

Design teaching and industrial enterprises: a relevant relationship? An exploratory study of two didactic situations of design

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Abstract

This article presents an exploratory study concerning the “initial training / enterprises” relationship in the field of industrial design education. This study aims to characterize the intervention of an industrial enterprise (a sponsor) in a situation of design teaching and specifically its impact on the students’ design activity.

We based our exploratory research on the clinical analysis of concrete cases. We want to analyze the design activity of students confronted with the same design task (an industrial “order”), but in two different teaching situations. In one of the studied training situation, students have met the “industrial sponsor. In the other training situation, students only had the “industrial order”. At the end of the exercise, students of both situations have been interviewed about the tracks (notes, drawings, plans, models or CAD) that they have produced in order to accomplish the prescribed design task. The analysis of the students’ design activity has been realized through the verbalizations collected during these interviews.

The processing and analysis of six students’ verbalizations, allow us to highlight the influence of the presence of an industrial sponsor in a situation of design teaching. On the one hand this influence appears in the assimilation and processing of requirements contained in the specifications (the prescribed task), on the other hand, in the development of assumptions about the artifact to be designed. This study helps to show not only the importance of the teaching situation constructed by the teachers and their mediating role, but also the impact of the representations that the students have of the situation itself (didactic, operational, both). The presence of an industrial sponsor – invisible in one of the situations or physically present in the other one - engages all the students in researching a technical “credibility” (feasibility) of their artifact assumptions. Encouraged by their teachers, the students who have not been in direct contact with the industrial sponsor

have privileged training objectives and, for this purpose, they have “falsified” the requirements proposed by the industrial enterprise. The students in contact with the industrial enterprise have strictly complied with the requirements, denying any didactic objective.

One of the teaching situations can be described as a simulation, and the other as a re-creation, of the “complex of interactions” (Lebahar, 2007) inherent to every situation of design. The analysis of these two teaching situations raises questions about the relevance of a “situated design learning” based on “hybrid” design situations, neither completely operational, nor totally simulated.

Introduction

The industrial design practice and generally applied arts practice, in opposition of fine arts practice, cannot be conceived without a sponsor (issued from the industry or crafts). Industrial enterprises appear thus as “natural” partners when it comes to train industrial design students. Also, a lot of collaborations between “design schools” and industry, often in form of orders, have mapped out the design education history since the beginning of the 20th century.

What characterizes a teaching design situation integrating an industrial sponsor? The aim of this exploratory study is to try to characterize the intervention of an additional actor (an industrial sponsor) in a design teaching situation and specifically its influence on the design activity of future designers.

We can consider several theoretical approaches of the product design activity: an activity of resolution of ill-defined problems (Simon, 1969), a construction activity of representations allowing the control and management of uncertainty (Lebahar, 2007). The concepts of “*situation*” (Dewey, 1938; Vergnaud, 1991), of “*didactic situation*” (Brousseau, 1988), and of “*situated action*” (Lave, 1988; Suchman, 1987; cited by Beguin & Clot, 2004) allow Lebahar to define the design situation as a “*complex of interactions*”, represented on figure 1. At the center of this “*complex of interactions*” is the professional “*designer*”, (Lebahar, 2007, 2008), and around the “*elements of [the] operative environment*” (Lebahar, 2001) of the designer: the design task, the design competences of the designer himself, external knowledge sources, communication media and representation media and, at last, the other subjects (Lebahar, 2001, 2007).

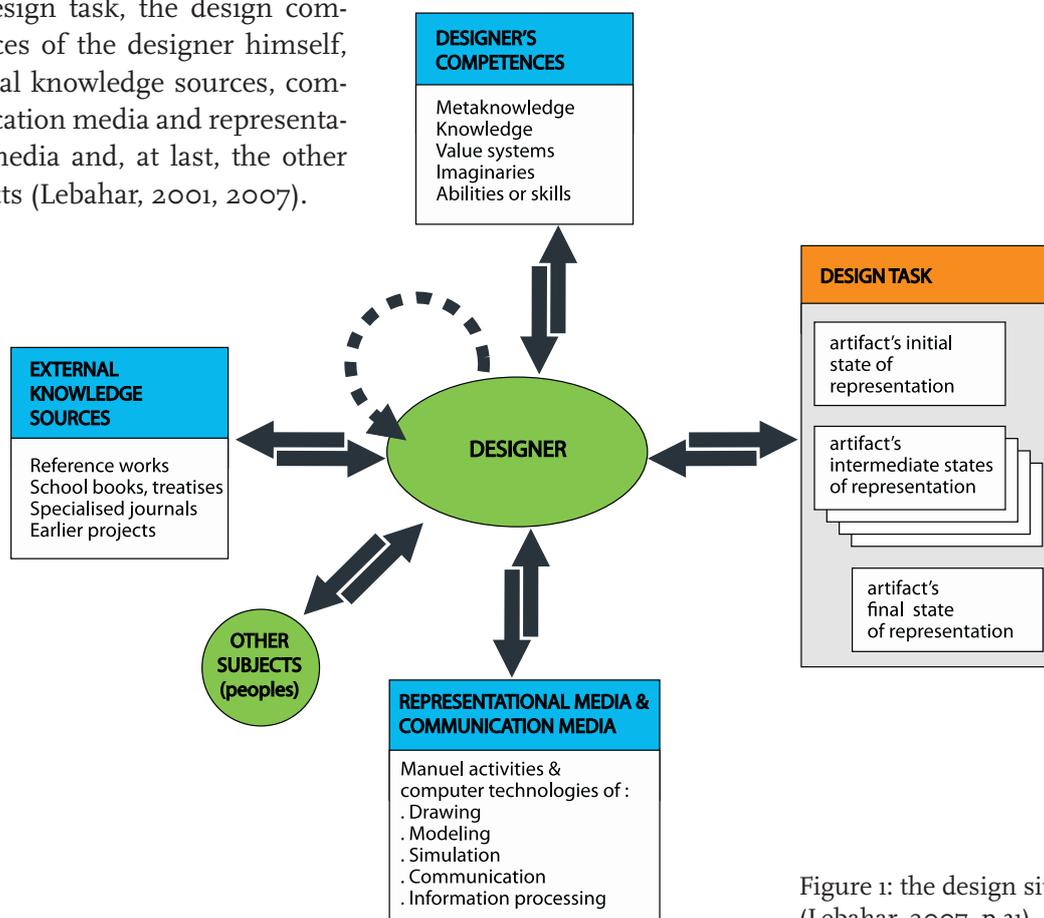


Figure 1: the design situation (Lebahar, 2007, p.31)

Taking as a basis these different approaches concerning professional design situations we are interested in design teaching situations. We can try to sketch the outlines of an artifact design didactic by grounding it in “the *project of professional didactic*” (Rogalski, 2004). This didactics could be theoretically based “*at the crossroad of cognitive ergonomics and didactics area*” (Rogalski, 2004, Samurçay & Pastré, 1998). The concepts of “*didactic situation*” (Joshua & Dupin, 1993, Brousseau, 1988), of “*didactic transposition*” (Chevallard, 1985), of “*relevant professional reference knowledge*” versus “*legitimated (scientific and cultural) knowledge*” (Rogalski & Samurçay, 1994) and of “*social practices of reference*” (Martinand, 1981), show the difficulty to produce a model of a such complex activity as product design activity. These concepts raise two questions: on the one hand, about the nature of the necessary transposition to work out a “relevant” didactic situation of design (Rogalski & Samurçay, 1994; Tortochot & Lebahar, 2008), on the other hand, about the practices of reference this transposition should be grounded on. “Design schools” often answer these questions by “working” with industrial enterprises within the framework of design exercises. In these cases, the subject of the exercise usually takes more or less the form of a sponsor’s order. Our objective was to observe and analyze the introduction of an operational sponsor into a teaching design situation in order to characterize its influence on the activity of the apprentice industrial designers. We have also tried to characterize the competences and knowledge the students have acquired at the end of this activity.

According to Lebahar:

“The analysis of the apprentice designer’s activity, during his training, reveals, not only design competences, but much more, one building episode of its design competence. As a future professional designer, he’s preparing to adapt to the constraints of certain tasks and to the constraints which condition the relations of exchange and co-operation between the various actors of the labor division” (Lebahar, 2007, p. 243).

However, the question of the training of the “*relations of exchange and co-operation between the various actors*” is not tackled in the studies carried by Lebahar.

Research Methodology

Built on the work of Lebahar (Lebahar, 2001, 2007, 2008) our investigation - a clinical analysis of specific cases - is based on the analysis of the design activity (Lebahar, 2007) of product design students in the context of two different teaching design situations.

The survey takes for frameworks the department of applied arts of the University of Nîmes (situation A) and the design product BTS (Brevet de Technicien Supérieur) section of the High school Jean Perrin of Marseilles (situation B).

The same design exercise, grounded on a sponsor’s request was proposed to two groups of students with comparable design competences (two years of applied arts training after high school diploma).

In order to select the sponsor, the teachers have used the following criteria: the wish of the enterprise to participate in the students’ training and the acceptance of planning constraints stipulated by teachers. The enterprise has engaged itself to give the students a counterpart in the event of industrialization of a model designed within the exercise framework. The choice of the enterprise also has been conducted by the technical simplicity of the products to be designed and by the fact that these products are domestic products, familiar to students (i.e. kitchen utensils, laundry utensils or drying racks, little garden tools or flower pots).

The same design task was presented in writing in a similar form to all students. The task was also orally presented by the teachers in the situation B and by the industrial sponsor in situation A. The planning of the exercise is set out in figure 2.

All students were asked to elaborate an individual logbook all along the design exercises. This logbook had to present, in an exhaustive and chronological way, all the tracks (notes, drawings, plans, models or CAD) produced in order to accomplish the prescribed design task.

To achieve the design task, students have worked in two different contexts. In situation A the students were in direct contact with the sponsor. In the situation B, the students received the instructions only by the teachers and had never been in direct contact with the sponsor. Thus, the students involved in situation A had met the leaders of the enterprise three times while the students involved in situation B had never met them.

In both teaching situations, the exercise was performed over comparable periods of times in the two education establishments, in Spring 2010. Students worked for approximately 35 hours at school with their teachers and approximately 35 hours on their own, in their residence.

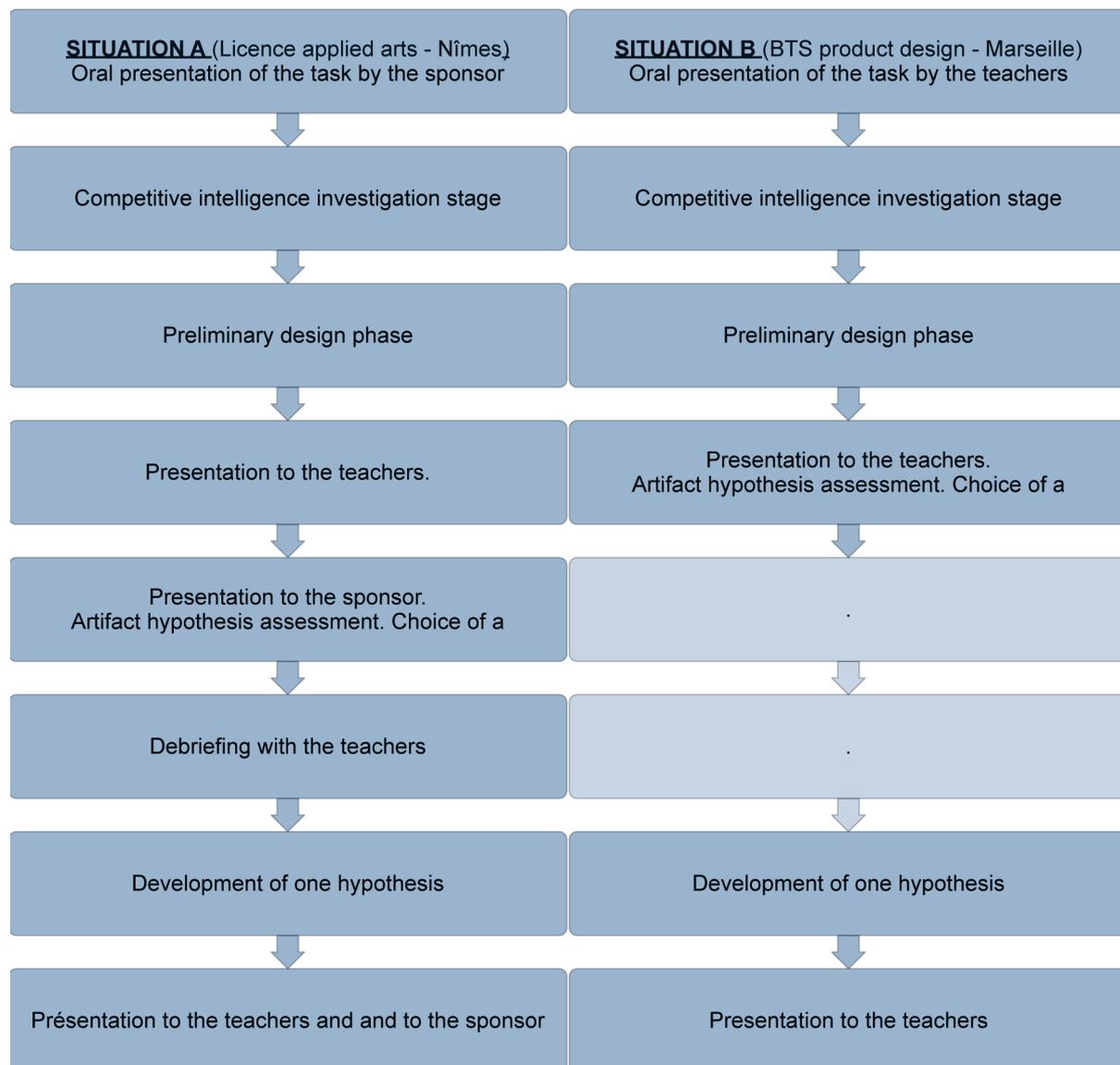


Figure 2: Workflow within the framework of the two situations

Collection of the data

At the end of the exercise, the students handed in their “logbooks”: notes, references, elements of the competitive intelligence investigation, sketch, drawings or annotated plans, which are “*successive states of representation*” of the artifact hypothesis (Lebahar, 2008).

We have used six students’ “logbooks” as support to perform semi-directive interviews of six voluntary students. Three interviewed students had taken part in the teaching situation A and the three other students had followed the teaching situation B.

The students’ verbalizations have been literally transcribed and then segmented into elementa-

ry sentences and lastly into elementary proposals. Thus, we obtained a “*linguistic corpus*” (Lebahar, 2007, p.67), which we have analyze “*with the semantic models provided by linguistics [...] and semiology [...].*” (idem).

Results

The analysis of data collected through the semi-directive interviews based on the students’ “log-books” highlights the knowledge or competences used or acquired during the exercise but also the “*reasoning*” and the “*dialogue strategies*” (Lebahar, 2007) with the teachers, the sponsor and the other actors of the situation. Lebahar shows that the produced representations allow an analysis of the various successive design states that correspond with various “*states of the representation*” that the designer has of the artifact to design.

This study also shows the direct or indirect links between the students’ activity and the industrial sponsor, physically present (situation A) or “invisible” (situation B): through the consideration of the prescribed task, through the activity organization, through used strategies and through the situation representations.

We will present here three results found in the students’ verbalizations analysis.

The first result is that the existence of a sponsor (“*the teachers have not found the subject*” said a situation B student) has forced or encouraged all the students to refine their artifact assumptions from a technical point of view, (“*more definite*”, “*more real*”, “*that really works*”, “*that can be made*”, “*all must be feasible*”, and so on). This constraint, which is not specified in the subject of the exercise, is deduced from the training situation they experienced and more generally from the design situations: it is the “*principle of reality*” (Lebahar, 2007). All the students involved in both situations have mentioned this “*principle of reality*” and they justified its respect by the existence of a sponsor. Thus, the students of situation B confer to the absent sponsor a symbolic function (Piaget, 1945) of “*guarantor*” of a “*technical reality*”. In order to respect technical constraints, all the students make use of their own technical competences, acquired during their formation, or use their teachers’ technical expertise. A student in situation B also has developed collaborations with an external actor to the teaching situation, expert in 3D modeling and in the resistance of materials.

This particular point enables us to present a second result about the students’ targets in both situations. The students involved in situation B have sought to apply and to consolidate technical knowledge or representation skills (CAD) already acquired. To this end, they free themselves from the sponsor’s specifications. For the students involved in situation A, technical feasibility is an essential precondition to achieve the industrial development of their assumption, which is their main objective. So they perceive the situation as an operational situation rather than a teaching situation. The execution of design tasks, in operational framework, “*requires a performance and the product (here a model of artifact) have to be accepted by the sponsor within the timetable.*” (Lebahar, 2008, p. 238). Therefore the students in situation A have selected quickly among their assumptions and then have focused on the “*technical feasibility*” of their model of artifact but also on an attentive respect of the sponsor’s requirements (simplicity, distribution networks, marketing targets...). Lebahar notes: “*a performance based approach does not systematically correspond with an approach of building of competences* (Idem). However, the implementation of a sponsor’s requirements is not limited to the respect of an “*uncontextualized*” technical feasibility. The requirements (including specifications), contain, other parameters such as the market requirements, the know-how constraints, the numbers of products to be manufactured or the company’s production tools.

We can extract a third result regarding acquired competences. The students involved in situation A have expressed themselves on the stages of their activity of design and on their direct or indirect interactions with the sponsor, but haven’t expressed themselves on acquired competences. This fact is consistent because, for them, it was not about a didactic situation. Therefore, they don’t place themselves in a learning situation. About the students in situation A, we can hypothetically say that they acquired a “*complex skill*” of the operational situation. Even if this competence cannot easily be subdivided into “*under-competences*”, we can deem the acquisition of competences

related to the assimilation of requirements and skills related to the “dialog” with a sponsor, in all its forms (verbal, boards of presentation, artifact assumptions and so on). The purpose for these students was always to see their artifact assumption industrially achieved, not to acquire competences.

For their part, the students involved in situation B are able to make a reflexive return on the acquired competences (technical competences and knowledge, representation skills). However, they are aware that they have not complied with the initial requirements (“I have not worked for the enterprise” says a student involved in situation B). Encouraged by their teachers, they focused on the acquisition of the above-mentioned competences.

Discussion

Our case studies can be compared to the design activity analysis conducted by Lebahar within didactic or operational situations (Lebahar, 2001, 2007, 2008). The question remains of the transposition or of the recreation of a complex “situation of reference”. Do the teaching situations that we observed allow a *“training of the situations rather than the acquisition of knowledge”* or *“know-how”* (Mayen, 1999, Pastré, 1999 and 2000, cited by Leblanc and coll., 2008)? Does the complexity of the situation of reference (Raisky, 1999) have to be preserved? Tortochot notes: *“Taking into consideration complex and multiple practices of reference, the acquired competences and their difficult evaluation highlight the [essential?] complexity of the learning situation of artifact design”* (Tortochot, 2007). Is a didactic transposition by *“decomposition (cutting, decoupling and focusing)”* (Rogalski, 1998, cited by Leblanc and coll., 2008) preferable? This last solution also simplifies the assessment of the students’ work.

We can also analyze the form and the nature of the prescribed task. The formulation of the prescribed task (subject of pedagogical exercise, operational order) and the “status” of the “prescriber(s)” (sponsor, teachers) are central in the operational design situations and didactic situations (Leplat & Hoc, 1983, Lebahar, 2007, Quarante, 1994). It appears that the representation of the role and “status” of the “prescriber(s)” (teachers, sponsor, both) conditions the representations the students have of the situation itself. These representations allow us to consider several natures of situations: *“didactic”* (Brousseau, 1998, 2003), *“operational”* (Lebahar, 2007), *“situated learning”* (Wenger & Lave, 1991), *“simulated operational situation”* (Mayen, 1999, Pastré, 2005, Pastré, 1999 and 2000, cited by Leblanc and coll., 2008), *“sufficiently similar to the real situation”* (Caens-Martin, Specogna, Delépine & Girerd 2004 cited by Leblanc and coll., 2008). The representations of the nature of the situation (operational within a “school” or only pedagogic), expressed by the students, also determine his purpose (teaching on the one hand, industrial and commercial of the other), as shown in figures 3 and 4.

Our analysis shows that the two situations (sit. A. and sit. B) experienced by students can be described as a superposition of two different situations: a didactic situation and an operational situation. It could be described as an “hybrid situation” (figure 5). This complex situation “overlays” two goals (operational and pedagogical) and students seem to have difficulties to accept this duality. Thus, when the sponsor is not physically present (sit. B), the students choose, encouraged by their teachers, to perform their design activity within a didactic situation and “falsify” the initial requirements and specifications. For their part, students of situation A have denied any didactic status to the situation, despite the presence of their teachers.

This complexity has to be regulated by the teachers according to the students’ level of “design competence”. We can speak about *“a reduced participation [of the students] in the practice of an expert”* (Rogalski, 2004). The teachers’ role and their competence of mediation at the time of the situation construction and at the time of the elaboration of the prescribe task - at the same pedagogical exercise and operational order - remains a key element of the relevance of this kind of training situation. This mediation ensures the didactic nature of the situation.

At last, we will specify a limitation of our study. Indeed, important methodological biases were introduced into our observations by the fact that the exercise was prescribed to students of two different teaching establishments, by different teachers and within different teaching programs.

Through an identical prescribed task, one can't neutralize the institution's influence and its actors' influence on the training situation of design. Within the situation B, the teachers have "arranged" the prescription, during the exercise, in order to make it "coincide" with their training targets and with the program of the "BTS". The objective of these teachers is also to evaluate the assimilation of pedagogical contents provided during the year. The design activity is here reduced to the execution of the design task, disconnected from the "complex of interactions" described by Lebahar (Lebahar, 2007). Lebahar described this kind of design situation as "robinsonnic" situations (idem). There is a simplification of the "complex of interactions" by simulating or removing the major part of the interactions.

The primary goal is therefore different in the two observed situations. In one case (sit. A), the teachers consider a necessarily situated learning of the operational design situation. In the other case (sit. B), the teachers target a synthesis of the teachings and the preparation of the "BTS" exam.

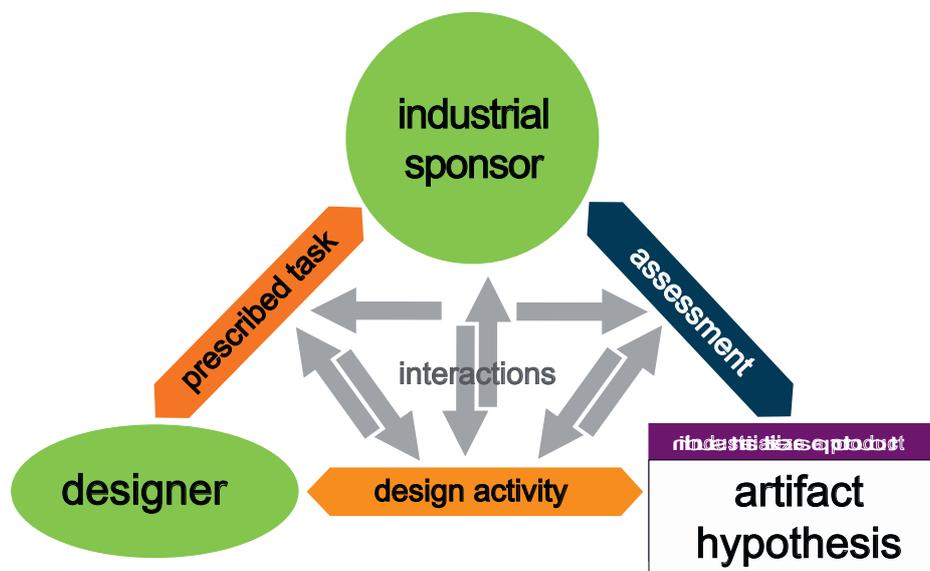


Figure 3: the operational design situation and its objective

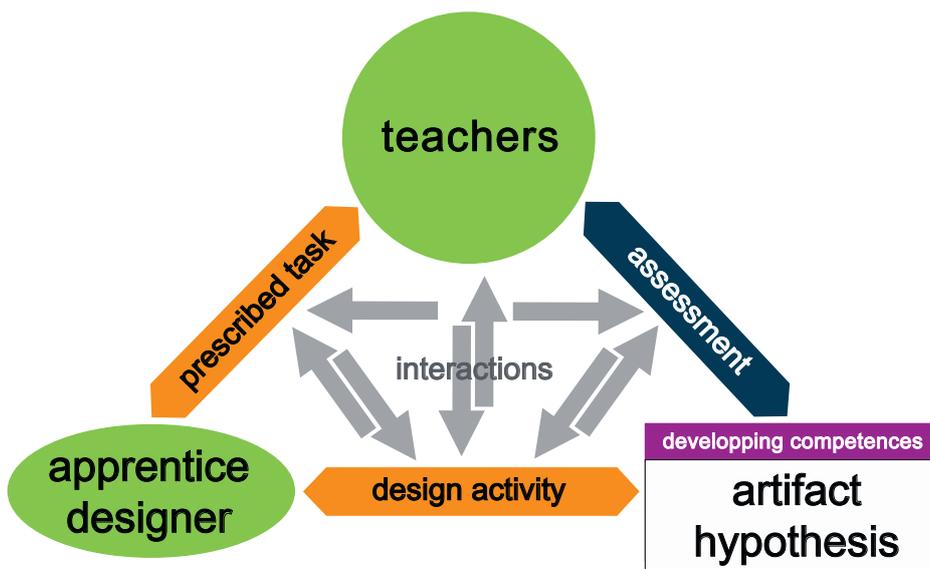


Figure 4: the didactic design situation and its objective

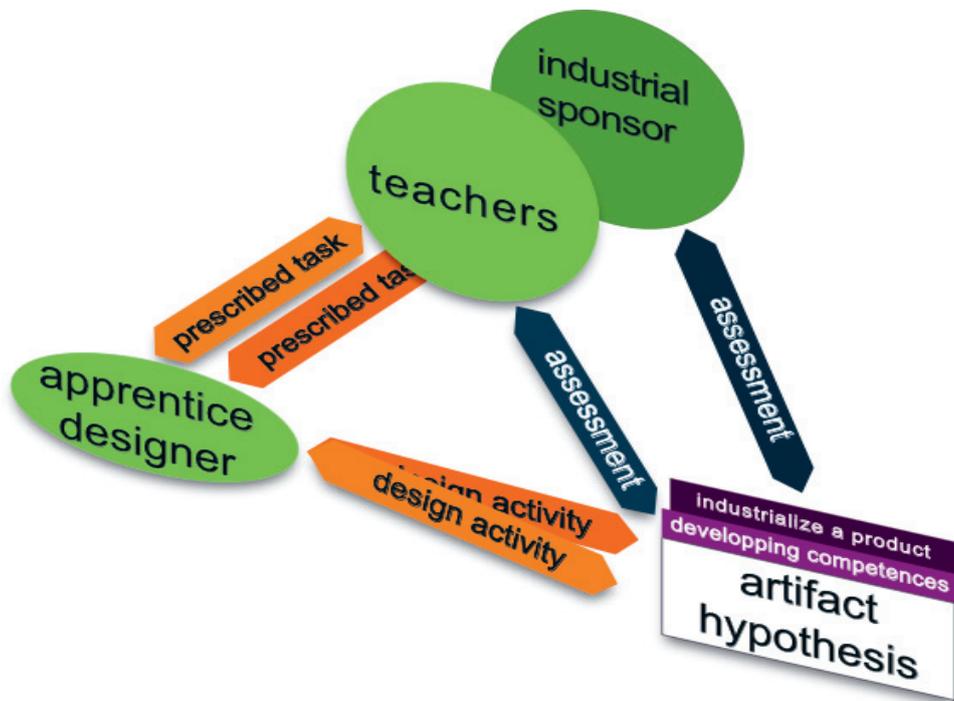


Figure 5: the “hybrid” design situation and its objectives

Conclusion

This exploratory study based on case studies, enabled us to analyze the activity developed by students to achieve the same prescribed task of product design within two different learning situations. We have, through students’ verbalizations, analyzed the representations they have, first, of the nature of the prescribed task (pedagogical exercise/operational order), secondly, the representations they have of the design situation (didactic, operational, “hybrid”), and lastly, the representations they have of the roles of the various actors of the situation (teachers, sponsor, technical experts). The question of the census, of the nature and of the evaluation of the design competences acquired within each situation remains to be refined (competence of assimilation of a prescribed task, analytical competence, communication skills, representation skills, project management skills, “intelligence of the situation”).

However, we have highlighted the fact that the representation that the students have of the situation strongly conditions their activity and especially the assimilation of the specifications included in the subject of the exercise. Thus, the presence of a sponsor engages all the students in research of a technical “credibility” of their artifact assumptions. But only the students who have been in contact (in interaction) with the sponsor have complied with the requirements. These students have had an experience of the “*design situation*”, of its environment and of a non-simulated “*complex of interactions*” (Lebahar, 2007).

What kind of pedagogical device would one implement in order to make the students understand the concept of the “*design situation*”? Does this concept have to remain a theoretical object or can it be used as a ‘tool’ for the development of a “situated training” in a relevant environment?

At last, this study presents two French situations that we considered representative of a widespread typology of cooperation between “design schools” and industrial enterprises. A thorough investigation of this kind of practices in France and in Europe would allow us to draw up a more precise cartography. We could also extend our research to the entire design teaching situation described by Lebahar (Lebahar, 2007), in order to clarify the pedagogical challenges but also the political or even financial challenges which encourage the “design schools” to develop such partnerships with industrial enterprises.

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