demonstrators makes it possible to address people whose learning styles are geared towards concrete experience or active experimentation.

Experiential learning theory provides us with a methodological framework for implementing the elicitation/explication video at the macro level, by validating the concrete experience - abstract conceptualisation cycle. It also emphasises the importance of taking into account. the existence of different learning styles among learners, which the hybrid mode makes it possible to address.

[31] D. A. Kolb, Experiential Learning: Experience as the source of learning and development, Pearson, 2015, p. 68.

3.1.6 Conclusion:

What are the links between these contributions and the teaching methodology we are proposing for the Craeft project?

Firstly, there is the reminder of the importance of the pedagogical objective, which, although it seems natural to define, too often remains implicit or is imprecisely defined. And it must be clearly communicated to the learners beforehand and/or at the start of the session.

Context is a determining factor in learning, even if the natural tendency is to focus on the action or gesture. Thinking about and working on the context opens up ways of optimising the impact of the educational tools used. With this in mind, the mode The hybrid proposes a mixed use of digital and traditional tools to optimise and enrich the context, making it more variable if necessary. For example, scenario three of a visit to a museum offers an enriched environment using digital tools, see § 4.2.2.

The differentiation between techniques and methods makes it possible to discern the dividing line between what comes under the process. and What comes under the gesture in the performance of a task, and to focus the time spent in the workshop on learning the technique, the gesture, whereas what comes under the process can be handled by tools such as VR workshop simulators or video elicitation. A clear definition of the roles of each teaching tool to optimise their impact.

Developing reflective practice, particularly via the video elicitation tool, but also through the methods of use of the e-learning platform (for example, by implementing flipped classes), aims to empower learners by offering them the opportunity to take ownership of their study subjects.

By verbalising what has hitherto remained implicit in the course of action during the performance of a task, the aim is to raise awareness of the action experienced, to create an awareness of the "components" of the action, to enable better control, greater vigilance about errors and their correction, and therefore greater progress in the acquisition of expertise.

'The eye only sees what the mind is ready to understand. [32]

In addition, Explanatory sessions enable exchanges to take place between experts and learners, and between peers, and provide an opportunity outside the workshop to step back and reflect on the experience of the action. This formalises and systematises the back-and-forth between action/experience and reflection/conceptualisation.

The hybrid mode, which encourages a cycle of concrete experience, reflective observation, and abstract conceptualisation and active experimentation, addresses learners more openly through their different learning styles.

These diversions through the fields of learning theory are intended to shed light on our approach to developing the teaching methodology and scenarios for using the digital tools in the Craeft project.

[32] Henri Bergson, 1859-1941

3.2 Our proposal: a co-constructed, hybrid approach to apprenticeship.

What is learning? It means "to take, to grasp", *'to grasp with the mind, to study'*.[33]

What is understanding? Understanding is *'the action of grasping together'*, *'the action of grasping with the mind'*[34] or *'grasping together'*, *'embracing with the mind'*.[35]

Learning would then consist of grasping knowledge and know-how, taking possession of it, and making it one's own. Understanding involves the group, the notions that take on meaning once brought together, or the human group, grasping with others, grasping with the help of others, peers, or trainers.

This echoes the hybrid mode.[36] which proposes bringing together different modes of access to knowledge and know-how in the same space and at the same time to promote understanding.

3.2.1 What is the hybrid mode (why?)

The idea of a hybrid mode is to improve the scenarios for using digital tools to maximise their positive impact on learning.
It is based on the complementarity and relevance of the use of digital and/or traditional tools depending on the learning phase, with the intention of creating bridges between in-situ/workshop learning and learning via digital tools.
This hypothesis opens the way to new opportunities in the way we learn and assimilate a trade.

3.2.1.1 Close interaction between traditional and digital methods

Create an interweaving of learning times, previously separated into distinct blocks. Identify the most appropriate methods for transmitting a given area of knowledge or know-how in the teaching progression.
In particular, focus on concepts that are usually difficult to learn.
The notion of complementarity between digital and traditional methods is the basis of the notion of hybrid mode, which we will endeavour to clarify in the following paragraphs.
"Complementarity: Digital tools must be used in conjunction with traditional methods to enrich the learning experience. This complementarity makes it possible to combine the advantages of both approaches".[37]

The table Learning phases / Modalities / Activities. (Figure 8 - Table of learning phases/), illustrates an outline of the uses and interactions between the modalities according to the learning phases and activities (in line with the CAP reference framework). For example, for cross-disciplinary subjects, a "traditional" classroom lesson could be based on 3D modelling or videos, available on the e-learning

[33] Dictionary of the Académie Française - https://www.dictionnaire-academie.fr/article/A9A2249
[34] Dictionary of the Académie Française - https://www.dictionnaire-academie.fr/article/A9C3296
[35] Wiktionary - https://fr.wiktionary.org/wiki/compr%C3%A9hension
[36] The etymology of understanding also echoes the split attention effect and the modality effect of Cognitive Load Theory.
[37] Extract from §6.1 conclusions of D6.1 education & training Y2

platform, to explain an abstract concept tangibly, with 3D printing material "demonstrators" using the virtual "demonstrators" to provide a link/bridge between the concept and practice through handling and exercise aids, and finally, assessment of what has been learnt could be carried out on the e-learning platform, using interactive quizzes.

learning phases	learning modality			Activities
	e-learning	VR workshop/3D modeler/Ghost gestures	workshop/classroom	
Discovery	tools and machines		optional : workshop tour	Preparation
		workshop tour		
Cross-cutting matters : HSE - GT - Technical drawing - History of glass...	Interactive course		Course	Preparation & Communication
	2D/3D Visualisation		Manipulation	
	quiz / reminder		Exercices	
What you should know before practice in workshop	key elements			Preparation & Implementation
			key elements + master	
Process	process & video elicitation methodology			Preparation, Implementation & Communication
			Experiment + master + video	
	experiment report			
Training	process			Preparation & Implementation
		process + gesture +basic training		
			Experiment & produce	

Figure 8 - Table of learning phases/methods/activities

3.2.1.2 Decompartmentalising learning methods

The experiment carried out in 2024 showed that the modalities.[38] were used in a compartmentalised way, implemented in parallel with little or no interaction between them.

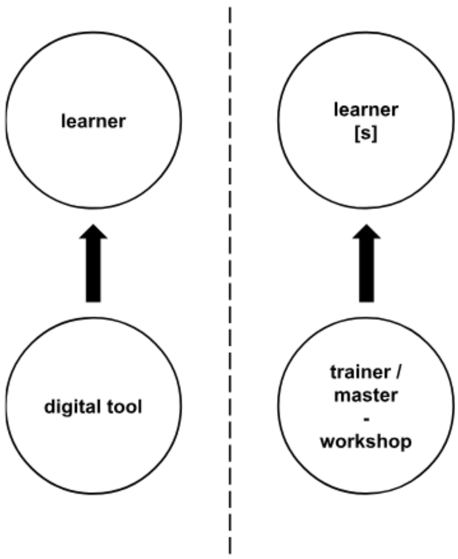


Figure 9 - Illustration of the parallel mode

[38] Digital and traditional modalities

The "learning phases/modalities/activities" table in Figure 8 - Table of learning phases/ led us to question the appropriateness of each modality and tool according to the learning stage. The notion that emerges is that of the role of actors and tools in transmission.

3.2.1.3 Precise definition of the roles of teaching tools

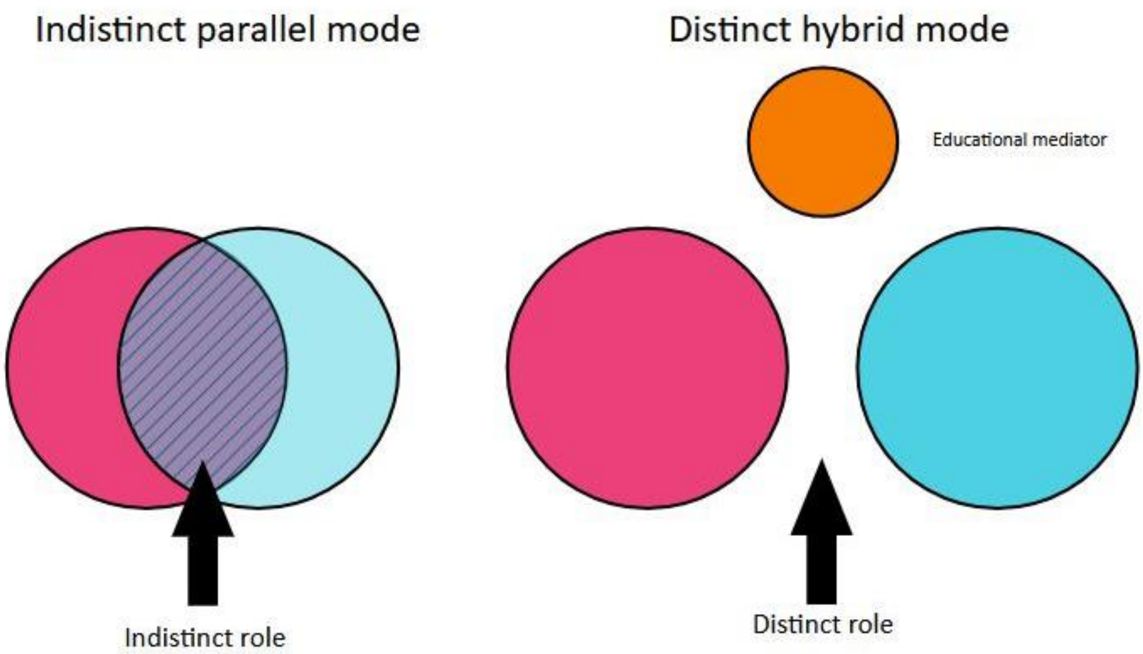
Another aspect is the role played by the players or tools in each digital or traditional modality. In a non-hybrid configuration where traditional and digital learning take place in parallel without communicating, their role may be the same, overlap and create confusion for learners.

The hybrid mode aims to define the field of intervention and the relevant role assigned to each traditional or digital teaching tool in order to optimise their effect and create coherence for learners.

Although this may be counterintuitive, the use of digital and traditional modes in parallel creates areas where their roles overlap. For example, the e-learning platform covers a concept that will also be covered in a paper-based course given by the trainer.

We will call this the indistinct parallel mode. The traditional and digital modalities are used independently in parallel, but their role is indistinct and not defined in advance in an intentional way. Figure 10 - Parallel versus hybrid mode - *parallel mode versus hybrid mode.*

The proposal for the final version of the pilot is to experiment with and evaluate a distinct hybrid mode, see Figure 10 - Parallel versus hybrid mode, characterised by a dialogue, an interaction between the digital and traditional modalities, whose roles remain distinct. A distinct role means that each tool has a specific, pre-defined function that does not cover the field of use/intervention of another tool. This specialisation of the tools used in each mode[1]is designed to optimise their impact on learning.



Zone of disinterest/redundancy:

- What does digital technology add?
- No learner-trainer-tools interaction triangle

Definition:

In this configuration, the roles played in the transmission of knowledge or skills overlap between traditional and digital modes of transmission.
This implies redundancy between the modes, which may or may not be beneficial.
The major risk is that people will react by asking, 'What use is this tool to me if I can do it another way?' or 'What use is the trainer if I can learn it on the e-learning platform?'
There is interference between the modes.

Avantages:

- Redundancy of information, overlap between transmission modes in the intersection zone.
- Comfort, as it is a familiar mode of operation.

Disadvantages:

- Passivity, demotivation.
- Loss of meaning for trainers or guides: 'What is my place, my role?'
- When to use the traditional mode or the digital mode: blurred boundaries.

Zone of disruption / co-construction:

- Knowledge is absent, replaced by method (e.g. information searches)
- Cognitive conflict
- Need for an educational mediator, object or trainer/guide
- Establishment of a triangle of interaction between learner, trainer and tools

Definition:

In this configuration, there is no overlap between the roles, methods of knowledge transfer or skills between traditional and digital transmission. Some information is missing, which requires the intervention of an educational mediator, who may be the trainer or guide. Intermediate educational objects can bridge the gap between the virtual and the physical, between the intangible and the tangible, for example a 3D print of a technical plan.

Avantages:

- Create motivation
- Create dialogue between learners, trainers and tools
- Cognitive conflict* leads to discussions between peers and promotes understanding and memorisation.

Disadvantages:

- Requires learner autonomy
- Leads to changes in perceptions, which can be unsettling

* Cognitive conflict is not systematic; it can arise, for example, from a disagreement over understanding or interpretation.

Role of the traditional mode in transmission — Role of digital mode in transmission

Figure 10 - Parallel versus hybrid mode

The distinct hybrid mode[39] , is also designed to enable interaction between learners, trainers and digital tools, see Figure 11 - Illustration of hybrid mode. The differentiated use of modalities according to the learning phases, see Figure 8 - Table of learning phases/, requires communication between these modalities, for which the trainer remains the guarantor.

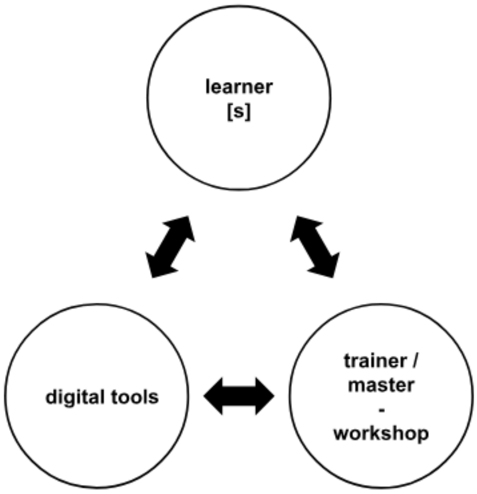


Figure 11 - Illustration of hybrid mode

This objective of optimising tools, whether digital or traditional, is based on establishing links between theoretical and practical learning. Integrating knowledge through manipulation, integrating know-how through conceptualisation[40] , creating a unity of time, place and action in the learning process.

Practice embodies theory, theory enlightens practice.

3.2 Proposed changes to educational and digital tools

As part of the Craeft project, we are proposing to experiment with complementary digital teaching tools. Of course, the tools envisaged are not exhaustive and are the basis of the experimentation for wider development.

3.2.1 What additional educational tools?

3.2.1.1 Video elicitation/explicitation

Video elicitation aims to provide information about a practice and to allow implicit knowledge to emerge. In the context of training, this "invisible" knowledge is usually not or only be transmitted with difficulty. For example, an expert trainer who has been familiar with a gesture for years will not think of explaining it because it has become natural and automatic.

[39] We will refer to the distinct hybrid mode as hybrid mode in the remainder of the document.
[40] D. A. Kolb, *Experiential Learning: Experience as the source of learning and development*, Pearson, 2015.

Another advantage of this tool is that it encourages learners to take a reflective look at themselves, watching what they are doing "from the outside" to become aware of areas for improvement.

Lastly, a significant aspect of our experimentation is to implement video elicitation and the explanatory interview.[41] usually carried out face-to-face, between the interviewer and the interviewee, in the context of research projects, towards a group elicitation methodology for educational purposes.

3.2.1.2 Intermediate learning object, demonstrator

Blandine Brill clarifies the difference between method and technique.[42] , which could be reduced in the Craeft project to transmission that can be done remotely via e-learning tools and the part of the gesture whose transmission is irreducible and requires face-to-face learning.

The intermediate pedagogical object aims to bridge the gap between method and technique and to create a link to generate understanding, making available a tangible object enabling an otherwise abstract notion to be manipulated, for example, the interaction between mould and object in curvatures and negative curvatures.

3.2.2 Improving the digital tools already tested

The digital tools already developed in the Craeft project have their place in the hybrid modality, and we are questioning and refining their use and mode of intervention.

- E-learning using multimedia potential.
- Workshop simulation in a VR environment.
- Haptic controller

For example, the e-learning platform will be used in different ways depending on the RCI, particularly in Marble, Silversmithing, Wood carving and Glassblowing, using interactive videos, educational quizzes, diagrams and graphs.

Experiments will also be conducted to better integrate the use of the platform and modify the learning sessions by combining traditional and digital methods, for example with the flipped classroom principle:

a. Ask learners to work on the e-learning platform before the face-to-face class.
b. Ask learners to take the course.
c. The trainer completes, corrects, structures and re-explains.
d. Demonstrators are used.
e. Assessment can be carried out using traditional or digital methods, depending on the specific nature of the exercises.

Simulations, porcelain turning and virtual reality glassblowing workshops will be refined in terms of their behaviour and response to learners' actual movements, degrees of freedom of the tools, physics, hand position, etc.

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[41] P. Vermersch, *L'entretien d'explicitation*, ESF Sciences Humaines, 2019.
42 B. Brill, *Geste technique et apprentissage: une perspective fonctionnelle, in* Patrick Pion & Nathan Schlanger, *Apprendre : Archéologie de la transmission des savoirs,* La Découverte / Inrap, 2020.

4 Usage scenarios

4.1 The central question

Starting again from the conclusion in paragraph 2.1, *'Basis for the construction of the final version of Pilot 1'*, the objective of optimising tools, whether digital or traditional, is based on establishing links between theoretical and practical learning.
The central issue is to define how to choose and articulate the modalities according to the subjects and learning contexts, to catalyse the creation of links between concepts, understanding and memorisation.

4.2 How does hybrid mode work?

We have come up with three scenarios that can be used as examples, as though experiments, for experimenting with hybrid mode.

4.2.1 Proposed scenario:

- Blended courses - theoretical, Figure 12
  - Face-to-face with a trainer
  - Paper-based and e-learning
  - Use of an intermediate teaching object
- Video elicitation/explicitation - practical, Figure 13
  - Workshop with a trainer
  - Interaction between method and technique (cf. Blandine Brill)
  - Verbalising implicit knowledge
  - Developing reflexivity
- Person - place - knowledge - discovery (museum visit), Figure 14
  - Create an interaction between a digital medium offering activities linked to the museum tour and the techniques and objects on display.
  - Encourage comprehension and memorisation
  - Make learners active participants in their own learning

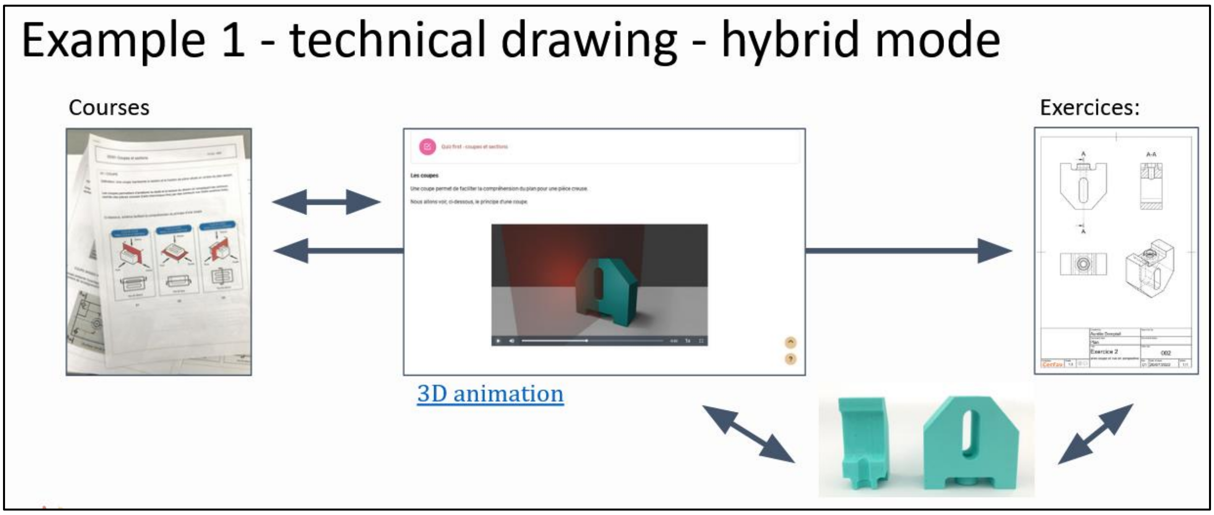

Figure 12 - Blended course - theory

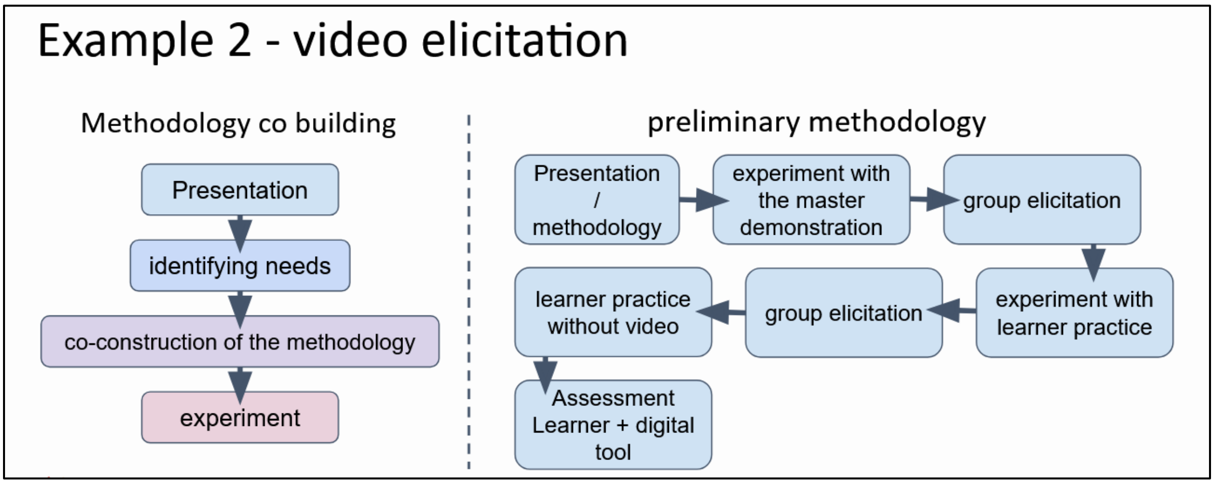

Figure 13 - Video elicitation/explicitation

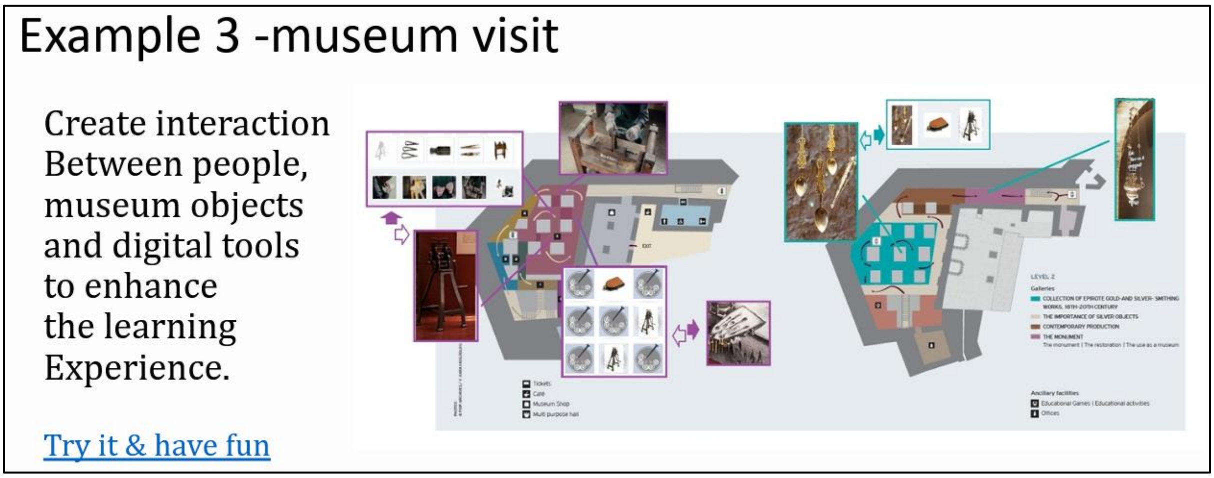

Figure 14 - Museum visit

4.2.2 Description of scenario 3 – museum visit, impact of the implemented modalities:

In this paragraph, we analyse the impact of digital tools according to the way they are used in an educational session. We identify the factors influencing the learning outcome and deduce an optimal scenario for integrating digital tools with traditional methods.

Example PIOP - Silversmithing museum visit:

<u>Key concept to be conveyed:</u> Recognise the different techniques, associated tools and associated products.

<u>Learning aim:</u> Identify and name the different techniques, associated tools and products, using an assessment aid, without fail or with a score of x/10.

<u>Target group:</u> Lower secondary school pupils.

Let's imagine several ways of doing this:

A. A traditional museum visit with a guide.
B. A traditional museum visit with a guide, followed by digital knowledge/exercise activities (separate time and place).
C. A museum visit supervised by a guide or teacher, followed by knowledge/exercise activities on digital media, as the visit progresses. (unity of time and place)

1. The visit is followed by an evaluation questionnaire to find out what the pupils/learners have learnt.
2. The visit is preceded by a briefing for the pupils on the topics they will be asked about at the end of the visit (setting out the objective of the session), followed by an evaluation.

This involves six possible scenarios, A1, A2, B1, B2, C1 and C2.

	1 - Non-contextualised assessment	2 - Contextualised assessment
A. Traditional visit	The learner listens to/chats with the guide. The points of attention are defined by the guide or the learner's personal interest. ⇨ Divergence Divergence between personal interest and educational objective.	The learner listens to/exchanges with the guide, with the instruction to prioritise his or her attention on assessment-related topics. However, the pupil or learner is not guided; their attention is not focused on the concepts linked to the instructions given beforehand, and it's up to them to find out. ⇨ Convergence (-) Here, the learner knows what they are looking for, but do they find it? The "needle in a haystack" effect.
B. Traditional visit + digital	During the visit, the same as A1. During the work on the digital tools, if they are well designed, they draw the attention of the pupil/learner to concepts linked to assessment (what we want them to remember according to the educational objective). ⇨ Divergence Here, we potentially have a divergence of attention between the visit and the work on the digital tools. => confusion, too much information.	During the visit, the same as A2. During the work on the digital tools, same as case B1. ⇨ Convergence Here we have a convergence of attention between the visit and the work on the digital tools. => clarity of objective, redundancy of information in different forms to help memorisation. (Subject to consistency between the objectives of the guide and the trainers).
C. Hybrid mode	The learner listens to/chats with the guide and interacts with the museum environment via digital technology, or directly with the digital tool. The points of attention are defined by the guide or the learner's personal	The learner listens to/chats with the guide and interacts with the museum environment via digital technology, or directly with the digital tool. The points of attention are defined beforehand and recalled through interaction with the digital tool.

	interest, through interaction with the digital tool. ⇨ Divergence ++ This can create confusion through the multiplicity of points of interest: guide, personal, and digital tools. Or cognitive conflict, if, for example, the guide and the digital tool provide different information. This can be beneficial if the learner exchanges with the guide and/or their peers. On the other hand, if they do not communicate, this can be destabilising and unproductive in terms of knowledge acquisition. ⇨ Divergence ++ Note: *this scenario seems risky to us and is not recommended.*	Note: *ideally, you should also be able to interact with the guide so that he or she is aware of the educational objective and can "play along".* ⇨ Convergence ++ ⇨ Creating a dynamic, setting things in motion, and taking required actions. In this scenario, the learner's attention is focused on what they have to learn and refocused during the visit by the interaction between the site and the digital tool. The conditions are therefore favourable for the acquisition of knowledge, thanks to the redundancy of information in different forms and to the dynamic created by the interaction between guide-place-digital tools-learner. Note: *a point of vigilance remains depending on the guide's adherence to the educational objectives, although clearly setting out the aim of the visit beforehand minimises the impact of any discrepancies.*

Figure 15 - Comparison of use cases.

We can see/suppose from the table above. Figure 15What creates convergence between the operational learning objective (OLO) and the focus of the learner's attention is informing them upstream of what they will be asked to know at the end of the session/visit. (what they will be asked about). Clearly define the objective of the session.

The digital tool, in cases C1 and C2, can be a catalyst for focusing attention on the educational objective, but also for divergence.

4.2.3 Description of the pedagogical process sought/proposed by the hybrid mode:

We have just seen in the previous paragraph the importance of the teaching methods used in the learning sessions. Starting from scenario C2, with the definition of objectives for the learners beforehand and the implementation of hybrid mode, we propose an exploration of the processes involved.

- An objective is set before the visit begins, "to be able to identify, through the objects in the museum collection, the two main techniques presented, the tools used and the manufacturing processes".

Setting the objective enables the brain to focus on it and identify the sensory stimuli related to it.

- There are two possibilities here: treasure hunt mode or guided mode.
    a. "Treasure hunt" - on the digital tool, a series of images is displayed on the home page of the "visit the museum" session; these images refer to quiz/exercise numbers. When learners recognise an object in the museum, they complete the associated exercise. (instructions to be given beforehand) [option to use product recognition].
    b. Guided mode, when learners come across an object, they are invited by the guide or trainers/teachers, or a special, identifiable cartridge, to complete the corresponding quiz/exercise.

Note: the exercises and quizzes contain cross-references, which create redundancy for memory and links for understanding. For example, the first exercise is built around the casting mould, the shape of the print is the same as the object produced, which the learners will find later in the visit and on which an exercise will also be planned (see Figure 16 - visit plan. 3D-printed replicas could be handed out at the start of the visit as a reference point, to help them recognise the object in the imprint of a mould, on a photo, or the object itself, which also helps them to get to grips with the world of the trade through the object.

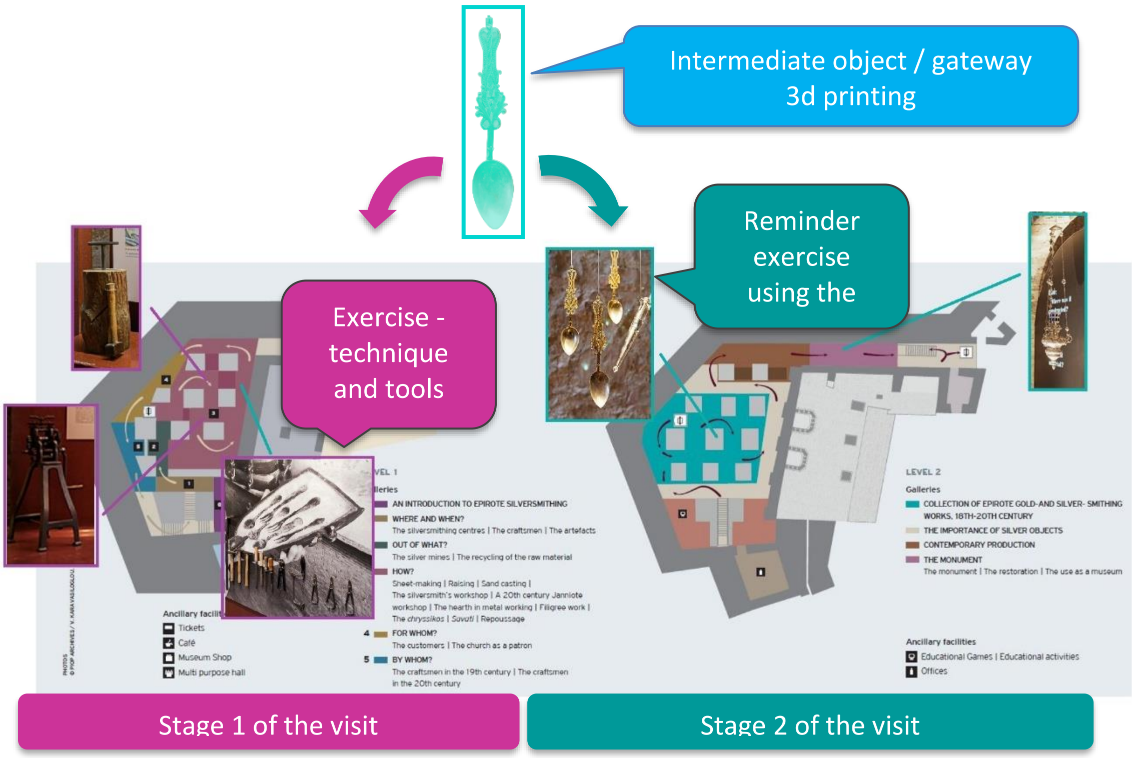

Figure 16 - Synopsis of the tour

1. During the first stage of the visit (ground floor, techniques), we associate the object with its production technique and tools, creating the link through the shape of the object.
2. Stage 2 (second floor of the museum, the collections), "here we are in front of object x we have just seen its production technique and the tools needed to produce it (first floor of the

museum, first part of the visit), can you associate this object with its production technique and tools (Creating a link between object and technique, reinforcing the memory trace, active memory recall => Ebbinghaus, see memory recall exercise, Figure 17).

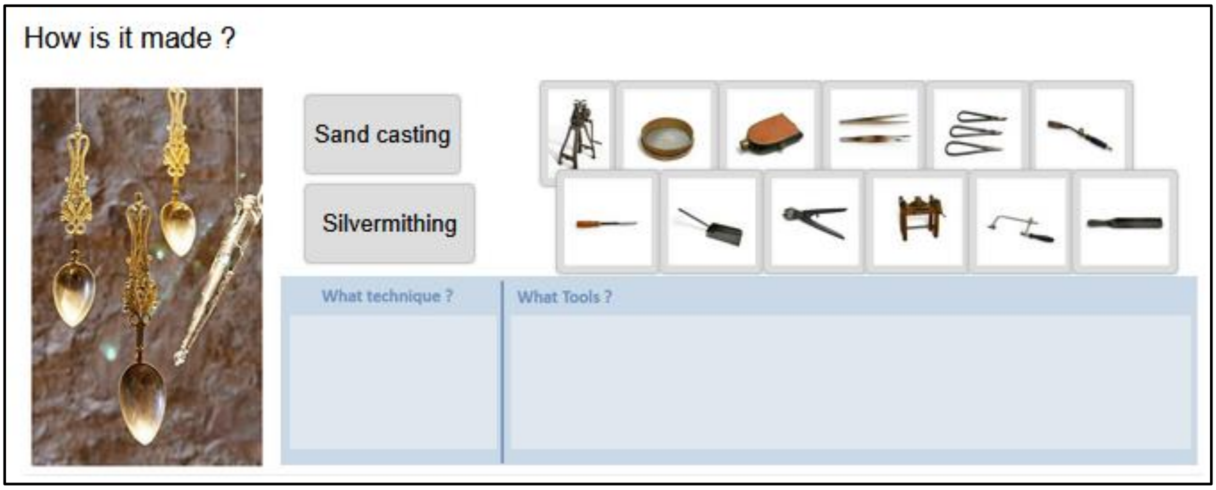

Figure 17 - Memory recall exercise using an exhibited object

3. A final quiz summarising all the concepts seen and learnt in relation to the learning objective. This quiz aims to check that knowledge has been acquired and, together with the correction/solution, to provide a further memory recall (as a possible remedial aid).

4.2.4 Evolution of the methods according to the tools.

With reference to Figure 18, "Digital tools modalities table year 2" in paragraph 2.5 "Dependent modalities on the scenarios and the digital tools used", we propose an evolution of the modalities according to the digital tools used, integrating the hybrid mode. This mode is basically On-line, On-site and synchronous, but can evolve through different configurations of the modalities. For example, hybrid mode can be asynchronous in the specific case of the flipped classroom. See Figure 19.

Modalities	**Scenarios / digital tools**			**Workshop**
	E-learning platform	Design Studio	Apprentices Studio Craeft Studio	
Connections	On-line	Off-line	Off-line	Off-line[1]
Location	Everywhere	FabLab or workshop	FabLab or workshop	Workshop
Time	Everytime	Project session	Project session	Workshop session
Synchronicity	asynchronous	synchronous / asynchronous[2]	synchronous / asynchronous[2]	synchronous

Figure 18 - Digital tools modalities table year 2024

Modalities	**Scenario / digital tools**			**Workshop**
	E-learning platform Interactive courses	E-learning platform Video elicitation + Workshop Hybrid mode	Apprentices Studio / Design Studio	
Connection	On-line	On line	Off-line	Off-line
Location	Everywhere	Workshop/classroom	Classroom	Workshop
Time	Every time	Workshop/course session	Course session	Workshop session
Synchronicity	Asynchronous	Synchronous Asynchronous	Synchronous	Synchronous

Figure 19 - Digital tools modalities table year 2025

5 Implementation

5.1 Operational implementation for each RCI

Implementation in the various bodies representing the craft trades will be based on their own needs and constraints, and the hybrid methods that we recommend will be deployed as far as possible.

5.1.1 RCI 1 – Glass blowing with a pipe (making a cup):

The experiment carried out in 2024 made it possible to define the experimental methodology and to obtain initial results on the impact of the Craeft digital tools.

In 2025, the methodology for experimenting with Craeft's digital tools with second-year apprentices will remain unchanged in order to assess the impact of improved digital tools, all other things being equal, and to be able to compare the results of the experiments in 2024 and 2025. We will refer to this experiment as the formal experiment.

Educational aim:

- Acquire glass-blowing techniques using a cane to make a goblet.
- Acquisition of key concepts in cross-curricular subjects, HSE, general technology and technical drawing.

Participants: second-year apprentices in the Glass Arts CAP, in two groups, T and TA (40 people), aged 16 to 25.

Trial dates: September, late October/early November

As the time available for the second-year apprentices to get together was limited, two weeks in September and two weeks at the end of October/beginning of November, we wanted to open up the experimentation with digital tools to the other Cerfav classes, in particular the Glass Creators, so that the digital tools could be developed before the second-year apprentices started to get together. In addition to the added value and the flexibility given to improve the digital tools, this experimentation will allow us to collect qualitative data, which we will call informal experimentation.

It should be noted that the evolution of digital tools includes their own improvement as well as the improvement of their usage scenario.

The following table summarises and compares the Craeft digital tools evaluated in 2024 and 2025 for RCI 1 - glassblowing.

Experiment 2024	Experiment 2025
VR glassblowing workshop simulation (version 3 & 4)	VR glassblowing workshop simulation (version 5) + haptic controller
e-learning	e-learning + demonstrator + flipped classroom
Project management from A to Z	Project monitoring (start)?
	Workshop work + video elicitation

Figure 20 - Comparison of the 2024 and 2025 experiments

5.1.2 RCI 2 – Limoge Porcelain

For the 2024 and 2025 experiments, the educational aim is to visualise porcelain-making skills, improve postural transmission and encourage innovative porcelain design using digital tools.

The digital tools used :

- 3D Avatar
- Skeletal views
- Hand-tracking
- Virtual porcelain lathe

For 2025, the experiment will be based on the results of 2024 and on improving the porcelain generator (Plaster Turning Simulator).

Trials scheduled for autumn 2025.

5.1.3 RCI 3 – Cretan Clay

5.1.4 RCI 4 – Marbre Carving

Educational aim: to identify and name the stages in the manufacturing process and the tools as part of a visit to the Tinos Museum.

Participants: a school group of 10- to 15-year-olds

Experimentation: June 2025

5.1.5 RCI 5 – Woodcarving

Educational aim: introduction to woodcarving techniques

- Tools
- Materials
- Safety instructions
- Process
- Practice session

Participant: adult public

Trial: June 2025

The experiment will involve three groups:

- A control group - face-to-face
- A "hybrid" group - with face-to-face and digital phases
- A 100% digital group - following the courses solely via the digital modality

5.1.6 RCI 6 – Silversmithing

Educational aim: to identify and name the stages in the manufacturing process, the tools and the products as part of a visit to the museum in Ioannina.

Participants: mixed groups of adults and children

Experimentation: October 2025

The specificity of this experimentation is that it will cover both WP 6.1 - education and training, and WP 6.3 - valorisation.

5.1.7 RCI 7 – Aubusson Tapestry

Educational aim: create a virtual training path in tapestry techniques

Participants: adults (large audience)

5.1.8 RCI 8 – Cretan Weaving

/

5.2 System for assessing the impact of digital tools

5.2.1 Questions concerning the establishment of representative samples

5.2.1.1 Context:

There are structurally few apprentices or students in RCI-related professions. For ethical reasons, only people who volunteered or at least consented to take part in the study.

As the participants were divided into two groups, test and control, their numbers were very small for some of the experiments in 2024.

Our questions concerned the representativeness of the people taking part in the experiment, in order to define the scope of validity of the results.

We therefore questioned the representativeness of the groups of people, the "population samples" participating in the experimentation and the consequences on the field of validity and the precautions to be taken in interpreting the results produced.

5.2.1.2 What is a representative sample?

For reasons of time, cost, organisation, etc., it is not always possible to carry out an exhaustive study of a given population of people. For example, all European craft apprentices. The representative sample is then a portion of this population which is supposed to take on its characteristics and produce a study whose results are very close to those of a study carried out on the whole population.

If the population is homogeneous, its individuals have similar or close characteristics, and a small number of individuals is sufficient to represent the population. But the population can also be heterogeneous in terms of its characteristics and distribution (spatial, for example). The questions then are, what is the prior knowledge of the population, and how can a representative sample be defined?

There are several methods for establishing a representative sample

- Statistical, probabilistic, involving chance in the choice of people
- Non-statistical or reasoned - does not involve chance in the choice of people

5.2.1.3 Small numbers statistics.

Tools exist to define the representativeness of a sample, on populations comprising a small number of individuals, Student's law, X^2 or Chi2. The scale of the sample is based on a "confidence level", a level of representativeness and a "margin of error" for the results.

These methods use a statistical selection of participants, which is not the case in the Craeft experiment.

In addition:

> *"It is only for populations greater than 100 that the notion of sampling really makes sense statistically.*[43] *"*

5.2.1.4 Reminder of the description of the methodology of the study on the impact of digital tools on learning[44]:

1. The framework of the study
    a. European Craeft project, see Appendix A, context § 1.2 and analysis of the request §1.3
2. Type of study
    a. Impact of digital tools on the transmission and learning of arts and crafts professions
3. Study period
    a. Three years
    b. Year of implementation
    c. Year one: initial experimentation
    d. Year three improvement of tools and final experimentation
4. Study population including
    a. The participants in the study depend on and differ according to the ROI
        i. Secondary school students (RCI 4 marble, RCI 6 silversmithing)
        ii. Young adults aged 16 to 25 who are apprentices (RCI 1 - glass)
        iii. Students (RCI 2 - porcelain)
        iv. Adults (RCI 4 - CETEM)
    b. Inclusion criteria
        i. Volunteering
        ii. Exemption from the general CAP subjects for RCI 1, for organisational reasons, as part of the assessment focuses on personal projects, carried out only by exempt apprentices.
    c. Criteria for non-inclusion
        i. Not volunteering

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[43] I. SLIMANI, *Fiche pratique: Contitution d'un échantillon*, Comité d'Harmonisation de l'Audit Interne, https://www.economie.gouv.fr/files/fiche_pratique_constitution_echantillonv1.pdf

[44] By Firmin Bossali, Gilbert Ndziessi, Noël Paraiso Moussilao, Edgard Marius Ouendo, François Napo Koura, Dismand Houinato, Justine Kapo-Chichi, Michel Makoutodé, Hugues Armand Matongo, Jean Rosaire Ibara and Assori-Itoua-Ngaporo, *The research protocol: an essential stage in the research process guaranteeing the validity of the results*, Cairn.info - https://stm.cairn.info/revue-hegel-2015-1 page-23?lang=fr

        ii. Not exempt from general subjects in the CAP for RCI 1
    d. Sampling method.
        i. Here again, the method may vary from one RCI to another,
            1. All of the people who have taken the target training course used to evaluate the Craeft digital tools. In this case, we cannot talk about a sample, but about a population reduced to a few members.
            2. Volunteers who have taken the target training course.
            3. It should be noted that these groups are themselves divided into a test group and a control group, which are not necessarily equal.
        ii. As participation in the study is based on small populations, less than 100, or on volunteers, the method is by default non-statistical or non-representative.
5. Data collection techniques and tools
    a. The data collection technique was based on several evaluation tools
        i. Group collection of on-the-spot reactions
        ii. Questionnaire on the initial and final state of skills
        iii. Self-assessment questionnaire on mastery of tools
        iv. Satisfaction survey
        v. Comparison of formative and final evaluation results
6. Any ethical and administrative considerations
    a. Participants were informed of the terms and conditions of the experiment
        i. Implications
        ii. Documents to be completed
        iii. Time spent
    b. The surveys were carried out in such a way as to ensure that participants were not discriminated against.
        i. The selection criteria, if any, were explained to the participants.
        ii. The selection criteria are linked to the organisation of the experiment and not to the qualities of the participants.
7. The plan for analysing the results
    a. The data was mainly analysed from a qualitative point of view
    b. Statistical studies were carried out on the data to define indications and preliminary interpretations, identifying ways of improving the digital systems and serving as a basis for a possible larger-scale study.
8. Possible difficulties encountered
    a. One of the major difficulties encountered was the diversity of experimental situations in each RCI.
        i. There are various constraints on the RCIs, such as the fact that they may be far from structures for passing on craft skills.
        ii. Harmonising systems for assessing the impact of digital tools
        iii. Ensuring the representativeness of groups or samples with populations that are not homogeneous from one RCI to another.

5.2.1.5 Conclusion

Due to the conditions under which the Craeft experiment was carried out, with a small number of participants based on voluntary participation, the definition of the samples will be non-probabilistic, non-statistical via the so-called reasoned method.

It should be noted that for certain RCIs, all participants in the training courses concerned by the experiment could be taken into account. For RCIs where some of the apprentices or students did not agree to participate, the definition of the groups is less "reasoned" than "by default".

This situation will have to be taken into account in the results of the experiment in order to identify any bias produced by the method used. A first bias is introduced by the notion of voluntariness, which can lead people who are the most resistant to digital tools not to participate.

One point to emphasise here is the difference between correlation and causality:

- correlation indicates an association between variables
- causality demonstrates a cause-and-effect relationship

Causality can only be demonstrated by studies based on groups of large numbers of individuals over a long period of time (ten years or so). The results of the Craeft experiment will therefore be correlational.

> *"The approach places particular emphasis on the long timeframes of the processes studied, as the causal chains explored are generally long-term.* [45]

The method used to validate the results of the Craeft experiment will be:

- Contextualise the results by describing the conditions under which they were produced.
- Use the figures and statistics carefully. For example, if a sample represents 2/3 of learners, if half the sample passes an exercise, we can say that at least 33% (one third) passed and not 50%, because we have to relate the result to the overall 'population'.

In short, the results of the Craeft experiment on the impact of digital tools on apprenticeships in the arts and crafts sector will enable us to draw up several strong recommendations for changing the way in which technical skills are passed on. However, these results cannot be generalised as being valid for all kinds of apprenticeships throughout Europe.

5.2.2 Developments in the assessment of tools.

To evaluate and compare the results of the experiments carried out in 2024 and 2025, "all other things being equal", our recommendation is to retain the methods and media used in 2024 during the first phase of the experiment.

As a reminder:

- Group feedback
- Questionnaire on the initial and final state of skills
- Self-assessment questionnaire on mastery of tools
- Satisfaction questionnaire
- Comparison of formative and final evaluation results

On the other hand, in view of the conclusions of the previous chapter, it seems essential to be able to add a narrative describing the context in which the evaluations were carried out. The utmost care must also be taken when interpreting the data, particularly the quantitative figures and any statistics that may be derived from them.

[45] P. Bezes, B. Palier, Y. Surel, *Le process tracing - du discours de la méthode aux usages pratiques*, Revue Française de science politiquel, vol. 68, no 6, 2018.

Further Reading

- Cognitive Load Theory
  - See appendix 1 - cognitive load theory
  - Source, Wikipedia: https://fr.wikipedia.org/wiki/Charge_cognitive
  - See also: https://theses.hal.science/tel-01735371

- The Ebbinghaus forgetting curve
  - Source en, Wikipédia: https://fr.wikipedia.org/wiki/Courbe_de_l%27oubli
  - Source en, Wikipédia: https://en.wikipedia.org/wiki/Forgetting_curve
  - See also: https://www.pedagogie.ac-nantes.fr/innovation-pedagogique/echanger/la-courbe-de-l-oubli-d-ebbinghaus-1290774.kjsp

- Pierre Vermersch
  - L'entretien d'explicitation, ESF éditeur - 2019.

- Blandine Bril
  - *Geste technique et apprentissage : une perspective fonctionnelle*, in Patrick Pion & Nathan Schlanger, *Apprendre : Archéologie de la transmission des savoirs*, La Découverte / Inrap, 2020.
  - B. Brill and V. Roux, *Geste technique : Réflexions méthodologiques et anthropologiques*, Éditions Érès, 2002.

- Kolb's learning styles
  - David A. Kolb, *Experiential learning: Experience as the source of learning and development*, Pearson, 2015.

- Jean-Claude Combessie
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  - *Comment retracer les mécanismes causaux- Les différents usages du process tracing*, Revue française de la science politique, Vol. 68, N°6, p 967-990, 2018

- Philippe Bezes, Bruno Palier, Yves Surel
  - *Le process tracing - Du discours de la méthode aux usages pratiques*, Revue française de la science politique, Vol. 68, N° 6, p. 961-965, 2018.

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  - *How to construct a sample, Module 3, Analysis of quantitative data in the human and social sciences (ADSHS)*, Université de Grenoble Alpes, 2016 – 2017.
  - https://www.fun-mooc.fr/fr/cours/analyse-de-donnees-quantitatives-en-sciences-humaines-et-sociales-adshs/
  - https://lms.fun-mooc.fr/asset-v1:grenoblealpes+92001+session01+type@asset+block/mod3-cap2.pdf

Annex D – User Guide

CRAEFT

care, judgment, dexterity

Abstract

The user guide is a practical guide to build a training session, face-to-face or distance learning. This document describes step to step the way and tips to implement a training session. This document is intended to help other RCIs implement the experiment.

Preamble

By questioning the role of Craeft digital tools in learning, we notice that they do not replace the workshop experience.

- Digital tools can be used to supplement and reinforce training in fundamental concepts.

  Example: in cross-disciplinary subjects, the 5 essential concepts via the e-learning portal.

- Help with preparation before going into the workshop
  - the safety rules that absolutely must be observed
  - know the work process
  - prepare the tools

The concepts covered in one session will be revisited as a backdrop or reminder in a subsequent session, in order to create links between the knowledge, make sense of it and help understanding.

The aim is to encourage memorisation by reinforcing mental patterns (cognitive load theory) and organising memory recall (Ebbinghaus forgetting curve).

Contents

1 How to do?

photo credit: Enrique - pixabay.com

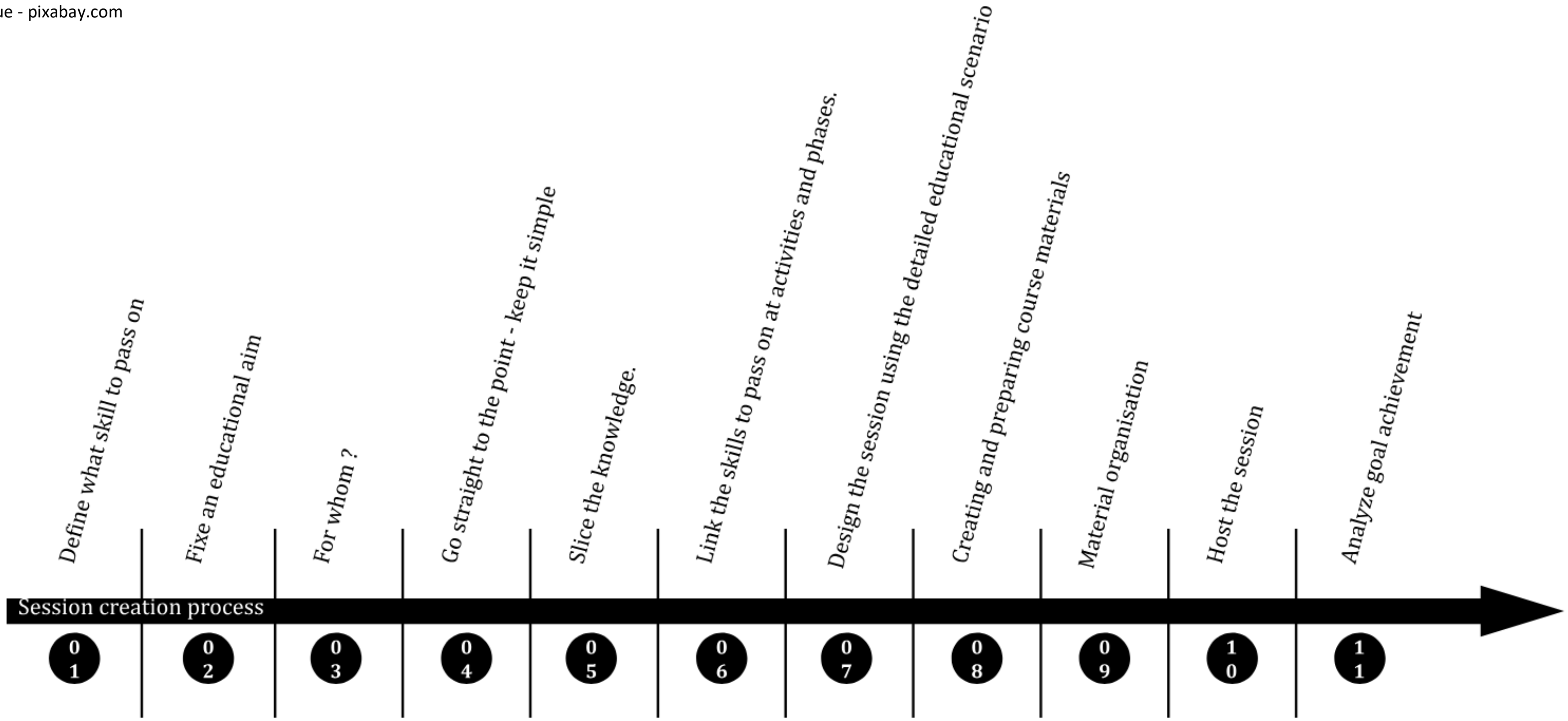


Figure 1- synopsis of the phases of a session

1.1 - Define what skill to pass on

photo credit: Craeft

What skill, what gesture, what part of the craft, I would like to pass on in the course I'm creating, through the e-learning platform or in présential?

Example: for the glassblowing curricula, blowing-pipe glassmakers.

Starting from glass and crystal, lead glass art refers to (see page 10, fig. 1)

- “I’m select” the activity => C2. Prepare
- “I’m select” the skill => C2.3 Choose and check machines and tools and adjust tools. (fig. 2)
- “I’m select” the elementary task => preparing the workplace for blowing a cup.

Certification standard

(Appendix Ib)

DEFINITION OF COMPETENCES

Summary table of competencies

C1 Be informed

C1.1 Read the instructions and decode the documents provided (technical file and procedure).
C1.2 Identify work materials,
C1.3 Identify materials, tools, fluids, C1.4 Identify control tools,
C1.5 Be aware of health, safety and environmental regulations.

C2 Prepare

C2.1 Establish the chronology of the operations to be carried out according to constraints, C2.2 Prepare the work materials
C2.3 Choose and check machines and tools and adjust tools, C2.4 Organize and adapt work space.

C3Implement

C3.1 Carry out pickings with the ferret and the cane,
C3.2 Shape the taken glass in order to blow it
C3.3 Carry out the blowing to carry out the requested part,
C3.4 Carry out the pressing to carry out the requested part,
C3.5 Carry out the detaching, the setting to the annealing arch
C3.6 Complete the finishing touches (tracing, decalletage, slotting, chamfering, sawing, re-brushing, flatting, de-polishing, polishing),
C3.7 Carry out the decoration (compaction, roughing, cutting, sanding), C3.8 Ensure the stop of the manufacture

C4Maintenance

C4.1 Ensure preventive maintenance (standard: NF 13306 of June 2001),
C4.2 Detect possible malfunctions,
C4.3 Maintain the station in working order.

C5 Check

C5.1 Adapt gesture and posture according to the operation to be carried out and respecting the rules of ergonomics,
C5.2 Check the conformity of the realizations in the course of manufacture, C5.3 Carry out the auto control.

C6 Communicate

C6.1 Pass on instructions,
C6.2 Participate in problem solving by proposing improvements or solutions.
C6.3 Report orally, graphically or in writing, choosing and using the appropriate tools, media, techniques, principles and codes.

C7Respect the rules of hygiene, safety and environment

C7.1 Respect the rules of hygiene and safety, C7.2 Respect the rules of environment.

10

Figure 2 - CPC referential

C2.3 Select and check machines and tools and adjust tools.	Environmental elements : - The workshop, the workstation. Available resources: - Technical file, - Procedure sheet.	The choice of the tool and the machine is adapted to the required realization. The tool and machine are in working order. In the case of anomalies, the person responsible is informed.

figure 2- Skill description

⚠ - If you don’t have any referential, you need to formalise it with the master craftsman and define the activities and skills.

1.2 - Fix an educational aim

Formulate the three components of an educational objective:

photo credit: Meineresteram - pixabay.com

- Observable behaviour
- Achievement condition
- Performance criteria (if assessed)

- Definition of the operational educational objective, see page 57 of the educational kit.

Example:

- Observable behaviour: at the end of this session, the learner will be able to prepare the workstation for blowing a cup.
- Achievement condition: in the workshop, using the technical file and the procedure sheet (see referential, skills table, skill C2.3, page 13)
- Performance criteria (if assessed) :
  - The choice of the tool and the machine is adapted to the required realisation.
  - The tool and machine are in working order.
  - In the case of anomalies, the person responsible is informed.

(see referential, skills table, skill C2.3, page 13)

1.3 - For whom?

photo credit: Cerfav

Define the audience for the training session, in order to adjust the method, the tools, activities and educational aids and any difficulties suspected at the outset.

Example:

For apprentices, encourage an inductive approach, starting with them, their interests and what they already know. Encourage experimentation and demonstration, summarise knowledge using practical exercises and adapt the pace of training.

- See the principles of the experiment, page 5 of the educational kit.

1.4 - Go straight to the point - keep it simple

Select the key information, most relevant for understanding. photo credit: Cerfav

⚠ - This stage is a difficult one, because we often would like to pass on as much of our knowledge as possible.

This is a difficult stage for the trainer, as it is essential to select and summarise the fundamental concepts to be passed on, focusing on the objective of the session.

Example: preparing the workplace for blowing a cup.

skills/tasks:

- choosing the right tools
- prepare the bench
- prepare the mould
- check, maintain and adjust tools

cross-cutting skills:

- ❖ know how to read a technical file
- ❖ know the procedure, or know how to read the procedure sheet
- ❖ comply with health, safety and environmental regulations.

Not needed skills for this session:

- ➢ checking and adjusting tools not used for this work sequence
- ➢ How the tools are made
- ➢ the work position on the bench (to be seen in another session linked to implementation)
- ➢ etc.

1.5 - Slice the knowledge

photo credit: Alexander Fox - pixabay.com

The learner studies simple concepts one by one and then assembles them into more complex concepts. This method is based on the mental patterns of the cognitive load theory and is part of the pedagogical progression.

The trainer will have to break down the skill to be taught into elementary tasks or learning units.

- At this point, we implement the cognitive load theory, see the intrinsic load and element interactivity effect, see page 59 of the educational kit.

- The smallest "slice" of skill will be the capability, which is the control of an elementary task forming part of a competence, see glossary, page 56 of the educational kit.

Example: preparing the workplace for blowing a cup

Skill sliced in capability, elementary task:

- Choosing the right tools (list of tools depending on the task)
  - jacks
  - shears
  - pincer
  - bloc
  - mold
- prepare the bench
  - positioning the bench in the workshop
  - placing tools on the bench
- prepare the mould
  - placing the mould
- checking, maintaining and adjusting tools
  - check
    - Are the jacks waxed
    - Are the pincers unwaxed
    - is the mould waxed

1.6 - Link the skills to pass on at activities and phases

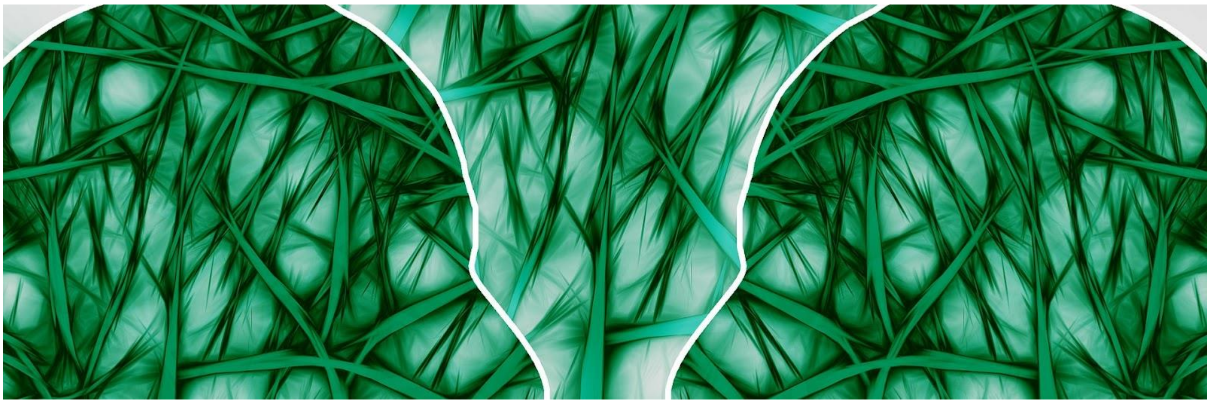


photo credit: Gerd Altmann - pixabay.com

Which Craft tools are associated with the skills to be passed on?

- See the definition of activities and phases on pages 10 and 11 of the educational kit.

- At this stage, for each ability or skill to be acquired, you can define whether it is knowledge, know-how or interpersonal skills, and the level of mastery expected.

If necessary, you can refer to the reference.

This stage will enable us to define which skills or abilities will be imparted using which Craeft tools, e-learning platform, Design Studio, and Apprentices Studio.

Example:

Prepare the workplace to blow a cup

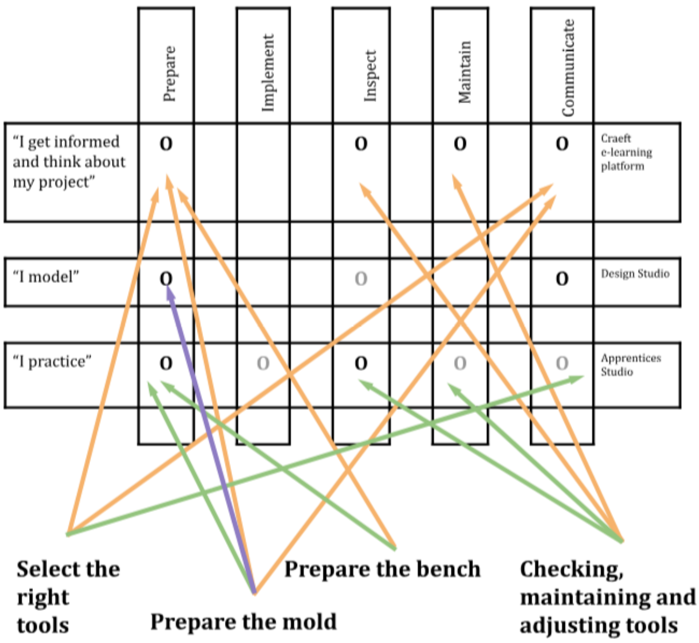
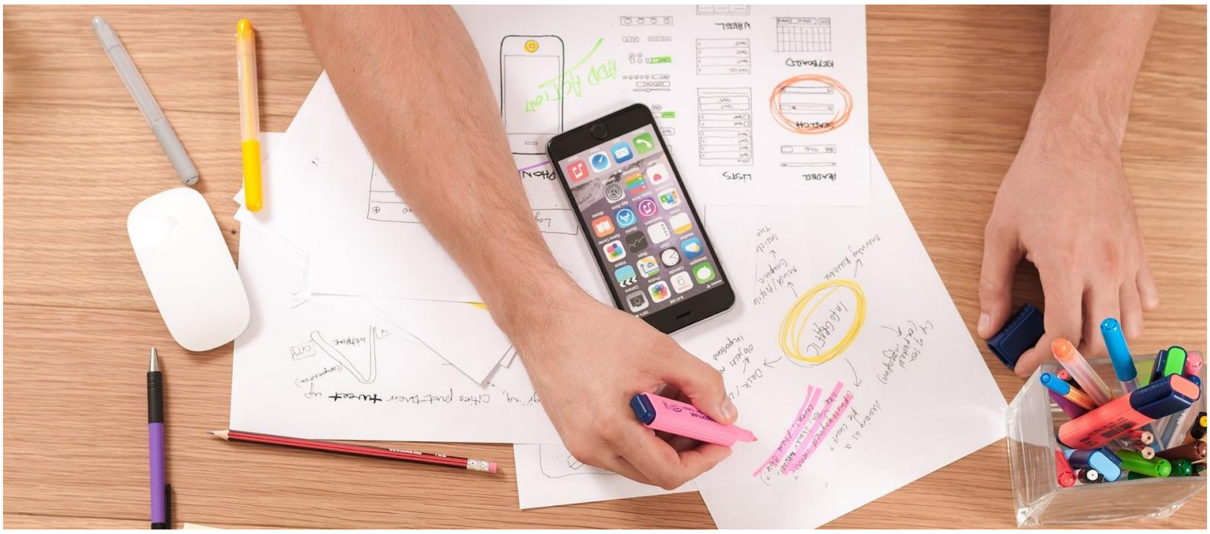


Figure 3- distribution diagram of skills in the scenarios

Skills/capabilities	Type of skills (Taxonomy)			Craeft tools used		
	Know	Know-how	interpersonal skills	e-learning	Design studio	Apprentices Studio
Select the right tools.	X			X		
Prepare the bench	X	X		X		X
Prepare the mould	X	X		X	X If a specific shape	X
Checking, maintaining and adjusting tools	X	X	X	X		X

Figure 4- distribution table of skills in the Craft tools usages

1.7 - Design the session using the detailed educational scenario



"What am I doing at this time of the session with what tools?" photo credit: Firmbee - pixabay.com

The detailed educational scenario is a time frame for the training session.

Based on this framework, everything remains to be worked out: how to implement the method to achieve my objective, what activities and materials will I create, carry out and use at each stage of the session.

⚠ - In this creation session phase, the choice of educational tools will be implemented
The educational approach and method.

☝ - See educational principles, page 13 of the educational kit.

Inductive approach
From particular to general
Linked educational methods : • Active • Active experiential • Project-based
The learner: "I like doing"
"I have a project, I'm going to learn the knowledge I need to succeed". *Access to skills is direct from the learner to the knowledge; the trainer is a facilitator. Access to knowledge is discontinuous:* *"I test and start with skill D".*

Inductive approach
From particular to general

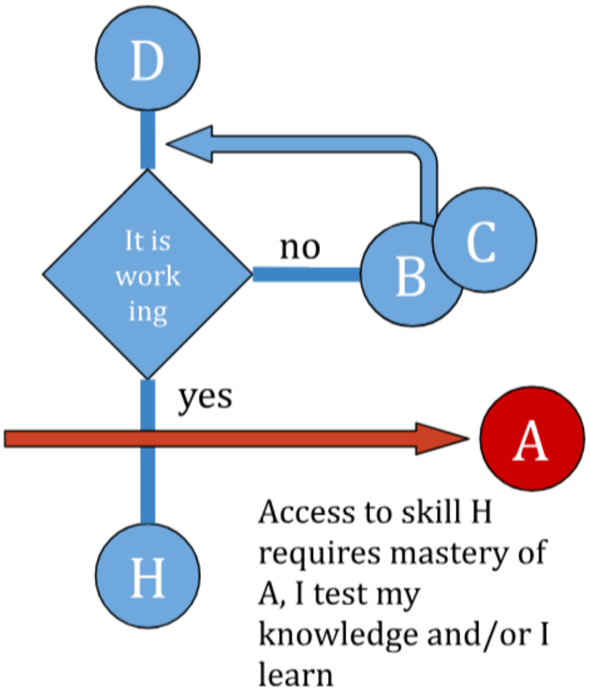


Figure 5- educational inductive approach

⚠ - The detailed educational scenarios proposed on the educational kit are focused on presential learning. For e-learning courses making, the detailed scenario is the sequencing of the topics.

⚠ - For learners, being able to situate themselves in their training path is one of the sources of motivation.

At the start of the session:

- It is therefore important at the start of the session to set the context
- Review the concepts covered in previous sessions
- Set the aim and communicate the plan for the session
- Discuss the aim with the apprentices to give meaning to the learning.

At the end of the session:

- Summarise the concepts covered
- Assess

- Remedy if necessary
- Put into perspective, looking ahead to the next session

- See the structure of the educational scenario, page 12 of the educational kit.

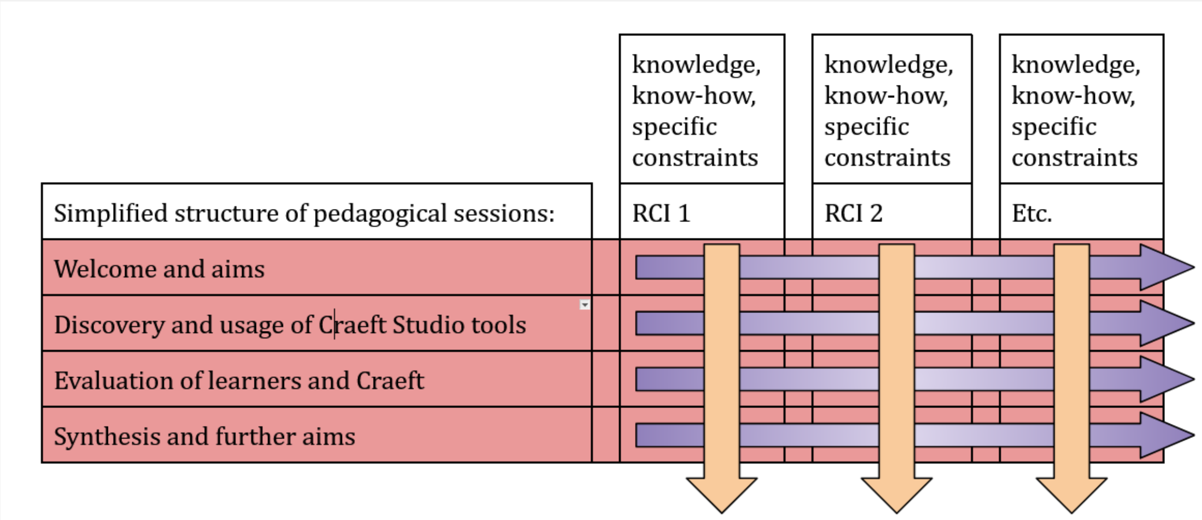


Figure 6- transversal session phases for all RCIs

Example:

Craeft Studio platform tools discovery session

Session phases	Not a recommended method	Recommended method
Launching / contextualisation		
A reminder of what has already been seen during the presentation of the Craeft project.	"Last time we saw..." was only spoken. (Passive attitude / auditory channel)	"Who would like to write on the board what we saw last time? (active attitude / auditory and visual channels)
Course aim	"This is the goal..."	"What do you think we're going to see today?"
...		
Presentation of the e-learning platform		
To provide essential guidelines for using the e-learning platform	"Should be known..." (regular classroom teaching) or have a look at the documentation on the website.	• "Who has ever used an e-learning platform, the Cerfav platform, for example?" - "What can you tell me about it?" • demonstration by the trainer or "Who would like to try it? • summary "So what's in it for me? (make a note or ask someone to make a note on the board)
...		

Figure 7- Phases of a session and recommended method

1.8 - Creating and preparing course materials

photo credit: Anna_Sunny - pixabay.com

This stage takes the shape of the tools designed. It consists of producing the training aids in the form of a text, video, diagram, PowerPoint presentation, quiz, etc.

<u>Example:</u>

Search for a video, create a click-and-drop quiz using images on the e-learning platform, write a document, etc.

1.9 - Material organisation

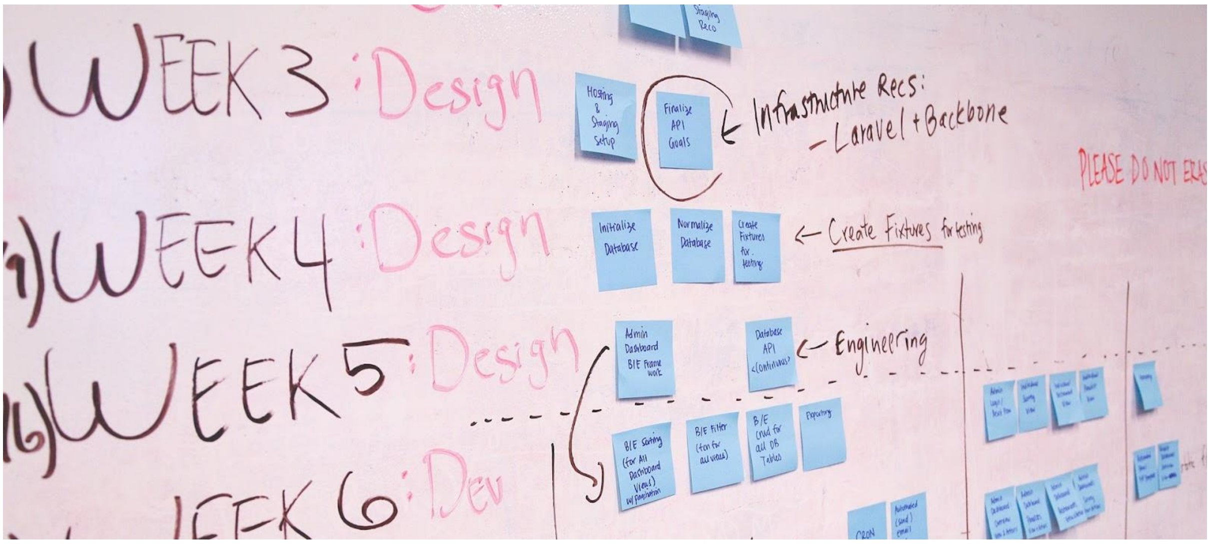


photo credit: StartupStockPhotos - pixabay.com

- room reservations
- participants list
- reserving the video projector
- Arrange for printing materials
- Post-it notes, paper, pens
- felt pens for the blackboard
- Prepare the environment for XR
- etc.

⚠ - Plan this organisation to avoid last-minute stress.

⚠ - Don't forget to test any installations or devices beforehand.

⚠ - Have a plan B, a paper version of your presentation, for example.

📢 - Have your own felt pens for the whiteboard.

1.10 - Host the session

Everything is ready, all you have to do is run your session!

photo credit: PIRO - pixabay.com

a few tips:

- Have the detailed educational scenario in front of you
- Organise the materials to be distributed (if necessary) according to the session timetable
- On the computer, filing documents for easy access

1.11 - Analyse goal achievement

photo credit: pixabay.com

After each session, you can take stock of what worked well, what didn't work so well or what didn't work at all, and identify areas for improvement.

Example :

- Achieving the learning objective
- Satisfaction survey
- Timing of the session
- Adherence to the proposed activities and materials
- Clarity of materials/comprehension by learners
- Relevance of assessment
- etc.