Abstract
This paper presents the interest of the “instrumental conflict” concept, developed by Marquet (2005), to understand the relationship between didactics and classroom management in the training programs of math teachers. It also shows some results of a survey, conducted in 2008 among pre-service teachers in the Université du Québec en Outaouais (Canada), revealing a perceived gap between both domains. However, those two domains are closely related during teaching in the classroom. The paper also presents a plan to better understand and improve the situation. Cooperation between classroom management and didactics specialists is highlighted.

Context
Didactics and classroom management are two very distinct domains in the teaching of mathematics. Most research in the education field focuses on one of these aspects, and not on the relationship between the two. In the university setting, activities offered in the didactics classes are very different from the ones proposed in the classroom management classes. The theoretical models on which these two disciplines base themselves are so different that one could, to a certain extent, believe that they are not related. However, in the classroom setting, the reality that teachers face is very different. In fact, when one teaches mathematics, the planning of learning activities, their execution, and the management of classroom atmosphere are closely interrelated. The authors of this paper – respectively mathematics didactics expert and classroom management specialist – are proposing an approach to better understand the situation and find solutions for it in a collaborative perspective.

The importance of the relationship between didactics and classroom management can be illustrated by a situation where one learns through the solution of problems: in this educational context, in tune with the direction of the training program, the mathematical content is studied through situations in which the learners do not know, at first, the method to solve the problem. This approach seeks to foster “situational interest” (Pallascio, 2005; Beaudoin, 1998) in order to motivate students to invest the necessary effort to discover the underlying lessons. What happens if the situation does not generate this interest for the student? In addition to the fact that the lessons are not assimilated, problems related to the learning atmosphere might become more pronounced. The interest in mathematics is actually closely related to the involvement of learners in the activities offered, and consequently, in the classroom management aspect (Beaudoin, 1998), which reinforces the importance of paying attention to the relationship between the didactics of mathematics and classroom management.

Conversely, learning based on mathematical problems can pose certain challenges for the teacher in the management of his or her classroom. These challenges might impel the teacher to avoid this educational approach. In such an educational context, learners must invest efforts in finding a solution to a problem for which they do not possess all the prerequisite knowledge, and the teacher acts more as a guide than an instructor. Some teachers are concerned about the possibility of losing control of their class in this type of setting, where activities are less controlled by the teacher. Some also fear that the time spent on the exploration of problems could detract from the learning of the mathematical concepts and processes that are part of the required curriculum.

Teachers must now work in a unique context with regards to student groups. These include: students with learning and behavioural difficulties that must be integrated into regular classrooms; students of different ages; students in specialized programs (sports-study programs, international school programs, etc.); young adults groups. While the classroom management aspect of a teacher’s training takes these parameters into consideration, the discourse of didactics specialists does not address them.
We do not believe that the relationship between subject matter didactics and classroom management has been sufficiently studied, particularly in the existing context in schools. Where, in the training programs for teachers these are presented as two distinct areas, they are closely related in practice. It is through practice and reflection that the teacher (whether teaching or in training) usually succeeds to integrate these two fundamental dimensions of the art of teaching.

Preliminary work conducted at the Université du Québec en Outaouais

During the fall of 2007, a survey was conducted with teaching graduates at the Université du Québec en Outaouais. These students had just completed their fourth (and last) internship. They were enrolled in the preschool and primary school teaching bachelor program, school adjustment bachelor program and secondary school teaching bachelor program (French, Mathematics, Social Studies). A total of 87 students completed the survey. The questionnaire was based on the indicators of the tool for the assessment of professional competencies (“référentiel des compétences professionnelles”) used for their internship. From the bank of indicators, we selected six that were related to didactics, five related to classroom management, and three pertaining to both of these disciplines. Students were invited to select six indicators that appeared to be the most important, and to prioritize them. For each of the six selected indicators, students rated their presumed level of ability.

In all three above-mentioned programs, the indicators that pertained simultaneously to both domains were selected as most important by students. Students also indicated that they felt most proficient in the areas that combined both disciplines. These results should be compelling to those who train teachers, both in the fields of initial training and continuing education. Even if the theoretical university training does not prepare them explicitly, students consider that the intersection where didactics and classroom management meet is a priority. The role of practical training (internships) in the combined application of these two disciplines, which pertains to teacher’s contact with his or her students, is therefore very important.

On the other hand, graduating students considered less important such elements as interpretation of the subject matter and mastering of basic techniques in classroom management. They also feel less proficient in these fields. This situation does not seem ideal, to the extent that new teachers could lack important competencies related to the interpretation of programs and to the use of basic techniques in classroom management. Lefstein (2005) has underlined the distance that seems to exist between classroom management and what pertains to didactics in the material used to train teachers. An interpretation of the disconnection between these two dimensions would allow to better understand this challenge and to remedy it.

Goals

We would like to better define the issue regarding the relationship between classroom management and didactics to validate a training model for teachers that takes it into account. Our goals are as follows:

- Document the potential conflicts between didactics and classroom management with teachers in training, particularly in the field of mathematics.
- Consider the potential impact of these conflicts.
- Observe the manifestation of these conflicts with the teaching interns.
- Develop and validate a training model that could solve these conflicts.

Conceptual framework

The mathematics curriculum of the Province of Québec favours the acquisition of knowledge through problem solving (Pallascio, 2005) and the use of democratic models for classroom management. The theory of didactical situation (Brousseau and Balacheff, 2004) serves as an important base for this curriculum and for the training program for teachers. This model covers the relationship between knowledge, the learner and the agents responsible to guide the learning. However, it barely takes into account the behaviours of the student or of the student group that may help or hinder the learning process. In the field of classroom management, many documents (Charles, 1999; Nault; 1998) define classroom management as the ability of the teacher to consider the complexity of the environment, the needs of the students and the objectives of the program.
Although the link between didactics of mathematics and classroom management has been acknowledged by a few authors (DeBlois, 2009), the study of this relationship has not been thoroughly documented and the intersection of didactics-classroom management does not explicitly urge the renewal of practices in the teaching of mathematics.

Moreover, the concept of “instrumental conflict” developed by Marquet (2005; 2003; 2004) in the context of computer environments for human learning (“Environnements Informatiques pour l’Apprentissage Humain”) presents a great deal of interest for the study of the relationship between didactics and classroom management. Marquet defines instrumental conflict as the consequences of an interference that could arise between one of several tools at play in an instrumental situation. The educational intervention of the teacher might be considered to be a situation where he or she must simultaneously use and apply several tools in order to sustain the learning of students. According to Rabardel and Pastré (2005), this constitutes an instrumental situation, one in which the educational and didactics approaches can be considered to be artefacts that are transformed into tools by teachers.

Rabardel (1995) has underlined two simultaneous processes in the development of a tool: the instrumentation and the instrumentalization. The instrumentation involves the emergence of a utilization approach on the part of the subject, whereas instrumentalization involves the adaptation of the tool to the subject. Obstétar (2008) and Marquet (2005) expanded on the concept of the instrument to include objects in a learning situation and gave rise to the potential conflicts between didactics and educational approaches. The study of these potential interferences in the instrumentation and instrumentalization processes in the didactics and educational approaches amongst teachers in training form the basis of our contextual framework.

Measures

By basing ourselves on our respective expertise in the field of didactics of mathematics and of classroom management, we will put the following measures forward.

Conflict documentation

The preliminary study conducted at the Université du Québec en Outaouais has allowed us to identify, through the input of students, some potential areas of conflict between the didactics and educational aspects. We will further document these conflicts through a questionnaire to be completed by internship supervisors and associate teachers in schools.

Study on interns’ conflicts

We will observe all intern mathematics teachers. These subjects will be divided between internships 2, 3, and 4 of their teaching training program. We have excluded the first internship, as it is based on observation. These interns will be observed by a classroom management specialist and a didactics expert during two classes where they will be asked to accompany students in their learning. The conflicts pertaining to the didactics and educational aspects will be identified, and the student will be required to provide comments on the subject. The analysis of the comments will allow for a better comprehension of the perception of the conflict from the student, and will allow him or her to find a solution.

Model development

The documentation and study of these conflicts with the interns will allow us to develop training activities that will integrate both dimensions, particularly in the context of learning through problem solving situations. At this stage of our reflection, we can predict the following elements:

- Interventions by the mathematics didactics expert in the classes given by the classroom management specialist, and vice-versa, particularly for the management of learning through problem solving situations;
- Integration of elements related to classroom management in the planning of activities for the teaching of mathematics during internships;
- Development of training sessions for the continuing education of practising teachers, under the joint responsibility of a mathematics didactics expert and a classroom management specialist.

Impact in the teaching of mathematics

1. Learning through problem-solving situations

This education approach, which is a priority for the mathematics curriculum, is undergoing implementation difficulties in Québec. Classroom management could be one of the causes. Our
research will contribute to better implement this educational approach, and to foster greater success for students.

2. Use of ICTs in the teaching of mathematics

The integration of ICTs in the learning of mathematics also seems limited by problems associated to classroom management. The results of our model will be able to be reinterpreted in this context.

3. Differentiated instruction

Mathematics teachers are now asked to work in environments where differences between groups and learners within a same group are particularly important. The management of these differences is difficult because of the sequential aspect of several mathematical learning processes. Our work will help to better equip teachers in this field.

4. Initial training and continuing education of teaching staff

Our work will have impact on the initial training and continuing education of mathematics teachers. The preliminary results we have obtained have already elicited thoughts on the compartmentalization of the training fields of teachers. Our project will allow for the implementation of continuing education for practising mathematics teachers, done jointly by a didactics expert and a classroom management specialist.

Impact in the research field

In terms of knowledge, we will be able to develop a niche that has been, up until now, neglected by research. While some authors write about the importance of good classroom management in order to encourage the optimal functioning of didactics and vice-versa, the approach that we are proposing will enrich knowledge by studying it through instrumental conflicts. The project will also allow for a broadening of the scope of the instrumental approach, developed through the appropriation of technologies, to another field. Our work will also allow us to document the importance of studying the impact of the conflict between the different approaches used by the teacher (Trouche, 2007) on the students.

5. References


