Anton Dakitsch collection – the scope of mathematics teaching in Brazilian industrial education in the 1950s

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Abstract

As early as in the 1930s, the Brazilian government expressed their interest in renewing and expanding Vocational Education. A representative factor in this movement was the hiring of foreign professionals and the production of didactic material. Anton Dakitsch was one of those professionals. He came to Brazil and worked in Industrial Education as a teacher, author of textbooks and left us a collection of books and technical journals. In this work at hand, one of Dakitsch's textbooks is analysed concerning the content of mathematics. I aim to assess the status assigned to mathematics within the theme of standardization of paper size, proposed by Anton Dakitsch in his 1950 textbook entitled Standardization of paper size in general [free translation], aimed at Industrial Education. To this purpose I consider the way the mathematical instructional content is presented and dealt with will be determinant of its status as a 'tool' or as an 'object'.

Keywords: History mathematics education; Brazil; vocational teaching; mathematics textbooks

Introduction

In the early 1930s, a demand for public policies aimed at renewing and expanding professional education in Brazil arose. The hiring of foreign professionals and the production of didactic material were representative factors in this movement. Anton Dakitsch, one of those professionals, came to Brazil and worked in Industrial Education as a teacher and an author of textbooks. He left us a collection of books and technical journals, today allocated to IFF Campos, Rio de Janeiro State. But to explore the Dakitsch's collection with a focus on the books that were oriented towards vocational education, a representative approach was the documentary research, to investigate teaching careers and to consider the cultural diversity that

1 This paper is an integral component of the research project entitled *Anton Dakitsch – a Swiss Instructor in the Brazilian Vocational Education System* (2011-2016), developed by the author and Wania Manso (coord.) through a partnership with: UFF- Fluminense Federal University; IFF- Fluminense Federal Institute; PUC-Rio – The Pontifical Catholic University of Rio de Janeiro. This project has been funded by MEC/CAPES (The Brazilian Department for Education and Culture /Department of Staff Development) and by FAPERJ (Research Support Foundation of Rio de Janeiro State). FAPERJ's funding has enabled the listing and renovation of Dakitsch's personal collection.

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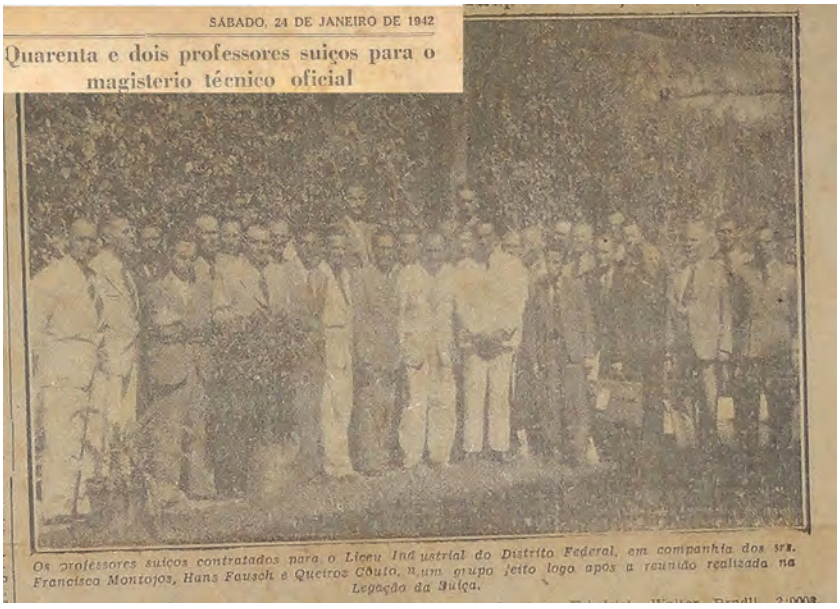
interweaves Dakitsch's instructional production. I have used that collection as the primary source.

In this work at hand, one of Dakitsch's textbooks is analyzed concerning the content of mathematics. My aim is to assess the status assigned to mathematics within the theme of standardization of paper sizes proposed by Anton Dakitsch in his 1950 textbook *Padronização de papéis em geral* [Standardization of paper size in general](Dakitsch, 1950), aimed at Industrial Education. And I have explored the content of the discipline of mathematics – as a *tool* or as an *object* – according to Douady (1991), in order to explore the role played by mathematics within the paper size standardisation approach as proposed by Dakitsch.

Anton Dakitsch – a Swiss teacher in the Brazilian vocational education

Dakitsch arrived in Brazil in 1942 and worked in Industrial Education as author of several textbooks, and as a teacher for four decades. The arrival in Brazil of 42 experienced Swiss teachers of diverse backgrounds, made headline news in January 22, 1942 – '*Forty two Swiss teachers for the official technical magisterium*'.


SÁBADO, 24 DE JANEIRO DE 1942

Quarenta e dois professores suiços para o magisterio técnico oficial

Os professores suiços contratados para o Liceu Industrial do Distrito Federal, em companhia dos srs. Francisco Montojos, Hans Fausch e Queiroz Côuto, num grupo feito logo após a reunião realizada na Legação da Suiça.

Fig. 1. The Swiss teachers hired by Liceu Industrial, Federal District, together with Mr. F. Montojos, Mr. H. Fausch and Mr. Q. Couto. Dakitsch's collection. Newspaper clipping: Correio da Manhã, Jan 24, 1942.

Amongst them was Anton Dakitsch (1909-1993), who taught vocational school between 1942 and 1980. A timeline shows Dakitsch working in Industrial Education as a teacher and as well as author of textbooks, and shows the Brazilian context of vocational educational reforms (Almeida & Almeida, 2012).

> **Aug 30, 1909** – Born in Brugg, in the Canton of Aargau, Switzerland. Parents: Anton Dakitsch and Anna Elise Dakitsch. Marital Status - married.
>
> **1936** – Entered a Master`s Degree in Binding from the School of Industrial Arts in Bern (Switzerland, Kunstgewerbeschule).
>
> **1941** – Signed contract for Vocational Technical Instruction with Brazil`s Department of Education and Health.
>
> **1942** – Came to Brazil.
>
> **1942** – Brazilian Industrial Education Reform.
>
> **1942-1957** – Hired as teacher by Industrial Secondary School and National School, Brasilia Federal District.
>
> **1948-1954** – Expert Technician working in Teacher Development Courses supplied by the Covenant Agreement between MES/CBAI (Brazil`s Department of Education and Health/Brazilian-American Commission for Industrial Education).
>
> **1949-1956** – Author of 13 textbooks on various themes aimed for Industrial Education: a) Books edited by MES/CBAI: Book binding course, 1949, 2v.; Book binding course, Teacher's guide, 1949; Book gilding, 1950; Technologies, 1950, v.1; Technologies – operations, 1950, v. 2; Technologies – tasks, 1950, v. 3; Technologies – Teacher's guide, 1950, v.4; Paper size standardization, 1950; Planning and Organization of Typography Workshops, 1953; Suggestions for Planning and Organization of Typography Workshops, 1953. b) Books edited by MEC/DNE (National Education Department): Cardboard crafting, 1956, 2v.; Painted Paper Making, 1956.
>
> **1951**– Entered the Brazilian Registration for Professor, MEC/DEI (Brazil`s Department of Education and Culture/Section of Industrial Education), Typography Course, Disciplines: Technological Culture, Technical Design, Technology.
>
> **1954**– Naturalized Brazilian.
>
> **1972-1979** – Hired as teacher by the Campos Federal Technical School.
>
> **1980** – Retired.
>
> **1993** – Passed away

See below some photos of Anton Dakitsch. The first is his passport photo, and according to his wife the following photos show Dakitsch around 40 and 70 years old.

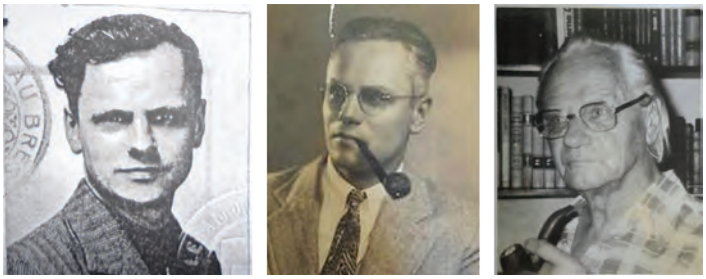


Fig. 2. Dakitsch's pictures. Dakitsch's collection.

Brazilian policies for industrial instruction and for hiring foreign instructors eiducation

In 1940, the São Paulo University Polytechnic School Professor Roberto Mange, Swiss in origin, was nominated to go to Switzerland and select properly-fit foreign teachers. Mange selected 42 experienced teachers, including Dakitsch, who arrived in Brazil in January 22, 1942.[2]

Fig. 3. Covers of Dakitsch's textbooks: Standardization of papers size in general; Typography; Book Binding.

2 Also in 1942 the Industrial Education Reform was put in place. There is a legislation that provides for the organizational base of the Industrial Education: 1942 - Decree-law no. 4.073, of Jan 30, 1942, the Organic Law of Industrial Instruction; 1942 - Decree-law no. 4.127 of Feb 25, 1942 provides for the organizational base of the federal network of industrial education centers; 1943 – Motion nº 28 (embraced by the 1st Conference of Education Ministers and Principals of the American Republics, held in Panama) established the Covenant Agreement between MES/CBAI (Brazil`s Department of Education and Health/ Brazilian-American Commission for Industrial Education) and the US for the exchange of educators, ideas and instructional methods.

Industrial Education was basically organized into 8 Sections. The Typography and Binding Course that encompassed the discipline of Standardization belonged to Section VIII - Graphic Arts. Dakitsch's book *Standardization of paper size in general* was published aimed at Graphic Arts.

In his 13 textbooks for Industrial Education, major themes were paper size standardization, book binding, book gilding and cardboard crafting. These books show that various disciplines of Industrial Education share a mathematics basis and thus are a research source for the history of mathematics education.

Mathematics teaching in Brazilian industrial education

In order to explore the role played by mathematics, I considered the paper size standardization approach as proposed by Dakitsch in his textbook *Standardization of paper size in general* (idem, 1950). For this purpose I considered the way the mathematical instructional content is presented and dealt with, which will be determinant of its status as a tool or as an object (Douady, 1991).

Dakitsch designed and published this book by MES/CBAI in 1950, volume 6 of the Series C – Technical Education, aimed to Industrial Education, more specifically Graphic Arts, a Printing and Binding Course. The author's works show that paper size standardization is a major line of study to qualify graphic designers, given its application in typography and book binding, amongst other disciplines.

As a graphic arts teacher Dakitsch emphasized in several of his books that it was important to study the standardization of paper for vocational training. So in order to grasp some aspects of the scope of mathematics teaching in Brazilian industrial education in the 1950s, I have used his textbooks collection as the primary source

According to Dakitsch (1950) his book aims to "spread the knowledge about the norms that guide the rational use of paper in compliance with DIN standards" (p. 1). His book is divided into three sections:

1. Standardization of paper size;
2. Types of paper: specifications, endurance testing and quality assessments;
3. Instructions for typographers.

The table of contents of Section 1 'Standardization of paper size' lists theme-related specifications and market-oriented standardization of paper sizes – the envelopes and market-oriented types of paper.

1. Standardization of paper size:

-Paper sizes (notes), international standard;

-Use of the main series.

-Standard sizes for all market-oriented types of paper;

-Underlying principles;

-Envelopes.

-How to fold drawings;

-Size of elongated paper sheets; business letters.

The presentation of the theme in Dakitsch`s textbook starts with the statement "The standardization of paper sizes consists of a harmonious set of models aiming not only at saving paper but also at having sustainable labor throughout the process" (idem, Presentation).

Dakitsch explains that standardization, although not a new trend, has not yet become universal due to the need of adapting the existing equipment to new standards. He then builds the case for standardization using the DIN paper size system. The DIN – Deutsches Institut für Normung [German Institute for Standardization] has set an international standard for paper size.

According to Dakitsch, in the DIN System, the base A_0 size of paper is defined as having a rectangular area of 1 m^2 which when folded in half results in another sheet with the same ratio of lenth of sides.

The author explains that this condition is met only when the width (x) to length (y) ratio of the sheet is $1 : \sqrt{2}$, that is 1 : 1.4142. He adds a figure showing the geometric construction of the square root of 2 and points out that the square root is the diagonal of the square with the side measuring one unit.

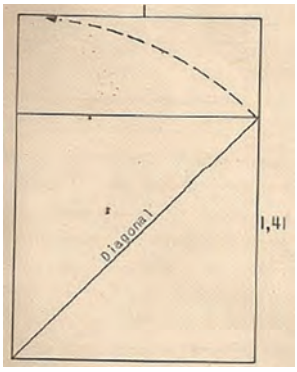


Fig. 4. Geometric construction of the r sizes ratio $1 : \sqrt{2}$ or 1 : 1.41. (idem, p. 4)

Fitgure 5 shows the development of the author's explanation: an equation system allows us to get values $xy = 1\ m^2$.

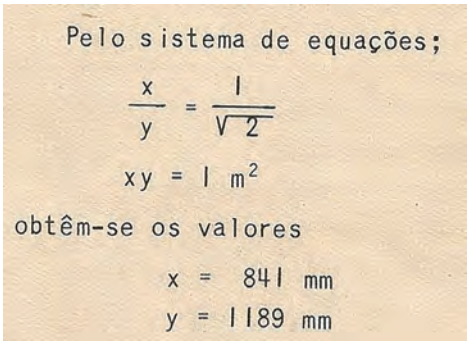


Fig. 5. Excerpt. (idem, p. 5)

Translation of the excerpt above: The equation sistem allows us to get values It results in $x = 841$ mm and $y = 1189$ mm.

Dakitsch notes that "By the sucessive division of the A_0 sheet is obtained the formats of the A Series, denominated A_0, A_2, A_3, A_4, etc." (Idem, p. 3). The figure below ilustrates this sequence.

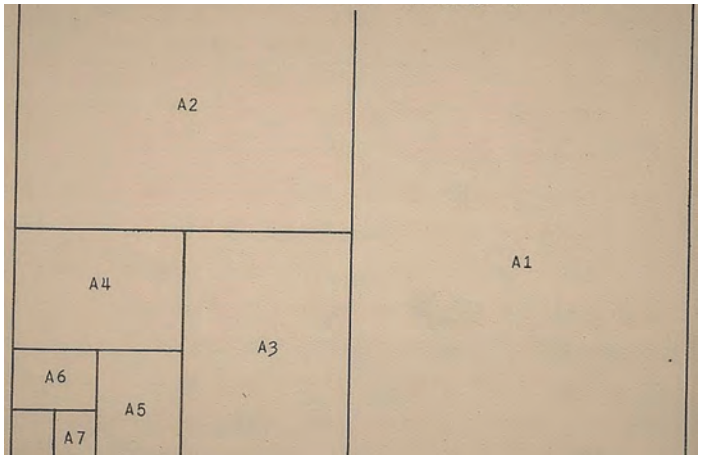


Fig. 6. Iternational Format A series. (Idem, p. 4)

Then Dakitsch (idem) summarized the principles of paper sizes.

> **1)** Each size is an xx geometric mean (half the size) of its predecessor and twice as big as the following size. Thus, A5 is half the size of A4 and twice the size of A6.

2) The formats are geometrically similar and the ratio between the sizes is $1 : \sqrt{2}$.

3) The metric system is used, so the standard size A_0 corresponds to the area of 1 m^2. (p. 6)

In order to to make the spread of standardized sizes easier and to ensure its universal usage, four series of standards were designed. So, in addition to the major Series A, there are also Series B, C and D. Figure 7 shows the table of sizes of the series A, B, C and D (Idem, p. 2.)

1.2 Formato internacional	A	B	C	D
	DIMENSÕES EM MILÍMETROS			
0	841 x 1189	1000 x 1414	917 x 1297	771 x 1090
1	594 x 841	707 x 1000	648 x 917	545 x 771
2	420 x 594	500 x 707	458 x 648	385 x 545
3	297 x 420	353 x 500	324 x 458	272 x 385
4	210 x 297	250 x 353	229 x 324	192 x 272
5	148 x 210	176 x 250	162 x 229	136 x 192
6	105 x 148	125 x 176	114 x 162	96 x 136
7	74 x 105	88 x 125	81 x 114	68 x 96
8	52 x 74	62 x 88	57 x 81	48 x 68
9	37 x 52	44 x 62	---	---
10	26 x 37	31 x 44	---	---

Fig. 7. The four Series A, B, C and D of standards. (Idem, p.2)

Translation of the text in figure 7: International format A, B, C, D. Sizes in milimeters.

The following example of the practical application of Series C shows that the paper standarization can be useful in the production of books and envelops.

In the case of the book industry, the A_1 format is 610 mm x 860 mm. In series B, the size B_1 is 707 mm x 1000 mm and if a margin of 20 mm is allowed on each side, then the total paper size is 727 mm x 1020 mm. As the B_2 format is half of the B_1 format, the sheet will have a total size of 727 mm x 510 mm and this allows paper to be used.

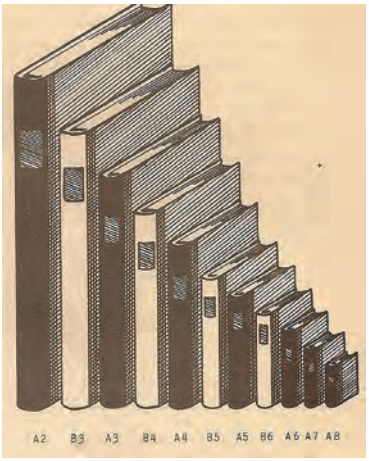


Fig. 8. Books industry. (Idem, p. 3)

Another example of the practical application of Series C presents the envelope with window C6 DIN 680 that is, with the 114 mm x 162 mm according to the previous table. The C format series belongs to auxiliary sizes, amongst which are series B and C, used for envelopes and a relative common choice for small-sized paper applications: a) visiting cards, congratulations cards, forms, postcards, letters, brochures, flyers; b) format folded longitudinally; format with a jacket, envelopes, larger remittances; sheets inside binders.

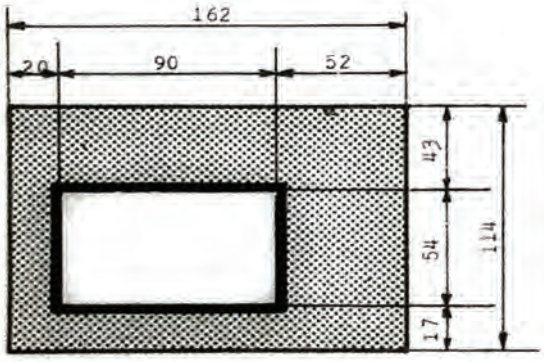


Fig. 9. Envelope with window, C6 DIN 680, that is with the 114 mm to 162 mm ration. (Idem, p. 12)

Dakitsch's approach shows that the study of standardization of paper sizes involves a wide range of mathematical contents. All these are contents of the primary school, with specific application to the industrial education in the 1950's. To grasp some aspect of the scope of the mathematics in this case, I follow Douady's assertion that

the way the mathematical instructional content is presented and dealt with will be determinant of its function as a *tool* or as an *object* (Douady, 1991).

Douady presents the meaning of a *tool*:

> We say that a concept is a *tool* when the interest is focused on its use for solving a problem. A tool is involved in a specific context, by somebody, at a given time. A given tool may be *adapted* to several problems, several tools may be adapted to a given problem. (Douady, 1991, p. 115)

And she explains when a concept is an object:

> A concept is an *object* when it is considered in a cultural dimension, as a piece of knowledge independent of any context, of any person, which has a place in the body of the socially recognized scientific knowledge. An object is mathematically defined. This can be by various means: properties, na effective construction, or by an existence theorem. The status as object allows the capitalization and the structuration of knowings and the extension of the body of knowledge. (Douady, 1991, p. 116)

The mathematical principles that underlie the DIN paper size system, according to Dakitsch rely upon the ratio between segments and upon proportions. These mathematical contents acquire, thus, the status of *object* of the mathematical knowledge to be discussed by the author of the textbook and to be learned by students. Other mathematical concepts as measurement systems, operations with decimals, areas of geometrical figures are used to develop the baseline content. As prerequisites, their status is that of *tool*s, that is, theiy are used for solving a problem.

Wrap-up

Dakitsch`s approach depicts the role played by mathematics in the instruction of paper standardization. But the instructional content may be viewed from two indissociable perspectives: its mathematical specificities and its practical usages. Thus, the work of Dakitsch shows that the practical application of the mathematical content justifies and should motivate the teaching of paper standardization in Industrial Education in Brazil, thus aggregating instructional value to this discipline, given its application in typography, book binding and cardboard crafting, amongst other possible uses in the field of graphic arts.

When applied to the solution of practical problems in the technical, professional and economic spheres, the status of *tool* of the mathematical content that underlies paper standardization shows that the usage of the DIN paper size system leads to saving paper and labor. The practical outcomes of adopting the DIN System point to the need of setting an International Technical Norm that allows for a larger scope

of the system application, since, as remarked by Dakitsch, the usage of this system was not universal in the 1950s. And still in relation to technology, in 1950, the gap between the new paper size format and the existing equipment hindered the move towards the universal usage of the DIN paper size System.

Dakitsch`s textbook published in 1950, which was the object of my analysis, as well as other works of his collection that span over 1910 through 1950 and which were published in several languages and countries, are all oriented towards the instruction of graphic arts. They constitute the primary source for studying Dakitsch and as such, they reveal a close connection between the technological base available at that time and the design of instructional materials. The current Technical Education in Brazil does not provide the teaching of disciplines such as paper standardization and book binding. Anton Dakitsch's history can contribute to the records of the history of Brazilian Industrial Education - a history we know very little about.

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