Coaching interdisciplinary teams of students in a MAKE project

1 Introduction

1.1 Objectives of MAKE interdisciplinary projects

The challenges that students will be confronted with once they graduate are becoming increasingly complex. Besides requiring a solid background in a core discipline, they demand an ability to work at the intersection among many fields. The objective is to give students an opportunity to confront themselves with the challenges posed by interdisciplinarity during their training, giving them a head start in developing the necessary skills they will need in their professional future.
By participating in one of these challenges, students will acquire team-working and project management skills and will get a first hands-on experience in a real-world project at the same time. These skills will further bolster their core competencies.

1.2 Purpose of this document and rationale

This document is intended to provide advice and inspiration for supervising/coaching students on interdisciplinary projects at EPFL. It is not intended to provide a step by step procedure but rather general advice gathered by observing pioneer projects.

This document is dedicated mainly to academic supervisors of MAKE interdisciplinary projects but the content might inspire other formats of project-based teaching/coaching as well.

Moreover, MAKE projects are a great opportunity to develop transversal /professional competences. However, a recent study including some (not all) interdisciplinary MAKE projects suggests that students hardly improve on skills like collaboration or most of the project-management skills that were evaluated. Students only referred to having gained skills to assess risks in their projects more accurately. This certainly calls for a more accurate and **explicit encouragement** of those skills, and this document can help you support your students better and help them gain those skills over time.

1.3 Definition

Before going deeper into details, it is relevant to provide a few definitions/clarifications regarding the use of certain terminology:

• "Successful projects": we mean pioneer EPFL educational projects where students had a good opportunity to learn, and not necessarily projects that won an international student competition.
• "Good practices": by good practices in coaching students involved in these specific projects, it is meant "intuition of what might work based on observations from pioneer projects". Indeed, each project is different and it is extremely difficult (probably even counter-productive) to try drafting a general procedure or a magic formula for coaching students everywhere.
• "Projects": it means specifically MAKE interdisciplinary projects and not necessarily all formats of project-based learning existing at EPFL.
• "Pioneer projects": it means interdisciplinary projects that already happened at EPFL and were successful. Today, these projects (solar decathlon, swiss cube, EPFLoop (hyperloop), hydrocontest) are either terminated or ongoing with several years of experience behind them.
• "Professional/transversal skills": EPFL students are already realizing projects at EPFL (semester project, bachelor's and master's project) during which they apply the theory learned and have an opportunity to develop practical hands-on skills. However, MAKE projects are offering an opportunity to work in bigger teams in an almost industry-like type of setting. Therefore, students have an opportunity to develop other types of professional competences and it is then relevant to attempt defining this term:by professional/transversal skills, it is meant competences that can be reused in a wide variety of work settings. For example:

- working in organised teams;
- being able, when facing difficulties, to focus on problems and solutions rather than spending time on "who is to blame?";
- assessing risks and being able to cope with uncertainties;
- planning a project in relation to timeframes, tasks and roles;
- evaluating the outcomes of the project and derive useful feedback to improve it;

- understanding a system and its subsystems and being able to visually represent such systems and their interfaces;
- applying rapid prototyping methods and lean management methods (test hypothesis faster and cheaper);
- developing efficient and effective learning strategies (like extracting essential information and relating it to one's own project), etc.

1.4 Process of documentation

The process selected to document the good practices in coaching students involved in these projects at EPFL has been done in 4 steps (see figure 1). The following 4 chapters of these documents can be summarized here:

1. ***Why?*** What are the students learning, what are the skills we think they have been able to develop when participating in these projects? Why is it important to set learning goals at the beginning of the project and make them explicit for students?
2. ***How?*** What kind of coaching strategies can we put in place to facilitate the development of these specific skills (i.e. transversale/professional)?
3. ***How to quantify/assess*** what has been learned (if possible to quantify/assess)?
4. ***Case studies*** - the first three chapters of this document are providing very general concepts of good practices, the objective for this chapter is to offer very concrete examples of different pioneer interdisciplinary projects that have been successful at EPFL.

Note that in the first three chapters of this document, the content has been either extracted from the scientific literature on the subject or has been inspired by discussions with a group of practice (composed of coordinators of MAKE projects and pedagogical advisors from the LEARN center and the teaching support center, CAPE).

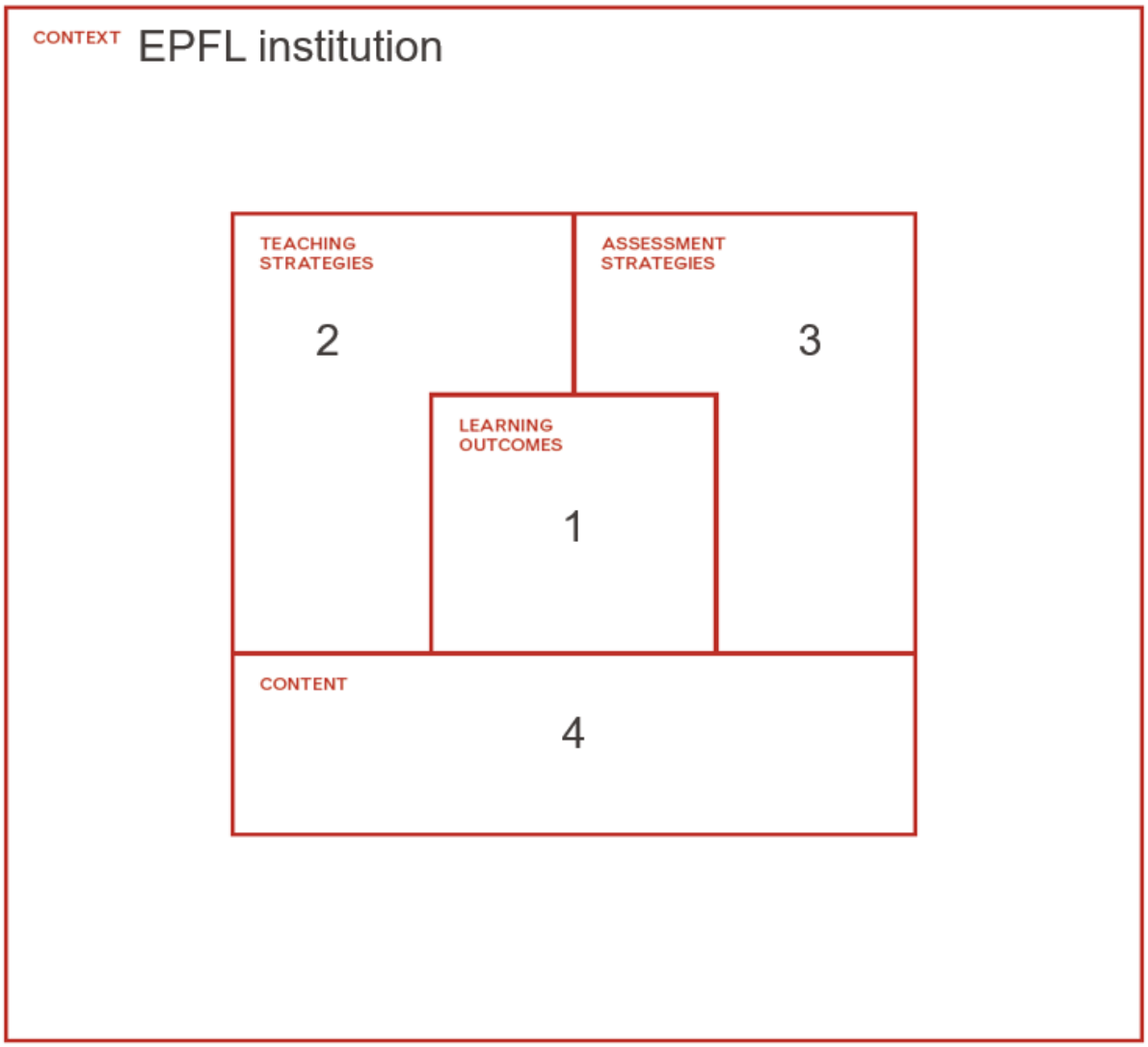

Figure 1: The four steps of documenting the good practices of teaching / coaching students involved in MAKE projects : CREDITS for this structure:Dr. Marc Laperrouza, CDH

1.5 Warnings

Before spending energy on questions related to coaching, one must question: how to promote the appropriate environment for students to realize their project?
It has been observed for all successful pioneer projects that two warnings must be considered before being able to focus on the learning process of the students:

1. **Organizational and operational matter:**

For instance, what are the necessary infrastructures, IT resources, legal and financial needs, administrative support required to ensure the project will run smoothly? It becomes difficult to coach students when they have to spend all their energy finding a screwdriver for example. *"Supportive policy and*

resources in aspects of finance support, promotion standards, infrastructure and learning equipment from the institutional level are needed to smooth PBL practice processes" (Chen, Kolmos, Du, 2020).

Another document (and more recently a training for MAKE students) is intended to provide advice and guidelines on how to run an interdisciplinary project at EPFL on an operational/organizational standpoint. This document however, focuses exclusively on coaching students assuming they have the right working environment already.

Note that for bigger scale projects (see section 5.1), operational/ organizational issues are not to be underestimated. It has been observed that for such projects, these issues tend to take a considerable amount of time and resources for the supervisors and the students, and they make it difficult to focus on the learning process. **Moreover, these bigger scale projects were the type of projects** included in the following study, study suggesting that it has been difficult for the students involved to improve on some transversal/professional skills.

2. **Structuring the project in time**:

Successful projects have always structured the development process in time using **milestones**. At each milestone, the students understand what is expected from them. Typical milestones are following a design process with a "preliminary design review", a "critical design review", a "prototyping" phase and finally the "assembling and testing of the prototypes" final phase. Of course, *there is not a single way of structuring projects* (Benett et al., 2018). For example, it has been observed that some projects have more **iterations** of this design process (they restart several times a loop of designing, prototyping and testing).

Finally, these milestones tend to provide a general backbone to the project allowing the coaching to provide feedback and tighter supervision if necessary. However, it is not designed to micromanage the students. The objective here is simply to provide a general structure of the project in time and to find the right **tradeoff (see figure on constructivism VS ex-cathedra/ ted talk in chapter 3.3)** between:

- giving enough freedom for the students to be creative and propose their own solutions
- but at the same time avoiding the typical mistakes observed with engineering students: i.e. going too fast towards a single solution, underestimating the importance of setting clear requirements, not questioning their design, not collecting feedback all along the process, falling in love with their first idea.

2 Learning objectives

2.1 Definition

Project-based learning is different from simple professional projects in that there are *learning objectives* (Condliffe et al., 2017). Learning objectives respond to the following question: *what do my students will learn in this project? What will they be capable of doing?*

There can be simpler and more complex learning objectives. Simpler learning objectives can refer to the understanding of certain knowledge and they answer the question: *What do students need to know?* E.g., for the EPFL robotic competition we can find objectives like: understanding basic electronic systems, basic mechanical principles and manufacturing methods as well as basic computer vision detection algorithms are necessary to build a cleaning robot from scratch. In that case, students must comprehend a particular theory, concept or principle. More complex learning objectives refer to how students must act upon reality using their knowledge, skills and attitudes to solve problems or to create new artifacts. These objectives usually entail *competencies,* i.e., the capacity to act upon reality and solve complex problems using, in an intertwined fashion, knowledge, skills and attitudes. E.g., for the EPFL robotic competition we have objectives like: being able to apply system integration methods in building a robot, being capable of working in teams efficiently, etc. In that case, learning objectives do not refer to simply understanding a certain situation, but to being capable of analysing, synthesising or evaluating a certain situation or problem and producing certain products. Given its nature, Project-Based Learning (PBL) represents an ideal pedagogy for promoting more complex and competencial learning objectives. In the context of MAKE, it makes sense that coordinators and teachers evaluate the most complex learning objectives (i.e., related to evaluation, synthesis and analysis of knowledge), and laboratory staff evaluate the simpler ones (i.e., related to knowledge, comprehension and application).

Below you will find a categorisation of learning objectives where they go from simpler objectives related to understanding of knowledge (on the base of the triangle) to more complex ones related to application, analysis, synthesis and evaluation (on the higher levels of the triangle).

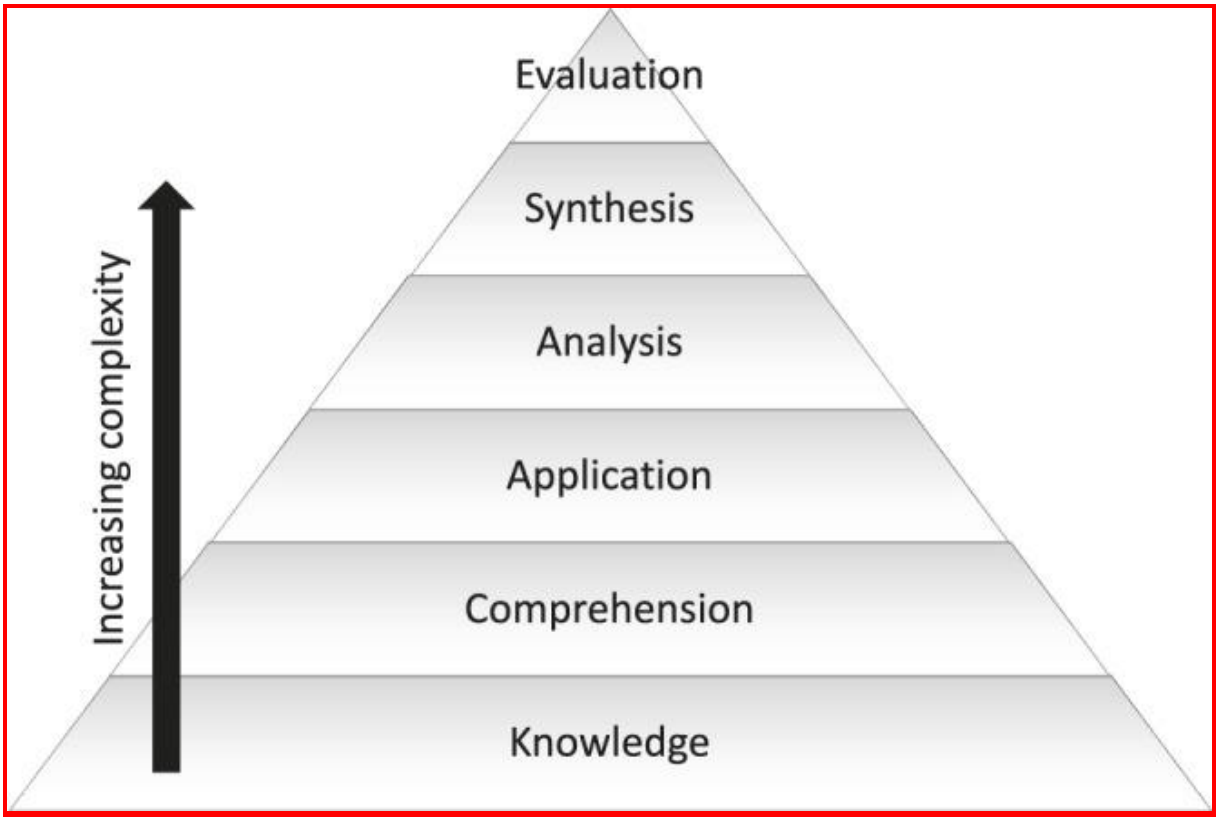

Figure 2.1: Bloom's taxonomy of learning objectives. A tool to help you set your learning objectives. Source: Adams (2015)

2.2 Common guidelines for setting up and using learning objectives

While designing the project-based learning scenario for your interdisciplinary project, it's always a good idea to follow certain guidelines. For example, take your time to think about what you really want your students to learn and see how well these objectives align with the learning objectives of the sections where your students come from. See what courses your project relates to, and take a look at the learning objectives they usually propose. Your proposal should *look for continuity and expansion of your students' background* (Kokotsaki et al., 2016). *Your learning objectives should complement and broaden* the learning that your students usually carry out in those subjects. For instance, while your students find many knowledge-related objectives in their sections' subjects (e.g., understand and apply basic electronic circuits/systems), you should consider introducing learning objectives related to the so-called professional/transversal competences like project-management, collaboration and communication. Indeed, *we can't assume students are good project managers right from the start* (Pucher Lehner, 2011). It's always recommended to take into account your students' background (previous subjects, specialisation, previous knowledge and skills) while designing the learning objectives for your project. To see examples of transversal skills go back to section 1.3 and see the paragraph on professional/transversal skills, or see the examples collected from MAKE projects in section 2.3.

Another recommendation is *to clearly state and share the learning objectives with your students and promote their ownership among them*. Explicit learning objectives can guide everyone in the later implementation and assessment of learning (Condliffe et al., 2017). This can be done in a number of ways, from presenting them, to discussing and analysing their adequacy with students, to pointing out through which activities they will be achieved, etc.
Ideally, there should be a clear relationship between the learning objectives, the learning activities and the assessment tools. E.g., you should be able to explain which activities will be useful to develop which learning objectives, and how each objective will be assessed (see figure 1 above). For that purpose, it's useful to have *a clear structure of the project you want to develop with its main phases and milestones well designed on a timeline.*

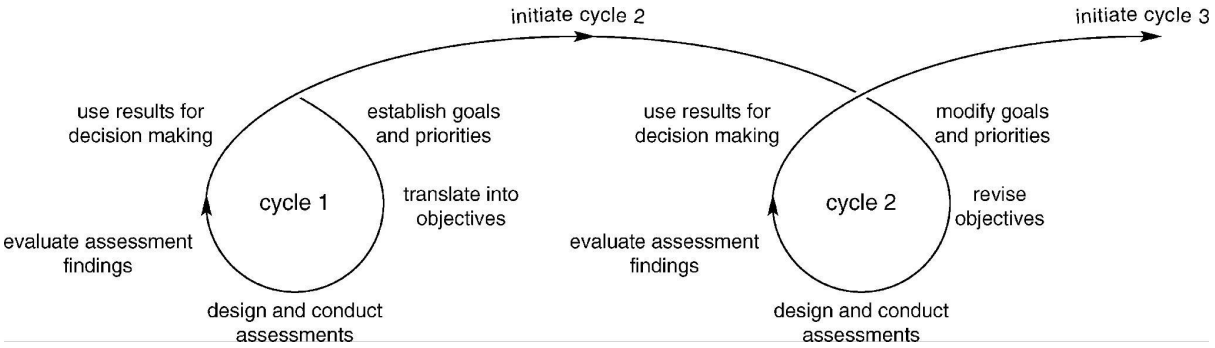

Figure 2.2. Iterative cycles of assessment. Source: Towns (2010)

Bear in mind that clear learning objectives will allow you to clearly assess your students, and this will allow you to make decisions regarding further editions of your project to implement iterative cycles of assessment of your project (see figure 2.2). You will be able to leverage the strengths of your previous project where your students got good results, and to improve on the weaknesses of your project where your students got worse results .

2.3 Learning objectives of pioneer projects

Following the objective of this document which is to provide inspirational material, below are some examples of learning objectives proposed by coordinators of previous MAKE projects including the Hydrocontest, the EPFL Racing Team, CHIC, and the Robotic competition.

Some of them are skills that you can find in the list of the 32 transversal skills proposed when creating a course sheet at EPFL (see annex 1.1)

Communicate, process and generate information:

- Write a scientific of technical report
- Access and evaluate appropriate sources of information

Personal efficiency

- Manage priorities
- Continue to work through difficulties or initial failures to find optimal solutions

Project management

- Assess progress against the plan and adapt the plan as appropriate
- Set objectives and design an action plan to reach those objectives

Working in society

- Respect relevant guidelines and ethical codes for the profession
- Take responsibility for environmental impacts of her/his actions and decisions

Working in groups and organizations

- Communicate effectively with professionals from other disciplines
- Communicate effectively, being understood , including across different languages and culture

The following learning objectives were again proposed by coordinators of MAKE projects but they are not included in the list of the 32 transversal skills proposed when creating a course sheet at EPFL:

Specific learning objectives proposed by MAKE projects coordinators:

- Be part of a team, work collaboratively including under stress
- Be at ease with productive failure, dealing with real world uncertainty and complexity
- Apply rapid prototyping techniques
- Apply a user-centric approach, identify expert sources and contact them
- Find a sweet spot between viability, feasibility and desirability, respect every input (even non-tech fields)
- Reinforce theoretical learning through practice, transform “book” knowledge into concrete applications
- Not afraid to be ridiculous, ask any questions
- Carry out a project from end to end
- Manage a budget
- Design and implement an appropriate documentation architecture
- Identify and use the appropriate communication vector
- Value the development process and not only the product

3 Coaching strategies

3.1 Definition

Coaching in education relates to the guidance, assistance and support of student's learning by establishing a one-on-one relationship with the students, whereby the coach addresses the learner's individual objectives, s/he follows up their learning process and provides more or less directive support, feedback, and advice in each stage of the process, and accompanies the learner's transitions (steps forward and backwards) to facilitate the achievement of their goals (Bettinger and Baker, 2011).

Usual procedures followed by coaches include (but they are not limited to) observing the student carry out learning tasks, describing and explaining the process the learner must follow, giving feedback (and this may include suggesting the use of a learning strategy, explaining why this learning strategy is appropriate, suppressing or correcting the use of a strategy), and requiring the student to carry out inquiry independently, and build a positive alliance (i.e., relationship) with the student (Hamman et al., 2000; Pierce & Buysee, 2014).

Here below, we will talk about coaching strategies when referring to a set of multiple coaching/teaching interventions that are orchestrated together in time.

3.2 Common guidelines for coaching

There are many guidelines we can follow for effective coaching in projects, for a quick reference, see figure 3.1 for 'effective coaching practices and suggestions of use'. Here,

Effective Coaching Practices	***Description***	***When used***
Observation	Watching the student in the classroom or environment carry out project tasks	Every coaching cycle
Modeling, also referred to as demonstration	Showing the student how to carry out a specific task or practice	Based on needs (e.g., when the student is unfamiliar with practice or uses practice incorrectly)

Performance Feedback	Presenting formal or informal data about the student's performance or learning process Characteristics of effective feedback: o Specific o Positive o Corrective (if warranted) o Timely Delivery mechanisms: o Verbal, written, or graphical data presented during pre–post observation	Every coaching cycle
Alliance Building Strategies	Using specific strategies that relate to factors of alliance to build a positive relationship in a student–coach dyad, Factors of alliance: o Interpersonal skills o Collaboration o Expertise o Conveying coaching is non-evaluative Examples of alliance-building strategies: o Empathetic listening o Restating and summarizing information conveyed by the student o Conveying expertise in learning and deep content-area knowledge o Identifying and working toward the student's goals and needs.	Every coaching cycle

Figure 3.1 - Effective coaching practices and suggestions of use. Source: Pierce & Buyssee (2014).

we'll only comment on some general ideas mentioned in the literature. First, the literature suggests that coaches must remain vigilant about the workload that is assigned and assumed by the student: *unachievable and heavy workload, and limited time and resources are serious obstacles to learning in PBL (Chen, Kolmos, Du, 2020)*, so it is important that the

workload aligns as well as possible with the time required from the ECTS credits the student must do (even though this is difficult today to achieve at EPFL, because most MAKE projects are working thanks to students motivation and rewarding them appropriately with credits isn't always possible).
When planning the project and our coaching, we must take into consideration that, generally, *a flexible combination of phases where students act independently and phases with tighter supervision and direct instruction (e.g., modeling, lecturing) by coaches may be suitable* (Kokotsaki et al., 2016). According to some literature reviews (e.g., Kokotsaki et al., 2016), this can be done in multiple ways, like planning more direct-instruction activities at the beginning of the project, and leaving more space for independent and autonomous activities in the middle and at the end of the projects. The quantity and quality of the assistance given to the student is not fixed, and it always depends on the context, and the needs of the individual student. *Generally, students acquire more independence as the project unfolds.* Also, students with more expertise and experience will require less supervision and direct assistance, and vice versa (see figure 3.2). *Students need more support when they have less knowledge and skills, and vice versa. Not everyone needs the same kind of support and coaching (Lafuente, 2019).*

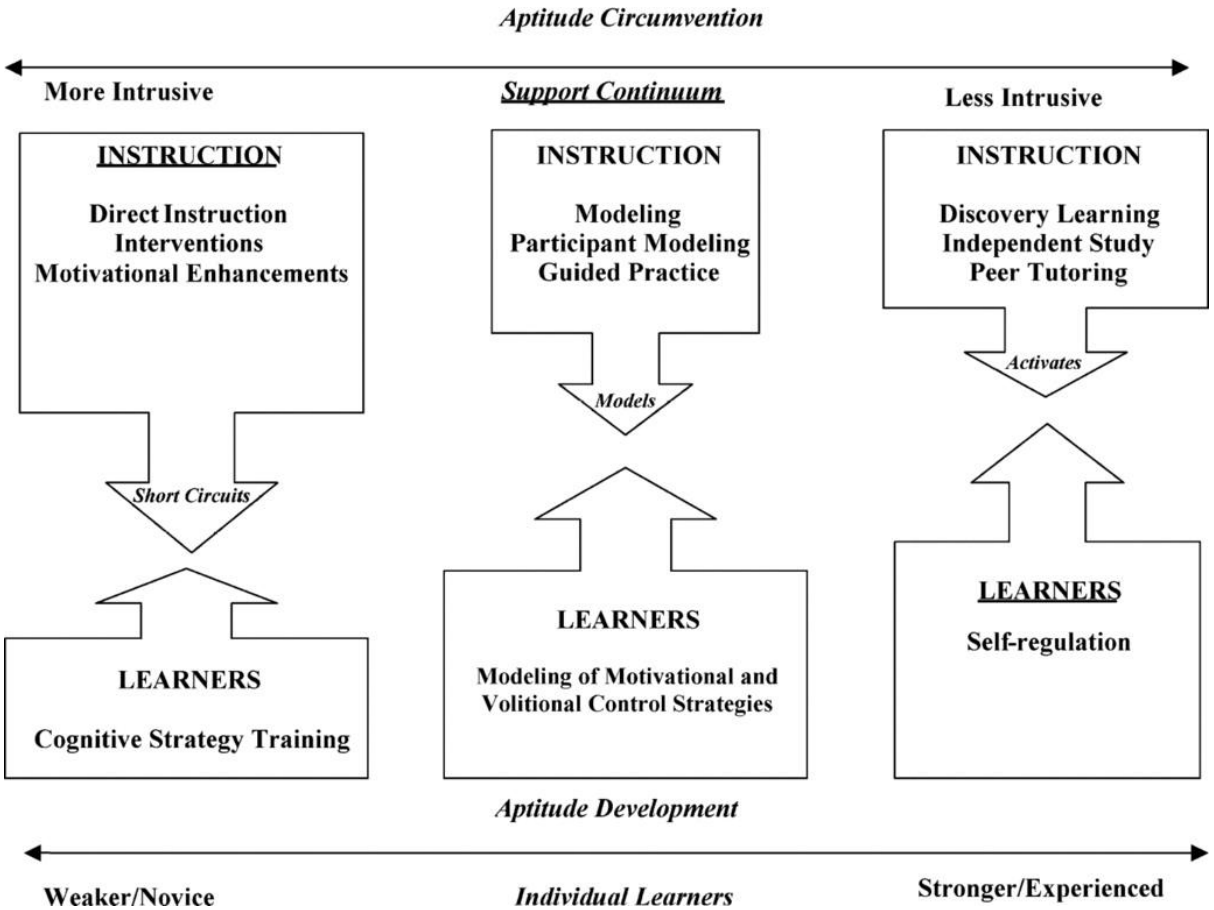

Figure 3.2 Specific support strategies for different types of learners. Source: Corno (2008).

Another good idea is to plan collaborative spaces where students can support each other. *Let students help each other: expert students can take the lead and support novices in collaborative teams (Condliffe et al., 2017).* Collaboration does not emerge spontaneously and it requires to be scripted and regulated, i.e., the coach must provide clear instructions as

to what the different stages of the collaboration are and what to expect out of all of them (Dillenbourg & Jermann, 2008).
Good projects not only rely on 'doing', but they also leave enough room for learners to reflect upon their actions and products (Thomas, 2000). In that sense, it's important to let the students carry out their actions, but also to prepare some points throughout the project where they must evaluate and reflect on how it's going, their main achievements and main weaknesses to be remediated.

3.3 Orchestrating coaching interventions, an example from a pioneer project

As described in the section above, different coaching interventions can be useful to support students. These coaching/teaching interventions are well known today and they are already used in typical semester/master projects at EPFL. However, in MAKE projects, the student not only reinforces theoretical learnings (material seen in class) through a practical implementation, but they are also intended to develop transversal competences.

When it comes to transversal competences development, the coaching strategy usually requires multiple coaching interventions (see section 3.2). For example, it might be difficult for a student to improve their communication skills by following a 2h lecture. Instead, the student could benefit more from engaging in a 6 months project with multiple coaching interventions including feedback from coaches and teammates, guided practice, personalized assessment and reflexive notes, etc.

Here below is an example of a set of coaching interventions used in one of the pioneer interdisciplinary projects (CHIC). Not only do we have a set of multiple of these interventions, but the figure here below is showing how they are orchestrated throughout the project. Some of the interventions are proposed during the main milestones of the projects, others are performed by the students during their free time. As commented above, multiple strategies can be useful, and a flexible combination of phases where students act independently and phases with tighter supervision by coaches may be suitable (Kokotsaki et al., 2016).

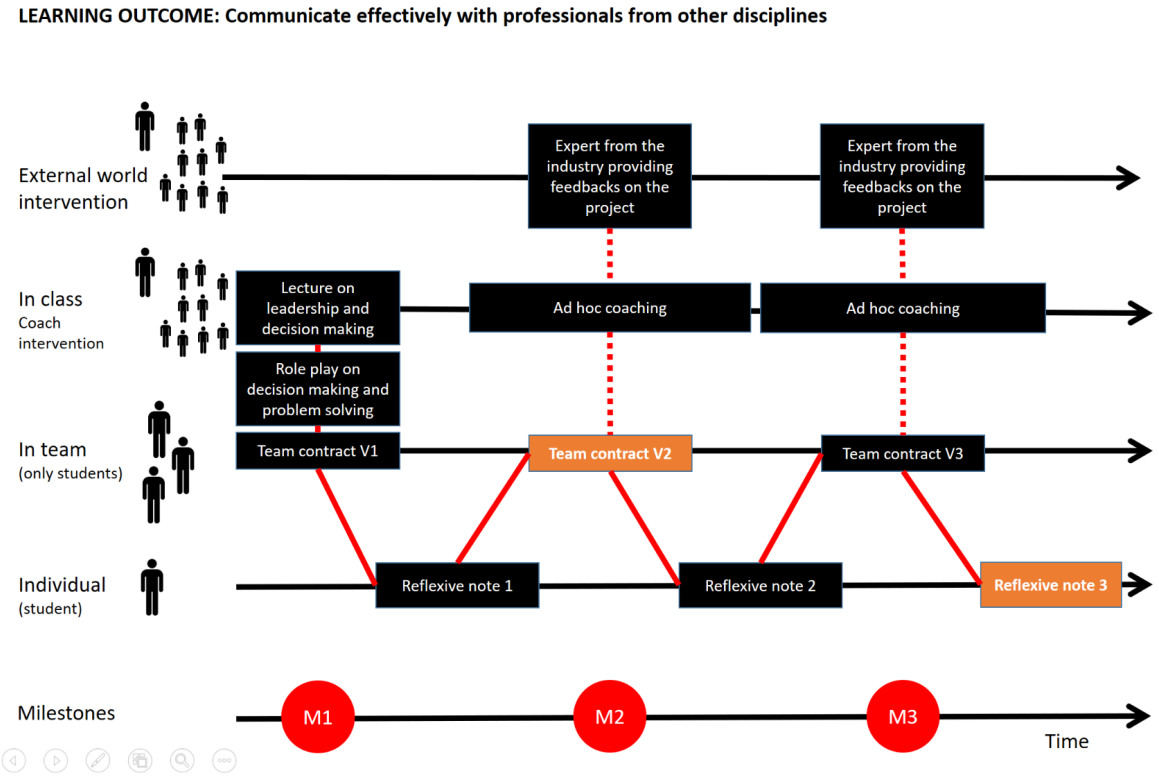

Figure 3.3 : example of an orchestration from the CHIC project. Multiple coaching interventions designed and orchestrated to allow students acquiring communication skills in interdisciplinary teams. Some interventions happened during the different milestones (M1 - M2 - M3), students also had to draft reflexive notes (individually) in between the different milestones. **In orange are the interventions that did not work as expected (mainly because the students had other priorities at that point in the project)**

It is advised when the learning objectives are set at the beginning of the project, to do this exercise of orchestration and answer the following question: “what type of coaching strategy (set of multiple interventions that are orchestrated) can I propose during the project to facilitate learning of specific learning objectives?”. Of course, in order to do that, one has to have previously designed clear and explicit learning objectives (see section 2). You can use the figure above to get inspired and design similar types of interventions for your own project.

Your project may oscillate between two poles: moments where the teacher/coach presents contents and models strategies, and moments where students experience more freedom and act independently. As for the first side of the spectrum, this can be illustrated through a TED talk, the perfect example of a pedagogical method consisting of transmitting information in one direction only (i.e., direct instruction). This method can be very efficient when one wants to clarify/explain specific contents or procedures, but it must be combined with other types of interventions for developing complex transversal skills. This can be done by promoting more independence in students. This is what “constructivism” proposes, a pedagogical movement inspired by the work of Jean Piaget with the objective to let the learner (in this case the student) act independently to “construct” their own knowledge and

skills. . Some research reviews currently support the idea that, for students with enough knowledge and skills, it is good to let students fail to a certain extent, and then leverage those failures to give constructive feedback and promote student's advancement in their learning (Shina & Kapur, 2021).

When designing coaching strategies, you might want to find a tradeoff between those two methods. Meaning that the student will have some freedom to develop/try/fail, but will also receive some concrete instructions, presentations and feedback at some point in time. Without these coaching interventions, the students will tend to only perform trials and errors and will not learn the best practices in carrying projects.

Figure 3.4: general suggestion when designing coaching strategies. Finding the right equilibrium between constructivism and direct instruction. When it comes to learning the best practices in PBL, the students need to learn by doing (having the freedom to try/test/make/fail) but they also need guidance and coaching interventions from experts. Sources: Prof. Pierre Dillenbourg and (***Schneider and Blikstein, 2015)***

4 Assessment strategies

4.1 Definition

To assess learning is to judge the quality of the student's learning. This is one of our duties as coaches, not only because we must certify that the student has achieved the learning objectives involved in the project, but also because assessment will help us to improve the student's learning by providing feedback to them, and it will help us to judge whether the project itself was successful in pedagogical terms. When we use the information from assessment to provide feedback to students and further enrich their learning, assessment of learning becomes assessment for learning (Hargreaves, 2005).

4.2 What can we assess? Alternatives to traditional assessment methods

Assessment should be focused on the learning objectives we have set for our project, whether they deal with knowledge, skills, attitudes and motivation, or more complex competences. Assessment can be applied to multiple cognitive processes, from the simpler understanding to more complex evaluation (see figure 4).

Category and description	Example of skills	Instruction words
Knowledge the ability to recall what has been learned	Recalls terms, facts, methods, formulae, principles	Name, define, list, label, select, state, identify, describe...
Comprehension the ability to show learning material has been understood	Understands facts, concepts, theories, rules, principles. Interprets information in various forms (charts, tables, graphs…)	Explain, summarise, interpret, give examples, compare, contrast, precise, defend, illustrate...
Application The ability to use learned material in a new task	Applies concepts, rules, principles to new situations. Applies laws and theories to practical situations.	Apply, modify, predict, demonstrate, find, solve, discover.
Analysis The ability to break up information into its component parts	Recognises unstated assumptions. Argues logically. Distinguishes between facts and inferences.	Analyse, break down, distinguish, relate, discriminate, separate, find, infer, deduce, classify...

Synthesis The ability to structure a situation of information to form a new pattern or whole	Writes a well organised theme. Writes a creative piece. Combines information from different sources to solve a problem. Devises a new taxonomy.	Device, design, plan, reorganise, rearrange, create, combine, generate, solve, invent, compose...
Evaluation The ability to evaluate the worth of material, theories, methods, information, etc. for a given purpose	Judges whether conclusions are supported by data. Uses criteria to judge the value of a work (plan, computer program)	Compare, contrast, justify, appraise, criticise, determine, draw conclusions...

Figure 4.1. Bloom's taxonomy of cognitive learning objectives, and examples of skills and actions that can be assessed on each category. Source: Imrie (1995)

It's always a good idea to be clear and transparent about the activities or methods that will be used to assess the students, and how grades will be derived. Depending on the moment and objectives, we can distinguish three main types of assessment:
Prior assessment: it's carried out at the very beginning of the project, and this is intended to find out about the students' prior knowledge, skills, and expectations on the project. If we know this, we'll be able to better adjust to their idiosyncrasies in the future and better measure their progress throughout the project.
Formative assessment: it's carried out during the project, and this is mainly intended to provide feedback to students, as well as to evaluate their advancements regarding the different learning objectives. We can also make decisions about what project elements to tweak according to the information we gather (e.g., if we detect students failed at producing a certain artifact, more time and assistance can be devoted to this).
Summative assessment: this is conducted at the end of the project, and it's main purpose is to derive a grade for the student, as well as to derive final feedback.

The literature suggests that *PBL works better when we emphasize formative assessment* (Thomas, 2000). It's a good idea to assess students during the project *(and not only at the end of it).* Conducting a whole project during months and just evaluating students through a final exam means that we are wasting a good opportunity to provide feedback to them that they can leverage to improve their results. Feedback is a key component of PBL, and we shouldn't waste opportunities to provide it. *Students usually appreciate productive feedback both on the things they do right and on how to correct mistakes. In projects, it's important to give precise feedback to support student's learning (*Thomas, 2000).

A plethora of methods can be used to conduct assessment beyond the traditional test or exam at the end of the learning process. Some literature reviews (Chen, Kolmos, Du, 2020) suggest methods like:

- *observation:* this provides key information about the students' actions, their difficulties and what they already know, how they collaborate with each other (or not), etc. A simple observation of a small team trying to solve a problem can provide lots of information for coaches; some more elaborate observations demand to use observation systems (Bell et al., 2019) with categories that we can follow when

observing the students (e.g., do they provide explanations and support to each other? Do they show difficulties or express doubts? Did they finish the task?). Sometimes, we can use rubrics to evaluate student's learning, where we set a matrix composed of different criteria and performance levels (see figure 5).

- *portfolios*: this is a space where students can gather, not only their products elaborated throughout the project, but also their reflections on the process they have followed (Klenowski et al., 2006), along with the appraisal of their learning objectives (see self-assessment in the next point).
- *Peer and self-assessment:* peer-assessment is carried out among students, where one student makes decisions about the role and learning of another student, while in self-assessment it's the same student who reflects about their own learning (Dochy et al., 1999). If used appropriately, these methods can help students (and teachers) to obtain deeper reflections about their learning achievements and areas to improve in the future.

	Expert 3	Practitioner 2	Novice 1
Select a topic of inquiry.	Identifies a focused, feasible, and significant topic that thoroughly addresses all relevant aspects of the topic, which may identify innovative aspects of this area of inquiry.	Identifies a focused and feasible topic that broadly addresses the relevant aspects of this area of inquiry.	Identifies a topic that: (a) Is far too general and wide-ranging as to be feasible, or (b) Is too narrowly focused and leaves out relevant aspects of the topic.
Access and evaluate existing knowledge, research, and/or views.	Accesses information using effective, well-designed strategies and comprehensive sources. Demonstrates ability to refine search. Analyzes own and others' assumptions and carefully evaluates the relevance of contextual factors when presenting a position.	Accesses information using a variety of search strategies and some relevant sources. Demonstrates ability to conduct an effective search. Identifies own and others' assumptions and several relevant contextual factors while presenting a position.	Access information using simple search strategies, retrieves information from limited sources. Questions some assumptions. Identifies several relevant contextual factors when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).
Uses information effectively to accomplish a specific purpose.	Synthesizes in-depth information from relevant sources representing various points of views/approaches.	Presents in-depth information from relevant sources representing various points of views/approaches.	Presents information from relevant sources representing limited points of views/approaches.
Use information ethically and legally to accomplish a specific purpose.	Consistent employment of the expected information use strategies with virtually no errors in use of citations and references. Appropriate choice of paraphrasing, summary, and quoting. Uses information in ways that are true to original context. Clearly distinguishes between common knowledge and ideas that require attribution.	Consistent employment of the expected information use strategies with only a minimal number of errors in use of citations and references. May show imbalance in choice of paraphrasing, summary, and quoting, Uses information in ways that are true to original context. Clearly distinguishes between common knowledge and ideas that require attribution.	Inconsistent employment of the expected information use strategies with a high number of errors in use of citations and references. May show over-reliance on quoting versus paraphrasing and summarizing. Extrapolates information beyond original context. Distinction between common knowledge and ideas that require attribution unclear.

Figure 4.2: rubric to evaluate the inquiry competence of students. Source: McConnell (2013)

As an example of an assessment method, we can reuse the coaching strategies seen before in chapter 3.3. In this example, the team contract (drafted by the students and specifying how they were going to communicate inside the team) as well as the personal reflexive notes of students were used as material to help the coach assess if the students were actually improving the skills in question. It is difficult to give a traditional grade on such complexe competences (having a 6 or a 3 for example in mastering interdisciplinary team communication skills would be difficult to attribute). However, using non-traditional assessment methods (in this case a team contract and some personal reflexive notes) to get a general picture on the progress of a student in mastering these types of skills, is always useful to provide feedback.

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