# Co-construction of Meaning via a Collaborative Action Research Approach

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**Abstract.** This article sets out the four stages of an analytical approach which enables student - designers at the end of their academic career in the domain of design, to "metareflectively" consider their design and collaboration processes. Inspired by collaborative action research approaches, this analytical approach aims to create a space in which the student can learn and co-construct meaning relative to the activity of collaborative design. It plays a role in enabling the learner/designer/observer to take a step back from their activities, both when considering the activity in isolation and in confronting it to others' points of view. This article explains the steps and tools (methodological, theoretical and analytical) involved; it also provides feedback on experiences from 7 different contexts. It shows how the system as a whole enables analysis, interpretation, questioning, and critical and collective reflection of the situation.

**Keywords:** Conception collaborative · Sciences cognitives · Collaborative design · Analysis of complex activity · Scientific approach · Design sciences · Collaborative action research

## 1 Introduction

Design careers (architecture, engineering, industrial design, etc.) usually require a training period of five years (three years for a bachelor's degree and a further two years for a master's degree). This training is often centred on the project itself and the designing of it, but it also includes a theoretical element that brings the student into contact with a group of areas and fields necessary to master the complex activity of design. The training is often based on "project-based approach" [1], so the students are as engaged in practical learning as they are in theoretical learning. Throughout their studies, they must learn to conduct their projects via iterative, undetermined, and often multi-faceted processes; they are expected to be creative in order to find a solution to an open, unclearly defined and complex problem which often has to be expressed in words to other collaborators. Without challenging the relevance of such a learning format, which is perfectly adequate for understanding design, this article focuses on the following question: is design teachable in a collective format other than "project workshops", especially when it requires the


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involvement of several participants from the outset of the project (as is the case in the field of architecture and engineering [2]?

To help students take a step back and consider their own design and collaborative processes, this article expounds on a complementary approach to that of the workshop, inspired by collaborative action research methods [3]. In bringing together researcher-guides and learners playing the role of either the designer or observer, all of the participants are "engaged in critical and dynamic reflection on a situation with which they are confronted" [4, p. 78]. The aim is to focus the attention of the learner on the process itself rather than on the object to be designed. This will help learners to consider their own design and collaboration processes metareflectively.

To explain this collective approach, this article first introduces the general modalities of the workshop proposed here, entitled "workshop+". The four component stages are then defined relative to the objectives and methodological, theoretical and analytical tools specific to each step. The various applications, in seven different contexts, which have been conducted to date are then listed. Finally, the feedback from the learners regarding their experiences is put forward; this will detail the input, limitations and perspectives addressed at the end of this implemented educational experience via a collaborative action research approach.

## 2 General Procedure

Participatory approaches to research are varied but share a common goal, that of balancing experience, action, practical work and analysis of that work [5]. "Action research" is one such approach, marking a break with the classic scientific approaches that separate an action from its analysis, and collective practices from their theoretical generation [6]. Its principal objective is to manage the participants' preoccupations when faced with a situation set by researchers wanting to develop a shared understanding of the situation [7]. An approach is said to be "collaborative" when all the participants (researchers and practitioners, observers and designers) strive to co-construct new meanings relative to their activity. This co-construction occurs through the synergy of their points of view, but also via reflection with others on one's own actions [8]. According to Desgagné [9], this approach is based on a reciprocal relationship of self/co-reflection and self/co-critique and therefore self/co-training with oneself and with the other participants. By integrating it into design training, our approach is inspired by reflections resulting from "collaborative action research". It involves a protocol which incites the participation of several designer/observer/researcher participants. Its educational purpose is not to assess the design project itself (as is the case in project workshops), but rather to describe the process behind it. Neither does it impose a design method; rather, it considers how the design process can be observed, analysed and broken down in order to enable the participants to better take a step back from both the activity and the complexity of the interactions involved. Our premise is that design is a complex process which is difficult to break down, and the outcome of which is thought out, negotiated, assessed, challenged and co-constructed before it even comes into existence. Two questions therefore arise: how can the design process be put into words, and

how is the process negotiated and co-thought by the group? To support this approach, tools are put into place to question the collaborative design. They have been defined in such a way that all participants co-construct an integrated meaning and decide together which actions should follow on from that (according to [4] p. 83). This co-construction of meaning for the activity and the fact of being able to take a step back from it therefore occur here *with* the designer, and not *on* the designer. The crossed action of taking a step back from the process is prioritised in the context of this Workshop+. It is composed of four steps, each of which is detailed below; we will expound on their implementation and objectives, and the tools used to enable participants to clarify their thoughts and begin self/co-reflection on their activity will be described.

## 3 Presentation of the Component Steps of the Analytical Approach

### 3.1 Step 1: Experiment

**Implementation.** Here, the learners apply an experimental protocol, previously defined by the researcher-guides. The protocol is constructed according to the formula imposed by the context (long vs. short integration). In order to apply it, each participant in the working group is assigned a role to assume throughout the Workshop+: either as designer (3 designers per group), or as observer (the number of which is defined according to the number of Workshop+ participants).

The protocol is divided into two periods during which the designers – each seated according to the predefined seating plan – respond to the design brief given to them. In the meanwhile, the observers take notes (relative to a shared temporal framework). To begin with, each observer takes notes as instructed by his or her assignment card. Each card is characterised by an attributed theme. The observers are then given pre-defined grids in which to take notes so as to systematise their observations and render their data more explicit, and therefore more easily quantifiable.

**Objectives.** By imposing a protocol, it is possible to define certain variables such as the seating plan for the designers at the table, the references given, the tools at their disposition, etc. in advance. This imposed organisation also enables the participants to better realise the influence the situation and context have on the design process and collaboration between designers (it should be mentioned that the designers are not told exactly what the observers are commenting on or identifying so as to limit any influence this may have on the designers).

**Tools Provided.** From a methodological point of view, the protocol is constructed here so as to describe the collective design activity according to 4 categories:

- collaboration (interaction between designers);
- the activity of design (how the object and its representations evolve);
- analogies (particular type of idea generation);
- tools (the means employed to support the process).

The protocol proposes a note-taking system that is adapted to multi-participant interactions in order to gather data. In order to do so, the observers are trained, in private and in advance, on note-taking techniques and the relevance of respecting such a protocol in the context of a scientific procedure. At this stage, only the note-taking grids are given to the observers. Everything is recorded "on the fly" relative to a chronometer in clear display as the single and same temporal point of reference, enabling the observers to synchronise their actions (Fig. 1).

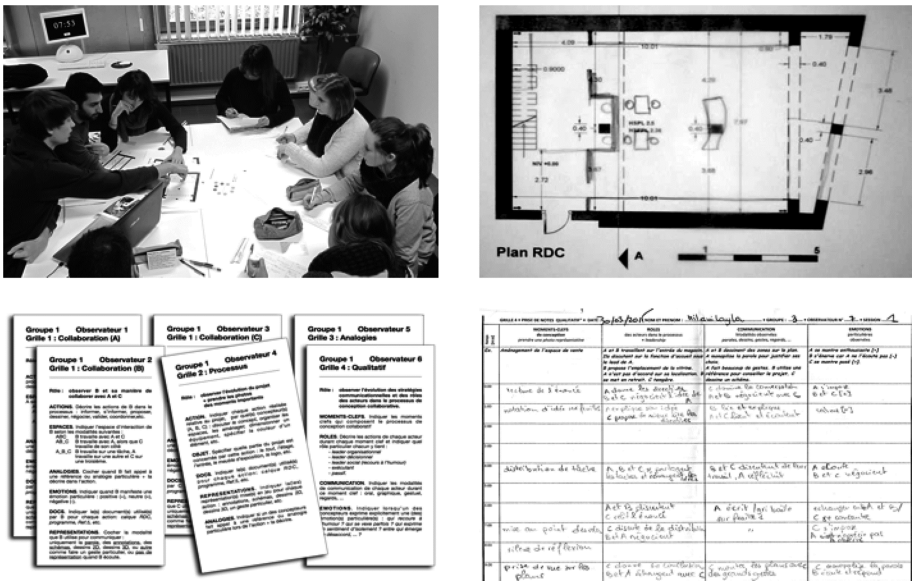


**Fig. 1.** Protocol and example of a project produced. Assignment cards and note-taking grid.

### 3.2 Step 2: Transcript

**Implementation.** For this phase, each group, composed of student-designers and observers, and guided by a researcher-guide, is asked to pool the notes taken, and describe in chronological order the actions carried out by each of the designers during the experiment. Each action bears witness to the design and collaborative operations put into practise by each participant relative to his or her points of view, relevance and references. These actions are then assembled to form key moments, thereby dividing the process into several sequences (for example: general implantation > layout of the ground floor > layout of the first floor > processing of the input > etc.).

**Objectives.** This stage allows for the student-observers to make eye contact and synchronise the note-taking for a temporal communal description of the collaborative design activity (with the student-designers and researcher-guides). It is through this stage that each participant enters into dialogue with himself or herself, as well as with the

other participants, to organise and specify the sequence of events for the activity. By describing each action, the various participants negotiate and strive to understand one another's contributions. This stage requires the participants to leave implicit messages to one side and to be explicit; this sometimes even requires deconstruction/reconstruction of the previous representations that the participants had of their activity [10]. The transcript grid is therefore defined in advance by the researchers so as to propose a reference system which enables the observers to collectively (by consensus) identify the main actions to study. It serves as a basis for discussion with the researcher-guides as it enables the querying of certain criteria defining the activity.

**Tools Provided.** The transcript grid provided to all the participants (in excel format) is composed of several categories which are themselves broken down into diverse exclusive criteria that can be redefined, completed or queried. A methodology guide is also made available to the participants, defining the various elements of the transcript grid. Automated formulae are introduced therein, thereby aiding the participants to rapidly detect coding errors.

### 3.3 Step 3: Coding and Processing the Data

**Implementation.** Once all the members of the group agree on the temporal description of the process in the form of actions (cf. step 2), they code the data relative to the completed categories and criteria in order to describe the evolution of the design project, the collective activity and the various analogical thoughts brought into play by the designers. These criteria and categories are the result of research and state of the art previously exposed to the learners as part of the theory taught in conjunction with this Workshop+.

**Objectives.** The step of processing the transcripts, bringing together the designers and observers, enables the participants to understand how to build links between the theory (lessons and models) on describing the collaborative design process, and their own observations. The objective of this task is that the student be able to take a step back from his or own activity and think about the knowledge acquired in the course. Incidentally, the learners may query the transcript grids and coding by redefining certain criteria or adding new criteria.

**Tools Provided.** For this step, three new categories are added to complete the transcript grid; these are relative to: the design (according to the degree of comprehension of the object versus the degree of abstraction of the object, collective actions [11], and analogies. Each category is composed of several criteria to more precisely specify collaborative activity in design. These criteria are the outcome of theoretical concepts introduced via lessons spread throughout the Workshop+ (taken from cognitive sciences, design research and CSCW [12].

### 3.4 Step 4: Analysis and Highlighting of the Results

**Implementation.** This final step marks the shift from description to interpretation. Here, the learners cross-reference the quantified data and choose the appropriate formalism to affirm or disconfirm their qualitative observations using the Common Tools tool (see below), made available to them as part of this Workshop+.

**Objectives.** The objective of this step is to link the quantified results from the students' coding with the research questions and qualitative observations that arose during the experiment. This step leads the group to asking themselves the following questions: what are our research questions? What do we want to showcase relative to the observed collective activity and design process? How can we enhance our results? How can we take a step back from what has been observed/experienced in our roles as designers and observers?

**Tools Provided.** Here, the learners shift from describing the facts to interpreting the results; by choosing relevant visual formalisms as support for data interpretation, they enhance the value of their results. In order to do so, a web platform - Common Tools - is made available to them, enabling them to transform the data from the transcript and coding grids into quantified data with a variety of visual formalism options (pie charts, stacked columns, time lines, crossing, clouds, etc.). Initiated within the context of the ARC Common project [13], and developed by LUCID (the University of Liège), this platform provides learners with a powerful and interactive data visualization tool for the analysis of collective design activities (Fig. 2).

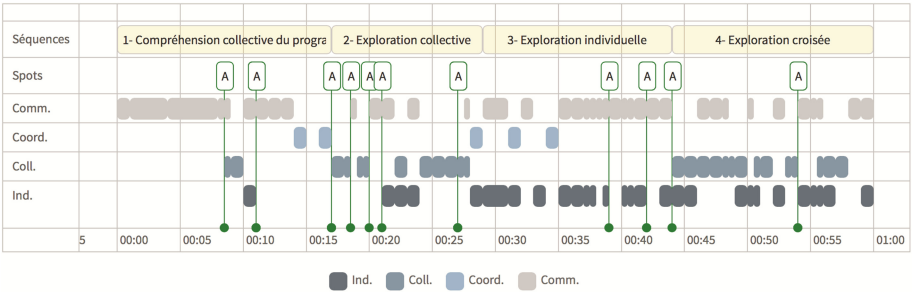


**Fig. 2.** Example of formalisms from Common Tools: timeline (of individual- /collective- /coordination- /or communication-actions).

## 4 Implementation Contexts

The described approach has been proposed and brought into play in the context of advanced training for students in master's or research master's programmes; the aim is to train them in reflective and shared analysis of their own collaborative design processes. It supports the training given in engineering, architecture, design, ergonomics

and management programmes that we conducted on an international scale: architectural engineers at the Polytechnic Faculty of the University of Liège (B), ergonomists, designers and engineers at the University of Paris 8 (F), space, product and image designers from the ESSTED Tunis School of Design (TU), and architects from the University of Liège and the Université Libre de Bruxelles (Brussels) (B).

Two variations – short and long integration – are offered relative to the operational targets (time available to carry out the Workshop+) and the educational targets (relative to the educational objectives of the teachers wanting to apply this approach).

**Short Integration.** This short formula of the Workshop+ can be carried out in between ½ a day and two days. Only the assignment cards are used for "on the fly" note-taking. The objective of this formula is to (1) initiate the learner to the construction of an experimental protocol, and (2) begin the act of taking a step back and performing qualitative evaluation of the collective design activity and the querying of said design via the confrontation of diverse points of view.

**Long Integration.** This long formula of the Workshop+ can be spread out over 4 to 8 days. The assignment cards, the note-taking and transcript grids, and Common Tools are used. The objective of this formula is to (1) initiate the learner to scientific research and methods of data collection, processing and analysis, and (2) begin the act of taking a step back and performing qualitative and quantitative evaluations of the collective design activity.

## 5 Discussion

**Integrating a Scientific Approach.** As described above, the real challenge of this analytical approach is epistemological. It requires a dichotomy between the act of gathering data (which can only be carried out by the observers), and action research which claims to be collaborative in involving the designers in a global reflection process (with the observers of this process) in their collaborative design activities. To avoid this dichotomy while conforming to collaborative action research approaches, the Workshop+ proposed here implements several methodological, theoretical and analytical tools to serve in the shared collection, processing and analysis of the data gathered. These tools are defined in such a way that once the experiment stage has been completed, all the participants collaborate in the reflection stages. This approach seems to represent a shift from the classic conceptions of scientific work. Nevertheless, if the proposed approach is installed in parallel with the classic scientific approach (cf. Fig. 3), it is possible to show that one approach feeds the other, and they barely contradict one another.

The four steps described above strive to respect the demands of a classic scientific approach by allowing the various participants (researcher-guides, student-designers and student-observers) to begin the process of taking a step back from their work and querying the pre-requisites and theory they have been given. This functions via:

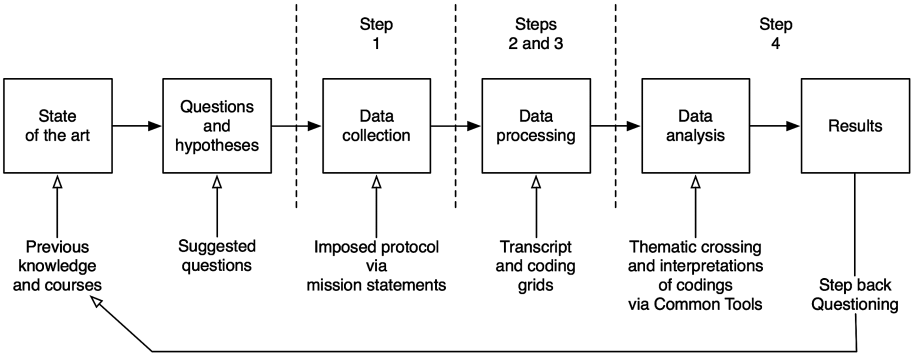


**Fig. 3.** Inscription of the Workshop+, regarding the principles of the scientific approach.

- the act of respecting an experimental objectified protocol that is rigorous and appropriate, and based on the definition of operational working hypotheses and the description of the facts as concerted actions: this first requirement enables better observation of the influence the situation and context have in the design and collaboration process between designers;
- the objectified description of the concerted actions via a pre-constructed transcript grid, (re)defined in accordance with the theory and the code of practise: because of its synergetic nature, this second requirement enables the objective cross-referencing of the observations, knowledge and skill of the participants, thereby producing meaning effects [8], and in doing so, combining individual reflections with that of the group;
- The cross-referencing of qualitative and quantitative analyses of the activity: this third requirement ensures that the data analyses are complementary, thereby facilitating the act of taking a step back from the task.

**Enable Iteration.** This approach is also introduced in such a way as to encourage reflection that is simultaneously progressive, self-confronted, co-evaluated and co-constructed. Actually, from step two ("transcript"), which serves as a reference for all the participants, a reflective and collaborative exercise is initiated in step three ("coding and processing the data"), and continues in step four ("analysis and highlighting of the results"). Describing the actions by collaborative coding of the imposed criteria incites the participants as a whole to consider the very activities of collaboration and design.

Via the interaction of diverse epistemological reflections, the participants are obliged to put their experience into words and communicate it objectively to the others in the group. This progressive strategy - a strategy that is in motion - ensures that the process of co-construction of meaning and the querying of the prerequisites remains active, while also ensuring triangulation between the transcript, analysis and interpretation of the data. Even if at first glance these steps appear to be perfectly locked (relative to the scientific approach described in Fig. 3), they influence one another, and moreover, they enable query and retrograde actions. The (anonymous) questionnaires given to the students to

evaluate this Workshop+ clearly show the importance of this type of approach in a university course, and in the student's training: more than 80 % of them attributed a value equal to or higher than 4/5 for this criterion. This extract of written feedback from one of the groups on completing their first experience also testifies to this effect: *"we enjoyed this first research experience as it enabled us to highlight the importance of a clearly defined protocol, and it also made us aware of the importance of context in group work. It served as a reference in our attempts to objectify our observations"*. According to the students, this exercise was not only an opportunity to study the activities of collaboration and design, but also to collaborate with one another (researcher-guides, student-designers and student-observers) to develop a common meaning relative to the various concerted actions: *"the challenge became clear when the group had to agree on a sole description of the processes observed during the experiment and find a compromise to construct one reflection from several. Only this group reflection, based on the consensus and the search for a shared construction of the observable factors enabled us to maintain correct comprehension of the subject and progress in our research*". The approach thereby clearly applies collective intelligence to the benefit of the analysis and interpretation of a complex assigned activity, as well as the act of taking a step back from said activity.

**Providing the Tools for Analysis and the Act of Taking a Step Back.** In addition, the students underline the synergy of the accompanying tools made available to them; the tools were provided to ensure the development of a common reflective area and the construction of this perpetually developing collective intelligence. Supported by an approach as qualitative as it is quantitative to analyse the complex activity, these unique accompanying tools open up a new area for reflection and negotiation at each step, thereby facilitating continuous interpretation of the highlighted results. The transcript grid, for example, enables the distancing and collective interpretation of a complex experienced/observed/analysed activity via the imposed criteria. Common Tools enable the rapid and quantitative illustration of the particularities of the observed process. This application requires the participants to hierarchize the processed data and choose the appropriate visual formalisms (step four). This step encourages them to specify their objectives once more and co-construct their research questions. They positively identify what should be accentuated in their results. The mediation provided by the tool therefore enables the rapid uprooting of points of view and shifts in meaning thanks to the visual formalisms which assist the objectification and co-construction of the interpretation. More than 70 % of the students highlighted how suitable the tool was when interpreting the data from the transcript grid. Certain learners even confirmed that, *"the fact of perceiving our own design and collaboration activities differently since this experience has generated a consciousness which pushes us to question our actions and regulate them*". The participants not only understand the complexity of the situation, but also the involvement of the context, their individual roles, the communication strategies used and the very process of design in their manner of working together.

## 6 Conclusion

The analytical approach to the complex activity of design as described in this article and inspired by collaborative action research approaches, aims to bring practical work closer to research, and thereby exposing skills to knowledge. When applied to training provided at the end of the academic career in the field of design (second year of a master's or a research master's programme), the objective is to prioritise the sharing of the epistemological and didactic area:

- For the **teachers**, it allows to create courses about design learning using a « crossed point of view » approach;
- For the **learners,** it offers tools to (1) co-construct reflection on a skill (design), (2) structure and enrich management of this skill, (3) put the design into words, and work on how to do so, (4) develop critical thinking skills by confronting different points of view and initiate the act of taking a step back from one's work thanks to the introduction to the practice of design research;
- For the **researcher-guides**, the design and collaboration processes in diverse fields can be made explicit, and other approaches to comprehend design research can be tested.

However, it is not sufficient to share points of view in order to produce knowledge. This is the reason why this analytical approach implements several (methodological, theoretical and analytical) tools that promote the act of querying actions via the objectified co-construction of meaning relative to the activity studied.

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