

# Dermeval Saviani's thought and education in science museums<sup>I</sup>

Rafael Cava Mori<sup>II</sup>

Antonio Aprigio da Silva Curvelo<sup>III</sup>

## Abstract

This work aims to conduct a dialogue between the thoughts of Brazilian philosopher and educator Dermeval Saviani and studies about education in science museums and centers. Firstly, we investigate the historical development of these institutions, and then analyze mentions to non-school forms of education in Saviani's works. Based on the writings of this Brazilian educator, and considering the different meanings that the literature assigns to informal education and non-formal education, we propose to situate education modalities between the systematized/unsystematic and school/non-school categories. Thus, by understanding museum education as a modality of non-school education that is becoming systematized, and the specificity of museums concerning the concepts of knowledge and culture, we comment on some possibilities for these institutions to collaborate in making knowledge democratic, thus complementing and valuing school science education. In line with Saviani's critical position, we consider that, as science museums and centers establish education actions, they could contribute to improve the quality of science teaching by establishing a communicative relationship between museum knowledge and school knowledge. Thus, the specificity of the museum institution as the guardian of human heritage is not dissolved, nor is the specificity of school as the transmitter of culture to new generations.

## Keywords

Dermeval Saviani – Education in museums – Historical-critical pedagogy – Science education.

**I-** We thank Capes for funding this study.

**II-** Centro de Ciências Naturais e Humanas, Universidade Federal do ABC, Santo André, SP, Brasil.

Contact: rafael.mori@ufabc.edu.br

**III-** Universidade de São Paulo, São Carlos, SP, Brasil.

Contact: aprigio@iqsc.usp.br

# ***O pensamento de Dermeval Saviani e a educação em museus de ciências<sup>I</sup>***

Rafael Cava Mori<sup>II</sup>

Antonio Aprigio da Silva Curvelo<sup>III</sup>

## **Resumo**

*Este trabalho procura realizar um diálogo entre o pensamento do filósofo e educador brasileiro Dermeval Saviani e os estudos sobre a educação em museus e centros de ciências. Primeiramente, investigamos o desenvolvimento histórico dessas instituições para, em seguida, analisarmos, nas obras de Saviani, menções às formas não escolares de educação. A partir dos textos do educador brasileiro, e considerando os diferentes sentidos que a literatura confere às expressões educação informal e educação não formal, propõe-se que as modalidades de educação sejam situadas entre as categorias sistematizada/assistemática e escolar/não escolar. Assim, compreendendo-se a educação museal como uma modalidade de educação não escolar que vem se sistematizando, e a especificidade dos museus frente aos conceitos de conhecimento e cultura, são comentadas algumas possibilidades para que tais instituições colaborem para a democratização do saber, complementando e valorizando a educação científica escolar. Em acordo com a concepção crítica de Saviani, considera-se que os museus e centros de ciências, no estabelecimento de ações educativas, possam contribuir para a elevação da qualidade do ensino de ciências, estabelecendo uma relação comunicativa entre os saberes museais e os saberes escolares. Dessa maneira, não se dissolvem nem a especificidade da instituição museal enquanto guardião do patrimônio da humanidade, nem a especificidade da escola enquanto transmissora da cultura para as novas gerações.*

## **Palavras-chave**

*Dermeval Saviani – Educação em museus – Pedagogia histórico-crítica – Educação em ciências.*

**I-** Agradecemos à Capes pelo financiamento.

**II-** Centro de Ciências Naturais e Humanas, Universidade Federal do ABC, Santo André, SP, Brasil.

Contato: rafael.mori@ufabc.edu.br

**III-** Universidade de São Paulo, São Carlos, SP, Brasil.

Contato: aprigio@iqsc.usp.br

## Introduction

We had initially considered titling this article “Historical-Critical Pedagogy and Education in Science Museums”. Indeed, it is impossible to dissociate the name of the Brazilian philosopher and educator Dermeval Saviani (born in 1943) from the pedagogical tendency he began to create in 1979 – a tendency, moreover, founded on historical and dialectical materialism and considered by Saviani himself as a Marxist-inspired socialist pedagogy.

As we progressed in our studies, however, it became clear how unsuitable the first title was to this work. After all, the set of Saviani’s writings – and those of other authors who have been collaborating to the continuous development of historical-critical pedagogy – shows beyond doubt that his concern is chiefly directed toward education in its *school* form; education in museums is not, at any point of his works, an object of consideration.

To us, therefore, treating the historical-critical pedagogy *itself* and its contributions to the analysis of the museum education phenomenon here did not feel as suitable as treating Dermeval Saviani’s *thoughts* about aspects that could concur to an understanding of the educative processes held at, or triggered by, science museums and centers.

As we will see, although the texts more associated with the presentation of historical-critical pedagogy (particularly his book *Pedagogia Histórico-Crítica: primeiras aproximações* [TN: *Historical-Critical Pedagogy: First Approximations*]) actually contain relevant elements for discussing education in museums, they are also insufficient to achieve that goal. We will have to analyze other texts by Saviani, assuming that the set of his publications constitutes a solid, consistent whole, yet addressing quite diverse aspects of the educative process.

First, it will be necessary to present, in a historical perspective, what one can understand

by “museums”. The term currently encompasses a wide range of institutions; only based on a historical viewpoint can we distinguish its specificity regarding the concepts of knowledge and culture, which are also key to school education.

## Historical development of science museums and centers

We warn the reader that, although the discussion we conduct is, from now on, focused on science museums and centers, the events described here have counterparts in institutions dedicated to other interests, such as the Arts and history, and the focus we chose will not preclude the historical characterization of museums in general.

Gaspar (1993) reminds us that the habit of collecting objects dates back to prehistory, having survived also in Greek-Roman societies. Aristotle is known as one of the greatest names in Western philosophy, but many forget his importance in the field of what we now call the natural sciences, and some of the earliest taxonomies of living beings, produced by him, might not have been possible without the formation of his collections of specimens. It was probably from such private, research-oriented repositories that came the first institutions dedicated to sharing those collections with the public in general in the following centuries.

Also in the Hellenistic culture lies the origin of the term “museum”: a temple or sanctuary for the muses, a place for inspiration, meditation, erudition. The *Mouseion* in Alexandria (3rd century BC), perhaps the first institution to receive that designation, was, still according to Gaspar’s work, a teaching and research entity, similar to current universities.

Therefore, as we can see, the main purpose of museums since their origins has been to produce knowledge. The preservation – and, later, the exhibition – of natural or artificial artifacts was predominantly carried out for the sake of investigative endeavors.

Over time, the formation of collections in museums, once a mean, became itself an end. This process began in the Middle Ages, with the constitution of personal collections of riches by the nobility, and lasted until the Renaissance, when the cultural vibrancy of the period raised private collections to the condition of objects for esthetic appreciation. More than that: displaying riches and art works became a sign of mastering the erudite culture, which contributed to collections' quick publicizing. The *exhibition object* is created. According to Gaspar, the word "museum" is rediscovered to designate the places where collections are exhibited, an allusion to the literary, reflexive environment of the Hellenistic museum.

Another historiography of science museums and centers would note that, in different periods, these institutions also developed peculiar characteristics, and one could speak of successive "generations" of museums, which is how McManus (1992) treats the question.

Thus, a *first generation* would have started with the so-called "cabinets of curiosities" – the same nobility collections we mentioned earlier. From mere storerooms and stockpiles of objects, the cabinets progressively adopted organization criteria: paintings were separated from stuffed animals; the latter were sorted according to size and, later, according to the knowledge of Systematics and Taxonomy. But it is the heterogeneity of their objects what best characterizes these collections, typical of the 17th century, making the word "museum" – already used to refer to them – a possible synonym for "storeroom", as we already mentioned, or even "sanctuary". It was not until the following century that these collections, now more organized, become identified with repositories for scientific investigation, thus recovering the traditional meaning of the word "museum". Natural history museums appear, and public visitation, previously undesired, progressively imposes itself as a necessity. By the 19th century, the natural history museum

is already an essential institution for scientific investigations. The Enlightenment resumes the Renaissance appreciation for science, and throughout Europe, collections of natural objects proliferate, whether of biological or geological origin, organized in order to facilitate research.

The *second generation* of museums, which starts in the 19th century, reflects the enthusiasm with the progresses of Industrial Revolution. As true "showcases of advances", these spaces sought to portray and exhibit objects associated with the vanguard of science and technology of the time. A discontinuation can be seen between this period and that of the first generation: the museum is now a place open to visitation, and the objects displayed are understood as serving not only the work of science specialists, but also the education of the public. According to Valente and Marandino (2003), these museums would eventually meet the growing need to inform the population about the emerging concepts of science of the time – e.g., evolutionism – while contributing to lessen the isolation of the scientific community from society as a whole. Cazelli, Marandino and Studart (2003) note that this is the point when the question of scientific education is acknowledged as belonging not only to the school environment, but to wider spheres, and this contributed to a new responsibility for museum. Thus, if the first museums were organized on behalf of research, the need for specialized labs eventually weakened that goal, and museum's main function was eventually dislocated toward the educational field.

This is when the first interactive museums appear, i.e., the ones that foresaw the possibility of visitors touching or handling the displayed objects. This is the marking feature of *third generation* museums. The trend towards interaction took firm hold in the mid-20th century, along with the pedagogical movement that would result in progressive education. If the traditional pedagogy was being questioned in the educational sphere for its emphasis on

teacher and teaching, with the proposition of student and learning as central, the philosophy that guided exhibitions also sought to reduce the emphasis on the object, making the visitor a “protagonist”. A greater presence of displays and exhibitions based on push-button devices makes this generation a radicalization of the previous, according to Gaspar (2006). But that is not the only distinctive feature of the new museums. Along with interactivity, a certain desacralization of collection objects was promoted, according to Ruiz (2003), also cited by Gaspar. The exhibition object is no longer a value in itself: it serves an *idea*. Valente and Marandino’s (2003) presentation of Lourenço’s (2000) findings mentions the different categories of exhibition objects: pedagogic objects, built to teach concepts; and objects to popularize science, which seek to present science to wide audiences. In the third generation, the latter is the privileged category in the creation of exhibitions.

McManus’ typology does not delimit a linear pattern for the succession of science museums from the 16th to the 20th century; on the contrary, it understands that no generation has gone unrepresented in the new institutions throughout this history, and today, the same museum can show features of all three generations. Nevertheless, it is noteworthy that the historical trajectory presented in this section is merely schematic and ignores the complexity of the several museum institutions that have appeared since classical antiquity until today. What is essential to be learned about the historical development of science museums and centers is that, over the centuries, these institutions have incorporated as their social role not only research, but *education* – at an early moment – followed by the *communication* of knowledge to wide audiences.

### **A first approximation: Saviani’s statements about “non-school” education**

As we affirmed earlier, the pedagogy proposed by Saviani takes school education

as its main concern. School’s specificity lies in the transmission of knowledge to the new generations so they can appropriate the historical achievements of the human being, and the educative work is understood as “the act of directly and intentionally producing in each singular individual the humanity that is historically and collectively produced by all men and women” (SAVIANI, 2008, p. 7).

If we wish to access Saviani’s thoughts about education in other spaces than school, we must go through his considerations about school education itself. In his article “A pedagogia histórico-crítica e a educação escolar” [TN: *Historical-Critical Pedagogy and the School Education.*] (SAVIANI, 2008) Saviani warns:

[...] in today’s society, one can realize that it is no longer possible to understand education without the school, because the school is the dominant, main form of education. Therefore, in order to understand the different modalities of education, it is necessary to understand the school. On the other hand, the school can be understood regardless of the other modalities of education. (SAVIANI, 2008, p. 102-103).

Aware of this indication, we analyzed Dermeval Saviani’s works for statements about non-school forms of education – which include education in museums. Therefore, we structured this investigation as a *bibliographic* study with the following stages (GIL, 1999):

*exploratory reading*: we read Dermeval Saviani’s works, noting that his main theses were registered in books (e.g., works that compiled his scientific works that impacted most in the academic and educational environments);

*selective reading*: once the exploratory stage was finished, we were able to see that Saviani’s works are structured, generally speaking, in two subdivisions. The first comprehends books dedicated to a historiography of Brazilian pedagogical practices and ideas, or

to commenting important moments of national education (e.g., *A nova lei da educação: trajetória, limites e perspectivas* and *História das ideias pedagógicas no Brasil* [TN: *The New Education Act: Trajectory, Limits and Perspectives* and *History of Pedagogical Ideas in Brazil*, respectively.]). The second gathers his writings about philosophy of education, such as *Escola e democracia* and *Pedagogia histórico-crítica: primeiras aproximações* [TN: *School and Democracy* and *Historical-Critical Pedagogy: First Approximations*, respectively.]. This subdivision was where we found the author's main references to non-school education modalities and it thus formed our *corpus*;

*analytical reading*: by listing the bibliographic sources, we found that it was possible to arrange Saviani's thoughts regarding non-school forms of education by basing ourselves on his works *Educação: do senso comum à consciência filosófica*, *Pedagogia histórico-crítica: primeiras aproximações*, and *Educação brasileira: estrutura e sistema* [TN: *Education: From Common Sense to Philosophical Consciousness*, *Historical-Critical Pedagogy: First Approximations*, and *Brazilian Education: Structure and System*, respectively.], including some small contributions spread in other writings, as we will see.

Starting with the book *Educação: do senso comum à consciência filosófica* (SAVIANI, 2009, p. 60), first published in 1980, Saviani talks about the presence of a "diffuse, undifferentiated education in all sectors of society":

[...] people communicate with each other in view of other goals than educating, and yet they educate and are educated. In such cases we have an unsystematic education [...]; an educational activity occurs, although on the level of unreflected consciousness, therefore, unintentional, i.e., concomitantly with another activity, which is the one that is intentionally conducted. When educating becomes the explicit object of attention, and an

intentional educative action is developed, then we have systematized education. (SAVIANI, 2009, p. 60).

In a later chapter, three forms of education developed in contemporary society are distinguished: school education, diffuse education, and popular education:

School education corresponds to erudite culture. It is governed by erudite standards, its purpose being to form the "learned" man in the erudite sense of the word, and its content and form are erudite; in sum, it is the main mean to disseminate the "erudite culture". That which we call, for want of a more suitable term, "diffuse education" corresponds to "mass culture". It participates in practically every characteristic of that "culture" to the point that we cannot even identify one with the other. Its main diffusion instrument is the mass media. Finally, popular education corresponds to "popular culture". (SAVIANI, 2009, p. 101).

However, Saviani makes one important reservation to establishing this parallelism between education and culture:

Indeed, it could only be fully valid on the level of unsystematic education; but at that level, education and culture identify with each other. In the sphere of systematized education [...] the situation is more complex, mediations multiply, the different "cultures" intersect. Indeed, systematized education is normally an activity directed toward the other: another generation, another social class, another culture. Therefore, it assumes an actual heterogeneity and a possible homogeneity; an inequality where it starts and an equality where it ends. (SAVIANI, 2009, p. 101.).

We will find other mentions to these other modalities of education in *Pedagogia Histórico-*

*Crítica: primeiras aproximações* (SAVIANI, 2008), specifically in the text we mentioned a little earlier, i.e., “A pedagogia histórico-crítica e a educação escolar”. After describing the emergence of different educational conceptions over history, until the point where he designs his own pedagogy, Saviani presents the following paradox of the present: on the one hand, school education is required to expand, both in terms of years spent in school and students’ daily school hours; on the other hand, the non-exclusivity of the school as the institution responsible for educating is defended. These two claims collide as the result of a more fundamental contradiction, one inherent to the capitalist mode of production – where the ever greater development of productive forces, aimed at the private accumulation of capital, eventually requires the very socialization of means of production and, therefore, of knowledge. The author adds:

[...] it is said that not only through the school can one be educated; one can be educated through multiple forms, through other institutions, such as parties, unions, local resident associations, religious associations, informal relationships, coexistence, the mass media [...]. Therefore, there are multiple forms of education, among which the school is situated. According to this tendency, the school is not the only, nor even the main form of educating; some even consider school a negative thing from an educational point of view, the main of whom was Ivan Illich. (SAVIANI, 2008, p. 97).

And based on this consideration, Saviani stresses the current subordination of all modalities of education to school education itself:

School education is always education; the other modalities are always negatively defined. We refer to them using denominations such as non-school, non-formal, informal, extra-school education.

Therefore, the analysis reference, i.e., the parameter for considering other modalities of education is school education itself. (SAVIANI, 2008, p. 98).

Another passage where Saviani refers to non-school modalities of education can be found in the conference he gave during the *Simpósio de Marília*. To the following question from the audience,

Professor, how can informal education contribute to the cultural improvement of the masses, particularly those who are marginalized from the process of material production, and stream into large cities, occupying outskirts that cannot provide minimum living conditions? (SAVIANI, 1994, p. 274),

Saviani – who, besides informal education, refers to other terms such as extra-school, non-school, unsystematic, non-formal, non-institutionalized education – answers:

[the] informal education is a manifestation of the educative phenomenon that, despite having been supplanted by formal education, has not disappeared. It is present in our context, and, therefore, it can be activated, it can be used as an instrument for the wider purposes of education. But I believe this will occur in articulation with the school and, normally, in a way subordinated to the school, to the point that if both modalities should ever conflict each other, then we must decide for the main one. (SAVIANI, 1994. p. 286).

Finally, we can find more comments about this subject in *Educação em diálogo* (SAVIANI, 2011), a book of collected interviews with Saviani to various publications – more specifically, in the chapter titled “A educação fora da escola” [TN: *Education Out of*

School.], which virtually repeats the author's considerations presented above.

In sum, Saviani exalts, in several points of his works, the importance of school education in contemporary society, although he recognizes the role of other institutions than the school in the process of human education.

Apart from the distinction between school education and non-school education, the fragments above mention two other terms: systematized education and unsystematic education. Before we proceed to the next section, it is worth examining what the father of historical-critical pedagogy understands by these concepts.

Saviani's first book, *Educação brasileira: estrutura e sistema* (SAVIANI, 1975) contains a study about the meaning of the word system in the educational sphere. First, he distinguishes it from the word structure, since in the history of Brazilian educational legislation, both appear several times as either synonyms or wrapped in serious terminological imprecisions:

Structure implies [...] reality's very texture; it indicates the way things intertwine regardless of man and, sometimes, involving man (as in the case of social, political, economic, educational structures, etc.). System, in turn, implies some order that man imposes onto reality. Now, this should be clear: these concepts are not about creating reality. Man suffers the action of structures but, as he grows conscious of that action, he can manipulate its force, acting over the structure to attribute a sense to it. (SAVIANI, 1975, p. 76).

In a text of the same period (1974) titled "Estruturalismo e educação brasileira" [TN: *Structuralism and Brazilian Education.*], included in *Educação: do senso comum à consciência filosófica* (SAVIANI, 2009, p. 141-154), Saviani devotes a large space to the question, starting with an etymological study of the word structure, to reach the

following results: first, structure is formed by two levels, *infrastructure* ("concrete reality in its most proper, immediate sense") (SAVIANI, 2009, p. 149) and *superstructure* ("schemes built by people as required by the process of producing their existence", constituting "objective products", and "being characterized as components of culture") (SAVIANI, 2009, p. 149); both levels share a common attribute, which is *unintentionality*, as they are not intentionally or deliberately produced; structure presents itself as a concept opposed, in this respect, to the concept of system, because the latter implies intentional action; and, finally, as a result, a system implies a praxis, taken as a unity between theory and practice. Thus,

"System" is an objective organization that is the result of the systematizing activity aimed at the achievement of common goals. It is, therefore, a product of common, intentional praxis. [...] It is man who makes the system as he incorporates some theory into his praxis. And educators make the educational system as they incorporate their theory into their educative praxis [...] (SAVIANI, 2009, p. 149).

This reasoning is complemented with the following play with words:

[...] while the structure presents itself as a "system" that man did not make (or did so without knowing it), the system can be compared with the "structure" that man makes and knows he makes it. Note that, in the second case, the verb was used in the present, and not by chance; it is necessary to act in a systematized way in the educational system; otherwise, it will tend to move away from human objects, being thus characterized specifically as a structure (the common, unintentional result of intentional individual praxis). (SAVIANI, 2009, p. 150).



Back to *Educação brasileira: estrutura e sistema*, Saviani paraphrases Jean-Paul Sartre, explaining: “what one has made of man is structures; what he makes (of what one has made of him) is the system” (SAVIANI, 1975, p. 77). In the same book, we also find the following definition: “a system is the unity of various elements intentionally gathered to form a coherent, operating set” (SAVIANI, 1975, p. 75). A little earlier, Saviani clarifies:

Because it presupposes reflected consciousness, the act of systematizing is an intentional act. This means that, while performing it, man bears in mind a goal that gives it a sense: in other words, it is an act that materializes a previous project. This intentional character is not enough, however, to define systematization. Systematization also implies a multiplicity of elements that have to be arranged, unified [...]. Therefore, systematizing is intentionally giving unity to multiplicity. And the outcome of this is called a system. Thus, it is produced by man, from elements that are not produced by him, but offered to him in his existential situation. And because these elements, in the process of being gathered, do not lose their specificity, what guarantees unity is the coherence relationship that is established between them. (SAVIANI, 1975, p. 72).

If the system encompasses the categories of intentionality, unity, variety, internal coherence, and external coherence (SAVIANI, 1975, p. 72), then what would *educating in a systematized way* be? To Saviani, man is capable of that when he (SAVIANI, 1975, p. 78):

- a) becomes conscious of the situation (educational structure);
- b) captures its problems;
- c) reflects about them;
- d) formulates them in terms of feasible goals;

e) organizes means to achieve these goals;

f) begins a concrete process to make them real; and

g) keeps a continuous dialectical movement of action-reflection-action.

Therefore, systematized education refers to the intentional praxis that fulfills the requirements above; whereas unsystematic education, in contrast, is unable to fulfill them.

### **Formal, non-formal or informal education**

Although Saviani refers to terms such as non-formal education and informal education among others as part of a single category – non-school education – without caring to distinguish them, the literature about science museums and centers has been debating the pertinence and applicability of such expressions. It is worth learning about these debates before we proceed to establish the dialogue between Saviani’s thinking and education in museums.

Marandino and collaborators (2003), in a review of these works and in a study with professionals connected to projects for diffusion of science, reached the following conclusions: both in the literature and in these professionals’ writings, there is some terminological confusion, to the point of calling non-formal education even popular education initiatives; in English language, all forms of non-school education are usually treated simply as informal education; in Portuguese, particularly in the production of Brazilian authors, non-school education modalities are normally divided in informal education (occurring incidentally from people’s coexistence or from their exposure to certain media) and non-formal education (e.g., that which arises from a visit to a museum).

Jacobucci (2008) suggests the following reasoning: when we are dealing with a formal space, then we are talking about a school space where school education is practiced; likewise, a non-formal space corresponds to a non-school

space. This can be either institutional (as in the case of science museums and centers) or non-institutional (such as streets, squares, beaches, etc.). In sum,

[...] one can say that formal spaces of education refer to educational institutions, whereas non-formal spaces are related with institutions whose basic function is not formal education, and with non-institutionalized places. (JACOBUCCI, 2008, p. 57).

Gaspar (1993) also uses parallels to address the terminological question. By adopting the theoretical framework of Vygotsky's psychology, and based on *Michlenie i retch* – the latest Brazilian translation of which is titled *A construção do pensamento e da linguagem* [TN: *The Construction of Thought and Language*.] (VIGOTSKI, 2001) –, the author thus considers the question: like the Russian psychologist distinguishes scientific concepts from spontaneous concepts, we can determine the most suitable places for the learning of each type of concept. If it is a task of the school – and the school alone – to promote scientific concepts, then science museums and centers would be content to at least further their public in the path from spontaneous concepts to pseudo-concepts, to true concepts. Therefore, if it is a task of formal education to teach properly scientific concepts, it is a task of informal education to, at best, contribute to that end. Thus, Gaspar ends up being one of the only Brazilian authors who do not use the term non-formal education to deal with science museums and centers.

Dib's (1988) article, in turn, distinguishes formal education, non-formal education and informal education, based on a directivist criterion for educative activities. More teacher-centered activities would be the main characteristic of formal education. Education through distance learning courses with a curriculum, certification, and assessments

would correspond to the non-formal type. Finally, informal education would be marked by the student's total freedom to regulate his learning – as in the visits to science museums and centers. Thus, a continuum would exist between the three forms of education: from formal to non-formal, to informal education, learning becomes less rigid and less teacher-centered, with a gradual fading of characteristics such as the need for a specific learning space, the student's presence as a requirement, evaluations, and even the curriculum.

The existence of this continuum from formal to informal education is virtually taken as undisputed among Brazilian researchers. Following the orientation of the research group headed by Martha Marandino at the Faculdade de Educação in the Universidade de São Paulo (Grupo de Estudo e Pesquisa em Educação Não Formal e Divulgação em Ciências), most Brazilian publications consider science museums and centers as non-formal spaces, unlike the views of Gaspar and Dib. Stressing the complexity of the subject, Marandino (2008, p. 15) notes that:

[...] a museum, for example, could be called a non-formal education space when we think of it as an institution, a project structured in a particular way with a certain programmatic content. However, if we see it from the public's perspective, we might consider it as formal education, when students visit it with some activity fully structured by their school, in order to deepen a certain conceptual topic [...]. And, still from the public's perspective, we can figure it as informal education, if we imagine a visitor looking for a museum for entertainment on a weekend with friends or family.

We do not seem to have advanced much toward understanding terminology better in the course of this section. After all, what would define the educative processes provided by

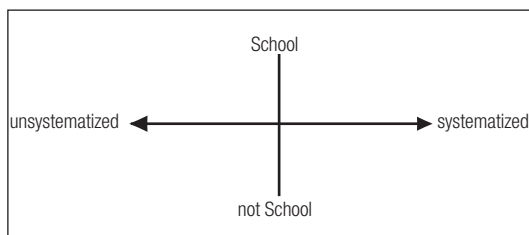
science museums and centers? Could we affirm they are characterized as a modality of non-formal education, even though we know that these institutions, like the school, are usually connected to the state, or at least emerge in response to interests as public and formal as the ones addressed by the school? Or should we consider science museums and centers the place *par excellence* of informal education – a term with a somewhat negative connotation, alluding to that which is hidden, stealthy, clandestine?

Let us see how we can treat this difficulty in the next section.

### **Systematized/unsystematic education versus school/non-school education**

Based on Saviani’s writings, we believe that the forms of education can be defined in terms of their degree of systematicity, in the continuum between systematic and unsystematic forms, and whether they are school or non-school forms, which we consider as discrete, non-continuous qualities. Thus, we would have the diagram shown in Figure 1.

**Figure 1-** Diagram of education modalities between school/non-school and unsystematic/systematized dimensions.



Source: Reseach data.

Therefore, there would be four modalities of education: unsystematic school education; systematized school education; unsystematic non-school education; and systematized non-school education.

Systematized school education is the institutional, official, formalized modality of

school education; it is, in fact, its very essence. The literature defines it as formal education, although we have shown the imprecision of this term.

That main form of school education coexists with another form inherent to it: unsystematic school education. Among curriculum studies researchers, this form is usually defined as a hidden curriculum: learnings that occur “on the back” of the teacher’s intentional educative work. It could be considered an informal school education of sorts. Students experience it during their conversations; when they visit the school library for readings unrelated to classroom topics; when they take teachers or other professionals in the school environment as a role model of behavior; when they organize in collectives to voice demands or with political purposes, among others.

Unsystematic non-school education is analogous to that form. It would be implied in similar activities to the ones described above, only in a different context. Thus, this form would encompass the learnings that occur in traditional spaces of coexistence (the home, the street, the square, etc.), in civil associations, in the contact with cultural artifacts and products – in sum, a similar modality to what is traditionally known as informal education.

Finally, systematized non-school education would be the one performed by several institutions, entities and companies that offer optional attendance courses, yet with a similar organization to that of the school. By this we mean schools of football, martial arts, music, languages, etc., certain vocational education courses with various lengths, the old correspondence courses, and the current distance e-learning courses. Therefore, it is identified with the forms listed by Dib as he refers to non-formal education.

So far, the question remains unanswered: what about science museums and centers? How to understand them based on school/non-school and systematized/unsystematic education forms?

Let us resume the contents exposed in the previous sections.

Museums appear in Antiquity as places devoted to inspiration, culture, and intellectual/creative work, being thus identified with institutions dedicated to the *production* of knowledge. Many centuries later, with the advent of Renaissance, they reappear, giving a new shape to a prehistorical habit of humanity – collecting objects –, with contemplative or esthetic purposes, yet serving also investigative endeavors. After 18th century's Enlightenment, and founded on the cult of reason that amounted to the Industrial Revolution, museums were modernized and gradually assumed a new purpose: the *transmission* of knowledge. From then on, they begun to be considered as places for instruction that operate in parallel with the school, hence being defined as promoters of informal or non-formal education. In the 20th century, it became accepted that the old notion of museum as a place for keeping or preserving a particular historical legacy was no longer enough to encompass the diversity of approaches and goals that emerged in the new spaces. Thus, in the sphere of sciences, the designation science center appears. The background of the multidisciplinary teams who organize these centers – scientists from specific areas, museologists, educators, communicators, architects, designers – make it impossible to restrict their activities to teaching and research. Now, it is necessary to consider them as *communicators* of knowledge, in an effort to disseminate the advances of scientific research to ever-larger audiences.

In this historical trajectory, the investigative role of science museums and centers now shares space with their educative and communicative roles. With the increasing specialization of sciences, the need for specialized equipment and specifically trained teams in each knowledge branch has led museums to lose their primacy as knowledge-producing institutions to university labs and research centers. The multiplication of knowledge branches that came

with the creation of new sciences directed the focus of scientific teams toward new objects of study, many of which are of no interest to, or do not fit in, museum institutions. Today, a very impressive scene unfolds before us where whole areas of research are devoted to the study of virtual objects by means of computer simulations, or even to the very creation of their objects of investigation.

On the other hand, the educative, knowledge-transmitting role of museums has never been so valued. Museums are understood to have a major responsibility as educational institutions, since it rests on them to provide much of the learning that individuals cannot find in their (short) school life. It seems a little controversial that science museums and centers should act complementarily to in-school scientific education. Some voices, however, advocate that so-called non-formal spaces should gradually take up a protagonist role in scientific education.

In response to that demand, we have seen science museums and centers increasingly devoting themselves to their educative role: more, better training is provided to guides/mediators, pedagogues become an indispensable part of their staff, visit programs are designed to cater for the school population, courses are offered to public system teachers, and even part of the early training of these teachers is now occurring in such spaces.

The institutions that cater to these demands, according to the terminology we have just proposed, are promoting a *non-school education* that is becoming increasingly *systematized*. In other words, the place of science museums and centers in the diagram in Figure 1 is both quadrants bellow the horizontal axis, with an actual tendency to occupy the right-side quadrant – a tendency, it is worth mentioning, originated with the second generation of museums.

Consistently with its historical formation process, the school is an institution that transmits knowledge to the new generations so that

human culture can both survive the passing of time and continue to guide the practical action of individuals in the world. In other words, the school *reproduces knowledge in order to preserve culture*. In these same terms, we have seen a complete reconfiguration of the purposes of museums also over the course of their historical formation. In the first generation of museums, according to McManus' typology, the "motto" of these institutions would be: *to preserve culture in order to produce knowledge*. In turn, the motto we could attribute to the following generation would be: *to preserve culture in order to reproduce knowledge* – therefore a reverse action in relation to schools. In the third generation, we can see a pursuit by museums to appropriate the school's motto: *to reproduce knowledge in order to preserve culture*.

This motto coexists with another one: *to communicate knowledge in order to (re)produce it*. Let us analyze the two senses synthesized in this same aphorism, as both will provide us four justifications for such communicative role. Communicating scientific knowledge is necessary to reproduce it in the sense that the science museum or center can contribute to school learning: 1) whether by serving as motivator to students; 2) or when it facilitates students' contacts with the applications and artifacts of material culture associated to scientific knowledge. And communicating this knowledge is necessary to produce it: 3) first, because there is a dialectical relationship between scientific knowledge and popular culture, which makes it necessary for science to communicate – i.e., to establish a bidirectional relationship of dialogue and reciprocity – with the knowledge of a larger public, so that science can even nourish itself from that still non-systematized knowledge, causing it to rise – by systematizing it – to the level of erudite culture; and 4) because science museums and centers can foment the interest of their audience to move toward scientific careers, thus contributing to minimize labor shortage in sciences.

In these terms, it is easy to define science museums and centers as entities similar to universities, or at least to the concept of university we have in Brazil, if we consider that today's museums, even third-generation ones, still keep characteristics of the previous generations. Just like higher education institutions abide by the constitutional principle of inseparability between teaching, research and extension, the so-called non-formal spaces too have acquired such missions over their historical formation: first research (*to preserve culture in order to produce knowledge*), then teaching (*to preserve culture in order to reproduce knowledge*), and, finally, extension (*to communicate knowledge in order to (re) produce it*).

**Conclusion:** is an education in museums according to historical-critical pedagogy possible?

In the course of this article, we could see that Dermeval Saviani's production hardly ever analyzes non-school education modalities. His writings dissert almost exclusively about only one of the quadrants in Figure 1, i.e., systematized school education. In order to guide educators' work in terms of providing education for marginalized sectors of the population, Saviani proposed the foundations of historical-critical pedagogy. It is a pedagogy that recognizes the reciprocal dependence between society and education, treating the latter as a mediating practice within the wider social practice (SAVIANI, 1993). Education is thus understood as a necessary – although insufficient – condition to transform the capitalist production relations, which alienate the poorer sectors from the higher products of material and non-material culture. Therefore, historical-critical pedagogy recognizes the class struggle (SAVIANI; DUARTE, 2012), standing on the proletariat's side, which it views as the population's sector whose aspirations

are set towards the movement of history, in contrast with the bourgeoisie, which opposes the movement of history in the pursuit of perpetuating its class privileges.

According to Saviani's thinking, the school is the knowledge-socializing institution *par excellence*, although non-school spaces, including museums, can also be a place of educative processes. However, we have been watching a process of making the school secondary to other institutions, with the depreciation of school knowledge. We are talking about the post-modern conceptions that find their expression in so-called "*learning to learn*" pedagogies, in the words of Newton Duarte – currently the main figure of historical-critical pedagogy after Saviani. To Duarte (2006), these pedagogies, the most hegemonic representative of which in the current educational scenario is constructivism, promote a questioning of school contents for the sake of a relativism that suits the neoliberal thinking, thus contributing to continue oppressing the classes least favored by the capital-accumulating class.

Although we cannot talk about a museum education guided by historical critical pedagogy, we can propose that educative processes occurring at, or started by, museums be arranged pursuant the theses of Saviani's theory. As we saw earlier, the educative role of museums lies in their specificity as guardians of the material and immaterial heritage of humanity – hence the motto *to preserve culture in order to reproduce knowledge*. After all, in professor Ulpiano Meneses' words in an interview to *Jornal da USP* in August 2012, museums are "spaces of resistance" that oppose the (typically post-modern) process of "dematerialization of society", which can be understood in a wider way as a de-referentialization, i.e., a loss of references, whether material or immaterial, about "principles, rules, values, practices, realities" (SANTOS, 1986, p. 18). Therefore, today's demands for museums to progressively assume the role of schools in providing elaborate knowledge to individuals, thus appropriating

the school's motto, *reproducing knowledge to preserve culture*, should not be encouraged, as this would further contribute to devalue the teaching profession and the school institution, while dissolving the specificity of museum education.

However, according to the view that we developed here – which sees museums as microcosms of the university, by housing teaching, research, and extension activities –, the proposals of scientific knowledge dissemination to wider audiences also have an educational component. By this we mean activities that are similar to university extension, represented by the motto *to communicate knowledge in order to (re)produce it*. Again, we can resort to Saviani's works for an understanding of this aspect, more specifically his article "Extensão universitária: uma abordagem não extensionista" [TN: *University Extension: a Non-Extensionist Approach*.], published in the collected writings *Ensino público e algumas falas sobre universidade* [TN: *Public Education and a Few Speeches about University*.] (SAVIANI, 1984). In this paper, the founder of historical-critical pedagogy defines university extension as a bidirectional relationship that allows common sense knowledge to gain systematicity by being put in touch with academic knowledge. By establishing that communication, both the museum and the society can benefit.

One example of this type of relationship can be found in the educative actions of science museums and centers – an element still barely investigated by extant research on education in museums, while studies focus rather on museum exhibitions. Understanding these educative actions – for example, supplying didactical collections or material for use in school environment – not as mere assistentialism, but as a communicative relationship between elementary teachers' experiential knowledge and the academic knowledge developed in the museum, promising perspectives open up both to knowledge and to the transformation of school reality: because the continuous improvement of these didactical

materials by the museum team provide a materialization of teachers' praxis; and because the school can take advantage of the resistance the museum offers to the dematerialization or de-referentialization of society.

Therefore, resuming Saviani's speech at the Simpósio de Marília, the struggle for knowledge democratization, although pervading the intransigent defense of school education, needs not (nor should it) give up the defense

and collaboration from other modalities of the educational phenomenon. In this perspective, the education in museums has great possibilities of articulation with school education, to which it should subordinate if it is to establish a critical, transforming process. This does not mean that museums should nullify themselves; their educative role is secured anyway, as long as there are institutions responsible for preserving the heritage of humanity.

## References

- CAZELLI, Sibebe; MARANDINO, Martha; STUDART, Denise Coelho. Educação e comunicação em museus de ciências: aspectos históricos, pesquisa e prática. In: GOUVÊA, Guaracira; MARANDINO, Martha; LEAL, Maria Cristina (Org.). **Educação e museu: a construção social do caráter educativo dos museus de ciências**. Rio de Janeiro: Access/Faperj, 2003. p. 83-106.
- DIB, Claudio Zaki. Formal, non formal and informal education: concepts/applicability. **American Institute of Physics Conference Proceedings**, New York, v. 173, p. 300-315, 1988.
- DUARTE, Newton. **Vigotski e o "aprender a aprender"**: crítica às apropriações neoliberais e pós-modernas da teoria vigotskiana. Campinas: Autores Associados, 2006.
- GASPAR, Alberto. **Museus e centros de ciências**: conceituação e proposta de um referencial teórico. 1993. 173 f. Tese (Doutorado em Educação) - Faculdade de Educação da Universidade de São Paulo, São Paulo, 1993.
- GASPAR, Alberto. **A teoria de Vigotski**: um novo e fértil referencial para o ensino das ciências. 2006. 192 f. Tese (Livre docência) - Faculdade de Engenharia da Universidade Estadual Paulista Julio de Mesquita Filho (UNESP), Guaratinguetá, 2006.
- GIL, Antonio Carlos. **Métodos e técnicas de pesquisa social**. São Paulo: Atlas, 1999.
- JACOBUCCI, Daniela Franco Carvalho. Contribuições dos espaços não-formais de educação para a formação da cultura científica. **Em Extensão**, Uberlândia, v. 17, p. 55-66, 2008.
- MARANDINO, Martha (Org.). **Educação em museus: a mediação em foco**. São Paulo: Geenf/FEUSP, 2008.
- MARANDINO, Martha et al. A educação não formal e a divulgação científica: o que pensa quem faz. In: ENCONTRO NACIONAL DE PESQUISA EM EDUCAÇÃO EM CIÊNCIAS, 4., 2003, Bauru. **Anais...** Bauru: Abrapec, 2003. 1 CD-ROM.
- McMANUS, Paulette. Topics in museums and science education. **Studies in Science Education**, Leeds, v. 20, n. 1, p. 157-182, 1992.
- SANTOS, Jair Ferreira dos. **O que é pós-moderno**. São Paulo: Brasiliense, 1986. (Primeiros passos, v. 165).
- SAVIANI, Dermeval. Desafios atuais da pedagogia histórico-crítica. In: SILVA JÚNIOR, Celestino Alves da; SEVERINO, Antônio Joaquim. (Org.). **Dermeval Saviani e a educação brasileira: o simpósio de Marília**. São Paulo: Cortez, 1994.
- SAVIANI, Dermeval. **Educação: do senso comum à consciência filosófica**. 18. ed. rev. Campinas: Autores Associados, 2009. (Educação contemporânea).
- SAVIANI, Dermeval. **Educação brasileira: estrutura e sistema**. São Paulo: Saraiva, 1975.

SAVIANI, Dermeval. **Educação em diálogo**. Campinas: Autores Associados, 2011. (Memória da educação).

SAVIANI, Dermeval. **Ensino público e algumas falas sobre universidade**. São Paulo: Cortez; Campinas: Autores Associados, 1984. (Polêmicas do nosso tempo).

SAVIANI, Dermeval. **Escola e democracia**. 27. ed. Campinas: Autores Associados, 1993. (Polêmicas do nosso tempo).

SAVIANI, Dermeval. **Pedagogia histórico-crítica: primeiras aproximações**. 10. ed. rev. Campinas: Autores Associados, 2008. (Educação contemporânea).

SAVIANI, Dermeval.; DUARTE, Newton (Org.). **Pedagogia histórico-crítica e luta de classes na educação escolar**. Campinas: Autores Associados, 2012. (Polêmicas do nosso tempo).

VALENTE, Maria Esther Alvarez; MARANDINO, Martha. The combination of traditional and interactive objects in science museums. **Museum Education and New Museology**, Brussels, n. 17, p. 30-37, 2003.

VIGOTSKI, Lev Semenovich. **A construção do pensamento e da linguagem**. Tradução de Paulo Bezerra. São Paulo: Martins Fontes, 2001.

*Received on January 07th, 2015*

*Approved on April 14th, 2015*

**Rafael Cava Mori** holds a doctoral degree in Physical Chemistry from the Instituto de Química de São Carlos (IQSC-USP). He is a professor at the Centro de Ciências Naturais e Humanas-Universidade Federal do ABC (CCNH-UFABC), Brazil.

**Antonio Aprigio da Silva Curvelo** is a full professor at the Departamento de Físico-Química-Instituto de Química de São Carlos (DFQ-IQSC-USP), and member of the Deliberative Council of the Centro de Divulgação Científica e Cultural - Universidade de São Paulo (CDCC-USP), Brazil.