Prototyping Hybrid Learning Environments through Distributed Design

Maria Dafni Gerodimou, Oliver Juggins, Santiago Fuentemilla, Xavier Dominguez & Eduardo Chamorro from Fab Lab Barcelona.

Introduction

A shift towards online education has been taking place over the past decade, with online resources for education providing the opportunity to gain new skills at a level of accessibility that wouldn't have been possible for previous generations. This transition allows for new and distributed models of learning to be developed which, in turn, provides a great opportunity in the field of design, where delivery normally takes place in-person due to the practical nature of activities in the courses.

The purpose of this review is to present the frameworks, research methodology and documentation tools developed by the Fab Lab Barcelona team in the transition to a hybrid learning environment during this academic year, for the Master in Design for Emergent Futures (MDEF) program; a key goal of the research being to identify the ways in which a hybrid model approach is not merely a replacement for a fully physical format of delivery (due to the pandemic's restrictions), but a viable alternative that adds value to an overall learning experience.

MDEF as a Case Study

In the 2020-21 academic year, in the face of the COVID-19 pandemic, the MDEF transitioned from a fully in-person master program to a hybrid course, meaning that there was a mix of on-campus and online students. This year's MDEF included remote students from all over the world and therefore the course structure, equipment and planning of the classes had to be adapted in order to adequately respond to the new context.

The MDEF is a complex learning environment as it incorporates different concepts and topics relating to emergent technology including synthetic biology, digital fabrication and machine learning into one coherent course. The course serves as a great case study for investigating the hybrid models educational approach and distributed learning practices as it is itself a hybrid master born from the intersection of design and the maker's world in collaboration with IAAC, Fab Lab Barcelona and ELISAVA School of Design.

Its structure poses several challenges from an instructional design point of view, as not only do each of these different learning areas demand their own dedicated learning strategy, but they must be intertwined into a holistic learning experience where the separate topics are not merely fragments of knowledge, but are equally important parts which complement each other and interconnect.

This context provided the perfect landscape for the education team of Fab Lab Barcelona to concretise ongoing research into hybrid learning frameworks, which has thus far been developed on a yearly basis, and without the urgency of a global pandemic for the global Fab Academy program. As a result, the MDEF course serves as a great case study for how the hybrid model can be implemented into a course with varied content spanning different disciplines and ranges of delivery formats. For instance, in the first term the course integrated different topics and external guest tutors, each one dedicated to a separate one or two week course. This meant that throughout the year, we had to encounter a number of different modules, from fully distributed online classes to hybrid digital fabrication workshops, depending on the content delivered. Whilst the hybrid model might seem to be adding complexity to an already challenging design course, it was a necessary leap to deal with our context. It also simultaneously presented a great opportunity for experimentation and therefore allowed for the emergence of novel learning practices, integrating both physical and digital tools.

In order to facilitate the transition to the hybrid model to MDEF, the Fab Lab Barcelona's educational team defined a research strategy with the purpose of developing a set of tools aimed to successfully extract and organise collected information throughout the duration of the course in an efficient manner. The latter provided valuable observations and reflections regarding the learning strategies and modules used.

There were a series of research questions and aims that were set out to guide the research framework:
- What can hybrid learning environments learn from the paradigm of distributed design?
- What are best practices that can be extracted to improve the learning experiences that are developed by the Fab Lab Barcelona as a whole?
- How will the approach to designing educational experiences evolve with the findings?
- How can we incorporate students and faculty in the research process to make the most of their insights?
- What is the necessary physical infrastructure that needs to be developed to successfully implement the hybrid model?

Future Learning Framework

The Future Learning Framework has been in development by the team in the Fab Lab Barcelona and provides citizens with the necessary methodology, resources and technology so that they can develop key skills and competencies for an uncertain future and become digital, social innovators.

The research activities and the development of the framework has been guided by the Sustainable Development Goals with the focus and definition of education experiences that are designed and delivered. This framework is constantly evolving and serves as a pedagogical tool that facilitates the development skills and competences that are based around three pillars: attitude, knowledge and challenge. Attitude refers to the engagement and interest of the students (or participant of a given learning programme), knowledge refers to the content of the learning experience and challenge refers to the task and goal of the learning experience.

Given the context that has been brought about this academic year, the opportunity to research what an educational distributed design model looks like through a hybrid model presented itself and has been one of the main research lines this year.

Research Methodology

The research carried out was built on an initial study into the hybrid model in order to prepare for the adjustment and planning of the different strategies that would have to be implemented throughout the year. The guide included initial assumptions and preparation in terms of infrastructure, interaction modes and instructional design strategies. The purpose of the hybrid model research is to enrich and potentially reform the guide, transforming it to a toolkit that can be used and adapted to similar hybrid learning courses in the future.

In order to conduct the research, the team developed a research methodology, building on the initial hypotheses but with the intention to dynamically adapt the focus as the course progressed and new learnings were formed. The research methodology includes:

Documentation Tools Used to Gather and Organize Data

- A Teaching Assistant position, created to facilitate the technical needs of the hybrid model infrastructure and observe and document the classes. The assistant participates in all the classes and is therefore responsible for gathering the insights as well as communicating on a regular basis with faculty and students in order to receive feedback regarding the course.
- Assessment methodologies including evaluation tools and feedback sessions with students and faculty.

Interaction Modes

In order to analyse the hybrid model and evaluate implementation, a number of interaction modes were synthesized (a term used to define the different types of possible formats of delivery), also looking at how they are experienced within both online and hybrid learning environments. This refers mostly to the interaction between the tutor and the students and expresses the different ways in which learning can take place.

These interaction modes include:

Presentation mode
One-directional lecture - tutor presenting. Student's presentation.

Activity mode
Hands-on Workshop / Making. Design Thinking / Ideation. Brainstorming.

Discussion mode
Group class discussions. Check-in / Check-out. Q&A / Troubleshooting.

The research aims to identify these interactions, analyse which ones work best in certain situations / contexts, and which combinations of interaction modes work well during an online or hybrid and even in-person environment. By observing and analysing the interaction modes through the research, our intention is to build an instructional guide, as part of the hybrid model toolkit which can be used as a reference in order to improve the specific courses but also the student experience as a whole.

Interaction Modes diagram
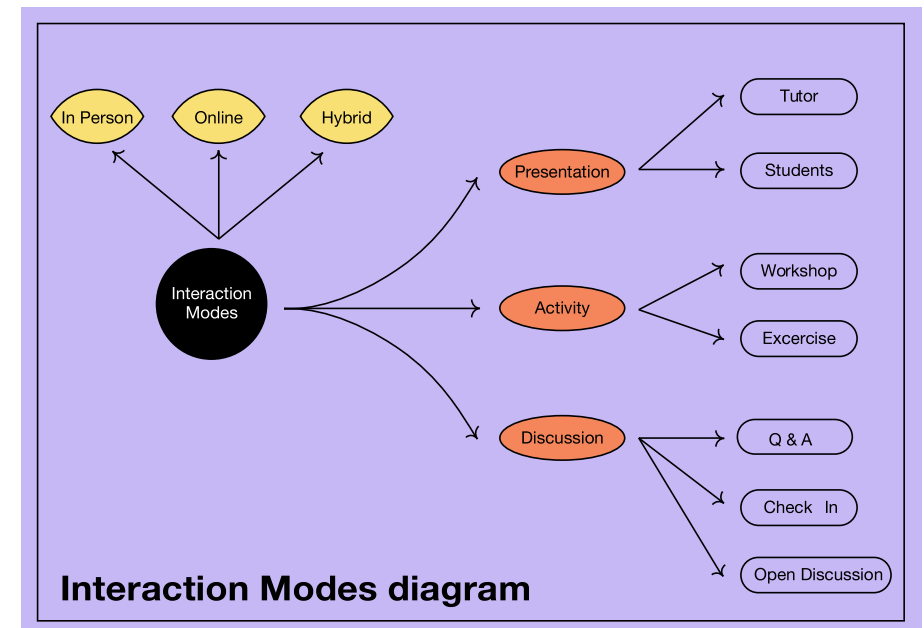
Documentation Tools

The Toolkit Template

For the documentation of the research, the team developed a set of tools including different templates and methods with the aim of building a complete documentation toolkit that can be used for other courses as well.

To document and organise the information of each course, we created a Google document containing:

- General information about the course syllabus, objectives and duration as defined by the course instructor(s).
- The delivery format of each module/class (distributed or hybrid).
- Workshop template dedicated to each class including:
  - Structure of the activities including timings and interaction modes.
  - Tools and platforms and technical infrastructure used (physical and digital).
  - Comments concerning problems or unexpected observations that emerged during classes.
- Assessment section referencing the feedback gathered by instructors and students after the course.
- Reflections of the course through which the research team examines to what extent the initial objectives of the course syllabus were met and whether the tools used to support the hybrid model were sufficient.
- Improvements or iterations according to the assessment and reflections.

To complement the toolkit documentation the team also created visual templates with the collaborative platform Miro which includes:

- Diagrams the workshop templates.
- Interaction modes diagrams and templates.
- Visual notes.

These visual tools not only complement the research, but facilitate the understanding of the different workflows and information. In addition, they are a more understandable way to communicate the information that is gathered and processed, not solely for the rest of the research team but also for external organisations and possible collaborators.

Assessment

By analysing the information gathered from the documentation toolkit, the team can then assess each course.

This evaluation process consists of:

- Observation documentation notes.
- Videos, photos as evidence of what happened.

- Student engagement during the course.
- Quality of the student assignments.
- Weekly student reflections (personal documentation).
- Interviews of students and faculty.

The assessment is a vital part of the research, as it validates the observations and reflections generated from the classes, as well as the assumptions made by the instructors when designing the course. This evaluation process provides valuable insights regarding the possible iterations and improvements of the course or similar courses.

Key Takeaways

At the beginning of the year, the planning for the hybrid model was based on initial desktop research, and experience over the years of on-campus activity. Classes were planned for three different setups: on-campus, online and hybrid. Over the course of the year, we gained key insights which can be applied to each of these class formats, some of these include:

- Alteration of different interaction modes within a specific timeline carefully planned by the guest. (Presentation / Group discussion / Activity).
- The importance of paying attention to the timeline of the class to not exceed the predetermined three hours.
- The use of a variety of different interactive tools (during the week but also during each class) to maintain engagement.
- Creative smaller tasks connected to the course (brainstorming, small exercises, thought experiment).
- Give students the opportunity to present their work to the class and get feedback from tutor and classmates. It is important for them to see their classmate's work.
- Integration of collaborative/sharing tools (Google doc where students share bibliography, Miro, etc.).
- Having small breaks during an online class.
- Asking students to share briefly how they feel or what they learned at the beginning and end of the class (check-ins).
- Creating visually engaging material to help students stay focused and interested.

Hybrid Model General Insights, Tools & Equipment

We found that the most interesting insights came from analysing how the different interaction modes can be used in relation to a hybrid class with a focus on making. This class, as predicted, presented the most challenges but the most opportunity for learning. These are some general insights for the hybrid model, and tools and equipment that are useful across each of the interaction modes.

Insights

Extra care and preparation must be taken to ensure the learning experience of the remote students. Appropriate and sufficient equipment as mentioned above. Frequent check-outs from the faculty asking both remotes and non-remote students how they are feeling and how the group work is proceeding.

Tools & Equipment

- Screen(s).
- Projector.
- At least one noise cancelling speaker-phone.
- External camera.
- Zoom / Breakout rooms and Zoom Chat.
- Collaborative working platforms, e.g. Miro.

These are some more specific examples for each of the interaction modes (activity, workshop and presentation).
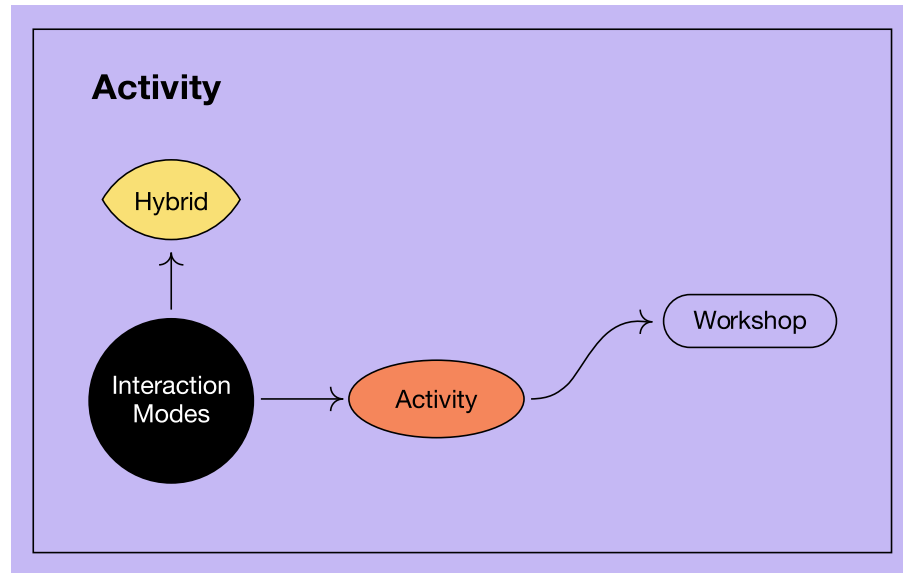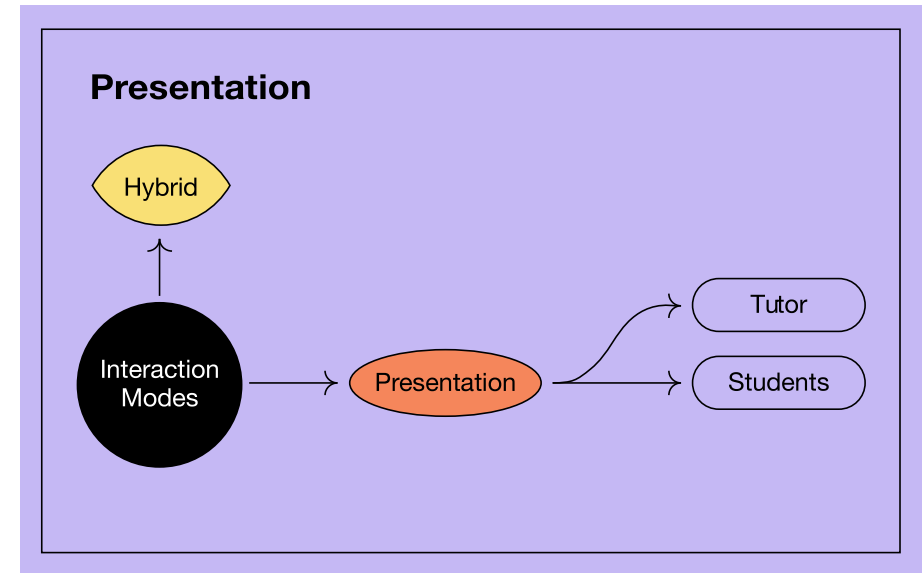

Interaction Modes-Activity diagram

Tips

- Making sure that the speaker is in proximity to the tutor, and checking with the remote's to make sure they are listening clearly.
- Having two screens - one big one for the presentation and one where the physical students can see the remote students so they

feel more included.
- Meticulous planning of the infrastructure needed for the class. Noise cancelling speakerphone, screen, cameras with different perspectives to the classroom.
- When forming hybrid working groups, it is essential that the remote students are evenly distributed according to their skill set. Otherwise, it is possible that they feel like they can't contribute equally to the project since not being physically in the lab is already a disadvantage.
- Maintaining a constant communication with students during the course and being able to adjust according to their needs.

Tools & Equipment

- Portable Cameras.
- Mobile phone.
- Headphones.

Interaction Modes-Presentation diagram

Tips

- Ensure that the person (student or tutor) speaking is close to the noise-cancelling speaker.
- Adjusting the camera to the person talking, or at least having a clear view of the whole classroom.

- Using the two screens (projector and screen,) one in gallery view and one in speaker view so the students and tutors have better visual contact with the remotes.
- Encouraging the remote students to participate by asking them questions. It is harder to engage in conversation while being remote so the tutor has the responsibility to include them as much as possible.
- Checking the chat frequently to vocalise the comments or questions of the remotes — some students are more reluctant to speak-up while being online so they prefer sharing their thoughts via chat.
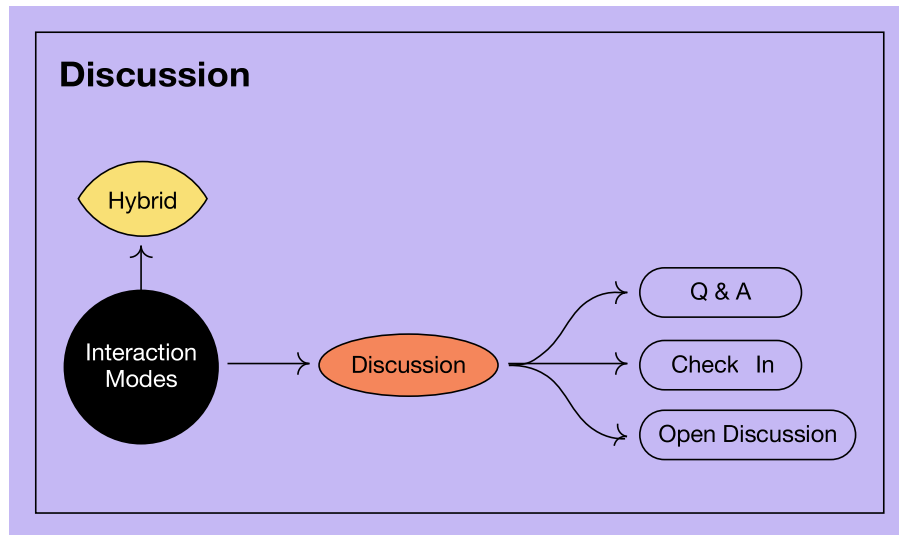
Interaction Modes-Discussion diagram

Reflections

The shift to hybrid models of education was an inevitable one, accelerated by the pandemic. The research carried out so far by the Fab Lab Barcelona gives some initial insights into the challenges and opportunities presented by hybrid learning environments, from the extra planning needed for the optimal student experience and engagement, to the practicalities of equipment used and room layout. We realise that, although we have gained some insights which can be taken into account when planning the next academic year, there is lots of room for improvement and a constant process of reflection and interaction will be necessary. The input from students has been instrumental in gaining these insights and will continue to be as the research continues into its second phase. As life becomes gradually more "normal", and as the changes brought about by the pandemic become less evident in society, we believe it will be important to keep in mind some of the major advantages hybrid learning environments

Experimenting with hybrid solutions during an MDEF class. Picture by Fab Lab Barcelona at IAAC

offer and continue to improve the student experience. For example, there are environmental benefits in tutors not travelling around the world to give a two day seminar if it can be done online.

In the near future, the distinction between "types" of learning environments will become less clear, as we believe hybrid formats will gradually become more common. There will always be a place for on-campus learning, particularly when it comes to making activities. However, as tools become more advanced and digital learning experiences can be enhanced by technologies such as VR, the question as to whether it makes sense to physically move around the world for learning becomes increasingly important and one we should ask ourselves. It is also possible that hybrid learning can apply to entire courses, not just classes where there are moments of synchronous, on-campus learning carried out in conjunction with periods of remote asynchronous learning. While this may be some years away, we think it is important to keep speculations such as these in mind as we work in the present.