THE APPROPRIATION OF THE NEW MATH ON THE TECHNICAL FEDERAL SCHOOL OF PARANA IN 1960 AND 1970 DECADES

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The subject of this text is the appropriation of the New Math on the Technical Federal School of Parana in 1960's and 1970's. From a historical perspective, founded by Certeau (1982), Chartier (1990) and Julia (2001), this study sources from scholar documents, located on ETFPR files. The study concludes that the ETFPR did not prioritize in its Course Plans, the teaching of the New Math. In this period, the scholar culture of ETFPR was marked by teacher initiatives directed to elaboration of didactic material suited to the technical courses which were, in that moment, engaged in approaching the scholar mathematics to the technical culture, transforming it in a useful tool for the urgent need of forming the necessary work force to the industrial and technological development of the country.

Since 1960, the international New Math Movement (NMM) has penetrated several countries schools, seeking to introduce a new language into the scholar Mathematics as well as trying to adjust it to the new challenges brought by scientific and technological development that emerged in this period.

In Brazil, the movement has increased its force through actions of countless math teachers, like the ones triggered by the Group of Study of Mathematics Teaching (GEEM). The GEEM was created in São Paulo – Brazil and coordinated by teacher Osvaldo Sangiorgi, one of the most enthusiasts members of the NMM in Brazil.

In Brazilian educational context, the technical industrial teaching had a fundamental role in society economic projects, essentially in 1960 and 1970 decades. At that time, the increasing of education levels, especially for poor people, had the main objective of preparing the taskforce for industries, as well as absorbing imported technologies from rich countries. The Federal Technical School of Paraná (ETFPR) [1] carries out a main role, at that moment, of forming taskforce to technological and industrial development in Paraná State.

Considering the importance of local studies for understanding the national history of the NMM, recognized as a major change applied to Scholar Mathematics in a World level basis, the present study aims to understand how the New Math was appropriated by the ETFPR, in 1960 and 1970 decades. According to Valente (2008, p.665):

> The NMM constitutes a fundamental reference to the Mathematics Education as a Research Field. The associated historical moment had triggered the organization and the systematization of scientific activities related to the teaching and learning of Mathematics. In other words: The NMM made the emerging of the Mathematics Education Research Field.

Oriented by a cultural and historical perspective, the study uses as sources the theoretical-methodological approaches of Certeau (1982), which conceives history as an "operation" that requires for its writing, as a practice activity, of a scientific approach. Besides, Certeau uses the concept of "Appropriation", from Chartier (1990), with the objective to understand the use that scholar agents have made of the New Math, disseminated by the Movement in a scholar culture (Julia, 2001). The study arise questions about changes occurred in the Mathematics discipline offered by the ETFPR, in the NMM discussion period.

The study sources were based in files archived in the Nucleous of Historical Documents (NUDHI) and the General Files of Federal Technological University of Paraná State (UTFPR), in Brazil. In those files, some documents were consulted, such as: Professors Council Proceedings, Class Diaries, Courses Plans, Curricular Grades, Math Books and normative documents.

To confront the date related to the NMM reception, in the scholar practices of the investigated institution, some interviews were conducted with three teachers and an ex-student, which were witness of the teaching, and learning process that took place at ETFPR in 1960 and 1970 decades.

THE PROFESSIONAL TEACHING IN BRAZIL

Professional teaching, in Brazil, has begun in the Imperial time when the first nucleous of professional formation were founded, in Jesuitical colleges and residences. They were called "factory-schools of artisans and other professions" (Manfredi, 2002, p.68). In that period, the most part of manual and manufacturing jobs were done by slaves. In first Republic, when Brazil was entering a new stage in terms of economical and social development, the professional schools gained a new role, becoming truly technical schools networks. The teaching system of those schools then takes the objective of teaching people in great Cities. This type of schools, at that time, were directed essentially to poor people, and due to this considered as a second category school. There was also a great problem of scholar evasion. The most part of the professions that were offered were manual or artisan type, like joiner, shoemaking and tailor's workshop.

After the 1930 revolution, with the large scale industrial development model adopted by the president Getúlio Vargas, that superseded the agro-exportation model, the factory-schools of artisans and other professions, which were initially the responsibility of agriculture ministry, became part of the new created Education and Health ministry.

In the New State Period, the professional education has the same role of the previous period, which was directed to poor classes. On the other hand, the secondary course was directed to elite classes. This duality was strongly discussed in the "Pioneers Manifest", in 1932, which makes the proposal of the organization of academic and professional courses in the same institution as well as the adaptation of schools to

regional interests. In spite of that, only in 1942 the pioneers concerns were accepted by Gustavo Capanema Minister, whose Organic Laws, among other things, rebuild the Industrial Teaching. According to Cunha (1977, p.55), one of the main factors of the new organization was the Second World War economical context. According to the author, the countries that were involved in the war drastically decreased the exportation of manufactured products to Brazil. One great change proposed by the Organic Laws was the definition of the Industrial Teaching as a secondary course, destined to professional preparation of workers to the industry. With that, the industrial courses students could enter superior courses related to the corresponding professional course.

In the same period, complementary legislation in professional teaching, the edict-law 4.048 of 22nd of January, 1942, created a professional teaching system which was "parallel" to the official system, sustained by enterprises. This new system, nominated National Service of Industrial Learning (SENAI), was supported by the Industrial Confederation and had the finality of organizing and administrating the Industrial Learning Schools of SENAI all over the country. The motivation to the creation of SENAI was that, due to the extinction of the "factory-schools of artisans and other professions", the old tasks of those schools then became an obligation of the Industries. So, professional enterprises assumed the task of preparing their own taskforce through SENAI and became, gradually, the inspiring model to the technical education for Brazil in later years.

Organized in two cycles (gymnasium and collegial), the first, brought by the Industrial Schools and second, by the Technical Schools, and systematized through the Organic Laws, technical education remained as a branch of education leading to the formation of professional demanded by the production system, therefore, a terminal branch of education. In the 1950's, through the 1821 Act, the forming students from technical, industrial, commercial and agricultural secondary courses were able to access university courses, provided if they submit to the demands of college entrance examination.

At the end of 1950, with the new National order "education for development", in the administration of Juscelino Kubitschek, occurred the reform of Industrial Education. With the Law 3552/59, federal technical schools have been given own legal personality, introducing administrative, educational, technical and financial autonomy and leaving them to constitute a uniform system, with organization and similar courses.

According to Cunha (1977, p.81), despite the autonomy given to technical schools, the control was taken by the Ministry of Education. This control was even increased by the Direction of Industrial Education (DEI) fixing the minimum required curriculum for technician's certificates in specific areas. Among other functions, DEI was responsible for development of curriculum guidelines, the evaluation system, examinations and promotions, besides the development of teaching materials, courses plans and school performance indicators.

At that time of growth and improvement of the Brazilian industrial chain, the spirit of the technique has been widely sown in industrial schools throughout the country. The work of the technical, according to Cunha (1977, p. 30), "begins to depend more on their knowledge than their manual skill or ability of direction"

With the Law of Guidelines and Bases of Education (LDB), which restructured the education in three Degrees: primary, middle and high, technical education began to be offered in three ways: industrial, agricultural and commercial. It was only with this Law that in fact the entry to high education was consolidated for students of professional education.

From 1960, more and more young people were seeking high education as a mean of social ascension, as the economic model of concentration income left no other alternatives. According to Cunha (1977), in that decade, the social-economic profile of students in technical courses was changing. The number of technicians enrolled in high education during the period between 1962-1966 (about 33%), showed that students of the technical industrial courses hoped that the function of the courses were propaedeutic, an instrument of social ascent.

THE MATHEMATICS DISCIPLINE IN ETFPR, AT NMM PERIOD

According to the Information Bulletin of the Brazilian-American Commission of Industrial Education (CBAI, 1960e, p. 4) [2], the qualified professional is:

> [...] the professional who knows the technology, the practice and still has sufficient basis for progressing into the professional field [...] needs of the concepts of general education as math, drawing, as well as extensive knowledge of technology related to their profession for the development of new techniques and improving of his work.

Considering Mathematics as a basic discipline for the technique culture of students, the biggest challenge that was presented to the teachers of technical courses was to contextualize the content, from problems of practical applications in technological world.

According Clemente (1948, p. 86):

> [...] it is usual to say that mathematics teaches reason and, in industrial education, this proposition assumes a broader character. It's the Math that plays the most important role in the mental training of specialists. Therefore, follows that the teacher of mathematics has, perhaps, the most important part in the sum of knowledge that will form the expert Professional.

In this article, Arlindo Clemente proposes that the teacher of mathematics workshop must bring the factory into the classroom and seek to solve real problems of the job, replacing abstract mathematical problems by concrete ones.

> The mathematical reasoning is the element that will transform the older worker, empirically formed, in the modern workman much more capable, with a

> greater intellectual capacity. And, no doubt, this parcel of culture is one that will give the worker the possibility of connecting his brain to his hands. This is the function of mathematics in the education industry. (Clemente, 1948, p. 87)

The main concern of Clemente was the practical application of mathematical concepts to technical disciplines of industrial education and the choice of essential and minimum contents, necessary for the training of technicians.

The article by Martignoni (1951, p.695), "The Mathematics in Practice and Education," published in the Bulletin of CBAI, in July 1951, also highlights the importance of mathematics to bring the workshops and cut the superfluous. His speech, full of pragmatism, questioned the need to study contents that were not directly related to the practical application. He stated that math science is the reason for scientific progressand also that more elaborate math should be left for advanced studies because it will not meet the purposes of technical courses under the guidance of CBAI. In this context, Math should have a strong character practical and utility. Meanwhile, the Federal Technical School of Parana, already in late 50's, faced major problems with teachers of Industrial Technical Education, focusing on courses' quality. Then, Director of Technical School of Curitiba, Dr. Lauro Wilhelm, indicated in 1959 two major factors for technical courses low quality: the poor training of all kind of teachers and the lack of control over teacher' activities.

In the end of 1950's, the discussion on the mathematics in industrial technical courses had national repercussions. In III Brazilian Congress of Mathematics Education (Ministério da Educação e Cultura, 1959), held in Rio de Janeiro in 1959, coordinated by the Campaign for Improvement of Secondary Education and Broadcasting (CADES), the Industrial Education, whose committee was directed by Arlindo Clemente who presented for discussion, a Program dedicated to the teaching of mathematics in technical courses, highlighting the math in the workshops and the correlation of mathematics disciplines culture technique (Ministério da Educação e Cultura, 1959, p. 28).

NEW MATH TRACES OF ETFPR

The modernization of Mathematics was associated with betting on technical progress. For Valente (2006, p. 39), "the Math was valued as part of a scientific training that would have continuity in Higher Education and to do so was needed an aproximation between approaches of mathematics in Higher Education and in secondary, considering conceptual terms, methodology and language". This approach to the mathematics of Higher Education was expressed on the main features in NMM: Accuracy, precision of language, deductive method, a higher level of abstraction, use of contemporary vocabulary, thought axiomatic among others.

However, even taking the Technical School teachers to participate in the preparation of textbooks of New Math of the group's Center for Research and Dissemination in

Mathematics Teaching (NEDEM) in Parana's State College (CEP), these actions do not seem to result in an upgrade of Mathematics programs. In the "Daily Class" (document 6) [3] of 1967 and 1972, teachers of the ETFPR Industrial Gymnasium do not show any trace of New Math.

In oral testimony, the teacher E1 [4] reported that mathematics' books, used in industrial Gymnasium, at end of the 1960's, were Marcondes (1969). The collection was divided into three volumes: algebra, arithmetic and geometry. Referring to the edition of 1969, there was not any New Math content.

It is important to remember that some Mathematics teachers, employed by ETFPR in the second half of 1960's, were still students in the Course of Mathematics at the Federal University of Parana (UFPR), and had no authority over his colleagues to propose changes in programs and in the textbooks adopted. The new teachers were in contact with contents of Modern Mathematics. In despite of that, they kept using programs developed by old teachers. Their independence was conditioned by a specific technical school culture which was the rule for many years.

Also, at the beginning of 1970's, new Mathematics teachers were minority. This is confirmed by the testimony of a former student from Industrial Gymnasium: They had some new teachers, but 70% were most experienced teachers (E3).

The teacher E1, in testimony to the researcher, reported that the first time he heard Theory of Sets was in 1967, when his teacher asked him an option to work on this topic. In 1970, when he graduated in Mathematics, by UFPR, he began working in the State Network for Teaching and ETFPR, teaching Mathematics belonging to gymnasium's course. According to E1, the network state of education first adopted the Mathematics book of NEDEM and later Oswaldo Sangiorgi´s book. He said he came to work a full year in the State Network with Theory of Sets. In ETFPR he taught some notions of collections, but that was not intensive (E1).

In 1966, teacher Ricardo assumed the direction of ETFPR. The entry of this new director gave new direction to the teaching-learning organization of the school. He brought in baggage more than the experience of CBAI, the coexistence with the Americans and the commitment with institution and students. The strong American influence received by the new director was largely responsible for the ideas of method, rationality, profficiency that came with greater intensity. In his testimony, Professor Ricardo Luis Knesebeck reported that first, as coordinator of instruction, and after as Director, implanted in a draconian way a program of education for all teachers. To him, was an something absurd to teach and don't commit with anything.

The document "Content to be determined" (document 11) [6], prepared by Mathematics teachers and approved by Didactic Coordination, in 1969, showed that the program was based on the contents sequence of Quintella's books' collection in (1966), which until 1970 did not have any trace of New Math, Theory of Sets, relations, matrices, etc. as specified in the "Pilot Program" (document 12) [7] published by GEEM, in the year 1968.

In oral testimony E1 said that teachers closely followed the book (the first to the last page) and the Head of the Department selected the book's exercises that the teacher should do. In his opinion, this hand method worked very well. In Mathematics Program in first years (document 11), we found a topic: "General Review of the 1st cycle of matter." This may be an indication of teachers concern about maintaining a certain quality of education. In their opinion, the low quality in Mathematics taught in the gymnasium could be problem.

In the analysis of the goals of textbooks delivered to students, called "Auroras", observed in 1973, compared with the program of 1969, the complex numbers and trigonometric equations were removed, as well as the study of vectors and orthogonal views was simplified. We also note a greater emphasis given to trigonometric functions.

In the "Auroras" program in 1975 some contents were evaluated:

> I - SET - Goal 1: Operating with sets. 1.1 - Determine the union of sets. 1.2 - Determine the intersection of sets. 1.3 - Determining the difference between two sets . 1.4 - Determine the complement of a set. 1.5 - Correctly use the symbols of the theory of sets. II - NUMBERS (NUMERICAL SETS BASIC) - Goal 2 - Understand the fundamental numerical sets (...). III - RELATIONS AND FUNCTIONS. Goal 3 - Represent graphically relationship and function. (...)3.3 - Determine the Cartesian product between two sets. (...)

This portion of student's evaluation manual confirms the evidence E1 of the introduction of theory of sets for students in secondary technical course and the new approach to function concept according to modern mathematics. Notion of variation and functional dependence of functions was virtually forgotten over the NMM that adopted the design of structural function of Bourbaki.

In the year 1975, the term "field of existence" has been replaced by "dominion" and "image" of trigonometric functions, which was the term used in the book Iezzi et al. (1973) [8]. Making a comparison between the "Pilot Program" (document 12), prepared by GEEM in 1968, for the first two years of secondary education, noted that ETFPR's program, although more extensive, included topics such as the trigonometric functions and triangles resolution, suggested by São Paulo's group.

In 1975 ETFPR made a complete revision of Algebra programs (Math I). With adoption book Iezzi´s et al., (1980), the topics turn to a deal with sets, sets numerical key, full study of the functions of the 1st and 2nd grade, depending Exponential, logarithmic function, the study inequalities of 1st and 2nd grades, exponential and logarithmic. The subjects were addressed in accordance with the "Pilot Program" (document 12) suggested by GEEM in 1968.

Iezzi's book presented the contents of duty by a graphical approach. Separating each chapter, there was an example of mathematics application in today's world. There

was a concern with the formal mathematics, but not so exaggerated. At the end of the book, there were several references about Modern Mathematics.

We noticed that probably the book's Iezzi *et al*, (1980) deals with the theory of sets to meet a market need, as Kline (1976, p.135) warned "Other texts begins with a chapter on the theory of sets, It was then back to the traditional math and would henceforth no longer refer to the theory of sets or any other topic in modern mathematics".

The book's Gelson Iezzi *et al* have consolidated a discussion of teachers in curriculum modernization, which was commom among ETFPR Mathematicians. In his testimony, teacher E1 said that he and his colleagues in the early of 1970 began to define functions as a particular case of the relationship between two sets (a structural design adopted by the NMM) rather than as a functional dependence as was discussed of Ary Quintella´s book. According E2, a teacher of ETFPR the 1960's, the technical course did not give much emphasis to the theory of sets, considering it was an education more focused on practice. One possible explanation for slow integration of Modern Mathematics in ETFPR could be one of the goals for Educational System in ETFPR "(document 4) [9] as defined in 1972:" Cut programs of study fictitions topics". Would be "fictitious subject", the content broadcast by the NMM? Would be inappropriate to technical education?

In the first half of 1970's, despite the strong tendency to follow faithfully the textbook, some mathematics' teachers of ETFPR started developing their own material to work with students, such as "Geometry of Space Material" (document 15) [10].

The exercises in first worksheets had not any relation with technical matters because there was a culture of integration between the areas. According to the interviewed, the teaching of mathematics was not aimed at career academies: No, it was generic. At the time, from 1969 until 1974, it didn't have a very great integration between the teachers of general education and culture specific; they worked half apart (E3).

In 1970's, with the support and encouragement of the Department Mathematics Coordinator, the production of teaching material itself was improved and marked in a more intensive way the culture of ETFPR. This initiative was not alone, it was occurring in several federal technical schools in Brazil. In ETFPR, this initiative was consolidated in 1980's and resulted in a collection mathematics books directed to the Technical Education.

FINAL CONSIDERATIONS

The study indicates some aspects emphasized by NMM, as the theory of sets, the axiomatization, the new mathematical language, laden with symbolism, seemed incompatible with the needs of the students training in a technical school in the 1960's and 1970's.

Concerned to offer a "practical education", required by technical training, an ETFPR not prioritized the teaching of modern mathematics in their courses, at the top of the

movement. The testimonies show that there was non-official insertion of "some" ideas of NMM and this can be evidenced by the few traces of Modern Math, in documents found in the school.

The study shows that only from 1970, some contents of New Math were introduced in the course of school, and that means textbook from 1980, Mathematics teachers ETFPR started the preparation of a Mathematics textbook colletion, putting an old idea to feature a "practice" to discipline by proposing a specific methodology able to articulate the rationale, graphic interpretations, problems applying physics problems and technical subjects. The weak presence of New Math in ETFPR, far from setting itself as a resistance from teachers to the ideals of the movement, indicates that in decades in question, a ETFPR wanted to amalgamate a difference in their school culture, slowly making a "creative consumption" of textbooks, strong responsible for the insertion of New Math in Brazilian schools.

NOTES

1. Today is called Federal Technological University of Parana (UTFPR). Use the name Federal Technical School of Parana (ETFPR), like this named because most of the period defined in the study, namely the 1960's and 1970's.

2. Bulletin of CBAI. Brazilian-American Commission of Industrial Education. Educational program of cooperation maintained by the governments of Brazil and the United States Research and Training of Teachers. Vol. XIV, n.5, 1960e, 16p.

3. Document 6: Diaries of the course belonging class of 1967 and 1972. - Archive of General UTFPR. 1967 to 1972.

4. The name of the interviewees E1, E2 and E3 was not revealed at their request.

5. KNESEBECK, Ricardo Luis ex-student, ex-teacher of physics, ex-director of the Federal Technical School of Parana. (Interview granted to Gilson Leandro San Mateo - NUDHI / UTFPR. Curitiba, 16/17 May 1995).

6. Document 11: Content to be established in 1969, 1969, 17p.

7. Document 12: Pilot Program for the school course prepared by GEEM in 1968. Sao Paulo: GEEM, 1968, 5p.

8. The first edition of this book is the year of 1973. In this study found was the eighth edition, published in 1980.

9. Document 4: The educational system of the Federal Technical School of Parana produced by the Education Department through the coordination of the Didactic ETFPR.

10. Document 15: Geometry of Space Materialmade by teachers of ETFPR. Library of UTFPR, s / date.

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