



# Reflection and Knowledge by Means of Integrated Practices in Courses for Initial and Continued Education of Mathematics and Physics Teachers

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## Abstract

*In the perspective of teachers' education, and the creation and fostering of graduation courses (which are called Licenciateship courses in Brazil) by Federal Institutes, the present work presents activities, practices and/or methodologies developed in the subject called Basic Mathematics, included in the curriculum of the first semester of the Licenciateship in Mathematics from the Farroupilha Federal Institute – campus São Borja. This subject has a 60-hour curriculum plan, divided into 40 hours of theoretical classes and 20 hours of integrated pedagogical practices. Throughout the course, the students get in touch with integrated pedagogical practices and integrating projects. Among these activities, it is included the participation in educational researches, extension programs, development of workbooks, development of projects for Science events, and others. In this sense, the Basic Mathematics subject has developed differentiated workbooks and materials for each one of its contents, allowing future teachers to guide future actions which may contribute to their own education and, consequently, to the learning of their students. Besides this, based on these practices, the undergraduates should write reports about the activities developed, having the opportunity to reflect about the actions developed, having as basis the theoretical principles studied in that subject. To summarize, these pedagogical practices aim at strengthening the articulation between theory and practice.*

## 1. Introduction and Justification

The Farroupilha Federal Institute of Education, Science and Technology (IFFarroupilha) has as mission to promote technological, scientific and professional education through the teaching, research and extension, focusing on the education of critic, autonomous and entrepreneur citizens. Based on this, and guided by the principle of a regional sustainable development, the campus in São Borja offers courses that answer the demands of the local community by means of technical and professional education courses and graduation courses in technology and licenciateships. So, based on the Law No. 9394 "The Directives and Basis for Brazilian Education" (LDB), from Dec 16/1996, and based on the National Council for Education's agreement No. 776/97, it was established in IFFarroupilha - Campus São Borja the Licenciateship Course in Mathematics.

This course has as objective to educate qualified professionals who will be able to work in basic education schools and in other formal or informal educative spaces, as well as to continue their studies in post-graduation courses. It is also hoped to provide the education of citizens with theoretical and methodological basis, aiming at the construction of significant learning, enabling the future teacher to take a stand in a critic, creative, responsible, constructive and autonomous way in the academic and social process.

The course seeks the education of professionals with a differentiate profile, rooted in the balance between the specific knowledge and the school practices. This kind of education academically respects the different fields of knowledge and sees the undergraduates as future teachers. Because of this, it establishes articulations between the specific, quotidian and scientific knowledge of the students.

In this sense, the subjects of the course, since the very first semester, seek to answer the expectancies and demands of the decree No. 3,462, from May 17/2000, and the CNE/CES agreement No. 1,304/2001 – "Curricular Directives for Mathematics Courses", as well as the CNE/CP agreement No. 009/2001, which establishes the National Curricular Directives for the Education of Basic School Teachers. Thus, the subject called Basic Mathematics, constituted of 60 hours, being 40 hours of theoretical classes and 20 hours of integrated pedagogical practices, and comprising the contents of exponentiation and Nth root, binomials, factorization and 1st and 2nd degree equations, seeks to



develop alternative materials in each one of these contents in order to contribute to the construction of alternative methodologies.

The present work has its importance justified by the unquestionable need for acquiring classroom experience, both in initial and continued education. This first contact with suggestions and construction of alternative materials provides a broader and more concrete view about the educational and learning perspectives, building up the possibility to make relationships between the theoretical and practical knowledge.

## 2. Methodology and Theoretical Framework

The teachers' initial education nowadays acquires special relevance because it is linked to the search for new ways to the school and the education in Brazil. In this sense, it is possible to say that the initial education of the future teachers is a prime demand in the current context, taking a position of prominence in the discussions regarding the instruction of professionals in education. Speaking about education, it is postulated that the Mathematics teacher should develop investigative and reflexive attitudes which go beyond the simple application of algorithms.

The association between theory and practice in education, having the later as a fundamental element for the education of the future Mathematics teacher, must primarily encompass a critic and socially responsible education which values the school as locus for teacher's education.

With this purpose, the Basic Mathematics subject proposed activities that can be applied by the future teachers in classroom, with the objective of helping the comprehension of concepts by the students, improving their capacity for solving problems and giving priority to the discussion of strategies in the solutions used for those problems. Another objective is to make the students reflect about the relationship between the contents and the resources used in the classroom and in the school.

So, the subject proposed, for each one of the contents previously presented, that the undergraduates should elaborate materials which could contribute for that content to become more significant for the students. This way, many were the proposals presented, focusing mainly on the use of games for teaching mathematics.

The proposals were offered by groups of undergraduates, who should present the objectives of the proposal, the way of its construction, the level of teaching that it should reach and mainly, the way the activity would be registered by the students. Each group presented the proposal and was responsible for delivering the materials to the rest of the class, and also for making the bibliographic references of the activities when these were taken from other materials.

Besides the contextualization between "theory and practice", the alternative materials presented by the groups can be considered as motivating instruments for the study of mathematics, since they prompt a greater interest in the students. Thus, using this methodology to make the students seek for mathematical knowledge is a way to make them increase their interest in learning mathematics.

Considering that we live in a country with alarming educational indicators, reflecting about the initial education of teachers becomes a continuous demand in the search for ways to overcome the contradictions of our society. So, the development of this work seeks fundamentally for the improvement of the teaching/learning process, implementing investigative and reflexive methodologies to the improvement of the quality of the teaching in basic education by using methodological discussion, awareness of the teachers for continued education, reflections about the construction of the scientific concept, and besides this, the construction, implementation and follow-up of workbooks and pedagogic materials.

The search for alternative methodologies by undergraduates in Licenciateship in Mathematics gets special relevance because it is linked to the search for new ways for the school and for the education in Brazil. It is possible to say that this relationship between theory and practice is a prime demand in the current context, taking a major position in the discussions regarding the education of teachers.

## 3. Analysis and discussion of the results

The undergraduates of the Licenciateship in Mathematics of the Farroupilha Federal Institute – Campus São Borja, started their activities on February 2012. Among the subjects of the first semester, there is the Basic Mathematics, which is divided into 40 hours of theoretical classes and 20 hours of practice. For each one of the contents worked in those 40 hours, the undergraduates should present a proposal for activities which should account for the content discussed.

Among the activities developed it is possible to highlight:



- Exponentiation and Nth root: the activities presented that involved these two concepts were games that brought exercises using exponentiation and Nth root, involving calculations, conventions, fractional bases in exponentiation, exponentiation of exponentiations, multiplication and division, comprehension of square and cubic root and properties.
- Binomials and Factorization: the activities presented about these contents approached the sum of two squares, the difference of two squares, multiplication of the sum and the difference of two squares, common factor, grouping and perfect trinomial square.
- 1<sup>st</sup> and 2<sup>nd</sup> degree equations: This content involved the history of equations, definitions, solution and applications. 1<sup>st</sup> degree Equation and inequalities in one variable, systems of 1<sup>st</sup> degree equation in two variables (algebraic and graphic solution) and 2<sup>nd</sup> degree equation. From the concepts studied, the undergraduates searched in books and websites for games that involved the study of equations. They also developed alternative materials that served to improve the understanding of the concepts studied.
- However, these materials were already constructed and constitute the collection of materials of the Mathematics Laboratory that is being built in the Campus São Borja. These activities will also be presented in the presentation of this work. The main objective of the present work is to show the viability of diversified activities that promote differentiated methodologies articulated to the pedagogical practices, since the very first semester of the Licenciateship course.
- This way, the Basic Mathematics subject aggregates a plural knowledge in the teacher's education. According to Tardif (2007) the knowledge of the teachers comes from various sources, considering their personal culture (life histories), their previous school culture and the pedagogical knowledge provided by the university, among others, that is, the knowledge of a teacher is constituted by a plural knowledge.

#### 4-Conclusions

It is understood that promoting the approximation of theory and practice since the first semester of the Licenciateship in Mathematics, in an integrating perspective of diffusion and sharing of knowledge, is an important strategy that may contribute for a social change and in the practices of future teachers who will work in our schools. Regarding the construction of materials, it is believed that it is a "door" that opens and promotes a link between the produced and shared knowledge and the hoped results in education, because it goes beyond the institutional limits.

Another important factor that the relationship between theory and practice provides is the cooperation and reflection as a strategy to overcome many of the problems regarding the practices of the undergraduates and their quotidian afflictions. It is a space for the socialization of ideas and for cooperative formulation of measures to improve the school work. To summarize, more than ever, it is necessary to rethink the pedagogical practice and direct the efforts to the search of a renewed and significant teaching for the students.

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