

SECONDARY SCHOOL JOURNAL: AN INSTRUMENT IN THE MATHEMATICS TEACHER TRAINING

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ABSTRACT

This study presents an analysis of the content of articles on Mathematics and Technical Drawing¹, published in the Secondary School Journal, between 1957 and 1963, in order to indicate a panorama of theoretical and practical recommendations, emphasised and defended in these texts, regarding to teaching and learning processes of notions, concepts and procedures related to geometry. This journal have been structured as an instance to train teachers, as it has emerged in a context in which the great majority of Brazilian teachers of secondary school was self-taught because, in 1957, only 16% of in-service teachers were graduated from Philosophy university courses. For this analysis, we assume that pedagogical press, being the result of editorial strategies addressed to teachers, plays a meaningful role in spreading ideas and knowledge taken as necessary and fundamental to docent act. In this paper, we identify recommendations about teaching and learning process of geometry contents that are highlighted in the docent professionalizing process according to the *appropriation* perspective (Certeau 1994, Chartier 1991 e Carvalho 2006) of the educational legislation of the 50's decade, by different authors of analysed articles.

Introduction

This study presents an analysis of the content of articles on Mathematics and Technical Drawing², published in the Secondary School Journal, between 1957 and 1963, in order to indicate a panorama of theoretical and practical recommendations, emphasised and defended in these texts, regarding to teaching and learning processes of notions, concepts and procedures related to these disciplines.

Our goal was to identify mathematical and pedagogical knowledge that are highlighted in the docent professionalizing process according to *appropriation* (Certeau 1994, Chartier 1991 and Carvalho 2006) perspective of educational legislation and Brazilian socio-economical context in the 50's, by analysed articles' various authors.

We assume, as Fernandes, Xavier and Carvalho (2006, p. 45), that pedagogical press, as a result of editorial strategies addressed to teachers, plays a meaningful role in spreading ideas and knowledge taken as necessary and fundamental to docent act. According to Fernandes et al (2006), journals and newspapers devoted to teachers are perceived as instance that have an important function in divulging and producing knowledge – theories, models, practices, experiences among others.

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The Secondary School Journal

The Campaign for the Secondary School Improvement and Diffusion – CADES –, governmental action developed by Brazilian Ministry of Education and Culture between 1953 and 1971, aimed to expand the Secondary Teaching in the whole country and to improve teaching quality, considering the bookish, abstract and elitist characteristics that marked teaching and learning processes in schools. In this way, one of the purposes of the Campaign was to broaden and improve secondary teaching level, *“to make secondary education more adjusted to the time’s interests and needs, providing efficacy and social meaning to the teaching, as well as creating possibilities for younger to have access to the secondary school.”* (Baraldi 2003, p.146).

One of the CADES actions – in 1956 – was to promote intensive preparation courses for exams, which granted to the successful ones the register of secondary level teacher and the right to teach where there were no graduated teachers from Philosophy University Courses. Such action have been justified by the fact that, in the fifties, there was a huge expansion of secondary teaching establishments and, therefore, the raise of enrolments, while the number of able teachers have not raised in the same proportion.

Besides courses for secondary level teachers, CADES has also promoted journeys for principals, educational orientation symposiums, secondary level inspectors meetings and courses for secretaries of teaching establishments.

Among these several activities, CADES also published the Secondary School Journal (from 1957 to 1963), whose aim was to guide teachers regarding to curricular, legal and didactic aspects. In the Journal’s first edition, the initial article presented a panorama of Brazilian secondary teaching at the time, and stated that the purpose of creating the journal was *“to serve as a vehicle of interchange among Brazilian teachers, in the exchange of ideas, suggestions and experiences, promoting the creation of a new, more progressive, mentality, more favourable to an objective observation, renewed experimentation and reviewing criticism of postulates, reasons, curricula and methods in which all our teaching is based on.”* (Revista Escola Secundária nº1, 1957, p.8).

It is convenient to emphasise that some sections of this trimesterly published Journal did not only show concern in discussing or consolidating technical knowledge, coming from General Didactic, but, above all, in providing ways to prepare more attractive classes in order to arouse students’ interest for discipline’s specific themes, and consequently to promote more effective teaching and learning processes. Journal’s nineteen issues approached themes related to various disciplines or areas that composed the curriculum: languages, mathematics, technical drawing, history, geography, physics, chemistry, natural sciences, philosophy, handcraft, domestic economy, etc. All published articles were about teaching techniques and methods, discussing adequate use of didactic materials and presenting plans to develop specific contents, in addition to discipline programs for some grades. All editions brought at least one article on Mathematics and Technical Drawing.

One of the Journal’s sections, under the title *National Education Establishment*, was devoted to spread innovative experiences aiming to convince, by giving examples, that it was possible to experiment new pedagogical proposals, with good results for the school and for the teacher.

When analyzing The Secondary School Journal, Fernandes et al (2006) attributed to it the function of bringing, for different Brazilian states, especially in the countryside, adequate pedagogical knowledge for secondary teaching development, as much as spreading current legislation related to that teaching level, including comments on its pertinence and range.

Also according to Fernandes et al (2006), the Journal worked as a legitimating vehicle of Ministry of Education and Culture (DESE-MEC)'s Secondary Teaching Directory actions informing about MEC's docent qualification programs, justifying its happening and suggesting both public and private teachers and schools adherence to the *Experimental Secondary Classes* Program. By means of this Program, the Ministry of Education stimulated experimentation of new proposals and pedagogical methods to be tested and evaluated in the secondary teaching.

In summary, it is possible to state that the journal has been structured as an instance to train teachers, since CADES emerged in a context in which the great majority of Brazilian teachers of this teaching segment were self-taught: in 1957, only 16% of in-service teachers were graduated from Philosophy University Courses.

About the notion of appropriation

Our investigation is supported by the notion of *appropriation* defended by Chartier (1991), that emphasises the plurality of interpretations and uses, and the creative freedom of subjects in contact with texts, laws and rules. To Chartier "appropriation aims a social history of uses and interpretations, related to their fundamental determinations and engraved in the specific practices that have produced them" (p.180).

In the case of the Journal, we are going to analyse appropriations made by different authors, considering the available legislation, considering that these authors had the role of spreading, not only the legislation, but also pedagogical models and necessary knowledge for docent act.

We use the concepts of strategy and tactic by the historian Michel de Certeau (1994), which, in summary, establish differentiation between practices related to a place of power: a position of use in the case of strategies, and practices related to or subdued by practices of power, in the case of tactics. In this way, the available legislation is situated in the strategy field (Certeau 1994), and the Journal, in this analysis perspective, in the field of tactics.

For developing this work, we share the ideas of Carvalho, considering that *appropriation* "always assumes to be referred to a particular situation in which the agents with specific competencies produce a new object, according to technical procedures and rules of a purposed conditioned by a position" (Carvalho 2006, p.144).

Mathematics' articles

The Secondary School Journal has published 34 texts related to Mathematics and its teaching in the 19 edited issues; among them, articles, reports and teaching plans – all signed by famous teachers at the time. These texts are about a range of themes: analysis of mathematical content developed in schools and of students' performance evaluation

instruments; teaching of arithmetic and geometry; teaching of deductive geometry; Mathematical proofs; teaching of linear systems; arithmetic and psychology of learning; History of Mathematics; students motivation; Mathematics and Natural Sciences; examples of guided study in Mathematics; Statistics teaching.

In a first reading of the texts, it is possible to notice the large range of contents in it and the lack of a project for systematically publishing, in each number, texts for both stages of secondary teaching (ginásio – first stage of secondary school – and científico or clássico – high school) – they had alternated privileged. It also seems that there were no criteria for distributing articles in different groups of mathematical contents: there are few references to the teaching of algebra, for instance. It is possible as well to state that the presented suggestions were trying to break some dominate practices at the time's teaching of Mathematics.

As it is not possible to analyse all of the Journal's Mathematics articles in this paper, we have chosen the geometry ones, in a way to highlight their didactical orientations. The choice is not only based in their larger quantity, but mostly in the concerns shown by the authors regarded to the teaching of this field of Mathematics, and which are so far very present: what and how to teach geometry, deduction in geometry, the extension of geometry contents.

We also emphasise that all these texts basically discuss the issue of deductive geometry, leaving reduced, if at all, room for the named "inductive geometry", which fundamentally includes terminology and measure (area and perimeter).

We have also chosen two other texts, which are not only about geometry: one that discusses Mathematics laboratory and other that criticizes programs and evaluations developed at schools. Such choices were made by the richness that they bring to our analysis: in them, it is possible to clearly identify not only the authors' appropriation of legislation, but also – maybe inevitable – contradictions regarding pedagogical models that they intend to spread.

In the analysis of these texts, we have identified how their authors appropriated the principles the Secondary Journal was supposed to spread, as it was conceived as a Ministry of Education's editorial strategy in order to intervene in teaching and learning processes. In this way, we try to answer the following question: were the didactical orientations and innovations they were trying to implement by using such publishing, especially the ones related to geometry, completely according to the legislation?

To answer this question, it is convenient to previously highlight some aspects of the regulation from 1951, that established the minimum program of the time. According to Pedro II³ School's Congregation, prompting minimum program conforming that regulation, would start a new path for the secondary teaching: *"... it is easy to verify that this new guidance that obeys the constitutional precept and takes up beforehand the 'Directive and Basis' law, will cause a revolution in the secondary teaching. The adopted program, so far, has not allowed the least flexibility that would come to answer regional*

³ Pedro II School, situated in de city of Rio de Janeiro, funded in 1837, was reference for Brazilian secondary teaching until the first half of the last century, influencing the elaboration of the legislation and of the programs to be followed in the whole country.

peculiarities of our immense territory". (Brasil, leis e decretos: ofício 305 de 21 de setembro de 1951).

Opposed to the Organic Law of Secondary Teaching (1942), which did not have didactical orientations in its programs, 1951's regulation has brought some methodological recommendations, although they were not novelty, as most of them were part of the curricula from Francisco Campos Reform (1931). The text regarding Pedagogical Instructions indicates, for instance, that, especially in the first years of ginásio, the teaching should have an essentially practical and intuitive character: deductive method in geometry should be introduced in the end of ginásio "with the care it demands" and when "the student realises the need of justification, proof and formal proof".

Analyzing articles specifically about questions related to proof in geometry, we realise that the authors tried to follow the legislation, emphasising, for instance, the need to "start deductive reasoning" by means of plane geometry theorems. We notice, in fact, recommendations that proofs should be developed only in the 3rd and 4th grades, justifying that such subject is difficult and unpleasant.

The author of one of the texts⁴ alerts that, in order to a teacher to minimise difficulties in the geometry learning and teaching processes, which is presented specially by deduction, he or she should start by organizing a list of axioms, including theorems of "intuitive formal proof", and after "*select a set of fundamental theorems and their main consequences in a way to constitute a good student training material for formal proof*" (Revista Escola Secundária, n.7, p. 65). Therefore, in that article it is considered that deductive geometry in ginásio should be seen more like a start for formal proof methods than a proper development of a theory.

Nevertheless, when this same author presents "a scheme" to give an example of deductive geometry development in the 3rd grade, it is possible to notice the proposition of a long list of theorems to be proof, emphasising that some of them should be proof by "the notion of movement" – perhaps an effort to minimize the complexity of the task and the length of the list. But, the extensive contents would exactly be one of the main problems of Mathematics teaching and learning processes according to this author.

In a way, this proposition is opposed to rules established by 1951's regulation, according to which theorems should be developed slowly "when the student shows interest". Besides, such regulation emphasizes "the importance of an active student participation in the teaching-learning process" and "the need to bring up their attention and interest". In 1951's regulation, it is also suggested that one should "always have in mind that teaching is not dependent on the discipline, but mainly on the student to whom one teaches" and that "what is important is not to teach much, but to teach well". For the first time, in official documents, it is declared that classroom actions should take into account that "Mathematics is not pure logic" and that the student should be on focus.

Another article⁵, that emphasises the importance of formal proof in a teenager formation, considers that the non-proposition of formal proof at school can provide the immediate teaching of Mathematics goals to be achieved: reflection, reasoning,

⁴ Professor Antonio Domingues.

⁵ Eleonora Lôbo Ribeiro

conclusion, deduction, induction, order, etc. The article also highlights that “formal proof made with active classroom participation educates the mind, imposing that the student has to be alert in order not to break a logical sequence when asked to participate” (Revista Escola Secundária, n. 3, p. 72). However, it does not discuss possible ways of performing such work. The author also mentions the matter of extensive Mathematics programs, especially in geometry.

In another of the Journal’s articles⁶, it is explicitly discussed not only what to teach, but above all, how to teach geometry. The author considers five fundamental points: accessible and direct language for young people; presenting “initial geometric” properties by direct reasoning and empirical proof; dominating the subject by solving very easy problems, with no use of the so called “mathematics intuition”; preparing for geometric proof “by schematically training calculation”; constructing a logical propositions system, only after an “empirical and illustrative exposition of this first part of geometry”.

Reading articles regarding Geometry makes it possible to say that the authors tried to follow the principles of the “Minimum Programs”, such as the fact that the teaching process should consider the student at the centre of the process, and not only how Mathematics is organised. Nevertheless, a possible appropriation of the Programs’ principles would be adjusting contents and methods to different realities; however, according to these authors, this has not happened, at least not explicitly.

Some of the geometry texts’ authors also consider, even indirectly, the extension of contents and alert that some topics, from the minimum list, are indispensable. Others assume that it is a very long list. This can be corroborated by the analysis of a group of teachers regarding the constant subjects in the partial Mathematics exams, in 1958, of various teaching establishments of secondary course.

Regarding the programs developed by these schools, the authors report that most of them have not accomplished the minimum program, emphasising that some have not even reached 1/5 of it. The following text shows the teacher-inspectors worries: “*one can observe the non execution of the minimum programs in its essentiality; in the study of mathematics it is not possible to sacrifice some subjects without incalculable damage for the students!*” (Revista Secundária, v. 10, p. 83). These teachers make recommendations to surpass these difficulties, suggesting, for example: the raise of Mathematics lessons; the organization, by teachers, of an executable course plan, in order to contemplate what is essential for each grade. However, they do not criticize the document that publishes the minimums and seem to completely assume the official discourse – maybe because they are temporarily in the function of inspectors, a control position.

Regarding of how to teach geometry, some texts try to go further than the minimum programs pedagogical indications (1951’s regulation), spreading to teachers different methodologies for the students’ learning. However, it is possible to identify contradictions in their discourse.

⁶ Autor:Thales Mello Carvalho.

In this matter, we can cite the article “The Method of Laboratory in Mathematics” by Malba Tahan⁷. In this article, material for the laboratory are indicated and described. In addition, some activities are suggested, such as: foundation of a mathematics club, publishing a mensal bulletin, conferences, etc. Teacher Tahan also evidences in his text speeches of some personalities that defend the use of concrete material in the teaching of Mathematics, like Rui Barbosa, about the importance of “Lagout’s Taquimetry” – the only method that allows to teach geometry and proof theorems “to more rudimentary intelligences” (p.78). Similarly, presents Euclides Roxo defence, emeritus Brazilian mathematics educator, regarding “excellencies” of the Laboratory by allowing a “self-discovery”, that would be a possible way to help the student to “climb the inclined ramp of mathematics abstraction” (p.79).

Tahan also enumerates advantages of the Laboratory to teach Mathematics, such as: guide the students to discoveries; guide the less successful to learning; motivate students and teachers. However, the author presents the disadvantages of the method: induces the student to accept as rigorous certain experimental and clumsy proofs; guide the student to run away from abstractions and try material resources for mathematical proofs; it is very expensive; demands long time and opens a possibility for the non accomplishment of the program; demands a lot of preparation from the teacher; cannot be applied in all contents of the program.

If one of the functions of the journal was exactly to spread new methodologies, to indicate so emphatically the disadvantages of a method, especially the teachers’ concerns, would not be the case of denying the innovations that one wished to suggest and experience?

Technical Drawing articles

In our analysis, we have included the technical drawing articles aiming to verify in what extension technical drawing teaching proposals, published at Secondary School Journal would be close or far from Mathematics, specifically for geometry. The 19 Journal issues have 21 articles on technical drawing.

These articles aimed mainly to mark both room for technical drawing teacher as a professional with his own identity, and the importance of the discipline.

One of the articles that treat the matter in a very explicit way directs to such professional – technical drawing teacher – a model that distinguishes him from the artist, the engineer, the Mathematics teacher, the primary teacher. In several articles there are also discussions about what characteristics a technical drawing teacher should have to satisfactory perform his function – personal requirements referred to drawing skills, to compose shapes and colours, aptitude and assurance to handle instruments, be able to abstract, to have aesthetic sense, among others.

The importance of technical drawing in students’ formation is defended in a dual perspective, for both culture and economy, as “scientific” drawing is useful in handcraft, in industry, in constructions, emphasising as well as needed in different professions: military, physicians, dressmaker, and craftsmen, among others. Another used argument to

⁷ Malba Tahan was the pseudonym used by teacher Júlio César de Mello e Sousa who was a professor at Pedro II School, renowned text-book writer, in the first half of the last century. Signing as Malba Tahan, he was well known specially by his book *The man who calculates*, translated into several languages.

value the discipline is the one of the importance of psychological function that drawing have in the progressive of child growth.

Drawing programs comprise the following aspects: natural, decorative, geometric and projective that, by been of distinct natures, created difficulties for both teacher training and choice of text-books for the teaching of the discipline.

One of the articles discussed the complex drawing teacher training course, developed in universities. These articles text make it clear the content of this course, emphasising the existence of a broad training in descriptive and projective geometry, and geometric drawing. According to this author's evaluation, the course was supported in two distinct areas of knowledge: science and arte, in addition to pedagogical knowledge in the last year.

In face of the need of professionals to properly teach knowledge from two distinct areas, one of the articles proposed a division, in the final grades of secondary teaching, between drawing that he called technique, corresponding to geometric and projective drawing, and the artistic drawing, natural and decorative. The first would be designated to technical carriers: engineers, architects, mathematicians, among others. The second, to not technical formation: physicians, dentist, teachers, etc.

Bibliographic references to the teaching of technical drawing was also problematic, as shown in one of the published articles, indicating some books, but emphasising the insufficiency of references in Portuguese, given the scope of the discipline.

The importance of didactics, above all, specifically didactics for drawing is also one of the strongly discussed aspects in different issues of the Journal. Some articles refer to the matter in a more theoretical way, considering factors that surround and regulate the didactics action: people's economical conditions, educational system, education purposes and goals, among others. Analysing such aspects in that time's Brasil, one of the authors considered that the country was passing through a huge transformation, having as main factor the increasing industrialization, while analphabetic rates varied from 50% to 80%. To this author, didactic would have an important and useful role in the progress of nation (Santos 1958, p.91-94).

Some articles emphasise the concerns that one should have with the students. In one of them, it is supported that the main of the drawing teacher concerns at secondary school should be the student. According to the author, it is necessary the teacher to program and guide his activities to serve the students' growing and formation needs "considering both his or her limitations and individual differences" (Santos 1958, p.93). To do so, knowledge on Evolutive and Differential Psychology of child and adolescent is essential. The conclusion of the paper brings a summary of "child drawing evolution stages". However, there are no indications and suggestions in order to the teacher consider differences and limitations of the various groups of students.

Treating didactics in a more practical point of view, some articles describe how lessons should be given, making a dual work of explaining both the content and how to teach it.

It is the case, for instance, of three published papers in three different issues, between 1957 and 1958, in which teacher Wanderley approached the teaching of descriptive geometry by the orthogonal projections method. In each article, the author detailed describes how the teacher should do to teach his students to project in orthogonal plans and construct the correspondent epura. It is presented interesting concrete material suggestions that should be used in classroom, as auxiliary resources in explanations: the

use of boxed card paper to represent orthogonal planes, paper balls for the point, sticks for lines. The author also calls the attention for the teachers to verify if the students properly understood each teaching phase before going further on the explanation. Teacher Wanderley's articles have the twofold of teaching the subject to the teacher and how the teacher should teach it for his or her students.

Teacher José Sennem Bandeira⁸ writes the article on technical drawing in the first publishing, in which he presents a brief history on the teaching of technical drawing in France and Brasil, and its relation of closeness and disengagement with geometry in History. One of the disengagement periods between drawing and geometry notions is due, according to this author, to psychologists influence in defence of free and spontaneous drawing, that was not corrupted by "geometrical basis methods" (Bandeira 1957, p.75). Nevertheless, the development of psychological studies on spontaneous drawing evolutive phases on child revealed that such phases would fatally end in the so called regression phase, in which the critics the child do on his or her own drawings discourage he or she to go on drawing. The teaching of drawing from geometry based methods would conduct students to surpass such phase. In this way, the author supports the 1941's minimum program regulation, that fundament drawing in Euclidean geometry, supporting, however, the importance of the free hand drawing, with no use of instruments (ruler, compass, transfer) in the first grades of secondary teaching.

The last article on technical drawing published in Secondary School Journal has a very different tone from the others. It is not as didactic, discusses a content which, according to the author, was not often worked because it was planned for the end of the ginásio – the equivalence of areas. The author criticizes geometric drawing lessons in which the content is worked by means of "recipe" and evaluates that the lack of students' motivation is because they do not know why. In his text, he justifies the constructions made in the equivalence problems based on mathematical concepts related to the calculation of area. Used arguments are based in new ideas that started to circulate in the beginning of the 60's decade, among Mathematics teachers, with the so called Modern Mathematics Movement.

Articles do not reveal articulation between teaching of drawing and Mathematics. On the contrary, there are indications of detachment, both in the sense of marking the discipline identity and critics to the lack of articulation, explicitly made by some authors.

To descriptive and projective geometry which would naturally have articulation with Mathematics, it was given a perspective of constructions recipes.

Final Considerations

Articles do not reveal articulation between drawing and Mathematics. Although such articulation was not explicitly put in legislation, it would be wished that articles' authors would do it, considering that the student studies, for instance, a given geometrical object in both disciplines. Such integration could collaborate with one of the 1951's regiments, supposing the student should be the centre of the Teaching and Learning processes. In this way, one of the possible appropriations would be proposing activities, tasks and lessons plans in which some articulation from the content itself would occur.

⁸ He was Drawing Special Didactics teacher at Philosophy Natinal College, at University of Brasil. Author of the text-book "How to teach drawing in ginásio", spread by MEC during the 50's.

Regarding to Mathematics, one can conjecture that the *appropriation*, by the authors, of prescriptions in the available legislation on the geometry teaching and learning process, specially the ones referring to formal proof, are strongly attached to principles that surround docent practice of Mathematics teachers. We know that such practices are deeply marked by how mathematicians produce and validate knowledge in this area of knowledge: rigor and formal proof.

In summary, these authors agreed on the prescribed programs in which deductive geometry should be developed in classrooms, respecting students' rhythm, needs and interests, as long as teachers practices do not go to far from the maxim: formal proof should be rigorous, considering that proof is crucial to the culture of mathematics.

In these articles, and others, one can identify a tension between adopting a taken as innovative, experimental and progressive discourse, and maintaining docent practices that were built by selective tradition, even if considered inefficient.

It is possible to observe that innovative discourse appropriation for Mathematics teaching and learning process, which focus is on the student, presupposes the amalgam of them with docent practices based on how knowledge produced by mathematicians is presented – focus on science.

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