

In-Service Teachers Education and E-Textbooks Development: An Integrated Approach

Victor Giraldo (victor.giraldo@ufrj.br) – Federal University of Rio de Janeiro, Brazil

Letícia Rangel – Federal University of Rio de Janeiro, Brazil

Cydara Cavedon Ripoll – Federal University of Rio Grande do Sul, Brazil

Francisco Mattos – State University of Rio de Janeiro, Brazil



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Context: The Project

- The Brazilian Mathematical Society (SBM) has been running, since 2012, ***MatDigital Project***: design of digital materials (e-textbooks) for elementary school (grades 6 to 9, ages 11 to 14).
- ***MatDigital*** is under the ICMI's Klein Project.

Context: The Project

Klein's Ideas

- The rupture between school and academic mathematics → ***double discontinuity*** in teachers' education.
- The ***role of school***: assessing education needs and establishing categories that will determine the production of new knowledge (rather than simply spreading knowledge produced at the university).

Context: The Project

Klein's Ideas

- Overlaps with current mathematics education research (e.g. Shulman, 1986; Even & Ball, 2009).
- For instance, as teachers often see poor relation between their undergraduate courses and their classroom practice, they tend to acknowledge their prior experience as school students as a major reference to build up their practice, as if these courses had to influence to shape them as teachers.

Project Design

- **Collaborative work** of a design team of 60 members, including elementary school teachers and university lecturers (in line with Klein Project's guiding principle).
- **Subgroups** (of 4 or 5 members), coordinated by a central editorial board.
- All the subgroups as well as the central editorial board are formed by **school teachers and university lecturers**.

Project Design

- Each chapter of the e-textbooks was assigned to a subgroup.
- The subgroups were instructed by the editorial board to design the chapters in **effective hypermedia structure**. That is, the chapters should incorporate a network of different modalities of media would playing an actual role in the approach of the concepts.

Challenges and Shifts

- 1. How to manage to collaborative work of a large team, including members with quite different (and complementary) backgrounds?*
- 2. How to make the best possible use of the available digital tools, as intended by the project's conception?*
- 3. How to incorporate e-textbooks into classroom, especially in the case of teacher who have little familiarity (and resistance) with digital tools?*

Challenges and Shifts

Expected resistance from teachers

- ***substantive dimension***: lack of familiarity or insecurity towards technical aspects of the tools;
- ***subjective level***: lack of preparation for the new classroom dynamics triggered by the use of digital tools, which can possibly drive students to a more independent attitude towards their own learning process, and seriously change the authority position established for teachers.

Challenges and Shifts

Integration with in-service training

- 1. to train teachers on the use the digital materials**, from both the perspectives of technical knowledge of software, and devices and of the preparation for potential changes in the classroom dynamics brought into play by the emergence of digital instructional tools;
- 2. to create and consolidate an environment**, involving school teachers, teachers educators and policy makers, for long- term joint discussion, integration the reflection on mathematical subject matter, classroom practices and use of instructional materials;

Challenges and Shifts

Integration with in-service training

3. **to enroll teachers in the development process** of the digital materials, as a means to turn passive use to authorship, and to reverse the traditional top-to-bottom paradigm on instruction development;
4. **to use the feedback** from workshops and testing in actual classroom situations to develop successively improved versions of the digital materials.

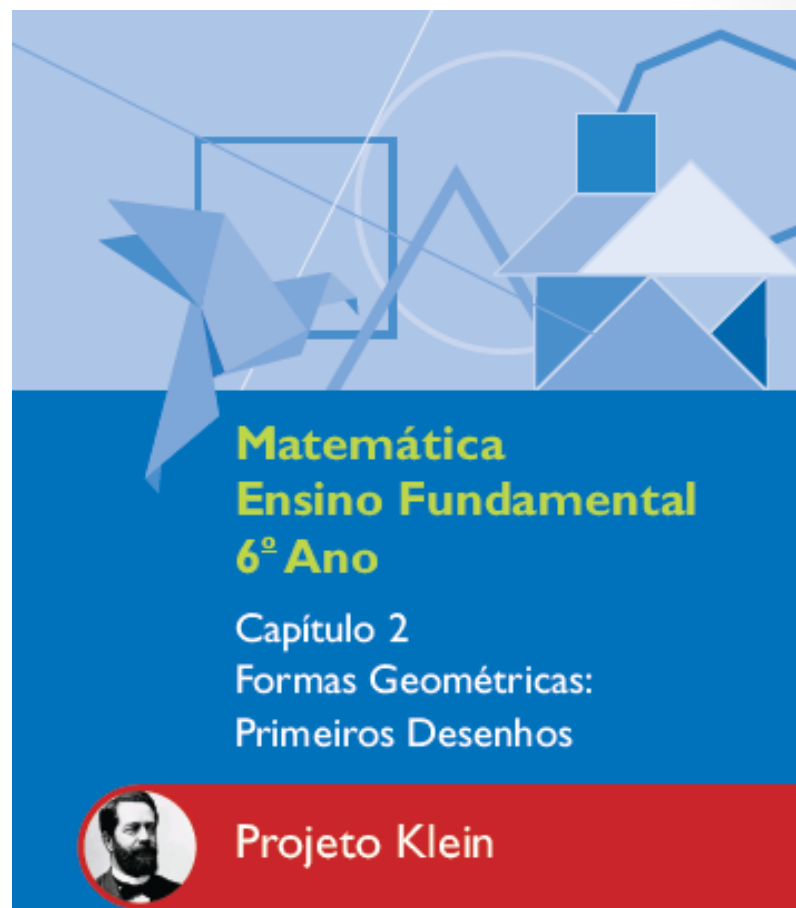
The Pilot Study



 **SBM** Sociedade Brasileira de Matemática



Coordenação de Aperfeiçoamento
de Pessoal de Nível Superior



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The Pilot Study

State	School	Number of teachers	Number of students
Amazonas	AM1	3	75
Minas Gerais	MG1	4	170
Minas Gerais	MG2	2	120
Minas Gerais	MG3	3	175
Minas Gerais	MG4	3	130
Minas Gerais	MG5	2	140
Piauí	PI1	1	40
Rio de Janeiro	RJ1	1	60
Rio de Janeiro	RJ2	1	140
Rio de Janeiro	RJ3	3	190
Rio Grande do Norte	RN1	2	125
Rio Grande do Norte	RN2	1	80
Rio Grande do Sul	RS1	3	210
Rio Grande do Sul	RS2	2	155
Rio Grande do Sul	RS3	11	250
São Paulo	SP1	6	115
São Paulo	SP2	2	180
TOTAL	17	50	2355

The Pilot Study

- Participant teachers were invited to a three days workshop to discuss the chapters.
- Their critiques and suggestions were taken into account for the versions of the chapters that were sent to schools.
- Communication among the participant teachers, and between them and the project's design team was conduct through an online discussion forum.

The Pilot Study

Data collection

1. written questionnaires from participant teachers, assessing adequacy and difficulties of each of the chapters;
2. interviews with participant teachers;
3. interviews with participant schools' pedagogical support teams;
4. students' answers to tests and selected tasks;
5. students' performance in exams;
6. written questionnaires from a selected sample of students, concerning their general experience and difficulties with the materials.

Results

Students' learning

- **Resistance:** Initial resistance reported by students was reported decreased through the study.
- **Engagement:** Students' responses to questionnaires revealed that: 93% claimed that they liked mathematics more after the experience than before; 89% claimed they liked the pilot study materials more than their usual textbooks.
- **Performance:** A significant increase on students' performance on exams exams was also reported.

Results

Teachers' practice

- ***Resistance:*** All the participant faced difficulties on adapting to a new classroom dynamics.
- ***Re-thinking practice:*** All of them claimed to be unable to resume previous practices after the pilot materials were used.
- ***Perception of students' attitudes:*** Teachers also reported an increase on engagement, performance and a more inquiring attitude from their students.

Results

Teachers' practice

- ***Self-perception:*** “We could not be the same teachers as they used to be before”.
- ***Perception of students:*** “They no longer take things for granted, and want to know *why* everything is like that”.

Results

Final Comments

- In our interpretation, **teachers' engagement** is more related with the results, than to any particular feature of the material.
- Therefore, results can hardly be generalized to a context in which teachers do not participate on discussion about the material.
- Participant teachers were invited to **discuss and criticize** the material with the design team, and encouraged to **exchange ideas** with each other.

Results

Final Comments

- This aspect seems to have created an environment that integrated **collective discussion** about mathematical content, pedagogical approach, use of textbooks and use of technology.
- This may have led to a shift on teachers' role: from mere recipients of instructional materials to a **sense of authorship**.