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## **CODESIGNED AND COCONSTRUCTED LEADERSHIP TRAINING OF ENGINEERS**

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## **INTRODUCTION**

Teaching team management and leadership to future engineers is far from easy, as this discipline demands both reflection on oneself and on one's relations with others. Moreover, it is not easy to create representative didactic transpositions of future situations in a student's professional life, within the standard framework of the classroom. Yet, the objective of this training module is to broach effectively the questions and problematic issues related to the management of teams, leadership and evaluation, with the aim of stimulating a better handling of collective situations. Indeed, the success of a team depends on the contribution of each individual and especially on the climate of confidence that must be established by the leader. Moreover, the latter should establish objectives, remove obstacles, make choices and assume responsibility. Teachers often fall back on case studies to illustrate good practices. However, leadership is action, a praxis that is mainly learned through the reality test: the experience of others, then our own. (Lapierre, 2006). That is why our approach consists in combining experience on the field, gained through challenges,

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with experience derived from anticipation, projection and reflexive retro-analysis in the classroom. This combined experience places the students in a human and environmental pedagogical context which they are not familiar with, producing a loss of bearings and a true learning opportunity. To put these principles into practice, we have set up a training system based on strong pedagogical convictions: firstly, we used discovery-based activities implementing the Houssayrian triangle (Houssaye, 1988), that is to say a context where the training content is not accessible without the participation and collaboration of the teacher and the students. Then, we applied the Devolution Principle (Brousseau, 1998) – a principle which proposes that teachers loosen their control over lessons and delegate their responsibility to the students to construct a co-creation of the pedagogical content to induce an individual, sometimes reciprocal (student and teacher), and auto-regulated learning process. The students and teachers are thus co-players of the targeted reflections and contents.

This article starts off providing a detailed description of the organization of the pedagogical activity. The participants then proceed to explain how they sought to produce tangible documents that could illustrate the reflexive leadership learning experience, and they present the first results of their analysis. Finally, an assessment of the activity is made, and the prospects for future improvements are outlined in the conclusion.

## 1 DESCRIPTION

This training activity was integrated into our school curriculum in the form of a one-week event. It proved extremely unifying for the students of a single cohort, as they experienced an original, collective and educational activity from a pedagogical point of view. This event was a new keystone in the human and social training of our school and mobilized all the de-compartmentalized skills required to succeed. All the teaching staff in the Human and Social Sciences Department of the school were involved and co-created this activity; for example, each member proposed a challenge based on his discipline: the language teachers suggested an activity based on communication in English, the management teachers set a challenge based on reaching a consensus etc.

The activity was divided into several phases and took place over several geographical locations, as detailed in Figure 1: the first and last days were organized at school; while the central activity was a 2-day bivouac in a military camp, which engendered a strong sense of disorientation, despite its proximity to the school (50km), in an unfamiliar yet safe environment. In a challenging scenario imagined by the teaching staff, a group of engineers had to survive an attack by terrorists who were trying to take them hostage. To escape, they had to succeed in a set of 8 tasks<sup>2</sup>. The success of the tasks depended on the capacity of the team to understand and share the objective, to find a solution together and to put this solution into practice. Each member of the team would become task leader in turn. The tasks had been devised so that they could not be solved by an individual acting alone.

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<sup>2</sup> A task is a challenge presented in the form of a problematic issue that the team must tackle. For example, one of them requires the team to coordinate to create a system out of paper designed to slow the fall of a live grenade, ready to explode at the slightest knock (represented by a raw egg) falling vertically from 2 meters; all in the strictest silence.

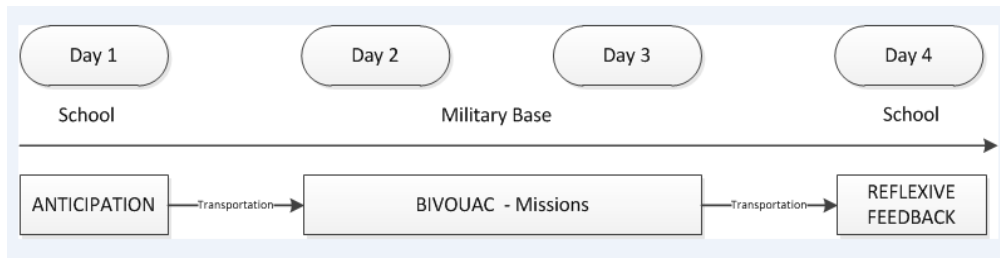


Fig. 1: General organization of the pedagogical activity

The teams were composed of 6 to 8 students chosen at random and not by affinity. During the anticipatory stage, they discovered the objectives set by the teachers, the composition of their team and the three pivotal roles of the particular task they were to be attributed: that of Team Member and Task Leader, Head of Workshop and Controller. Some students were French and foreign civilians while others were French and foreign military cadets destined to become officers<sup>3</sup>. According to their status, different roles were entrusted to the students as described in Table 1.

Table 1 : Pivotal roles in the leadership training activity

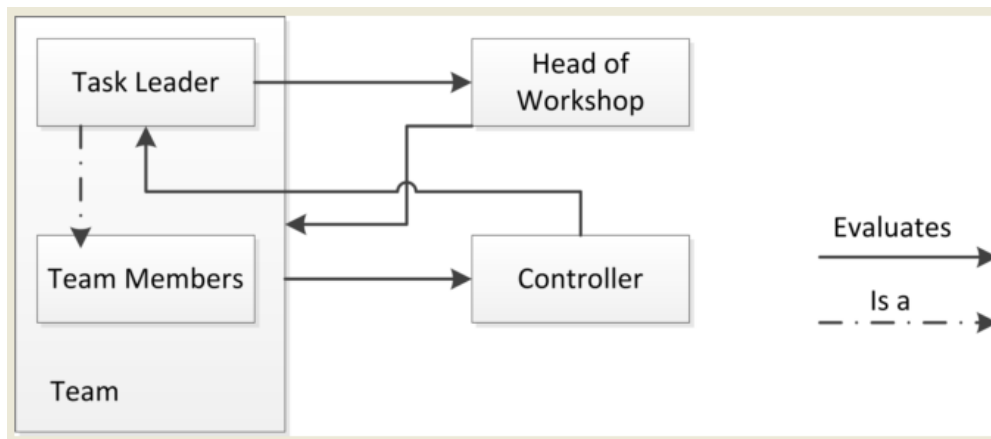
<b>Roles</b>	<b>Student's status</b>	<b>Mission</b>
Head of Workshop	Civilian or military	Lead a workshop on the field
Controller	Military	Be responsible for the team, the adherence to the safety rules and timelines
Task Leader	Civilian	As team coordinator, ensure the completion of a particular task

Still in the anticipatory stage, the students were called upon to reflect individually and collectively upon the roles and responsibilities of each of the members of the group during a challenge. To initiate this reflection, each team was asked to construct the longest bridge possible using spaghetti. They were then given an individual written assessment of their understanding of the stages necessary to succeed in the challenge and the roles they identified within their team. Then, together with the teachers, they collectively constructed an evaluation grid for each pivotal role in the task. This team reflection paved the way for a presentation in the final stage. The first day ended in the amphitheater with a presentation of the evaluation criteria by the students. The teams were formed and the students had to prepare to be at school the next morning for the 7.30 start. The 2-day bivouac on the field followed, with the completion of the eight tasks by all teams.

The last training day was organized so as to collate their experiences by means of two activities, namely the evaluation and feedback on their reflection, initiated during the anticipatory stage. For the evaluation, each student had to evaluate two activities that he encountered as specified in Figure 2 and negotiate with the group the mark proposed according to the pre-established grid. The reflexive activity in the

<sup>3</sup> Indeed, our school trains a certain number of Ingénieurs En Techniques de l'Armement (IETA) (Arms Technologies Engineers) for the DGA (French Procurement Agency) who are thus military students.

anticipatory stage consisted in encouraging them to question and analyze the roles retrospectively within a constituted group, allowing them to take up a challenge and to share their analyses in the amphitheater. The organization of the activity in this way made it possible to recover very interesting feedback about the perception of the students before and after experiencing the training and underlying learning process.



*Fig. 2: Cross evaluations of the different pivotal roles*

## 2 THE TOOLS OF CO-CREATION

During the anticipatory stage, the students were invited to reflect upon the roles and responsibilities that they were likely to assume during the tasks. The deliverables were matrices which simply described their roles by means of a verb and their attitudes through an adjective, as well as the evaluation grids for each of the roles. All these elements constituted the material analyzed in this study. The idea was to compare the output of the students concerning their perception of leadership before and after the bivouac. The limitation of the verbs and adjectives was motivated by considerations of efficiency and recurrent observations of the writing capacities of the students over a very short period. If an additional day had been possible, the composition of complete descriptive texts would have been desirable. The analysis of the feedback by the authors is still underway. However, the first results are available<sup>4</sup>: they concern the preconceived ideas of the students about the roles they were to play during the bivouac.

<sup>4</sup> The software used is R and the Text Mining Package

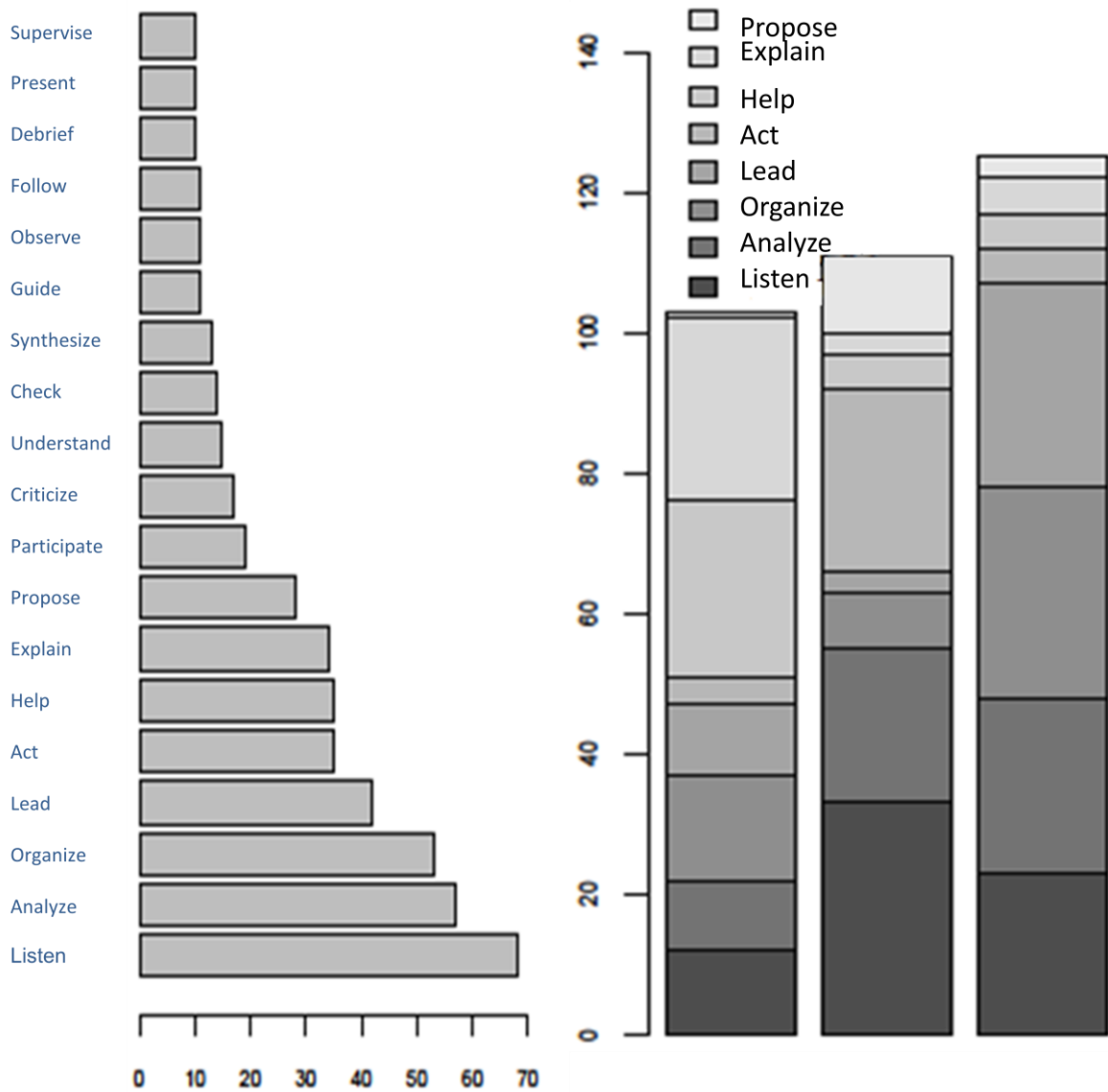


Figure 3: Frequency of the verbs chosen by the students to define their roles

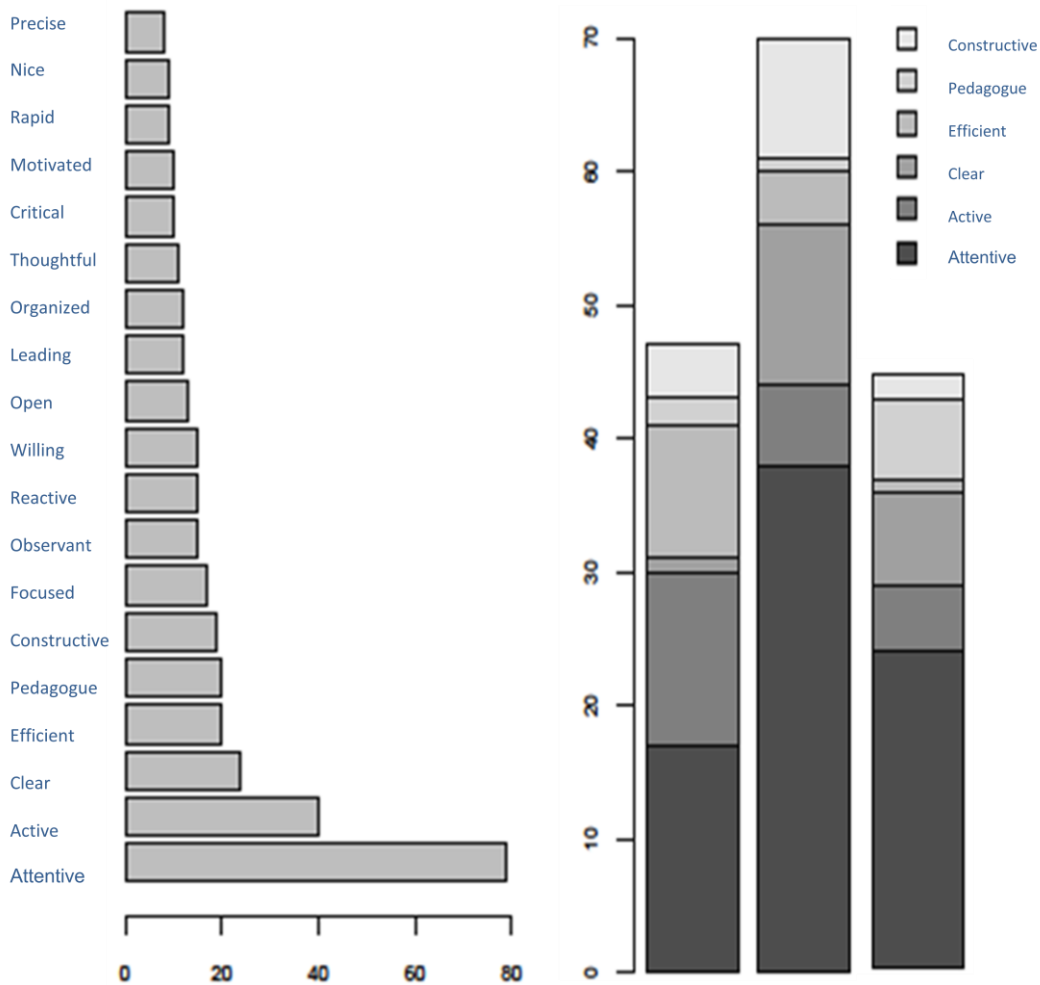


Figure 4: Frequency of the adjectives chosen by the students to define their roles.

The initial data of the students contain 1146 verbs and 805 adjectives. Figure 3 and Figure 4 show the verbs and adjectives most frequently chosen by the students to describe these roles. If the capacities to listen and analyze a situation seem essential, the distribution of the verbs *act*, *help*, *understand*, *lead*, *explain*, as well as the adjectives suggest that they clearly identified with the roles that we wanted them to play (Head of Workshop , Team Member and Task Leader).

### 3 CONCLUSION AND FUTURE WORK

The feedback from the students, the teachers, the school's directors and our military hosts is very encouraging for a first experiment. They have encouraged us to go further and to make this a permanent event. In order to do so, we are analyzing the data that we have collected with the help of text-data-mining software. This software has enabled us to identify trends and perspectives to improve this activity. From the start, it would seem that the co-creation and the complementarity of the learning processes throughout our activity are key to its success. As Brougère and Ulmann (2009) remind us, there are traditionally two pedagogical approaches: learning

through transmission linked to teaching and learning through participation if more importance is given to the student's activity. Our activity relies on all that the teachers have transmitted to the students during the first four semesters of school. Furthermore, it fully encourages students to be co-players in their education, to participate in activities of co-creation and co-evaluation, thus endowing their leadership training with meaning: inspire, tempt, convince, guide, rather than threaten, proscribe and impose.

## SUMMARY

This article presents a reflexive and co-created leadership skills activity, applied within the context of an engineering school. It consists in confronting the students with practical experience in leadership inducing cogitation and auto-evaluation. The co-created evaluation tools put in place by the teaching team are examined.

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