The French as an additional language for mathematics' purposes

Catherine Mendonça Dias

Senior Lecturer in linguistics and French didactics, at Paris 3 University. DILTEC.

catherine.mendonca.dias@gmail.com

Karine Millon-Fauré

Senior lecturer in mathematics, at Aix-Marseille University. UMR ADEF.

karine.millon-faure@univ-amu.fr

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Biographical notes

Catherine Mendonça Dias

Catherine Mendonça Dias is a senior lecturer and a researcher in linguistics and French as a Foreign or Second Language at the University Sorbonne Nouvelle – Paris 3 and in the research laboratory DILTEC. She has a PhD in Linguistics, about linguistic progress of multilingual learners with French as an additional language: her research focuses on determining the influence of French courses on the linguistic progress of students recently arrived in France. She's also leading investigations on migrants' schooling and scholarship, and she belongs to the scientific team responsible to the national project EVASCOL's second axis. Her website is here: http://www.francaislangueseconde.fr/

Karine Millon-Fauré

In 2011, Karine Millon-Fauré defended a thesis concerning the impact of migrant pupils' linguistic difficulties on mathematical activity at school. Since then, she has worked in the research laboratory ADEF (Aix-Marseille University; France) and she has conducted research in the field of mathematics teaching for students with special needs (students with great difficulties in mathematics, deaf and hard of hearing students…). For several years, she has taken part in EVASCOL's research and she is co-responsible for the second axe. Since 2014, she has been a senior lecturer in Aix-Marseille University and she has trained elementary and secondary school teachers.

Introduction

In French schools, the number of young migrants who come to France without or barely speaking French is increasing year-on-year. About 52 500 multilingual learners recently arrived have been identified during the academic year 2014-2015, which corresponds to 0.56% of the French school population (Robin & Touahir, 2015). All these students should attend regular classes and simultaneously 76% were enrolled to French specific courses called "Unité Pédagogique pour Elèves Allophones Arrivants" (UPE2A), which could be translated as follows: pedagogical classes for non-native speakers who have arrived recently in France. Special pedagogical classes have been created since 1970 (Mendonça Dias & Schiff, 2017). Today, these classes offer intensive courses of French as an additional language (FAL) during approximately 9 hours per week in the primary schools and 12 hours per week in the secondary schools[1]. Moreover, in this specific schedule, other courses are eventually added depending on the settings and local resources. Frequently, there are mathematics courses considering that students didn't pursue the same program in their previous country (for instance, geometry is not systematically studied at the elementary level all over the world) or there's a gap of knowledge and abilities due to the previous learning conditions (e.g. in overcrowded classrooms) or due to the own individual special needs. Hence, these reasons justify to review some basic notions before attending regular mathematics courses. That is why newcomers are gathered to improve advanced content knowledge in mathematics but also, to acquire the language of schooling necessary to understand in the maths class.

Nevertheless, each involved school organises usually language support for most of the new arrivals, brought together in the specific class, UPE2A, for a part of their daily schedule. That is why in the primary schools, the ages of these multilingual learners range between 6 to 11 years, and in the secondary schools between 11 to 16 years. Therefore, diversity is not only a multilingual one but also concerns the levels of programs and the degree of skills mastered by students for each academic subject. In addition there is no mandatory program for these special classes and also no compulsory requirement for the students at the end of the session. Although the group is heterogeneous and the issue concerns basically language learning, mathematics teachers are not adequately trained for this objective, contrary to French teachers since most of them had definite trainings on migratory paths, multilinguism, and intercultural approach. Then mathematics teachers experiment in their classroom different ways to teach to multilingual newcomers.

These ones are authorized to be enrolled to an UPE2A during only one school year even though educational policies promote a continue specific language learning for multilingual students with such needs. In these conditions, with a consistent schedule but through a complex pedagogical context, can they manage to reach a sufficient linguistic level in order to attend regular class without any educational support, for the following academic year? Are

[1] Circulaire n° 2012-141 du 2-10-2012, *Organisation de la scolarité des élèves allophones nouvellement arrivés.* Bulletin Officiel n° 37 du 11-10-2012. Available on: http://www.francaislangueseconde.fr/bibliographie/textes-officiels/

their potential difficulties rather linguistic, scientific or cognitive? Given that there's no program in the Upe2a, we make assumptions that at the end of a school year, some identified language difficulties may focus on student's needs that mathematics teachers could better consider through a language point of view rather than just in terms of mathematics knowledge.

The skills of multilingual learners recently arrived will be studied through several data gathered from a national multidisciplinary investigation EVASCOL[2] which aims to understand the new arrivals' schooling. This current analyse will concern the results of two numerical tests, achieved by 177 students during the school year 2015-16. Firstly the temporality for an additional language's acquisition in a school context will be reminded, and we will notice the evolution of an additional language teaching. Secondly the methodology used to collect the data will be explained before describing the students' products and analysing them. Finally, we will suggest pedagogical proposals for « non linguistic » subjects such as mathematics courses (whose main purpose is not language teaching), in order to enhance teaching practice to multilingual students who have just arrived in a new country.

1/ Theoretical framework about the temporality of an additional language's acquisition

Historic consideration to French as an additional language teaching

The linguist Braj B. Kachru had described a sociolinguistic model with three circles (1985, p. 12-13) to refer to "*the type of spread, the patterns of acquisition and the functional domains in which English is used across cultures and languages*" in an international context: the « inner circle » represented countries where English is mainly a native language or a primary language (L1), the « outer circle » concerned rather English as a second language – whose status may be nationally official, with other local languages – in former colonies of the UK or the USA. Finally, the « expanding circle » concerned territories where English is taught and learnt as a foreign language.

In France, Jean-Pierre Cuq (1991, p. 37) used the Kachru's model to describe different contexts in which French was used and he developed more precisely the topic of French as a second language (FSL). He reminded that in France, a large part of the population used to practice FSL and even, at the beginning of the 20th century, teachers had to punish students who used their own dialect (progressively forbidden by educational policies) rather than French at school (Boutan, 1996, p. 84). There wasn't a specific pedagogical teaching to these French students for whom French wasn't the native tongue, neither to the foreign students who came with their family for economical aspirations (Vigner, 2008, p. 37).

When Jean-Pierre Cuq mentioned the case of current immigration, he indicated that French

[2] EVASCOL (2015-2017) is a research carried out by INSHEA and funded by the Défenseur Des Droits Available on: https://evascol.hypotheses.org/

could be considered as a second language but in fact this one might become a « first » language for migrants settled definitively in France. Moreover if a second language could be defined as second in comparison with a first one (Besse, 1987, p. 14-15), it is not necessary the case for these multilingual people. Then, this terminology is maybe not the most adequate to characterize this sociolinguistic context (Cuq, 1991, p. 140; Verdelhan-Bourgade, 2002, p. 21). Anyway the expression « French as a second language » remains in France, especially to students who recently came to France and have language needs. This terminology supplied the lack of a singular expression to refer didactics different from French taught as a mother tongue to native students in France or as a foreign language in non francophone context. French is not only an academic subject in itself but also learning medium for all the subjects that are not linguistic: students learn *the* French language and learn *in* French (Marcus, arcus, 1993, citée par Marcus, 1999; Davin-Chnane, 2005: 412). In English, a specific expression appeared: French as an additional language, but there is not a similar expression in French to refer to didactics in school context[3].

In the 90's, the rare pedagogical publications retain in their title the phrase « French as a second language ». For instance, Catherine Marcus wrote a book (1999) with several pedagogical proposals to make students read literature with an intercultural approach, and develop metalanguage since a linguistic beginning level. In 1996, an official supplementary document to the national programs used this terminology; teachers are encouraged to make students work on instructions extracted from different handbooks, in order that they reformulate these statements in their own words to access progressively to the academic form. In 2000, the first official brochure was published with the title « French as a second language »: the pedagogical proposals took account of school context to select lexicon and type of academic supports with the global aim of achieving similar goals as in the general curriculum but with language adaptation. Regarding this pedagogical plan, teachers should target French's acquisition *for* all subjects and *through* all subjects. Therefore weekly schedule should include one specific period for each school subject in order to make acquire appropriate lexicon related to each subject with the qualified teacher (Bertrand & alii, 2000, p. 20). But there was still no program in the specific classes. However, only two handbooks have been produced for the secondary school, the first one in 2005 and the second one in 2012. This last was entitled *French as a second language*[4]. Both arranged innovative exercises not only with communicative goals, linguistic training and cultural contents mostly linked to educational environment, but also included texts from several school subjects in order to teach academic lexicon. In 2006, for the first time was published one mathematics handbook provided to French beginner new arrivals.

In 2012 a new editorial collection appeared and was entitled French as a language of schooling, which referred to language teaching to multilingual newcomers at school. This terminoly was preferred to FSL: the institution have considered that these linguistic issues should not be restrictive to migrants but extended to every pupil with special needs, therefore

[3] In English there is another expression: Teaching English to Speakers of Other Language (TESOL) concerning migrant adults, the equivalent in French could be « Français Langue d'Intégration » (FLI), French as Language for Integration.

[4] Cervoni, B., Davin-Chnane, F., Ferreira-Pinto, M. (2005). *Entrée en matière. La méthode de français pour adolescents nouvellement arrivés*, Vanves, Hachette FLE.
Levet, D. (2012). *Français langue seconde*, éd. Belin.

pedagogical adaption might be done by every teacher and not only few of them. This conception of the roles and tasks is assumed and communicated through a new official text from the Ministry of Education[5]: a specialization in FSL is not required to teachers receiving migrant pupils, but of course those may attend a next training.

Hence, these special classes have evolved from an organisation with a single multidisciplinary teacher to several teachers of different school subjects aiming both French's acquisition and academic knowledge's acquisition. But resources and trainings are seldom provided to teachers of other subjects than French one, whereas administrative teams used to schedule different courses in UPE2A as mathematics ones in which an intercultural approach's practice, through ethnomathematics for instance, could be profitable (Mendonça Dias, 2014).

Gap between the daily language and the specific mathematical lexicon

A number of previous studies have focused on the obstacles a multilingual learner might encounter when he or she tries to solve a math problem. According to Campbell, Adams and Davis (2007), limited linguistic skills, particularly concerning the language of mathematics, can be regarded as one of the major barriers to learning. Similarly Ni Riordain (2011), observed that students whose first language was Irish had encountered problems at the point when teaching passed into English, thus highlighting the impact of linguistic difficulties (above all, when they relate to a mathematical lexicon). A study by Schaftel, Belton-Kocher, Glasnapp and Poggio's (2006), conducted on nearly 8000 students, also found that language skills as a whole play a role in mathematics scores (for both migrant students or others), though the impact is not as significant as specific mathematical language skills: « *The characteristic of difficult mathematics vocabulary shows a consistent effect for all student groups at all grade levels* » (Schaftel & al., 2006, p.120).
These results are a reminder of the findings in Cummins' work (Cummins, 1979 a. et b. ; Cummins, 2000) who as early as the 70s and 80s, recommended distinguishing basic interpersonal communicative skills (BICS) involved in daily conversation, from cognitive academic language proficiency (CALP) skills used in teaching language. Cummins showed that CALP skills can require considerably more time to be developed compared to BICS skills. According to his observations, between two and three years are generally sufficient for a child in full immersion in a host country to be able to conduct a daily conversation in a second language. Indeed, in such a situation, several other sources of information (facial expressions, gestures, intonation, context etc.) can contribute to the understanding of the language. Furthermore, other motivating factors for developing these capacities may be particularly strong, for example a commitment to integrating the host country, a desire to communicate with friends, or a will to understand television shows. In contrast, Cummins estimates between five to seven years for integrating CALP skills in order to follow satisfactorily teaching in the host country.
Other studies confirm these results. Skutnabb-Kangas and Toukomaa (1976), on a study of Swedish children originating from Finland and who spoke fluently both languages, concluded

[5] Cf note 1.

that these pupils show a level of scholarly language well below the expected level of both countries. Spolsky and Shohamy (1999) having observed several schools in Israel, estimated that two to three years are sufficient to acquire daily language, but in contrast, seven to nine years to acquire the language skills necessary to succeed in all school subjects.

French as an additional language's acquisition

What about French language? A longitudinal research (Mendonça Dias, 2012) focuses on determining the influence of French courses on the linguistic progress of 190 multilingual learners, aged 11 to 17 years, and arrived during the school year 2008-2009. The results about linguistic levels reached, three years later, in June 2012 were read in accordance with individual profiles (age, sex, migratory purposes…) and educational contexts, and the data were analysed from the six levels of the Common European Framework of Reference for Languages (from the breakthrough A1 to the mastery C2)[6]. It appeared that the ongoing threshold level B1 in writing is necessary to gain a chosen academic orientation to the high school. In order to achieve this objective, at the least three years of learning were necessary for a non-French speaking student and it must be considered that the progress depended mainly on the former academic abilities. But some students were still at the beginning level A1, even regarding their oral abilities, which implied that they could only introduce themselves or somebody else and used very basic, familiar and concrete phrases even though they had spent more than 2 academic years in France.
As regards linguistic skills related to mathematics, a study from 2011 (Millon-Fauré, 2011) confirmed a gap for the multilingual new arrivals between the control of everyday language and the knowledge of the mathematical activity: the analysis of interviews allowed to identify some migrant pupils who had acquired lexicon essential for academic success in this content-area. Furthermore, linguistic skills involved in daily conversations are not systematically developed faster than the ones necessary for understanding and producing mathematical statements in French whereas they could not conduct a daily conversation.

2/ Methods

Procedures

Data have been gathered in the frame of a national multidisciplinary investigation entitled EVASCOL on the schooling of new arrivals. Both of us are responsible for the second axis about academic and language performances. Numerical mathematics and French exercises[7] have been submitted to students enrolled in a class with language support – the UPE2A –, in

[6] The study was possible thanks to the test results of the "Diplôme d'Etudes en Langue Française" (DELF), an international and official diploma, delivered by the Ministry of Education and that testifies the level reached in French. Moreover, there was a linguistic test taken by the students in their third school year in France.
[7] https://evascol.hypotheses.org/exercices-en-ligne

two periods: in December and in June. Numerical exercises were organised within a conditional structure: if a student successed an exercise, he could access the next stage and if he failed, the level of difficulties decreased. All the mathematics school levels, from the beginning of the primary school to the end of the obligatory secondary school, were covered. Placement tests have been prepared in several languages by the CASNAV of Aix-Marseille[8] and were spread in France since many years. Fortunately, this institution submitted also these exercises in French to about 600 native students to estimate the quality of this test and the average levels. These former results helped us to calibrate our own data. That is why the following results are not in comparison with the mathematics program's completion but with a medium score reached by a native student.

On our part, these tests were scanned in order to offer a numerical version. The 18 most represented languages in UPE2A were selected. In December, the goal was to verify multilingual newcomers' mathematics abilities in comparison with native students, for each grade level. Multilingual learners could choose the language they preferred use. But in June, in the second period, only French language was available to achieve the numerical mathematics exercises. The goal was to study acquisition and loss processes.

Moreover, in June, supplementary exercises were given to a limited sample of students. Indeed numerical version is practical for quantitative data but can't assess the skills in constructing geometrical shapes. That is why some activities in presence conducted by a researcher allowed to evaluate more geometrical abilities and academic language proficiency. Results will be studied in order to determine the causes of difficulties or eases: linguistic, academic or cultural influences (Millon-Fauré, 2013). In this article, we will develop more specifically the in presence tests results.

Sample

For this study, the sample is constituted by 177 students who passed the first numerical test in December 2015. All are enrolled in an UPE2A for several hours by week and they followed regular courses in an ordinary class. However, only 37% of them were enrolled in a regular classes that correspond to their age whereas the others were in a lower grade then, they were one or two years older than their French classmates (even exceptionally three years if they were previously unschooled). They came from 46 countries (the most represented are Bulgaria, Spain and Portugal) and ¾ of them arrived in 2015, the others came previously since one, or two, and seldom three years which is surprising given the fact that students shouldn't be enrolled in an UPE2A more than one full year. The participation of 82 girls and 95 boys was allowed thanks to the partnerships of 4 primary schools and 15 secondary schools, during the academic year 2015-2016.

[8] http://galileo.crdp-aix-marseille.fr/mathsenaf/

The geometrical test in presence was done by 26 students and among them, 6 were in one primary school while others attended the middle school.

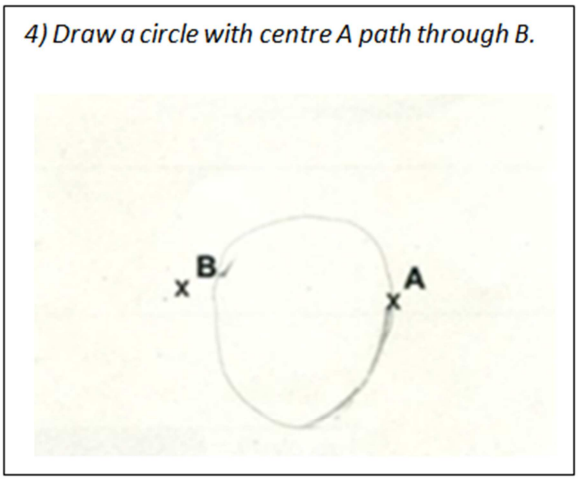
3/ Results

A warning about the interpretations

Using our analysis of students' answers, this article seeks to determine whether or not multilingual newcomers understood the essential terms of a mathematical lexicon which appeared in our questionnaire's instructions. We chose basic words which are used from the beginning of middle school, for example 'triangle', 'circle', 'square', 'to draw', 'to measure', 'axial symmetry', 'perpendicular', 'parallel', 'central symmetry'.

However, interpreting students' answers is sometimes a delicate operation. An erroneous answer or an absence of response may be due to several factors: a lack of understanding of some terms in the mathematical instructions, or an erroneous identification of the type of task concerned (particularly if the conventions or the coding are different from the ones used in schools attended previously), or difficulties in manipulating geometry instruments, or an ignorance of the mathematical knowledge involved in the task (for instance if they had not been taught this knowledge in the country of origin) etc. For example, a pupil we interviewed exclaimed "*we have never done that*" when he saw one of our questions.

This is why we systematically question whether or not the mistakes identified during the analysis of answers are actually due to an erroneous understanding of one of the terms we focus on. As an example of this phenomenon, let us consider the two drawings below:



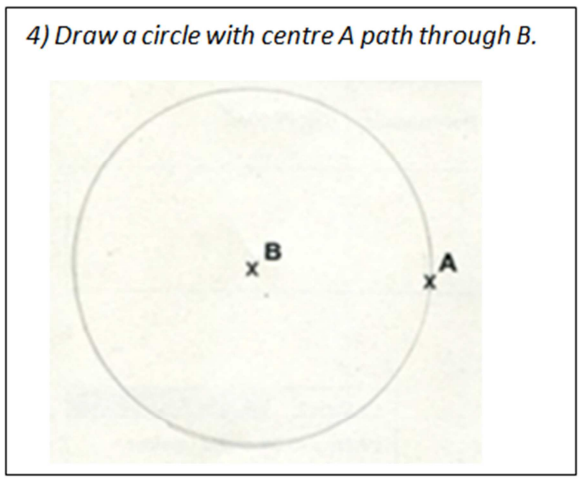


Figure 1. Figures drawn by two newcomers, several months after their arrivals in France[9].

In these two drawing, the restriction "with centre A path through B" seems not to have been taken into account. Besides, in the drawing on the left, we can notice the approximate plot which is certainly due to an inability to manipulate a compass. Hence these answers can not have been said correct. However, in both productions, we have considered that the word "circle" has been understood by pupils.

Conversely, it should be noted that a correct answer does not guarantee a perfect understanding of each term of the instruction. The pupil may have been helped by the geometrical figure which illustrates the instructions, or by mathematical coding, or by knowledge of some typical types of task, such that he or she is able to understand what he or she is supposed to do whereas some terms remain unclear. Hence, a correct answer is only a guarantee of an understanding of the target terms used in the context of our questionnaire.

Analysis of students' answers

Now that we have identified the problems in interpreting pupils' answers, let us focus on the results we were able to determine. First, some very successful answers were identified. For instance, two fourteen-year-old boys completed the last exercise of our questionnaire, which was a very difficult exercise both in terms of mathematics (the concepts involved were only required at the end of middle school) and language (the mathematical terms were hard to understand). Another example was the precision of the drawing of some figures (some triangles were constructed using circular arcs when the length of the three sides were known) or the use of coding (especially to indicate right angles) which proved that some migrant pupils had completely understood the mathematics teachers expectations.

However, our analysis also revealed some serious misunderstandings concerning the basic terms of geometry. For instance, the drawings below which were offered as answers to the instruction "*Draw a circle with centre A path through B"* showed some confusion between the concept of a circle and, respectively, the notions of a segment, a square and a triangle:

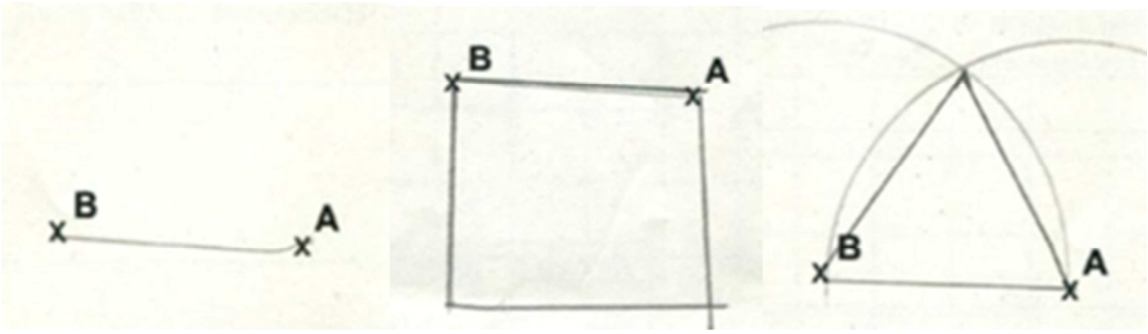


Figure 2. Figures drawn in response to the question "*Draw a circle with centre A path through B"*

[9] The written instruction was given in French.

We can notice the use of a compass to construct an equilateral triangle in the third drawing, which might prove that this pupil associated the term 'circle' with the geometry instrument used to draw this figure. However, the term 'circle' itself was not understood.

In the same way, as regards the instruction "*Draw in green the line perpendicular to (d), through the point E; then draw in red the line parallel to (d), through the point E*", many answers were wrong. Confusion between the terms 'parallel' and 'perpendicular' are, of course, relatively common, even for students who have always attended French schools, but multilingual newcomers' work presented other types of errors which are markedly more atypical :

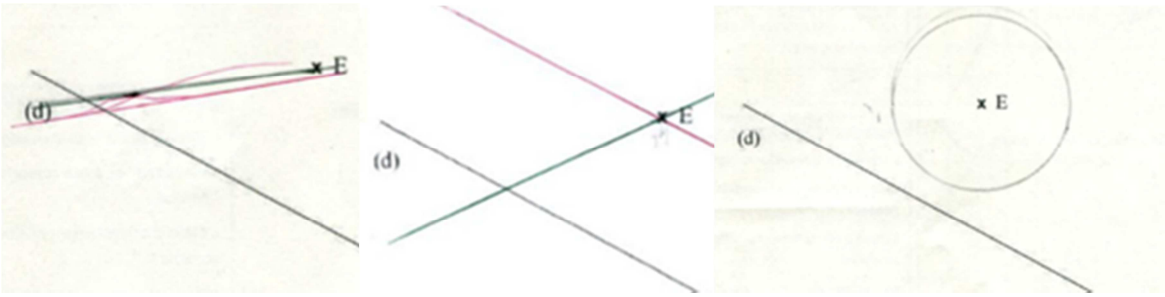


Figure 3. Proposals for the construction of parallel and perpendicular, done by three newcomers, few months after their arrival.

In the first example above, a parallel line and a perpendicular line were almost the same, which seemed to indicate that this student didn't distinguish between the two terms. Perhaps there was also some confusion as regards the expression '*horizontal line'*. In the second drawing, the term '*parallel'* seemed to have been understood, but this wasn't the case for the word '*perpendicular'*. Finally, in the third drawing, we can notice that the words '*parallel'* and '*perpendicular'* were not even associated with the concept of a line.

If we count the number of answers which demonstrate an understanding of the target terms, we obtain the results below:

To draw	22 out of 26 answers	Axial symmetry	20 out of 25 answers
To measure	22 out of 26 answers	Perpendicular	5 out of 26 answers
Triangle	19 out of 22 answers	Parallel	6 out of 26 answers
Square	20 out of 26 answers	Central symmetry	0 out of 15 answers
Circle	20 out of 26 answers		

Some students were not asked to answer all of the questions. For example, the question concerning the concept of '*central symmetry*' which is introduced in the second year of middle school in France, was not presented to students under thirteen who were not interviewed about this notion. Similarly, the word '*triangle*' appeared in an exercise in our questionnaire, which is only proposed at the beginning of middle school and therefore we are not able to estimate young students' understanding of this word.

Nevertheless, it is possible to conclude that some terms were relatively well understood by the students interviewed, whereas others, on the contrary, remained obscure. For instance, no student really understood the expression '*central symmetry*' and only approximately 20% related the right mathematical concept to the words '*parallel*' and '*perpendicular*'. However, both terms are regularly used in middle school and high school so this leads to the question of whether or not multilingual learners recently came to France really understand mathematical lessons provided in ordinary classrooms.

Knowledge about geometry furniture terms

The French language test included a reading comprehension task. At the beginner level, students had to read a short text that seemed extracted from a school agenda and in which it was indicated that a test was scheduled for the mathematics course. Therefore, five questions aimed to verify if students could locate easily concrete information as the date, the door number… It was also the opportunity to verify the understanding of basic geometry furniture terms used for several weeks at school. Indeed, in the text, a mathematics teacher reminded to take a ruler, a square and a compass, and it was specified that calcutor was forbidden. In the following exercise, the student needed to select the three correct pictures among six pictures.

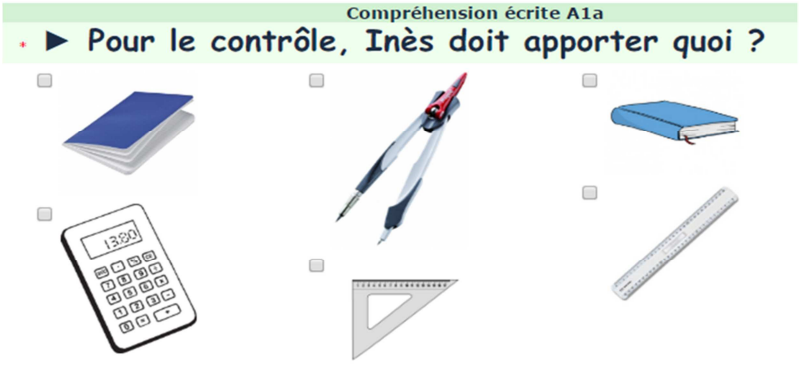


Figure 4. Exercise extracted from the numerical French test: the student must select the three correct pictures.

52 of the sample of 177 new arrivals were not concerned by this exercise because their level didn't correspond to this step (too difficult or too easy). For instance, on one hand, on 177 students, 32 were at the earlier stages of literacy in French and even in their own language (because they had barely attended school previously) that is why one third stopped exercises at a previous level A1.1 On the other hand, other students – with a regular scholarship – had

already reached an elementary level in French then they passed directly to level A2 without having to carry out this exercise. This explains why 52 students were not involved. Moreover a part of students didn't achieve the two sessions for different reasons, so that there is a sample of 100 students in December and another of 75 students in June.

In December, 100 students answered and 61% failed, which is understandable because even if they had already used this furniture in France, they didn't apparently memorize or remember these items' name. But it seems a bit more surprising in June, after one academic year, that 36 on 75 students still failed, while they should be only in a regular class the next school year, after the summer holidays.

For all following analyses and each sub-sample, every age is represented (form 8 to 17 years), every language (romance language or not) and every migratory situation, but it didn't appear as determining factors in these statistics. Moreover, the majority who selected the good answer declared to use French at home (but we don't know how frequently), a percentage a bit more important than those who gave the wrong answer, but not really significant. Furthermore, about 41% to 50% were enrolled in a class that corresponded to their age while the others were one or two years older than their classmates, in both categories and both sessions (correct or wrong answer, in December or in June).

What appears through the results? Students who gave the right answer in December and in June have clearly a common point: their listening comprehension results mostly corresponded to level A2 or above, whereas their written comprehension was rather estimated on level A1. Overall they had standard mathematics skills (that had been assessed in their own language, in December) in comparison with other native students of the same age.

On the contrary, for students who didn't choose the good pictures had lower oral and written skills in December and in June (only around 26% reached the listening comprehension A2, at each test). Moreover, 5 of them didn't manage to decode a phrase correctly. Furthermore globally the mathematical skills in their own language is not sufficient, and a consistent percentage of students had mathematical abilities below the beginning of primary level whereas they attended middle school. Of course, the combination of these factors is not constant since several pupils with medium mathematical abilities didn't find the good pictures, but we don't have objective explanation for these cases.

Case studies[10]

Let's examine in detail the 4 students' case studies, which appear to be especially informative.

Two cases: the relationship between daily language and the language of schooling

[10] Names have been changed in order to respect the anonymity of interviewees.

Delfina and Pira are two girls arrived in France in 2015. Delfina was enrolled in the final year of primary, while Pira in the first year of college. They were both one year older than the reference age of their class.

Delfina comes from Romania. His mother tongue is Romanian and at home, French is more or less present. Romanian is a Romance language that is very close to the French language. Before she left, she had studied French in Romania. Pira comes from Thailand. Thai is her mother tongue and at home, French and English are also present, because her father-in-law is French. Thai is far from the French language and works with a distinct alphabet, but the girl already had skills to decode with the Latin alphabet, thanks to the learning of English.

Pira encountered lots of problems with regard to knowledge of everyday language as she only had a level A1 in both listening and written comprehension. Furthermore, the rare answers she provided to our mathematical questionnaire were generally wrong and they proved Pira had considerable difficulty in understanding the instructions. In fact, she said herself during the interview that she "did not understand".

On the other hand, concepts could be taught differently. For example, depending on the school where she was enrolled in Thailand, it is possible that she used partially other measurement systems than those in France for lengths, weights... Finally, even taking into account the differences in school culture, it is none the less true that its performances are far below what is expected for her level of education.

Furthermore, on a fluency test achieved in June, it appeared that in one minute, she read 22 words correctly from a French narrative text, while Delfina read 139 from the same text, which corresponds to an average rhythm. Pira therefore experiences decoding difficulties, which she did not have in her original language as we could verify.

This affects all disciplines, such as reading a mathematical statement. Yet Pira was presented as a good student in her home country, according to her school reports.

In contrast, Delfina, who had also arrived in France only a few months before and who attended school with eleven-year-old pupils, obtained a level B1 in listening comprehension and in written comprehension A2 in December and B1 in June. She had studied French before moving to France.

Delfina felt ready to perform the mathematics tests directly in French rather than in Romanian, and as early as December Delfina succeeded in obtaining a score corresponding to her level of education, even higher than this one because her level is at the beginning of middle school regarding the geometry, whereas she is still enrolled at the primary level. In the mathematical in presence test, with the exception of the drawing of the square which was relatively approximate, all her answers were right.

Therefore, for these pupils, we can highlight a match between the development of everyday language, the knowledge of mathematics contents and the development of the linguistic skills

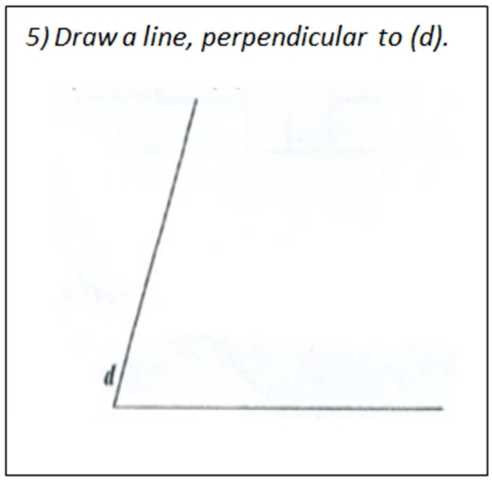
required for mathematical skills. This is not always the case.

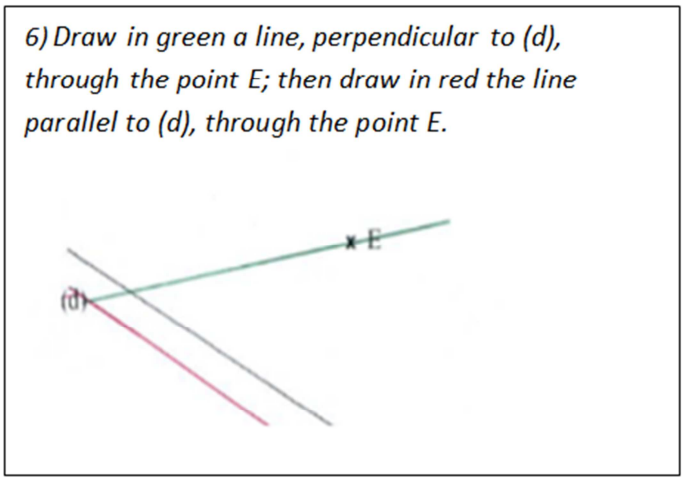
Two other case studies

As an example, let us consider the situation of Chourouk and Li who were schooled in the same classroom, with fifteen-year-old pupils and who arrived in France just over a year ago. Li was one year older than his classmates. Chourouk, whose mother tongue is Arabic, is Spanish-speaking because he lived and studied in Spain. At home, Li speaks Chinese, his native tongue, but also French.

As regards the mastery of everyday language, Chourouk obtained a level B1 in listening comprehension and a level A2 in written comprehension. He has more oral facilities than Li, but the skills in writing are much the same.

Yet, Chourouk's answers to our mathematical questionnaire proved to be worrying for a child of that age. In fact, even in Spanish, at the numerical tests of December, it appeared that Chourouk has a level corresponding to the beginning of the middle school for arithmetical abilities but he failed to geometry and measures exercises, bringing it back to the beginning of elementary program. Here are, for example at the face-to-face test, his answers to the instruction '*draw a perpendicular line to a given line'*:





Li encountered more problems than his classmate with regard to the control of everyday language (he had recently obtained a level A2 in oral comprehension). However, Li has an excellent level in mathematics: while the school year is still in its beginnings, he mastered in Chinese the skills expected for the end of the 3rd year. Moreover in June all his answers to our mathematical questionnaire were impeccable, except for the exercise concerning central symmetry where there is some confusion with the translation. As in the case of Delfina, he is studying mathematical notions already mastered in the Chinese language, while Chourouk -

like Pira - is confronted to a double cognitive challenge: at the same time, the study of mathematical notions not previously mastered but also learning a vocabulary in French. While Delfina and Li are in a situation of transferring skills from a first language to an additional language, Chourouk and Pira are in a situation of appropriation of new disciplinary knowledges and language skills.

The quality of previous mathematical skills, mastered in his first language of instruction, seems to be determinant in the acquisition of the terms specific to the discipline, better or sooner acquired compared to the learning of the usual language. Learning the language of specialty is no more complicated than learning the words of everyday life for those who master the notions. For instance, the word "umbrella" (estimated for level A1) is no more complicated to memorize than the word "perimeter" for someone who knows the meaning of these terms. Chourouk and Pira are likely to be able to identify the term "umbrella" more easily than "perimeter" even though the latter term would be more frequently pronounced in mathematics class. Hence, for these students, the development of everyday language control and the development of linguistic skills required for mathematical skills do not match.

4/ Discussion and conclusion

Actually, immersive class, and even UPE2A, seem not sufficient to guarantee mathematical lexicon's acquisition. Academic language in mathematics may be taught in UPE2A usually by practice, in immersion, by doing directly mathematics exercises with pedagogical adaption (slow and decelerated rhythm, differentiation regarding the grade level of each student, more explanation in reduced groups…). Does this correspond to the way teachers organise the contents in a context of French as an additional language? Mathematics teachers who prepare specific courses for multilingual newcomers focus their contents on different mathematical topics maybe because they receive students of different ages and class levels, who are gathered in the same classroom, and they have to provide some adapted activities corresponding to the mathematical abilities of each.

However it appears that even after one year of schooling in an UPE2A, many multilingual learners still have serious lacks in the mathematical language, which compromises their integration into an ordinary class. This study illustrates the scale of difficulties encountered by multilingual newcomers learning mathematics with French as an additional language. Obviously the daily language is neither necessary nor efficient to master the specific lexicon for mathematical activity. What is worrying is that students who have spent more than 10 school months were not able to understand a simple written instruction that referred to very common, useful, daily and concrete terms for this subject, terms accessible since the beginning of the learning, as 'a ruler', 'a compass'...

These observations lead us to question the existence of teaching practices capable of accelerating the learning of these language skills essential to mathematical activity. For this purpose, a specific module was tested for a few years in a secondary school in Marseille. It

aimed to propose to multilingual new arrivals activities that were both mathematically rich and designed in such a way as to promote the expression and comprehension of specific statements, in order to link the manipulation of the lexicon with the associated concepts mathematics so that migrant students could more quickly take advantage of mathematical lessons in a manner independent from the development of everyday language (Millon-Fauré, 2013). This experiment showed encouraging results concerning the memorization of the mathematical terms, and deserves to be studied further. Other practices also seem relevant to us to facilitate the students' learning of these language skills: specific oral and written language activities directly in relation with the mathematical activity, mediation through translation, pluralistic approaches to languages and cultures (language awareness, integrated didactic approaches, intercomprehension between related languages...), intercultural approach with ethnomathematics, promoted language acquisition, transversality of scientific subjects with French courses through some common project.
However, the complexity of the introduction of such practices for teachers in these special classes is stressed. These adaptations require reflection on the language skills necessary for the mathematical activity and on the type of practices allowing their learning. Therefore, it is necessary to think about training and accompaniment of these professionals, through in presence training or with e-workshops (Joseph, Leonard, Viesca and Hamilton, 2015).

References

Bertrand, D., Viala, A., Vigner, G. (coord.) (2000). *Le Français Langue Seconde,* Centre National de Documentation Pédagogique (CNDP), Collège-repères, publication du Ministère de l'Education Nationale.

Besse, H., « Langue maternelle, seconde, étrangère », Le français aujourd'hui, n° 78, Paris, AFEF, 1987, p. 14-15.

Boutan, P., « La langue des Messieurs », Histoire de l'enseignement du français à l'école primaire, Armand Colin, Coll. Formation des enseignants, 1996.

Blanchard, M. Desmottes, D. & al. (2004). *Enseigner les mathématiques à des élèves non francophones. Des outils français-maths*, SCEREN, CRDP, Cahiers de Ville Ecole Intégration, Académie de Créteil, 2004

Bouchard, R. & Cortier, C. (2007). « Cultures scolaires et enseignement-apprentissage du FLS en milieu français pour élèves allophones : le cas des mathématiques ». In Lucchini S. & Maravelaki A. *Langue scolaire (éds.), diversité linguistique et interculturalité*, EME/InterCommunications, 113-130.

Campbell, A. & Adams, V. & Davis, G. (2007). *Cognitive demands and second-language learners: a framework for analyzing mathematics instructional contexts.* Mathematical Thinking and learning – Lawrence Erlbaum Associates.

Chomentowski, M. & Gohard-Radenkovic, A. (2014). *Apprendre en français pour*

apprendre le français du FLE/FLS au FLS/FLSCO : l'exemple des compétences mathématiques, Revue française de linguistique appliquée 2014/2 (Vol. XIX).

Cummins, J. (1979 a.). Linguistic interdependence and the educational development of bilingual children. *Review of Educational Research*, 49, 222-251.

Cummins, J. (1979 b.). Cognitive/academic language proficiency, linguistic interdependence, the optimum age question, and some other matters. *Working Papers on Bilingualism,* 19, 197-205.

Cummins, J. (2000). *Language, Power, and Pedagogy.* Buffalo, NY: Multilingual Matters.

Cuq, J.-P. (1991). *Le Français Langue Seconde.* Origines d'une notion et implications didactiques, Hachette.

Desmottes, D. (2009). « En classe d'accueil, faire du français en maths » in Cahiers Pédagogiques, *Enfants d'ailleurs, élèves en France*, n° 473, mai 2009.

Girodet, M.-A. (1996). *L'influence des cultures sur les pratiques quotidienne du calcul,* Credif essais.

Joseph, N. M., Leonard, J., Viesca, K. M., and Hamilton, B. (2015). Mathematics teachers'perspectives on online professional development modules. *NABE Journal of Research and Practice, 6*, 1-33.

Kachru Braj, B. (1985). *English in the World*, Cambridge University Press/British Council, Quirk-Widdowson ed.

Marcus, C. & Blondeau, N. (1993). « Des pistes pour une méthodologie du français langue seconde en France en contexte scolaire », Revue Migrants Formation, n° 95.

Marcus, C. (1999). *Français Langue Seconde, lectures pour le collège.* CDRP de l'Académie de Grenoble. La collection 36. Delagrave, 227 p

Mendonça Dias, C. (2014). « Enseigner les mathématiques avec des écoliers non ou peu francophones », *Quelles ressources pour enrichir les pratiques et améliorer les apprentissages mathématiques à l'école primaire ?* Actes du 41ème Colloque international des Professeurs et Formateurs de Mathématiques chargés de la Formation des Maîtres (COPIRELEM), juin 2014.

Millon-Fauré, K. (2011). *Les répercussions des difficultés langagières des élèves sur l'activité mathématique en classe : le cas des élèves migrants*. Thèse de doctorat, Université d'Aix-Marseille I, Marseille.

Millon-Fauré, K. (2013). Enseigner les compétences langagières indispensables à l'activité mathématique. *Repère Irem,* n°90, p.49-64.

Naude, H. & Pretorius, E. & Vandeyar, S. (2003). Teacher Professionalism – An Innovative Programme for Teaching Mathematics to Foundation Level Learners with Limited Language Proficiency. *Early childhood and care*, 173, 293- 316.

Ni Riordain, M. (2011). A working model for improving mathematics teaching and learning for bilingual students. CERME 7. *Mathematics and language*.

Schaftel, J. & Belton-Kocher, E. & Glasnapp, D. & Poggio, J. (2006). The impact of language characteristics in mathematics test items on the performance of English language learners and students with disabilities. *Educational Assessment*, 11(2), 105–126, Lawrence Erlbaum Associates, Inc.

Skutnabb-Kangas, T. & Toukomaa, P. (1976). Teaching migrant children's mother tongue and learning the language of the host country in the context of the sociocultural situation of the migrant family. *Report written for Unesco. Tampere: University of Tampere, Dept of Sociology and Social Psychology, Research Reports*, 15-99.

Spolsky, B. & Shohamy, E. (1999). Language in Israeli Society and Education. *International Journal of the Sociology of Language*, 137, 93-114.

Zakhartchouk, J.-M. (1999). *Comprendre les énoncés et les consignes*, CRDP d'Amiens.