

The organization of study in French business school preparatory classes

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This paper presents parts of a doctoral research pertaining to the study of mathematics in French business school preparatory classes. In what follows, we identify the main features of the institutional devices designed and implemented by two teachers in their respective classrooms in order to influence and transform the working habits of their students. Our conceptual framework borrows constructs from the Anthropological Theory of Didactics as well as several works in the sociology of education field.

Keywords: Mathematics learning, preparatory classes (CPGE), organization of study, teaching devices, teacher practices.

Context

Student failure during the first university years is a widespread problem in France. However, it does not seem to affect students of all French higher education institutions. In fact, there are in France alternative selective institutions (IUT, STS, CPGE¹) where students achieve much better results in mathematics than those enrolled in regular universities, as is reported in official statistics provided by the French ministry of national and higher education and research². The numbers reveal a major difference between student results at university on one hand and those institutions on the other hand, which appears to play an important role in the attractiveness of the latter to students. The causes of university students' failure can be attributed to several factors that go beyond the simple diagnostic of lack of work. Numerous studies about this topic (Farah, 2015b, ch.II, section 3) have identified, among others, two main factors of failure at university: the discontinuity in terms of the mathematical contents and the nature of the required work at the secondary/higher education transition; the limited guidance and supervision of student work. In fact, in post-secondary education, students are expected to develop, without teacher supervision and in addition to the tasks that are prescribed to them, significant autonomous personal work that is not necessarily in the continuity of what ensured their prior success in high school.

¹ Institut Universitaire de Technologie, Sections de Techniciens supérieurs and Classes Préparatoires aux Grandes Écoles respectively. The latter prepare students over two academic years after obtaining the French baccalaureate to enter the *Grandes Écoles*, which are mainly business schools or engineering schools, by passing the *concours* (national competitive written and oral exams specific to each type of school which students take by the end of the second preparatory year). In the French educational systems, the two preparatory years are equivalent to the first two years of undergraduate study at university.

² Source: <http://www.enseignementsup-recherche.gouv.fr/cid75181/reussite-et-echec-en-premier-cycle.html>

Our study focuses on the CPGE in the continuation of the work of (Castela, 2011), who compared students' personal work in university and scientific preparatory schools. These institutions differ widely from regular universities in many ways that are commonly considered as the main causes of student failure (Farah, 2015b, chap.II, section 4). In fact, they are known for their selectivity in recruiting students who have obtained exceedingly above-average results throughout high school and in the French baccalaureate, as well as their supportive culture, which fosters student collaboration and provides them with close follow-up, in a relatively rigid high-school-like system within stable moderate-sized classrooms. All of the above characteristics are not found in regular universities. Thus, these institutions constitute a rich and interesting field of observation and study given both the resources they offer to students and the constraints they weigh on them.

In this paper, we are interested in the ways these institutions shore up their students and help develop a new working mode in mathematics, geared to the CPGE requirements. With the change of institution, from high school to CPGE, students face a significant rift with respect to the work they have to complete in order to succeed. In fact, in the CPGE, students are expected to develop without teacher supervision and in addition to the tasks that are prescribed to them significant autonomous personal work that is not necessarily in the continuity of what ensured their prior success in high school³. This topic was at the heart of our doctoral thesis (Farah, 2015b). We hypothesize that students are therefore required to develop a mathematical praxeological organization, as defined by Castela (2011), allowing them to correctly and autonomously summon and use relevant praxeologies to solve mathematical problems. This especially entails the construction of practical knowledge relating to the different techniques. We focus in this paper on the relationships that exist between institutional and students' personal organization of study in order to identify institutional devices implemented by the CPGE in general, and by the teachers in particular. Our study centers on the first year of scientific track business school preparatory classes (ECS)⁴.

Conceptual Framework

We are mainly interested in the institutional dimension and its impact on students' learning, subjects of these particular institutions. We claim that through their ways of functioning, these institutions help their subjects construct a new working mode adapted to the CPGE requirements. We refer to

³ We must clarify that assessment in the CPGE is entirely conditioned by the nature of the examinations of the *concours*. In mathematics, assessment is cumulative, covering the content of both preparatory years, which is never the case neither at university nor even high school.

⁴ CPGE have three streams: scientific (S), business and economics (EC) and literary (L). The EC stream which prepares students to enter business schools has three tracks: the economics tracks (ECE) targets students who hold an economics and social sciences baccalaureate; the technological track (ECT) targets students who hold an STMG baccalaureate, having had a teaching specialized in human resources, marketing, business and finance or information systems with little focus on mathematics; the scientific track (ECS) is mainly dedicated to students who hold a scientific baccalaureate and have a strong background in mathematics and sciences. For a detailed description of the structure and functioning of the CPGE, refer to Farah (2015b) pp.27-35.

the foundations of the Anthropological Theory of Didactics (ATD) to examine the weight and action of these institutions (Chevallard, 1992 & 2003). We endorse Chevallard's (2003) description of an institution as a social system that allows and imposes on its subjects - that is people who occupy different positions within the institution - ways of doing and thinking. Subjects are hence submitted to collective constraints and expectations that regulate their actions and thus subjugate them (in French, *assujettir*). For our study, we consider first, at a global level, the CPGE institution within which individuals occupy the positions of student, teacher, *colleur*⁵, and administrative staff... At a local level, we focus first on the teaching of mathematics in the broader sub-institutions, the EC stream then the ECS track. Next, we consider the teaching of mathematics in the school institution. Lastly, we examine the institution of the classroom of each teacher, with two main positions: teacher and student.

Regardless of the level of institution in question, it is important to bring forward the idea of organizational stability emphasized by Darmon (2013) and Rauscher (2010). Darmon identifies institutional devices that are shared among CPGEs, which put students to work while supervising them. In accordance with the ATD hypotheses, Rauscher advances that subjects of the CPGE institutions occupying the teacher position (per discipline, hence in mathematics in particular) predominantly share common experiences and background traits. They thus form a distinctive social group, as a result of several interacting mechanisms, and take decisions as a team. The hypothesized continuity and stability within the CPGE, with regards to the norms of the teacher profession and the study organization created by each teacher, enables us to foresee the influence of the global CPGE institution on the students' work.

So far, the ATD didn't really linger over the way institutions exert their subjugation actions and the resourcing of students' personal work. Consequently, our framework extends beyond that of the ATD to incorporate the work of Darmon (2013) in sociology, hence allowing us to clarify certain important aspects of the functioning and role of the CPGE institution. Darmon defines a specific type of institution based on the socializing functions of the CPGE and examines it as an institution where a specific type of persons is manufactured. According to her, these "*enveloping institutions*" (p.10) work the students, they shape and transform them through preparatory institutional socialization processes. Therefore, she analyzes the different daily functioning devices that make it possible for the institution to exert its effects on the students ("*surveillance, sanction, examination and pressuring techniques*"⁶, p.16). It appears that this subjugation process is undertaken by taking into consideration the individuals involved; this is far from common in higher education practices in France and sounds highly paradoxical. In fact, Darmon puts forward the fact that the CPGE strives

⁵ A *colle* is an assessment tool specific to preparatory classes and taking place every two to three weeks. In mathematics, it classically takes the form of a one-hour oral examination by groups of three students working individually but simultaneously on the classroom board, answering lesson questions and/or solving problems instructed by a *colleur* who is present to supervise and grade the work.

⁶ Darmon borrows the first three terms to M. Foucault. The term "pressuring" (*empressement*) is used in the sense to make sure the pressure and the rhythm are held (p.54).

to soften the preparatory violence. She describes the institution as being “*powerful but not totalitarian, violent but concerned about the well-being of its members, it operates by individualizing to the extreme rather than homogenizing, thus reinforcing its take over the individuals which are its members*” (2013, p.28). Her findings converge with those of Daverne and Dutercq (2013) who put forth the regretted yet accepted pressure to which are subjected CPGE students as well as the personalized adaptation of teaching, allowing a “*socialization through conversion*” (p.8). They take interest in the institutional devices that put students to work while ensuring personalized mentoring and psychological support.

Furthermore, we sought to develop the institutional dimension of our research from the point of view of the teachers involved our study. We hence considered two levels: the first one pertains to the way teachers are subjected to the CPGE institution and internalize the resulting determinations; the second one is related to the mathematics classroom of each teacher, the local institution s/he creates thanks to stable devices which we seek to identify. We believe that the subjugations to the CPGE generate an environment in which each teacher enjoys a given autonomy and can freely express his/her individuality within the boundaries of the common CPGE teacher culture highlighted by Rauscher. Using Darmon’s work, we bring forward the CPGE institutional functioning analysis in order to explore how the socializing function is exerted.

Therefore, based on the different didactical and sociological elements of our conceptual framework, we address the following research question in this paper: which institutional devices among those defined by Darmon lead to the transformation of the students’ personal work mode, at both levels of an institution, ranging from the global CPGE institution to the local teacher classroom institution?

Methodology

We must point out that our initial study had an important student component which is not accounted for in this paper, but which was used to generate certain hypotheses and develop the instruments we used for the teachers. In fact, halfway through our study, which was initially entirely focused on students’ personal work, we had to rethink our research questions to examine teaching practices due to several methodological obstacles we faced while collecting data. In the first phase of our research, we had students of two ECS track preparatory schools in the Paris area complete pre/post type questionnaires and we engaged in formal and informal discussions with them through interviews and email exchanges in order to gather quantitative facts about the classes (see Farah, 2015a). We thus managed to collect data about the personal work of the students, and also about the organization of the courses, the teaching methods, the assessment tools and the provided resources of the teachers. The second phase of our research followed from this and focused on the teachers. Therefore, in the below, we follow a specific approach in examining teaching practices through the lens of the results of the student questionnaires as well as information gathered through the discussions with them.

To answer the research question addressed in this paper, we mainly relied on qualitative analysis of data collected from two mathematics teachers of the schools involved in our study. We started with data obtained through semi-structured interviews conducted with each of the teachers. We used specific questions formulated based on questionings and hypotheses about his/her classroom that we

had developed after analyzing the data gathered in the first phase of our study. Our main objective was to obtain through the interviews additional information and clarifications regarding the devices instituted in the classrooms. Moreover, we designed and had each teacher complete two questionnaires. The first one, inspired from Rauscher's thesis (2010), is a multiple choice questionnaire about their career path and their choices with respect to teaching in the CPGE, which we believe determine their position and impact their subjugation within the CPGE institution. The second one, inspired from Darmon's book (2013), is about the assessment and pressuring devices the teachers implement in their respective classrooms to put the students to work, as well as their ways of softening preparatory violence in terms of the support and comfort they bring to the students. It is mostly composed of open-ended questions. We used qualitative content analysis of the interview transcriptions and questionnaire answers to put together a description of institutional devices implemented by each teacher those common across the different institutional levels. One could be surprised that, in an analysis of teaching practices, there have been few field observations; this limit is first and foremost due to practical constraints in terms the duration of a doctoral thesis.

Main Findings

We sought to approach teaching practices by examining their teaching devices as well as their “*meta discourse*”⁷ (Robert and Robinet, 1993, p.1) based on the information we collected through the teacher interviews and questionnaires. We must clarify that, besides some things that converge with what the students had told us through the different exchanges, we had very few elements that would allow us to determine the propinquity between the teachers' statements and what actually takes place in their classrooms. Nevertheless, we observed high internal coherence within each teacher's discourse. The findings show that the teachers seek to put their students to work and mold their study methods through numerous collective devices instituted in their classrooms. In addition, they closely follow-up on each student's work through customized devices. Thanks to the latter, the teachers develop and apply diverse pressuring techniques in order to ensure the students' intellectual training and their successful passing of the *concours*.

The teacher's course and the follow-up beyond

The course organization and progression are the first aspects of guidance to students' work. When the teachers explain a mathematics lesson, their priority is to retain the students' attention while encouraging them to actively participate by regularly asking questions. The lesson is completed and illustrated through examples and exercises, which are solved in class or at home, then corrected in class. During regular classroom sessions, if needed, teachers wrap up the work that they have previously started during practical solving sessions (called *Travaux Dirigés* or TD). These special sessions give students room to work on practice exercises in small groups, thus fostering

⁷ We must clarify that in what follows, the word “discourse” refers to verbal expression, i.e. the use of words to exchange thoughts and ideas. It is not a theoretical construct borrowed from a conceptual framework. As for the word “meta”, we refer to Robert and Robinet's definition (1993), whereby a teacher's discourse contains *meta* elements, i.e. about mathematics and about the ways of doing and learning mathematics.

discussions with the teacher as well as classmates. Both the professors involved in our study use a handout as the baseline for the lesson explanation; they distribute it to students either systematically or occasionally. Depending on the teacher, the class or the chapter, this handout can be exhaustive or having blanks to complete, and teachers modify it regularly in order to tailor its contents to the level of the students and their capabilities (concentration, understanding, note taking ability...). The course pace is slowed down or increased accordingly.

In addition to the time dedicated to lesson explanation and exercises solving and correction, teachers make sure to always be available to assist the students outside the classroom. They are willing to answer questions, provide explanations, recommend and even correct additional work despite believing that the workload they assign is already enough (regular exercise sheets and occasional extra exercise sheets with their correction for some chapters). They usually encourage students not to look for more resources (textbooks, online, previous exams...) and focus on what they provide due to time constraints. Moreover, the teachers hold weekly optional or compulsory tutoring sessions to ensure that students are getting all the needed help within the institution.

The recurring discourse about the ways of studying

The teachers encourage their students to regularly study their lessons and solve the assigned exercises (for both the regular sessions and the TD) and they always explain to them how they should proceed. They emphasize the importance of reading the lesson actively and critically then playing-back all important lesson contents mentally or preferably in writing. They also stress the crucial role of decontextualizing in mathematics learning. They underline the significance of both the results brought through proof and the use of generic components of reasoning, in addition to the techniques used in standard exercises which students must be able to acquire and plough back in other situations. Teachers also insist on the necessity of doubling efforts until mastery is attained when facing difficulties in solving an exercise. Regarding the way to review previously solved exercises, teachers incite students to go beyond simply reading the solution and work out the exercises in writing to validate learning.

We can refer to the notion of constructive help proposed by the teachers to guide students in studying the lesson, solving exercises and decontextualizing proof and exercises, especially when preparing for an exam, as well as when working on a daily basis between two mathematics sessions. In fact, we have identified several features of help common to both teachers in their discourse, more or less generic, about expected ways of studying mathematics and practical knowledge pertaining to the techniques which could help students gain know-hows relating to the awaited tasks. We can say that several students assimilate these discourse features since we explicitly detected them in the exchanges we had with them, thus highlighting their efficiency.

The assessment tools

In order to ensure that the students are completing the assigned work (lesson and exercises) and to identify their weaknesses and difficulties before the graded exams, teachers use personalized informal evaluation techniques during classroom sessions (regular and TD). They often resort to oral interrogations about the lesson notions by randomly calling on students or choosing those who are chatter or fall behind. Also, while the students are solving exercises in class, the teachers go

around to check what they have done, assess their understanding, and help if needed. Then, the teachers encourage the students to engage in discussions about the exercises' solutions before correcting them or asking a student to do so. One of the two teachers gives special care to exercises preparation. In order to push students to maintain regular work, he periodically calls students to the board and collects notebooks without prior warning when he notices that the work has not been fully done, without necessary grading any. His tactic seems to be valued by his students.

The teachers have several types of more formal assessment devices, institutionalized at the CPGE level, which allow them to evaluate the degree of investment and understanding of their students. Firstly, there are all sorts of written evaluations. Teachers mainly use short quizzes focused on the lesson content (definitions, theorems...) at the beginning of the school years to push the students to study, however they cannot maintain them throughout the year due to time constraints. They also have monthly exams (called *Devoirs Surveillés* or DS), and bi or triannual mock *concours* which are summative and are conducted in conditions similar to the official *concours*. One of the teachers quizzes his students about the correction of previous DS exams, and they highly appreciate it since it allows them to detect and address their weaknesses. In addition, teachers assign and grade homework sets (called *Devoirs Maison* or DM) on a monthly basis and they usually invite students to work on those in small groups. Last but not least, the *colles* are the most important assessment tool that teachers use to evaluate their students in a highly customized manner. They are usually carried out by an external examiner (another mathematics teacher from the same preparatory school or an external *colleur*). Both teachers and students agree on the many advantages of these *colles*. To summarize the main perks, the *colles* impose on the students a work and study regularity, which could be stressful and tiring for some students, but this pressure is eventually seen as beneficial for the majority. Students feel that *colles* sessions are similar to private tutoring sessions where they can discover their weaknesses, ask questions, obtain additional explanations and a new point of view, and practice by solving additional exercises. Further to these mathematical learning related aspects, the *colles* are characterized by their interpersonal feature and the know-hows and social skills they teach (stress management, oral presentation, self confidence...) which go beyond the scope of the classroom and even the school. Therefore, the *colles* are considered to be "*a summary of the best things the CPGE have to offer in terms of learning environment for their students*" (Daverne and Dutercq, 2013, p.182). They are viewed by many teachers as the "*the secret to students' success in CPGE*" (ibidem, p. 182), and the majority of students come out satisfied despite the difficulties and constraints they are subjected to.

Discussion and Conclusions

On one hand, we can conclude that the teachers who took part of our study are heavily involved in their students' learning. To accommodate the needs and level of a "*new population*" (ibidem, p.7) of CPGE students, more diversified in terms of academic and social backgrounds, teachers must redefine their teaching modalities and pedagogical devices and adjust the level of their expectations. Daverne and Dutercq state that "*if some young students have good working habits when they enroll in the CPGE, none yet has the general culture nor the confidence needed to face the concours, which requires from teachers a high level of commitment towards them and a constant care for*

their moral” (ibidem, p.8). Hence, the teachers participate in the didactical organization of their students’ autonomous study thanks to the advice they provide and the devices they institute and regularly adapt according to the needs and capabilities of the students. They are therefore clearly dedicated to their students’ success. This is also reflected through the closeness in the student/teacher relationships, which we do not tackle in this paper (for more information, see Farah, 2015b).

On the other hand, although the use of the varied pressuring techniques differs among teachers and depending on the students’ dispositions, the techniques themselves remain redundant across teachers and classes. This brings forward their generality and continuity within the EC stream of the CPGE institution, of which they become a specificity. As a matter of fact, we find in the teachers’ discourse common features underlining the coherence in the practices of teacher tribes (*“tribu”* Chevallard, 2003, p.89) per class as well as the stability of practices within each preparatory school, within the ECS track, and even within the entire EC stream. Thus, the coherence of practices noted among the two teachers involved in our study concurs with what the sociological studies of Rauscher (2010), Darmon (2013), and Daverne and Dutercq (2013) have identified.

References

- Castela, C. (2011). *Des mathématiques à leurs utilisations, contribution à l'étude de la productivité praxéologique des institutions et de leurs sujets / Le travail personnel au cœur du développement praxéologique des élèves en tant qu'utilisateurs de mathématiques*. Synthetic note presented for a Habilitation à Diriger des Recherches, Université Paris Diderot. Paris: Irem 7.
- Chevallard, Y. (1992), Concepts fondamentaux de la didactique: perspectives apportées par une approche anthropologique. *Recherches en Didactique des Mathématiques*, 12(1), 73-112.
- Chevallard, Y. (2003). Approche anthropologique du rapport au savoir et didactique des mathématiques. In S. Maury S. & M. Caillot (Eds), *Rapport au savoir et didactiques* (81-104). Paris: Éditions Fabert.
- Darmon, M. (2013). *Classes Préparatoires. La fabrique d'une jeunesse dominante*. Paris: La Découverte.
- Daverne, C. & Dutercq, Y. (2013). *Les bons élèves, expériences et cadres de formation*. Paris: PUF.
- Farah, L. (2015a). Students’ personal work in mathematics in business school preparatory classes. In Proceedings of the Ninth Congress of European Research in Mathematics Education. Prague, Czech Republic.
- Farah, L. (2015b). *Étude et mise à l'étude des mathématiques en classes préparatoires économiques et commerciales: point de vue des étudiants, point de vue des professeurs* (Doctoral Dissertation). Available at <https://tel.archives-ouvertes.fr/tel-01195875>
- Rauscher, J-B. (2010). *Les professeurs des classes préparatoires aux grandes écoles* (Unpublished Doctoral Dissertation). Institut d'études politiques, France.
- Robert, A. & Robinet, J. (1993). Prise en compte du méta en didactique des mathématiques. *Cahier de DIDIREM* n°21. Paris: IREM Paris 7.