HOW CAN VISUAL HISTORY AND THE ART OF FORTIFYING SERVE IN TRAINING MATH TEACHERS?[1]

Cláudia Regina Flores
crf@mbox1.ufsc.br

Universidade Federal de Santa Catarina - UFSC

ABSTRACT

This paper aims to question the history that is usually considered to treat history in mathematics education. It discusses new ways of conceiving history and historical objects, taking the cultural history and visual history as examples for the construction of a new narrative for teacher training. From the use of visual sources from the military art of the seventeenth and eighteenth centuries, rises five points that can answer the question of this article: how can visual history and the art of fortifying serve in training math teachers? Finally, we stress the importance of bringing it into teaching practice to build a new relationship with the concept of teaching, learning and relating to mathematical knowledge.

Keywords: history in mathematics education; visual sources; visualization and visuality; teacher training.

RESUMO

Este artigo questiona a história que, usualmente, é considerada para tratar da história na Educação Matemática. Discutimos sobre novos modos de se conceber a história e os objetos históricos, considerando a História Cultural e a História Visual como exemplos para a construção de uma nova narrativa para a formação de professores. A partir do uso de fontes visuais da arte militar dos séculos XVII e XVIII, levantam-se cinco pontos que podem responder a questão deste artigo: como a História Visual e a arte de fortificar podem servir à formação do professor que ensina matemática? Finalmente, salientamos a importância de se trazer tal discussão para a prática do professor, construindo uma nova relação com o ensino, a aprendizagem, e com os saberes matemáticos.

Palavras-Chave: história na educação matemática; fontes visuais; visualização e visualidade; formação de professores.

[1] This work is a result of the research for the Project titled *The geometrization of vision: visual culture and mathematics visualization for professional teaching development*, developed with North Carolina State University, USA, from February 2010 to February 2011, with financial aid from Capes, in the form of a scholarship for post-doctoral internship, under the supervision of Prof. Paola Sztajn, PhD.

Introduction

In the introduction to the Special Issue of *Journal of Educational Studies Mathematics* released in 2007, Radford, Furinghetti and Katz put the following question: "Can teachers and educators take advantage of the history of mathematics to enhance the students' understanding of mathematics?" (p.107, 2007). Later in this text, the same authors say that this question has been asked by Hieronymus Georg Zeuthen more than a hundred years ago, saying that a certain familiarity with the history of mathematics will help us get a better sense of discipline.

In fact, this issue has caused a lot of investment in research, discussing about the potential of the history of mathematics in mathematics education and, consequently, in teacher training (Freudenthal, 1981; D'Ambrosio, 1985; Dhombres, 1981; Fauvel, 1991; Radford, 1997; Bkouche 1997; Fauvel & van Maanen, 2000; Miguel, 2002; Jankvist, 2009). However, although there was a growing interest in this study area, there are many controversies about the how and why of the history of mathematics in education, particularly regarding the teaching methodology employed (Miguel, 2002; Motta, 2006; Noble, 2004).

In a categorization of the "why" and "how to" use history in mathematics education, Jankvist (2009) establishes two categories: *history as a tool and history as a goal*. In the first case, the argument is that history can be a motivation for student learning, or it can play a cognitive role supporting current teaching and learning. The identification of epistemological obstacles can aid in understanding the difficulties of students, providing clues to teaching methods and learning processes. The history of mathematics can provide different ways of presenting content. Still, a phenomenological approach in history can prepare the development of a hypothetical learning trajectory, helping us look through the students' thinking.

In the second case, the argument lies in the fact that learning the history of mathematics has a purpose in itself, focusing on aspects of development and evolution of mathematics as a discipline. In this case, the goal is to show students and teachers that mathematics exists and develops in time, space, and in different cultures. The goal is to learn something about meta-aspects or meta-issues of mathematics, showing that mathematics is a discipline that has undergone an evolution and not simply arisen arbitrarily and scientifically.

History of mathematics and mathematics education are therefore linked both to provide a field of research, and to be established as a base on the training of teachers and students. To think about our practices of reasoning and knowledge construction as coming from a historical process, known elements of this process to allow the creation and invention of methods for research and

teaching; assist the formation of our world view, contribute to the pursuit of the contents are meant for purposes of both the history of mathematics and mathematics education.

Thus, under the title "history of mathematics in mathematics education", a trend of research is highlighted that which makes use of mathematical history to guide actions related to mathematics teaching and learning. It is conceived, therefore, that the history of mathematics is the record of creation and the place of development of scientific mathematical knowledge, which, consequently, will settle in school knowledge. The history of mathematics is seen as being linked, naturally, to the mathematics education, whether by the enumeration of facts, names, places and dates (anecdote history) or by the historical development of concepts and practices (epistemology).

However, conceiving the History of Mathematics as coming from the dialogue between History and Mathematics suggests the other research endeavor. That would mean not only a better understanding of the educational issues related to teaching and learning of mathematics, but also the perception that a mathematical knowledge applied to a historical practice could be an exercise to develop actions both for the training of teachers, and for the teaching and learning of mathematics.

The goal of this article is, on one hand, to question the history that usually applies to mathematics education and, on the other hand, reflect on the connection of a "new history" with mathematics education. We start, thus, with a proposal to connect history and visualization issues in teacher training, taking as example the visual story and mathematical activity employed in the art of defense of the 17^{th} and 18^{th} centuries. The question that guides the discussion is: how can the art of fortifying contribute to the math teacher?

This article is divided as follows. First, we seek to understand a new concept of history from the cultural history and visual history. Then, we discussed visual sources and show an example for this article. Then raise a list of points that raise the debate about the history and visual art can help strengthen teacher training. Finally, we have made some comments in conclusion.

Cultural History and Visual History

There is an understanding of history which is to return to the past not to brood on memories and traditions (Albuquerque Junior, 2007), but to understand the mechanisms by which a society problematized knowledge, feelings, behaviors and produced knowledge through power relations and regimes of truth. Therefore, there is room for the

> History to take as its object of study ways of producing meaning. The assumption of its treatment is to understand the processes of production of meaning as social processes. The meanings are not taken as data, but as a cultural construction. This opens a field for the study of

> various texts and cultural practices, assuming that society is organized, too, from the clash of discourses and readings of texts of any kind – verbal written, oral or visual (Knauss, 2006, p. 100).

For this conception of history, one of the fundamental concepts concerns the archaeological analysis by seeking to prove "[...] the discursive practices as they give way to a knowledge, and that this knowledge assumes the status and role of science" (Foucault, 2000, p. 216). It is not, therefore, an interpretative or phenomenological analysis. In a phenomenological analysis, we seek to deduce the intentions of the speaking subject from the discourse, the thought that is being formed, while in an archaeological analysis we examine different ways in which the speech fulfills a function within a strategic system where power is implicated and by which the power works.

New objects, problems and methodologies have been proposed to historical research. According to Burke (2005), Cultural History seeks to analyze cultural aspects of human behavior as a privileged center of historical knowledge. This way of understanding history resulted in a shift from generalizing theoretical schemes, with the valuing of particular groups in specific places and periods, discussing issues that until then had not been approached by history: beauty, ugliness, vigilance, fear, the body, sexuality, visuality, among others.

To broaden the horizon of action and the instruments of research linked to Cultural History, Meneses (2003) entitled Visual History not as an alternative to History, replacing the existing modalities or putting them in parallel, but to highlight an aspect of History that concerns the relationships of the subject and the visual experiences with the technology of the visual.

As a methodological proposal for Visual History, Meneses (2003) proposes the investigation of three aspects related to visual sources: the *visual*, including, for example, visual communication systems, visual environments, production, circulation, consumption, actions of resources and visual products; the *visible*, concerning the sphere of power, the control systems, what is seen and not seen etc.; the *vision*, including instruments and observation techniques, the roles of observer, the models and modalities of the look.

Thus, history allows itself to be touched by this tendency to the visual, being interested in the visual studies or visual culture and visuality. Visual culture, according to Knauss (2006), covers the diversity of the world of images, visual representations, and processes of visualization and visuality models. Therefore, the visual and visuality are highlighted, questioning the vision as a natural gift and the universality of visual experience, abandoning the centrality of the category of vision. We start, thus, to admit the cultural specificity of the visuality to characterize historical changes of visuality and to put vision in context (Jay, 1996).

Therefore, in Visual History the attention to visual sources has changed. These come to be regarded as holders of historicity and not as mere deposit of empirical information, or as dependent on reading techniques. Thus, we seek to problematize the production of images, focusing on the everyday experience of the visual and being interested in the visual events in which they seek information. This allows us to historically understand how observation, representation and knowledge practices were introduced in the midst of the visual issues questioned by a society.

In this article, we question how Visual History can help us teachers, mathematics educators. Broadly, the answer may be because it serves us, on one hand, to understand how and where the establishment of methods and techniques of observing, representing and reasoning was possible, as well as the production of knowledge that is present in Mathematics Education today. On the other hand, it should lead to the training of the teacher, discussing how our vision was trained to format, put into geometry, mathematically analyzing visual sources of cultural practices, enabling the creation of mathematical activities to be developed in the classroom and also understanding the student as a historical and cultural being.

All this does not mean a search for the evolution of different observation practices, nor the mathematical knowledge that consists of discipline and school subjects in mathematics education. It does not mean an investigation of the mathematics subjacent to the artifacts and the different practices and human activities such as, usually, are employed by studies in ethnomathematics. Instead of all this, what we want to highlight here is the questioning of both visual practices and ways of representing space that remain today in the mathematics education, that is to perceive that they (the practices) are actions of the subjects constituted by the exercise of power relations.

According to De Certeau (2007), practices of representing space lead to a specific form of "operations", that is, ways of making. In this case, the space is not understood as a representation itself, but as representation of a way of experiencing. De Certeau´s ideas could be used to examine the ways in which human beings engage in various negotiated and oppositional tactics with practice of representing. Moreover, Foucault (1989) has analyzed modern societies as structured on a basic relationship of power/knowledge. He has argued that power relations establish the criteria for what is considered knowledge, and knowledge systems in turn produce power relations. Thus, we back to the history to understand how the space was being represented from human experiences, and also to analyze how ways of representing it were created for the purpose of surveillance, regulation and categorization, producing truths and knowledge.

Finally, we would like to say that our assumption is that history can be used in teacher education as a strategy of questioning habits, knowledge and techniques currently used in teaching mathematics.

Visual Sources

Meneses says that "Sources are not studied to better know them, identify them, analyze them, interpret them and understand them, but they are identified, analyzed, interpreted and understood so that, hence, one can obtain a better understanding of society in its transformation" (Meneses, 2003, p.26).

In particular, for the discussion of this article, the visual sources we consider are images of north-American fortifications designed by military engineers and architects of the 17th and 18th centuries. These images are analyzed in accordance with the provisions of treaties of military engineering of the time. As a theoretical hypothesis, it is considered that both the construction and representation of militarized space occurs through the mathematical activity. These sources are interesting because they lead to the analysis of how the use of mathematical knowledge enabled the intellectualization and generation of new forms of using the space and new ways of looking at the space[2]. The geometry, for example, as a method of cognition of nature and foundation of the human activity, served as a support for the art of representing, but also for the establishment of ways of looking.

Fort McHenry

Located between the city of Baltimore and Chesapeake Bay, the Fort McHenry was constructed between 1798 and 1802. It was in the shape of a five-pointed star and geometrically regular. Jean Foncin, a French artillerist and engineer, is usually credited with the design (Fig. 1).

[2] Flores (2012) focused on the analysis of one way of looking at and representing plans of Military forts, to understand how the operation of perception has become geometrical and how military architects have created and used mathematical knowledge to represent using technical perspective theory.

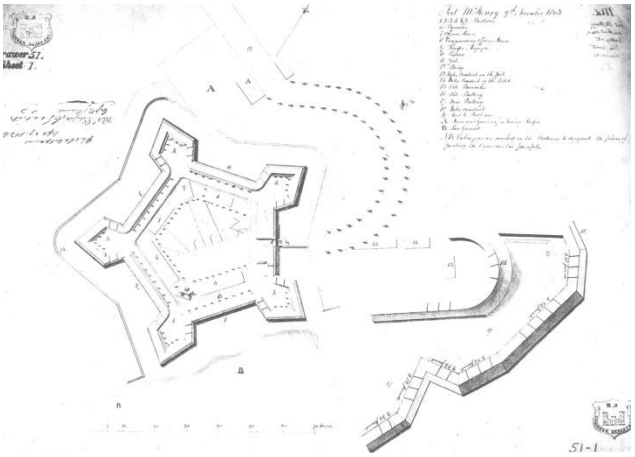

Fig. 1 *Fort McHenry*, Maryland (1798). Jean Foncin, engineer. Plan (1803).
National Archives, Washington, D. C.

Mathematical discipline and bastioned form was a popular design fortification during this period by European theory. According to Robinson (1977) the same bastioned form that had been developed in Europe was used in seacoast America, thus the bastioned Fort McHenry characterized pentagonal shape and regular traces by the concept of Vauban.

Sébastien Le Prestre Vauban (1633-1707), French military engineer, introduced a new and more scientific methods to attacking troops and developing more firepower upon the points selected for attack (Griffith, 2006). Vauban " (…) held as one of his principles that regular fortification-that is, work of geometrically ordered components – is much to be preferred to irregular" (Robinson, 1977, p.12) .

According to Robinson (1977),

> Vauban had profound influence on both the theory and the practice of the art of defense in Europe and in the New World. (…) On theory of defense, Vauban´s first system formed the foundation of academic work in military architecture in France. The highly esteemed École Polytechnique made the precepts of this system the basis for its program on field and permanent fortification and attack and defense of fortified places. Eventually, the United States Military Academy at West Point, founded in 1802, developed a curriculum similar to that of the esteemed French school (Robinson 1977, p.12).

With regard to the visual sources is appropriate to analyze the principles employed in the military treaty *The New Method of Fortification* (Vauban, 1762) that had been originally published in French in 1681. The treaty consists of two books dealing with geometry and five books dealing with the art of fortifying. In the *A New Treatise of Fortification*, Book III, Chap XVI Vauban teaches, for example, how to design and build a pentagon-shaped fort. We should

note, for example, that the drawing is started from a pentagon that is given by dividing a circle into five parts (Fig. 2).

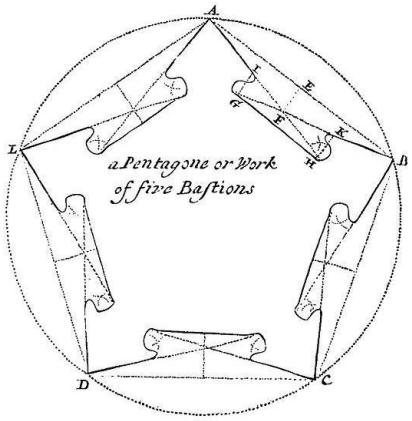

Fig. 2 *A Pentagone* or Work of five bastions by Vauban

Indeed, the mathematical concepts of Pythagorean and Platonic origin, based on the harmonic ideas, and which manifest themselves by simple interrelated dimensions, were part of a set of military knowledge of the time. Although the use of the regular geometric figures such as the pentagon, the hexagon, the square or the triangle depended from the intervention scale and the existing topography, they were privileged both in the drawing and in the edification of the fortifications. Due to their analytical character, the images distinguish the several elements of the work, serving to the same purpose as the technical drawings of a building. Besides, it permits a battle to be analyzed in its several details.

On the other hand it is worth observing that, as Flores (2012) analyzed, such images emerge from cultural practices that are connected to a regime of total visibility. Such visibility is analyzed from the forms of the panopticon. According to Foucault (1989, 2007), the disciplinary power, for example, is not applied only to the body of the individuals, but to panopticon. Thus, the person who is subject to a visibility field and, holding that knowledge, takes charge of the power constraints, triggers them spontaneously on him/herself, and becomes principle of his/her own subjection. The images, therefore, can both exercise power and act as an instrument of power.

However, we highlight that the history of the drawing of the fortifications implies to get involved in a study of the discursive practices, to the extent that they make room for knowledge, and that knowledge assumes, therefore, the status and the role of science, as Foucault (2000) demonstrates.

The image as a device and a question of method

Arfuch (2009) states that any image, be it artistic, photographic, informative, pedagogic, a drawing and so forth, conserves a vision of the world and inscribes itself in a context of intelligibility. Therefore, citing Meneses (2003) again, the images are analyzed for a better understanding of a society and its transformations. This means that the images reveal the regimes of visibility the society has created, has got involved in, and taken as the truth to look at and to represent things. In other words, it means that they are impregnated of discourses that reveal a particular knowledge, that configure the world as it is understood and as the things happen there. Going a little further, it means to understand the relations that concern the conditions of emergency of some specific forms of seeing and make visible an image, the statements[3] that are instituted as truth regimes of each epoch.

So, an image can be analyzed as a device. The concept of device, as employed by Foucault (2007), is understood as a heterogeneous set which encompasses discourses, institutions, architectonic organizations, laws, statements. Therefore, everything that is either said or not makes the network of a device.

The work with and about the image involving teachers, then, may rise possibilities both to think their forms and conceptions around the looking at and representing, and may allow the elaboration of methodologies for the teaching of mathematics. Our hypothesis is that only a research work based on a method that is constructed by following the movements of the subjectivities would give birth to the historicity of the visual sources. The practices of visualities fabricate both the subject who sees, and the object he/she sees, the visible things.

The cartography is constituted, therefore, as a possibility of method (Deleuze e Guattari, 1995): a method of research-intervention in which one presupposes the inseparability between knowing and doing, between researching and intervening; a procedure to be constructed case by case, a way to help in the study of the subjectivities.

Therefore, the history of how a rationalized, geometric, regular manner of representing space was formed is intertwined with the history of how ways of looking at space and its representation were constructed. The images of these representations, taken as visual sources, can be problematized in teacher training for various reasons and issues. Next, we start to discuss the main question of this article.

[3] Understanding statement as one of the threads that constitute the network of a determined discourse within the truth regimes of a certain time (Foucault, 2000)

History and Teacher Professional Development

We started this paper discussing the arguments that support the use of history in the classroom apply also to the case of teacher education. We suggested returning to this topic to raise a debate about how History Visual and mathematical activity by art of defense may serve to teacher education. We discussed the concept of History Visual to emphasize the role of mathematical and geometrical activity in the creation of visual sources by military engineering of the seventeenth and eighteenth centuries. Below we will propose a list of points of reflection in order to respond the question of this paper:
how can the art of fortifying contribute to the math teacher?

To reflect on the concept of space and its representation. According De Certeau (2007) the practices of space lead to a specific form of "operations", that is ways of making. So, the space is nothing more than a representation - a map is not a territory but a representation of it. This means that space in not perceived as representing the effect of copy or being equivalent, but as a mode of representation of our experience that occurs by the action of our knowledge. Thus, for the case of militarized space it comes into existence figuratively, being represented first, and becomes reality when it is practiced by military engineer.

To analyze practices of looking from a historical perspective. Foucault (1989) has argued how modern societies are structured on a basic relationship of power and knowledge. Disciplinary power, for example, is about training the actions of bodies under constant surveillance by panoptical institutions. In this case, observation and the gaze are key instruments of power. Therefore, analyzing the military art means understanding the eye of power, the gaze, and the panoptic principle, all of them are proper systems of government of the eighteenth century.

To consider the concept of visuality instead of visualization[4]. Visuality is a social fact from historical techniques of looking and discursive determinations of sight (Foster, 1988).Visuality implies knowledge of visual practices embedded in historical processes, which create visual discourses and that are established in statements of truth to see and represent. On the other hand, visualization is concerned with the understanding of visual skills and specific forms of developing vision capacity. Visualization, in mathematics education, tends to be concerned with issues of perception, representation, learning, memory, attention and reasoning. Then, visual sources could be interesting to address the discursive formation of the mathematical vision, and not necessarily for the learning of seeing the concept in representation.

4 Flores, Wagner and Buratto (2012) performed a study on the concepts and trends for research on visualization in mathematics education, and they found that the researchers ordinarily use visualization as the ability to manipulate mental images. Although this study claims for a new trend linked to the *visuality*, the authors did not take the discussion forward on the visuality, visual sources and math teacher. Indeed, other studies are yet to come in order to carry out some research with mathematics teachers, using visual sources and visuality as a strategy to discuss mathematical and visual thinking.

To relate art and mathematics education through visual sources from military art: "There's more to appreciate in art than form and function. Art offers endless opportunities to explore history, culture, math, and science" (Willingham, 2009). In the same way, we can think that the relationship between military art and mathematics education offers more to us than mere pedagogical approaches or historical discuss. Through the art of war we can understand the construct of mathematical knowledge, how it became mathematical school, and also the formation of a geometrical looking.

To recognize advantages (and limitations) of visual history for educational proposes. Discuss the history of construction of the space, the drawing, the vision, means creating ways to produce new knowledge and ways of teaching mathematics in relation to the knowledge of our ancestors. Still, it means understanding that school mathematics is the result of social relations, historical practices and arbitrary choices. However, history is not a metanarrative to answer all the questions of education. It can serve as a tool to build new understandings and new problems in mathematics education.

Final Remarks

We began this article discussing the initiative of many researchers in defining a space for history in mathematics education, where the history of mathematics is treated as, naturally, linked to its education. However, we sought to demonstrate here that other ways of conceiving history generate the creation of new objects and research problems. In this aspect, the history of the visual was taken as an example to discuss the fact that visual sources may be interesting to question the knowledge and the visual, as well as the conceptual relationship that we have created about them.

Given the proposition to think of the history of the visual in relation to mathematics education, five topics arose in order to motivate a discussion on the potential of this approach in math teacher education. These topics suggest, in general, that the teacher can build different ways of relating to the mathematical knowledge, in the sense that it (knowledge) is not an authoritarian imposition of science, or an abstract and universal entity, but an elaboration social practices and successes, in different times and cultures. They also suggest that the study of visual practices within the history leads to an understanding of our ways of looking as being charged for meanings, techniques and truths.

One question is still latent: why does the teacher need to know all this to improve their teaching practice? There's a contemporary discussion that thought may destroy the fantasies around a universal truth, recognizing that thought is produced in practice and is full of meaning and complex emotions. Also, recognize that the forms of power and regulation historically introduced operate our society to this day. Therefore, it is necessary to build new and different narratives, recognizing specific practices, identifying places of historical inventions in the

construction of all of us. This at least could lead to new understandings about how the teacher designs the learning, the teaching and their own mathematical knowledge.

References

ALBUQUERQUE JUNIOR, D. M. de. (2007). *História*: a arte de inventar o passado. Bauru, SP: Edusc.

ARFUCH, L. (2009). Ver el mundo con otros ojos. Poderes y paradojas de la imagen en la sociedad global. In ARFUCH, L & DEVALLE, V. Visualidades sin fin : imagen y diseño en la sociedad global, p. 15-39. Buenos Aires : Prometeo Libros.

BKOUCHE, R. (1997). Epistémologie, Histoire et Enseignement des Mathématiques. *For the Learning of Mathematics*, Vol. 17, No. 1, pp. 34-42.

BURKE, P. (2005). *O que é história cultural?* Trad. Sérgio Goes de Paula. Rio de Janeiro: Jorge Zahar Ed.

D´AMBROSIO, U. (1985). Ethnomathematics and its Place in the History and Pedagogy of Mathematics. *For the Learning of Mathematics*, Vol. 5, No. 1, pp. 44-48.

DE CERTEAU, M. (2007). *A invenção do cotidiano*: artes de fazer. 13ª ed. Trad. Ephraim Ferreira Alves. Petrópolis, Rio de Janeiro: Vozes.

DELEUZE, G. & GUATTARI, F. (1995). *Mil Platôs*, vol 1. Rio de Janeiro: Editora, 34

DHOMBRES, J. (1981). Pédagogie et utilisation de l'histoire: des tensions contradictoires. *For the Learning of Mathematics*, Vol. 2, No. 2, pp. 10-15.

FAUVEL, J. (1991). Using History in Mathematics Education. *For the Learning of Mathematics*, vol. 11, n. 2, Special Issue on History in Mathematics Education, pp. 3-6.

FAUVEL, J. & VAN MAANEN, J. (Eds.). (2000). *History in mathematics education*: the ICMI study. Dordrecht/Boston/London: Kluwer Academic Publishers.

FOUCAULT, M. (1989). *Vigiar e Punir*. Nascimento da prisão. Tradução de Ligia M. Pondé Vassalo. 7. Ed. Petrópolis: Vozes.

FOUCAULT, M. (2000). *A arqueologia do saber*. Tradução de Luiz Felipe Neves. 6ª ed. Rio de Janeiro: Forense Universitária.

FOUCAULT, M. (2007). *Microfísica do Poder*. Organização e tradução de Roberto Machado. 24ª ed. São Paulo, SP: Edições Graal.

FLORES, C. R. (2012). Iconografia Militar e Estética do Olhar: Ressonâncias na Visualização Matemática, *Bolema*, v. 26, n. 42A, pp. 87-103.

FLORES, C. R.; WAGNER, D. R. & BURATTO, I. C. F. (2012). Pesquisa em visualização na educação matemática: conceitos, tendências e perspectivas. *Educação Matemática Pesquisa*, São Paulo, v.14, n.1, pp.31-45.

FREUDENTHAL, H. (1981). Should a Mathematics Teacher Know Something about the History of Mathematics? *For the Learning of Mathematics*, Vol. 2, no. 1, pp. 30-33.

FURINGHETTI, F. (2007). Teacher education through the history of mathematics. *Educational Studies Mathematics*, Vol. 66, pp.131-143.

FOSTER, H. (1988). *Vision and Visuality*. Seattle: Bay Press.

GRIFFITH, P. (2006). *The Vauban Fortifications os France.* New York: Osprey Publishing.

JANKVIST, U. T. (2007). A categorization of the "whys" and "hows" of using history in mathematics education. *Educational Studies Mathematics.* Vol. 71, pp.235-261.

JAY, M. (1996). Introdution: Vision in context: reflections and refractions. BRENNAN, T. e JAY, M. (eds.). *Vision in context*: historical and contemporary perspectives on sight. New York/London: Routledge.

KNAUSS, P. (2006). *O desafio de fazer História com imagens***:** arte e cultura visual. Revista do Instituto de História da Universidade Federal de Uberlândia. Uberlândia, v. 8, n.12 pp.97-115.

MENESES, U. T. B. (2003). Fontes visuais, cultura visual, História visual. Balanço provisório, propostas cautelares. *Revista Brasileira de História*, vol.23, n.45, São Paulo.

MIGUEL, A. (2002). Breve ensaio acerca da participação da história na apropriação do saber matemático. F. F. Sisto, E. A. Dobranszky &, A. Monteiro (org). *Cotidiano escolar: questões de leitura matemática e aprendizagem*. Petrópolis, RJ: VOZES, 2002.

MOTTA, C. D. V. B. (2006). *História da Matemática na Educação Matemática*: Espelho ou Pintura? Santos, SP. Communicar.

NOBRE, S. (2004). *Leitura Crítica da história*: Reflexões sobre a história da matemática. Ciência & Educação, v. 10, n.3 p.531-543.

ROBINSON, W. B. (1977). *American Forts*: architectural form and function. Fort Worth, Texas: Amon Carter Museum of Western Art.

RADFORD, L. (1997). On Psychology, Historical Epistemology, and the Teaching of Mathematics: towards a Socio-Cultural History of Mathematics. *For the Learning of* Mathematics,Vol. 17, 1, pp. 26-33.

RADFORD, L; FURINGHETTI, F. & KATZ, V. (2007). The topos of meaning or the encounter between past and present. *Educational Studies Mathematics*, Vol. 66, pp.107–110.

VAUBAN, S. Le P. de (1792). *The new method of fortification, as practised* by Monsieur de Vauban, Engineer-General of France. 6a Edition. London: C. Hitch and L. Hawes. (Original em francês publicado em 1681).

WILLINGHAM, T. (2007). Teaching Art Appreciation: How Art Can Teach History, Math , Science Dec 19, 2007 (http://artseducation.suite101.com/article.cfm/art_appreciation) Consultado em 6/3/2010.