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ARTICLE

THE CONNECTIONS BETWEEN THE PISA AND THE STEM EDUCATION MOVEMENT IN BRAZIL

GUSTAVO OLIVEIRA PUGLIESE[1]
ORCID: https://orcid.org/0000-0003-4311-9055

VINICIO DE MACEDO SANTOS[2]
ORCID: https://orcid.org/0000-0002-7608-8745

ABSTRACT: In this article, we explore the fact that, far beyond obvious effects such as the ranking of *education*al systems and the construction of model countries, the narratives built by PISA also indirectly support the emergence of technicist *education*al trends such as the STEM *education* movement (Science, Technology, Engineering and Mathematics), which has occupied significant space in the Brazilian *education*al agenda and is already part of government policies. Based on the theoretical reference in sociology of *education*, we analyze how the arguments built around STEM *education*, not by chance, similar to OECD perspectives: the solution to the challenges of the economy through *education*, throwing the bill of economic successes (and failures) to the school and the teacher. We have established a critical analysis of how STEM *education* has been presented as a universal solution, supported by being a trend imported especially from the United States, and given as a norm in Brazil. We have observed that the STEM movement is a product of globalizing practices, a byproduct of the performance and competitiveness policies that the OECD establishes on *education* systems worldwide.
Key words: STEM *education* – International Assessment – Curriculum – Educational policies

AS RELAÇÕES ENTRE O PISA E O MOVIMENTO STEM EDUCATION

RESUMO: Neste artigo, exploramos o fato de que, muito além de efeitos evidentes como o ranqueamento dos sistemas educacionais e a construção de países-modelo, as narrativas construídas pelo PISA também sustentam indiretamente o surgimento de tendências educacionais como o movimento STEM *education* (*Science, Technology, Engineering and Mathematics*), o qual tem ocupado significativo espaço na agenda educacional brasileira e já faz parte de políticas de governo. Partindo do referencial teórico em sociologia da educação, analisamos como os argumentos construídos em torno do STEM *education*, não por acaso, são muito próximos das perspectivas da OCDE: a solução para os desafios da economia através da educação, jogando a conta dos sucessos (e fracassos)

[1] PhD at the School of Education of the University of São Paulo (USP). São Paulo, SP, Brazil. < gustapug@gmail.com >.
[2] Professor and Deputy Director of the School of Education at the University of São Paulo (USP). São Paulo, SP, Brazil. < vms@usp.br >.

econômicos para a escola e para o professor. Estabelecemos uma análise crítica sobre o modo pelo qual o STEM *education* tem sido apresentado como uma solução universal, respaldada por ser uma tendência importada especialmente dos Estados Unidos, e dado como uma norma no Brasil. Observamos que o movimento STEM é um produto das práticas globalizantes, é um subproduto das políticas de desempenho e competividade que a OCDE determina nos sistemas educacionais mundo afora.
Palavras-chave: STEM *education* – Avaliação internacional – Currículo – Políticas de educação

LAS RELACIONES ENTRE PISA Y EL MOVIMIENTO STEM *EDUCATION* EN BRASIL

RESUMEN: En este artículo, exploramos el hecho de que, mucho más allá de efectos obvios como la clasificación de los sistemas educativos y la construcción de países modelo, las narrativas construidas por PISA también apoyan indirectamente la aparición de tendencias educativas como el movimiento educativo STEM (Ciencia, Tecnología, Ingeniería y Matemáticas), que ha ocupado un espacio significativo en la agenda educativa brasileña y ya forma parte de las políticas gubernamentales. Partiendo de la referencia teórica en la sociología de la educación, analizamos cómo los argumentos construidos en torno a la educación STEM, no por casualidad, se acercan mucho a las perspectivas de la OCDE: la solución de los desafíos de la economía a través de la educación, pasando por la cuenta de los éxitos (y fracasos) económicos para la escuela y para el profesor. Hemos establecido un análisis crítico de cómo la educación STEM se ha presentado como una solución universal, apoyada por ser una tendencia importada especialmente de los Estados Unidos, y dada como norma en el Brasil. Hemos observado que el movimiento STEM es un producto de las prácticas globalizadoras, un subproducto de las políticas de rendimiento y competitividad que la OCDE determina a los sistemas educativos de todo el mundo.
Palabras clave: Educación STEM - Evaluación internacional - Currículo – Políticas educacionales

INTRODUCTION

PISA (*Program for International Student Assessment*) is a OECD (Organization for Economic Cooperation and Development) program created in 1997. It has had seven editions so far. The OECD defines PISA as follows:

> The idea behind PISA lay in testing the knowledge and skills of students directly, through a metric that was internationally agreed upon; linking that with data from students, teachers, schools and systems to understand performance differences; and then harnessing the power of collaboration to act on the data, both by creating shared points of reference and by leveraging peer pressure.
> (OECD, 2019, p. 3)

Although PISA results are presented as a fact in the general media, among academics, PISA (Program for International Student Assessment) receives a lot of contestation, rejection and criticism, to say the least (ANDREWS et al., 2014; GORUR, 2016; ADDEY, 2017; VOLANTE et al., 2018). In the academia, PISA forced the emergence of discussions on the impact of global agents on education and also of an intense discourse on the methodology of large-scale international assessments (VOLANTE et al., 2018). Since its first edition, in 2000, the results have got enormous attention from the media when they are released. In Brazil, the release of the 2018 assessment results was no different: PISA made headlines in the largest communication networks – TV, digital and print. PISA results have not only fostered academic debate but also fueled the reformulation and adjustment of curricula, programs and educational trends. As we will show

ahead, the STEM education movement (Science, Technology, Engineering, and Mathematics)[3] is one of those trends.

Several authors have raised serious criticisms about the methodology used by PISA, ranging from statistical validity to the validity of the exam's translation into the different languages in which it is applied. And those are only criticisms towards the assessment methodology. Goldstein (2017) also points out that certain linguistic issues are impossible to be overcome by translation, raising problems regarding the validity of test items. Furthermore, less than 15% of test items are disclosed so that other academics can analyze and interpret the methodology used in the preparation of the test. PISA assumes a comparability and universalism that, in fact, are contestable. In other words, in order to present itself as an exam that deals with different realities without taking into account the differences, PISA results try to compare the incomparable. In this sense, we agree with Nóvoa (2018):

> As in history, comparative research should not focus on "facts" or "realities," but on problems. The "facts" - events, countries, systems, etc. - are incomparable, by definition. We can elucidate the "specificities" and "similarities," but we can go no further. Only problems can be the basis of comparative reflection, because they place us in front of our memories and imaginations, producing new areas of examining a space that is not delimited by physical boundaries, but by boundaries of meaning. (p. 8)

In 2014, 100 educators and academics from various universities around the world addressed a public letter to PISA's director at OECD, Andreas Schleicher (ANDREWS et al., 2014) pointing out several worrisome issues and calling for greater dialogue and transparency with the scientific community. Thrupp (2017) states that:

> Often regarded as authoritative, PISA has also become widely criticized [...]. There are also some concerns about the statistical methodology of PISA and the cultural bias of test items, even though the tests are intended to avoid such bias. Nevertheless, all such concerns tend to be pushed aside by OECD officials, and politicians and policymakers in the countries involved. (p. 189)

In this study, we use literature on the impacts of two decades of PISA on educational systems to explore effects that, at first, are not so evident but that are the result of a complex scenario involving curriculum issues, trends and globalizing educational policies. One of these effects is the establishment of the STEM education movement as a response to the problems pointed out by PISA and to the narratives of crisis in education systems and in the labor market. We start with a more general reflection on educational policy before moving towards a discussion on the ideological bases of the STEM education movement.

NEW WAYS OF GOVERNANCE, NEW MEANING FOR EDUCATION

Two decades ago, Ball (2001) pointed to the gradual disappearance of the State from the educational field and policies, being replaced by policies focusing on economic competitiveness and on the logic of prescribing rules for success. Within this scenario, the author talks about a type of globalization that, instead of destroying local contexts, creates new meanings in a process of

> [...] bricolage; a matter of borrowing and copying bits and pieces of ideas from elsewhere, drawing upon and amending locally tried-and-tested approaches, cannibalising theories, research, trends and fashions, and not infrequently a flailing around for anything at all that looks as though it might work. (BALL, 2001, p. 102)

[3] The term is sometimes referred to as STEAM, including the A for *Arts* . In Brazil, this is the most common designation. There's also the STHEM form, with H for *Humanity*. The dispute over meanings for the STEM movement is relevant, but it has already been addressed in our previous works (PUGLIESE, 2020). For this article, we will use the STEM form as it is the predominant model adopted in the United States as well as the most interesting for our comparisons.

Thus, globalization is a key aspect to understand the transformations in the political sphere, because it establishes the paradigm that nations' thresholds alone are not enough to think about policies. At the same time, it creates a "series of political impositions" (BALL, 2008, p. 25) to be taken at national and local level.

In this context and from a neoliberal perspective, the State becomes excessive and unnecessary (APPLE, 2000):

> Many of the rightist policies now taking center stage in education and nearly everything else embody a tension between a neoliberal emphasis on "market values" on the one hand and a neoconservative attachment to "traditional values" on the other. From the former perspective, the state must be minimized, preferably by setting private enterprise loose [...]; from the latter, the state needs to be strong in teaching *correct* knowledge, norms and values. From both, this society is falling apart, in part because schools don't do either of these. They are too state-controlled and they don't mandate the teaching of what they are "supposed" to teach. (p. 31)

As a direct effect of the intense globalization that countries underwent in the 1990s and early 2000s, there is an emergence of Global Players in education. These are international agents, institutions, consultancies and philanthropy funds influencing educational policies through recommendations in narratives of "what works" and in educational neoliberalism (BALL, 2008; GUNTER, HALL & MILLS; 2015; MACEDO, 2016; SAURA, 2016; BALL, JUNEMANN & SANTORI, 2017). World Bank, OECD, World Trade Organization, European Union and World Economic Forum are examples of these institutions. Specifically in the case of OECD, there is a phenomenon of Global Governance (SELLAR & LINGARD, 2013; VOLANTE & FAZIO, 2018), a format in which the act of governing is not tied to the idea of a nation state, but to multiple actors and scales in the implementation and production of processes. Lingard (2016a), for example, shows that PISA helped to create a new field of global education policy – no longer restricted to nation states.

For Avelar & Ball (2017), these transformations are part of another profound transformation in the political sphere that created the so-called *heterarchies*, that is, forms of collective governance between companies, state and organizations. They involve a "de-governmentization" (p. 8) of state in such a way that

> […] the state no longer acts as the centre of power, rather new forms of political organization – heterarchies - are developing, in which governments no longer exert monopolistic control over state work but are becoming "metagovernors". "The new heterarchical mode of governance implies a conception of policy that should be seen as the collective efforts of a set of players who compete and form alliances in an ever-increasing networked political arena" (Olmedo, 2014, p. 253). This involves changes both in "who governs" and at the same time "how power is exercised". It occurs through the repopulating and reworking of existing policy networks and the emergence of new networks that give legitimacy to the role of business, enterprise and/or philanthropy in the solution of intransigent problems (like the form and content of the school curriculum) (AVELAR & BALL, 2017, p. 8).

As Avelar & Ball (2017) point out, "a new mix between state, market and philanthropy" emerges in which the roles of each one are reworked and, in the case of the state, it becomes a "market-maker, commissioner of services and performance monitor" (p. 2). Within this culture and new ways of governing, education and knowledge are seen as valuable assets in a knowledge economy. School knowledge becomes a commodity that, somehow, must be used in exchange for a job in the future (BALL, 2008). In this regard, educational reform is linked to developing skills for this knowledge economy and to aiming to build the workforce for the 21st century economy.

> What we are witnessing then in the celebration of competition and the dissemination of its values in education is the creation of a new ethical curriculum in and for schools and the establishing of a moral 'correspondence' between public and business provision. (BALL, 2001, p. 106)

In this context, there is a reorganization, a "re-regulation" of ways of governing. There is also an imposition of reform packages based on efficiency and performativity due to the branding brought by new agents occupying the political space. This branding is called corporatization by Saltman (2011) and involves

> [...] transforming education on the model of business, describing education through the language of business, and the emphasis on the "ideology of corporate culture" that involves making meanings, values, and identifications compatible with a business vision for the future. (SALTMAN, 2011, p. 71).

This model is based on standardization of curriculum, testing, and methods as well as teacher de-skilling and on a corporate performance approach. In this model, "[...] teaching, like factory production, can be ever speeded up and made more efficient" (p. 56), as well as that "schools must *'compete'* to be more *'efficient'*" (p. 56). In what Taubmann (2009) calls the cult of efficiency, the terms "*performance outcomes, best practices, data driven, metacognitive strategies, evidence based research and learning environments*, mobilize, anchor and normalize particular discourses on teaching and education" (p. 6).

In other words, the idea of efficiency and performativity becomes incorporated – or imposed – in a unique way for education, from corporatism to school management. Stephen Ball discussed this notion of performativity in several works (BALL, 2001; 2004; 2005; 2008), speaking about a "culture of competitive performativity" (BALL, 2001, p. 105) and of a performance regime. Such regime is established by managerialism, a culture that is supported by the figure of efficiency managers, in data, reports, regulations, comparisons and established goals (BALL, 2008). It is, therefore, a corporate culture that has been used to justify education reforms and to validate a change in the way of understanding school as a social institution.

Performativity and managerialism are two key concepts for understanding the role of the OECD in education change and for understanding how STEM education movement emerges from this rationality that is imposed by PISA, among other elements. According to Ball (2005),

> performativity is achieved through the construction and publication of information and indicators, as well as other institutional achievements and promotional material, like mechanisms that stimulate, judge, and compare professionals in terms of results: the tendency to name, differentiate, and classify. (p. 554)

In turn, "managerialism plays the important role of destroying the ethical-professional systems that prevail in schools, causing them to be replaced by competitive business systems." (BALL, 2005, p. 544). The author adds that "managerialism aims to impress performativity in the worker's soul" and that performativity and managerialism "are the main technologies of education reform policy" (p. 546).

In other words, there is a new form of educational governance based on comparison and on a culture that comes from corporatism, which works through constant performance monitoring – an essentially competitive culture in which the voices of private sector are more legitimized and become seem as inevitable in public administration.

In a synthesis of these transformations that we have been pointing out so far, Steiner-Khamsi & Waldo (2018) bring that:

> The twenty-first century intellectual kinship among policy borrowing researchers and global education policy researchers is not coincidental; neoliberal, quasi-market reforms of the late 1980s have spread like wildfire to every corner of the world over the past three decades. The fundamental changes in how educational systems are regulated, notably, the

> shifts from input to output, from government to governance, from external inspection to self-evaluation by numbers, and finally from state actors to public-private as well as national-international networks, have been convincingly documented. (p.2)

In a society of performance, it is worth saying that school is supposed to include pragmatic skills and also those skills that can be converted into monetary results. On the other hand, skills and knowledge (e.g. arts, sociology) that cannot be measured, quantified, or have no direct economic value are not seen as a priority.

SUPPORTED BY THIS LOGIC, THE STEM EDUCATION MOVEMENT

STEM (Science, Technology, Engineering, and Mathematics) education is a movement that emerged in the United States in the early 2000s as a response to several economic demands in that country. Pugliese (2020) describes how STEM became the main education agenda in the United States, mainly motivated by their need to supply their workforce in Science, Technology, Engineering and Mathematics.

In short, STEM movement was built on discourses affirming that the nation needed to be saved from both domination and economic collapse. Pugliese (2020) retraces the narratives that supported these discourses in the United States through publications with a perspective that education is responsible for sustaining the United States position as a global leader (For example: Friedman, 2005; National Academies Press, 2006). With a focus on "increasing economic competitiveness through development of skills, capabilities and dispositions required by new economic ways of high modernism" (BALL, 2004, p. 1108), we see that STEM education movement is in line with the performativity framework which we work with from our theoretical framework – especially when we consider the genesis of the movement.

This has profound implications for the advertising format of the STEM proposals and programs that have been disseminated around the world, especially the increasing entry of STEM education in Latin America as an inevitable trend, as the media often report. As we will develop later, part of our thesis is that STEM education in Brazil, being an American heritage that is often imported uncritically, also copies the vices and problems of this educational system. In particular, when it is disseminated based on a rationality that sees the school as responsible for the economic success of the country.

The dissemination of STEM education movement in Brazil follows a trajectory very close to that observed in establishment of Common National Curriculum Base (BNCC), as described by Macedo (2014), because of its articulation by private sector and their foundations before BNCC establishment. In addition, there is also political networks in these private sector foundations, which start to occupy debates and territories in a dispute for curriculum, as described by Avelar & Ball (2017) regarding BNCC. Therefore, in order to understand the growing popularization of STEM education movement in Brazil, it is important to analyze the journey of BNCC consolidation, as we will do more in detail later on. After all, STEM is a movement forged by the idea of crisis in labor market and in education, mainly fostered by private dispositions and brought to Brazil based on a dominant STEM education model in the United States.

But how is STEM education movement related to PISA? To answer this question, it is important to note that STEM education movement emerges concurrently with PISA creation. Far beyond a mere coincidence in time, STEM education movement is a product of globalizing practices, as well as an indirect result of policies aimed at making education systems responsible for ensuring economic competitiveness, as OECD advocates in its agenda. Furthermore, PISA is inserted in the Global Education Reform Movement (GERM) (GORUR, 2016; VERGER, PARCERISA & FONTDEVILA, 2019) and the discourse frequently evoked by STEM education enthusiasts is supported by recommendations of OECD. This discourse advocates for STEM education as it is the universal solution to many problems faced in different education systems.

When talking about a trend imported as a protocol - as a recipe for success -, we need to consider how discourses for STEM education in Brazil are guided by a logic of "best practices in education" that supposedly should be followed by starting from what economic rationality believes is best for school. Following this reasoning, we will discuss the consequences of performativity and managerialism context in perception of teacher's role from our theoretical framework.

THE TEACHER'S ROLE IN PERFORMATIVENESS CONTROL: AN UNAUTHENTIC PRACTICE

One of the effects of performativity on teaching practice is expelling teachers from educational system, from curricular decisions and from their profession itself. This happens more clearly in the process of teacher education in which, according to Ball (2005, p. 548), "the teacher is 're-constructed' to be a technician and not a professional capable of critical judgment and reflection. Teaching is just a job, a set of skills to be acquired".

Although that is nothing new in the teacher education field in Brazil carried out by private institutions and philanthropic organizations linked to education, teacher education path "from the outside in" (FANIZZI & SANTOS, 2017) tends to be a rule also in STEM proposals. In other words, the perspective in which a curriculum is prescribed by someone outside school and teachers only participate in the implementation of those new ideas prevails. Assuming that this happens helps to establish paths both to disentangle STEM education from the US model and to think about alternatives that are more consistent with Freire's autonomy pedagogy (FREIRE, 2011) and with Science Teaching in a critical perspective (SANTOS, 2007; GORUR et al., 2019). Establishing a new conception for teachers' role within STEM reform is a first step, despite ideological roots in STEM movement tending more towards denying rather than valuing the role of teachers in education reform.

On behalf of an ideology-free teaching practice aimed at improving student performance, teachers' role is void. Thus, teachers become mere appliers of pre-defined methods in order to achieve previously determined goals. Authenticity and subjectivity are taken away from the teacher:

> There are three versions of (in)authentic practice here: in relation to oneself, one's sense of what is right; in the teacher-students relationships, when a commitment to learning is replaced by the goals of performance; and regarding their colleagues, when effort and debate are replaced by compliance and silence[...]. (BALL, 2005, p. 553)

From the perspective of managerialism and performativity, teachers are seen as just imposing ideologies while inefficiently measuring and teaching. Individual beliefs become irrelevant and the sense of belonging to the school is replaced by the notion of an irrelevant player in a system whose ultimate goal is to determine student performance. As our experience in hundreds of teacher training workshops in both private and public elementary schools has shown, the teacher's feeling of insignificance and irrelevance in the system is enormous, because there is always another teacher to replace him/her without any impact on the process.

Therefore, software and algorithms support that indicate to teachers "where their students are doing badly" gain more and more power in the student's formative path. There are numerous platforms, such as Evolucional[4], Khan Academy[5] and Geekie[6], among many others available in Brazilian education market (for reference, see: CIEB, 2021) that point out students' weaknesses and supply what teachers are supposedly unable to do. This generates in both students and teachers "a sense, that is, of consciously being in a state of largely enforced adjustment"

[4] http://www.evolucional.com.br/
[5] https://pt.khanacademy.org/
[6] https://www.geekie.com.br/

(BALL, 2005, p. 553). Constantly pointing out weaknesses and limitations leads to some kind of control and domination, embedding feeling that one cannot survive with such weaknesses in a competitive world, whether in the school or professional context.

In this scenario, a good teacher is the one who can literally transmit the discourses that comes from external agents. This is the case of STEM programs, that train teachers to perform pre-defined successful strategies and to achieve goals such as those defined in the corporate environment. In these programs, the teacher is seen as a non-ideological and non-authentic agent.

Not coincidentally, Brazilian private primary education sector has seen a significant increase in the number of EdTechs consultants (educational technology companies and startups) (CIEB, 2021) offering varied "solutions" so that schools, teachers and managers are able to do the job that should have been done without such advice. In private schools, EdTechs have been introduced to parents and teachers as education quality providers and seals of assurance through education content and teacher education packages. Gunter, Hall & Mills (2015) review a state of "consultocracy" in England, very similar to that we observe in Brazil, in which networks of prominent consultants have obtained dominant positions in public institutions, especially those linked to education (MACEDO, 2014; TARLAU & MOELLER, 2020).

OECD, through its main instrument in education area - PISA, plays a significant role defining the agents of truth in educational public policies, in curriculum and in what should be adopted as an education reference in different countries.

THE EDUCATION THINK TANKS

Several authors have used network ethnography to point out the existence of dominant policy networks deeply embedded in National Congress, industry, universities and philanthropic entities, not only in Brazil, but as a global trend (SAURA, 2016; BALL , JUNEMANN & SANTORI, 2017; AVELAR & BALL, 2017; GORUR, 2017; VISEU & CARVALHO, 2018). Basically, the conclusion is the same: in recent decades, these networks have been connected by so-called education think tanks who, in turn, are the new players acting in education guidelines and have determined the format of national curricula.

According to Viseu & Carvalho (2018), in addition to their strategic presence in political elites, education think tanks impose a dependence on standards and comparisons in education management and in education process itself, that is, they reinforce a narrative based on performativity and managerialism. As mentioned above, in this case, performance parameters are determined by international comparisons and quantitative data presented through reports. This is an opportunity scenario for new actors and new spaces to be created in public policies (VISEU & CARVALHO, 2018). Think tanks have a better-established tradition in the United States, and Europe has seen an increase in self-proclaimed think tanks institutions. For Viseu & Carvalho (2018), the definition of think tanks:

> We conceptualize think tanks as "hybrid, boundary spanning organizations that work across academic, media, political and economic fields" (Lingard, 2016, p. 15) and as "nebulous configuration[s] of new and old actors, [with] ambiguous responsibilities and blurry margins of action" (Olmedo & Santa Cruz, 2013, p. 492). Therefore, we regard think tanks as being part of education policy networks, or as networks of experts (Normand, 2010). As they are responsible for the production and diffusion of knowledge, think tanks may be conceived as epistemic communities (Haas, 1992), since they are composed of networks of "professionals with recognized expertise and competence in a particular domain and an authoritative claim to policy-relevant knowledge within that domain or issue-area" (Haas, 1992, p. 3) and the use of this knowledge in decision-making. (VISEU & CARVALHO, 2018, p. 5)

When analyzing a think tank performance in Portugal, EDULOG, the authors describe it as a cognitive intermediary of public and private decisions. In other words, think tanks

claim a certain objectivity based on numbers and comparisons in order to ensure the "right path" in debates on public policies. In this regard, for Viseu & Carvalho (2018), the emergence of think tanks anticipated the establishment of a complex political process. In it, there is "the expansion of social actors who position themselves as producers of problem issues in educational reality and who also bring recommendations on how and in what sense the educational system should be re-oriented" (p. 17). However, this is done by imposing a narrative that (1) proclaim state's inability to fulfill its own obligations; (2) characterizes the school as incapable of managing itself; and (3) it brings so-called infallible success protocols from outside (VISEU & CARVALHO, 2018).

Regarding EDULOG, the authors highlight three characteristics which are easily translatable to what we have been experiencing in Brazil with the respective Lemann Foundation:

> Thus, regarding the rationales that 'define' think tanks, three features may be highlighted: (a) an agenda for education, in the sense that EDULOG chooses specific research topics on problems that are (re)conceptualized as priorities of the Portuguese education system; (b) a perspective on schooling that combines, drawing on Labaree's (1999) education conflicting goals, the "social efficiency" framework — i.e., schooling as a device to provide different groups of students with the specific skills and knowledge required to become productive workers for the current economy — and "social mobility" — i.e., schooling as a device to provide each individual with competitive advantages; (c) an approach to knowledge production and dissemination in close connection with economic and practical knowledge (see Ozga, 2008). Ultimately, the choices on the research agenda to be financed, the criteria for project selection, and interventions for the composition of research consortia, produce the legitimization of a certain knowledge and certain knowledge producers — and support their existence and expansion. Supporting the production of knowledge for policy is also to make a policy of knowledge. (VISEU & CARVALHO, 2018, p. 18)

Likewise, in his analysis of the Spanish foundation *Empieza por Educar* (ExE), Saura (2016) points to the emergence of a "new philanthropy" (p. 4) in which large foundations have acted not only for social welfare, but also in terms of the return they will have for themselves by creating new urban markets or, as the author defines it, "Venture Philanthropy" (p. 5). *Empieza por Educar* is no exception and repeats the format of a foundation "backed up" by an American think tank, Teach for All (TFA), working to establish political networks and intervene in curriculum guidelines. The author shows how *Empieza por Educar* has established itself in Spain as a non-profit foundation that works "saving the world through neoliberalism" (article title).

NEUTRAL IDEOLOGY

We must now clarify the issue of neutrality in *think tanks' discourse*. Such discourses called "ideologically neutral" and imposed by new actors in education are by no means neutral, but rather express a corporate rationality that probably knows little or nothing about the value of education for social transformation. Paradoxically, the claim for social transformation and improvement in education is also imposed by these actors in order to legitimize themselves in education scenario in which, until then, they had little insertion.

Macedo (2014) characterizes recent curricular reforms as producers of hegemonic discourses, because these reforms set the argument from policies for an education quality in crisis, establishing themselves as reforms for the common good. After all, who would be against social transformation, improvement of education quality, a school that prepares for the world, among so many other legitimizing speeches about the work of think tanks?

It is also noteworthy that this same change in governance culture is followed by a professed elimination of ideology from governance practices, as if neutral states were created that only govern for well-being, not for their own ideology, nor for a technicist education. This is the main campaign motto of the current Brazilian government, which presented itself to the population as a govern without ideology. This motto won so many votes, even though the fascist

educational project and the neglect of public schools are evident. The notion of performativity helps to understand how the discourse of a government of efficiency and neutrality has public support:

> Performativity plays a crucial role in this set of policies. It works in several ways to "tie things down" and rework them. It facilitates the monitoring role of state, "which governs from a distance" – "governing without government". It allows state to be deeply embedded in cultures, practices and subjectivities of public sector institutions and their workers, without appearing to do so. It (performativity) changes what state "indicates", changes meanings, produces new profiles and ensures "alignment". (BALL, 2004, p. 1108)

In this sense, education goals become the same as market's goals, and metrics are given by performance levels determined and imposed externally, as OECD does through PISA.

The logic appears to be simple: the new managers – think tanks – seem to be free from ideology, as they are external agents, experts in efficiency and governance. This governance, in turn, is based on creation of successful cases and patterns to be followed. If conducted "correctly", based on the logic of corporate administration, education starts to work. After all, the parameters of success are given from a corporate and objective point of view. However, this logic hides a very crucial fact: the problem that education ceases to meet students' needs and is no longer an emancipatory and democratic education, to become merely a matter of management or performance.

For Macedo (2013), implementing a notion of crisis is used to legitimize certain discourses. Thus, a question that intrigues us is whether these think tanks, self-proclaimed to be objective and well informed with accurate numbers, data and facts, are, in fact, solution providers, crisis providers, or providers of a crisis+solution package. According to Viseu & Carvalho (2018), this is the case of think tank EDULOG's role in the Portuguese education system.

Regarding educational goals established by think tanks, we ask whose needs they seek to meet: the state, disadvantaged students, or the labor market? Based on *Movement for the Common National Base* journey in Brazil, the question remains: why are philanthropic foundations interested in fostering the debate around curriculum and not other aspects of education in which they have even more expertise, such as funding and infrastructure? It seems more likely that the issue at stake has more to do with the use of curriculum as domination, as indicated by several authors (APPLE, 2000; LOPES & MACEDO, 2011; ARROYO, 2014; TARLAU & MOELLER, 2020).

With such questions, we want to clarify that it is not about denying the existence of deep challenges and problems in public education, nor denying the importance of participation of several voices in the education issue. We question what kind of crisis this is, so publicized in the educational environment and in the media, and if it is from the human and social point of view, or from the neoliberal point of view. Or, if we are talking about an identity crisis about what the role of schooling in students' lives should be. We are not trying to deny the plurality of social agents and perspectives that must be shared in the process of determining education goals, nor naively denying that education and especially curriculum are fields of ideological dispute and power (ARROYO, 2014). As Apple (2000) defines: "The curriculum defines what counts as knowledge. It is a policy of official knowledge. It is produced out of the cultural, political, and economic conflicts, tensions, and compromises that organize and disorganize a people." (p. 53)

Godoy and Santos (2015) bring the perspective that the curriculum is taken as a "battle arena" (p. 283) because it is intimately related to social and culture issues, being an instrument of social domination. In this sense, the curriculum can be understood as an instrument of power (LOPES & MACEDO, 2011; MACEDO, 2013; GODOY & SANTOS; 2015).

Thus, it is not surprising that the curriculum is one of the main focal points of education think tanks' work, as we see with STEM programs being implemented in Brazil. The two most representative examples of it in Brazil are secondary education reform and the implementation of the Common National Curriculum Base.

The New High School model, established by Law No. 13.415/2017, which amends the Law of Guidelines and Bases of National Education (LDB), presents training itineraries schools must implement starting in 2020. For this curricular change, Ministry of Education (MEC) and National Council of Secretaries of Education (Consed) published an implementation guide for the New High School program and presented a STEAM itinerary[7] , including an "A" for *Arts*, as a "curriculum template proposal" (BRASIL, 2021). This and other proposals that are available on MEC's official website were prepared by external consultants, CIEB (Innovation Center for Brazilian Education), Tríade Educacional, Brazilian Computer Society and Ayrton Senna Institute. This is something that goes in line what we have developed here about the use of consultancies, EdTechs and think tanks to establish curriculum policies.

In addition to presenting STEAM as an itinerary model, the National Fund for Educational Development (FNDE), through public notice of National Book and Textbook Program (PNLD), started to request didactic materials to feature STEAM as an integrative project for secondary education in all public schools in Brazil (FNDE, 2020). This can be considered a large step taken by MEC towards establishing STEAM as one of the pillars of the Brazilian school curriculum, at least with regard to the presence of STEAM in textbooks.

In the case of Common National Curriculum Base, we present below some considerations about how it is constituted from think tanks that use the United States as a reference, which helps us to also understand how STEM movement enters the Brazilian scenario attached to these curricular transformations.

AN IMPORTED BASE AND AN IMPORTED MOVEMENT

The idea of a common curriculum in Brazil is not exactly new and has strong inspiration in other countries, as presented by Macedo (2014; 2016). Furthermore, according to Volante & Fazio (2018), the marriage between curriculum standardization and large-scale assessments such as PISA is a phenomenon of the last three decades in several countries. Regarding BNCC in particular, Avelar & Ball (2017) bring the idea of policy pipelines: transnational policy pipelines extending from the USA to Brazil. This is the same logic as STEM pipelines that deliberately directs US students to STEM careers in the United States (SVINTH, 2006; CANNADY et al., 2014).

In relation to policy pipelines, Avelar & Ball (2017) explore in detail how the *Movement for the Common National Base*, based on American think tanks, has established Brazilian educational guidelines in the last decade, something also addressed by Macedo (2014). Tarlau & Moeller (2020), based on a work on network ethnography, show how the Lemann Foundation has radically interfered in Brazilian public policies, supported by a curriculum model from the United States and by a public education project based on the economic elite's ideals.

Another example in the case of this foundation is the creation of a research center at Stanford University on Brazilian public education, the Lemann Center for Educational Entrepreneurship and Innovation in Brazil. The text of the mission statement of this research center brings rich evidence about the practices of borrowing policies from other countries and acting on public policies by privately funded Think Tanks. In addition, it provides evidence on accountability practices and datafication of education, as well as universalization of the curriculum, practices and terms that are explored by Pugliese (2021).

> We work closely with public officials at the federal, state and municipal levels, with our student and academic colleagues, and with the Lemann Foundation and other partners in Brazil to develop and test new approaches to the educational challenges facing Brazil. We believe that new policies and practices must be grounded in hard evidence and rigorous analysis, and that improvement strategies cannot only target schools but must address the entire ecosystem of institutions that promote the well-being of young people.

[7] The Ministry of Education adopts the nomenclature STEAM instead of STEM.

> Practices that have proven successful in other countries should be adapted to reflect the cultural, social, and economic conditions in Brazil, and their adoption and implementation should be evaluated locally. (LEMANN CENTER FOR EDUCATIONAL ENTREPRENEURSHIP AND INNOVATION IN BRAZIL, 2022)

Also in relation to the genesis of BNCC, Galian & Santos (2018) show how the document in its final form reproduces the "conceptions, principles and guidelines" (p. 171) of a publication entitled *Four-Dimensional Education: The Competencies Learners Need to Succeed* (see: Fadel, Bialik & Trilling, 2015). The document, not coincidentally, was translated and published in Brazil by two think tanks, Instituto Península and Ayrton Senna Institute (linked to the Movement for the Common National Base), in addition to having a preface written by the director of PISA at OECD, Andreas Schleicher. Furthermore, despite not being our focus here, recent mergers and acquisitions in Brazilian private education sector (SANTOS, 2021) and the increasing participation of industry agents in curriculum reforms point to the perception of the Brazilian school as a profitable enterprise. This can be seen both as an investment in future labor force, and as a specific ideological project for public education (BORGES, 2016; AVELAR & BALL, 2017; TARLAU & MOELLER 2020).

According to Ball (2004) "the World Bank and the International Monetary Fund (IMF) in particular are firmly committed to the Americanization of the world economy" (p. 1114). In the case of OECD, Lingard (2016b) shows that the United States was an important actor in the creation of PISA and in the establishment of a culture of comparative statistical studies. In STEM education movement, several American foundations or Brazilian foundations with ideological roots in the United States have made the effort to bring not only the curricular and ideological logic from US, but also all associated by-products, for example the idea of STEM education as the solution to the education issue.

Invariably, in speeches of various agents, the claims for a STEM task force in Brazil are that it is necessary to educate students for the labor market; for 21st century skills; for the professions of the future; for a competitive industry and to improve education quality indicators – often adopting PISA as a parameter. In other words, the standardization of the curriculum and the need to reach the top of the ranking are created to serve the PISA, due to its influence on the rationality of these agents. It almost goes without saying that investment in STEM programs is often justified by the power to increase students' academic *performance* and students' motivation once they receive an immersion in STEM classes. This reinforces the idea that STEM is a universal solution to problems ranging from curriculum, to didactics, to the quality of teacher education, to students' personal life projects.

This scenario is the materialization of what we discussed above concerning the idea of performativity and managerialism, curricular standardization, imposition of a corporate logic and a conception of school whose primary function is to supply workforce to the labor market. It assumes that applying a method "already established" in the United States will be enough to improve in the indicators. The guidelines, objectives and themes proposed by Brazilian EdTechs often reinforce the tendency to apply foreign methods and trends, as a guarantee for innovation and for overcoming problems with teaching and learning. For example, within the private education market, education congresses, specialized media in education and the EdTechs market some "news" (STEM education, flipped classroom, hybrid teaching, maker movement, bilingual education) have been imposed as educational innovation, the solution for all schools problems and definitive methodologies and that every school must have. Interestingly, there is a preference to presenting them with their terms in English, or to associating them with US universities to ensure legitimacy.

The main finding in private education sector is that the market for products such as STEM (and any other imported proposal) has been highly coveted, as elite bilingual or foreign-

rooted schools have often made waiting lists to accommodate the demand for enrollment. (MATTOS, 2018; SCIAUDONE, 2018; CALAIS, ANDRADE & AGUIAR, 2020).

In the private primary education sector, the market for pedagogical trends and technologies for the classroom is at its peak. The best way to prove this is through annual congresses such as Educa Week and BETT Educar which, according to information on its website:

> Bett Educar is the largest education and technology event in Latin America. It annually brings together over 270+ national and international leading companies, 20 exciting edtech start-ups and 30,000+ participants from the education community. (BETT, 2020)

Both events (and a very long list of others across Brazil) have treated STEM as the ultimate hot ticket in the United States. In addition, the two most accessed Brazilian portals for news and education texts, Porvir and Nova Escola, are full of articles covering these topics.

Perhaps one of the best examples of the United States' actions towards implementing (or intervening through) local think tanks in Brazil is Grupo +Unidos, created in 2008, whose objective is to establish political-private networks of philanthropy:

> Grupo +Unidos is a collaborative social investment fund created by the American Embassy, through the United States Agency for International Development (USAID), formed by American companies established in Brazilian territory. (MAIS UNIDOS, 2020)

These are some of the companies participating in Grupo +Unidos: Bank of America, Citi Bank, Gerdau, ExxonMobil, FedEx, International Paper, Qualcomm, Paypal, among others.

This phenomenon does not occur only in Brazil, but also in several other countries in which STEM has become a priority on the national political agenda via the work of think tanks and their policy networks, such as Portugal (VISEU & CARVALHO, 2018), Spain (SAURA, 2016) and England (WONG, DILLON & KING 2016), to cite just a few examples. The fact that think tanks have a well-established tradition in the United States facilitates the importation of these trends to Brazil, such as the case of STEM education in the last two decades.

What draws our attention, apart from the absence of locally established public policies in Brazil and the fact that there is a progressive erasure of the role of the Brazilian State in Brazilian education, is above all the uncritical adoption of STEM education in Brazil. The absence of official continuing education programs for teachers who will develop STEM projects (not only STEM, but also the other Formative Itineraries, the New High School and the BNCC itself) is an indication of this. Moreover, the official curriculum documents themselves give few clues about what is expected with STEM projects in the classroom and how they relate to the curriculum as a whole (especially for teachers who do not teach in STEM areas and yet need to implement them). Finally, it is also worth mentioning the fact that the STEM education movement as a whole still has a long way to go in terms of critical science education that incorporates sociocultural and sociopolitical aspects in its foundations, mainly because it does not emerge with these agendas at the forefront. As Apple (2000) points out:

> In fact, the most powerful economic and political groups in the United States and similar nations have made it abundantly clear that for them a good education is only one that is directly tied to economic needs. (p. 31)

Based on this, we reiterate our fundamental questions regarding the curricular decisions made and the ones yet to come: (1) who reports that the American model is a reference for good practices in education? and (2) who says that the US STEM education model is the most interesting for Brazilian schools, or even the development of STEM areas in Brazil at all?

The central argument here is that STEM is a product built and presented as good practices, but it is born from a deficient education system, which does not meet the basic objectives of a democratic, emancipatory education and is oriented towards productivity (TAUBMANN,

2009; SALTMANN, 2011). In our perception, the STEM education model capable of bringing contributions to Brazilian education must dissociate itself from the technicist bases and create links with a science education that takes into account socioscientific and sociocultural issues, based on pedagogical and not economical needs.

What we want to highlight is the alignment of STEM with BNCC logic and the non-casual coincidence of agents promoting STEM in Brazil. Regarding the pro-STEM propaganda, one of the most evident mechanisms used by organizations is promoting conferences, workshops and articles in education media, valuing STEM as a formula for success, as it has been done in the United States during the last two decades (PUGLIESE, 2020).

The American STEM education movement pays strong attention to the demands of the digital technology industry because it is designed to project students into that industry. However, STEM education movement does not address the need for a sociological contextualization of knowledge and contents, and it is not committed to a critical and in-depth view of sustainability. Furthermore, the ability to understand and recognize problems in this model is strictly applied to problems related to "engineering and design". In other words, STEM education movement is founded on technocentrism and technological optimism, concepts addressed by Feinstein (2015) in his analysis of the core curriculum in the United States, the *Next Generation Science Standards* (NGSS). In other words, the American movement is not concerned with also addressing the issues of the Nature, History and Philosophy of Science, nor of the Science, Technology and Society (STS) movement (AULER & DELIZOICOV, 2006; SANTOS, 2007; GORUR et al., 2019).

THE SOLUTION FOR POOR PERFORMANCE IN PISA IN THE FORM OF STEM EDUCATION

Returning then to the issue of curriculum, according to Apple (2000), the social function of the national curriculum is to be seen as a "device for accountability, to helps us establish benchmarks so that parents can evaluate schools" (p. 67). PISA appears to create a system of classification and ordering of students and a mechanism for social cohesion that promises to measure schools with objective criteria. However, as the author indicates,

> The criteria may seem objective; but the results will not be, given existing differences in resources and in class and race segregation. Rather than leading to cultural and social cohesion, differences between *we* and the *others* will be socially produced even more strongly way, and the attendant social antagonisms and cultural and economic destruction will worsen. (This applies also to the current infatuation with outcome-based education, a new term for older versions of educational control and stratification.) (APPLE, 2000, p. 67)

Also according to the author, the national curriculum tends to be presented as a self-explanatory, objective curriculum, as well. However, societies are complex and governed by different powers and inequalities. Knowledge is anything but objective. As Holloway & Brass (2017) point out, "no knowledge is objective, neutral, pure, or apolitical" (p. 5). Treating knowledge as such tries to remove the teacher's subjectivity and autonomy so that another logic can take its place. In this sense, Macedo (2014) brings that

> This is also the promise of evaluation-based education reforms. On the one hand, the assessment will ensure good practices, promoting student success and enabling teachers to meet the impossible social goals expected from them [and from education]. On the other hand, there is the hope that the assessment represents the quality of the work done by the teacher, freeing them from shame and redeeming them from guilt (p. 1553).

Therefore, when associated with the inflection of education systems towards assessments such as PISA, the numbers in rankings generated by the exam actually show a

representation of what is expected, not necessarily what constitutes each system. As an example, some authors explore the inconsistencies between external and internal indicators, as is the case of Australia (MASTERS, 2018), and the explanatory limitations problematized by Morgan (2018).

Among criticisms towards the truth implemented by PISA, we highlight the fact that OECD is not seen among educators as a legitimate organization to define and influence the direction of education policies (ANDREWS et al., 2014). The following is an excerpt from the open letter to the director of PISA at OECD, Andreas Schleicher. The letter was signed by 100 educators and academics from various countries and published in The Guardian on May 6, 2014.

> As an organization of economic development, OECD is naturally biased in favor of the economic role of public schools. But preparing young men and women for gainful employment is not the only, and not even the main goal of public education, which has to prepare students for participation in democratic self-government, moral action, and a life of personal development, growth, and well-being.
> Unlike United Nations (UN) organizations such as UNESCO or UNICEF that have clear and legitimate mandates to improve education and the lives of children around the world, OECD has no such mandate. Nor are there, at present, mechanisms of effective democratic participation in its education decision-making process (ANDREWS et al., 2014)

Another important issue is raised by Komatsu and Rappleye (2017): from OECD, what is true for rich countries also becomes true for poor countries. Put differently, for PISA, the same assessment and interpretation of data that serves for one country serves for another that is completely different economically, culturally, socially and historically. Ball (2016) argues that OECD tells a truth about us - a truth that deteriorates the subjectivity of school and of the subjects of education. The articulation of truth through numbers becomes the usual practice of governing.

PISA has created a need among schools to compare themselves with other schools worldwide (VOLANTE et al., 2018). In a society of comparison and performance, these data are all what schools need to promote themselves as innovative models and a quality benchmark, since economic development is directly linked to school performance. According to Arroyo (2014, p. 57):

> The late understanding of the sacred need to urgently invest in human capital invades both the media and the analyses, increasing the pressure on the school system regarding quality education. The conflict set in the public school, its curricula and its teaching. The national evaluation policy became the measurement sacred rite of this nation's passage to the First World. Hence, the increased pressure on the need for training for the new country, for the new competitive economy, relays on the curricula. Competency-based curricula. This puts pressures on teachers, their qualifications and their commitments. And it affects how they get paid, based on their students results in tests, attendance, or for the way their fulfill the demand for reports.

Within this logic, we have one of the most well-known and documented effects of PISA: PISA shock (BREAKSPEAR, 2012; LINGARD, 2016a; PONS, 2017; SÄLZER & PRENZEL, 2018). Mainly in Germany and Japan, the disappointing results of the first editions of PISA were highly reactive and mobilized a series of changes aimed at reversing the poor performance in the exam (LINGARD, 2016a; SÄLZER & PRENZEL, 2018). Despite criticizing the expression PISA shock, Pons (2017) defines this context as a moment in which PISA starts to "[...] play a catalytic role in the decision-making process" (p. 133).

Although some authors point to the fact that the United States has been little reactive to PISA (MARTEENS & NIEMANN, 2010; BREAKSPEAR, 2012), this was true only in PISA's first editions (LINGARD; 2016a). Our interpretation is that the whole situation around the poor performance of American students taking place over the previous decades (TAUBMANN, 2009) gains *momentum* after some editions of PISA, and the US PISA shock was materialized in the STEM education format. The apex of the STEM movement in the United States occurs precisely from

the 2009 edition of PISA (TAUBMANN, 2009; LINGARD; 2016a), when the administration of former President Obama started to pay more attention to the STEM crisis and the media began to reproduce the mantra that *STEM is the lifeline for the economy and for schools*.

In addition, another effect of PISA is evident: the creation of Reference Societies (LEWIS, 2017; VOLANTE & FAZIO, 2018; TAN & REYES, 2018). Lingard (2016a) states that:

> The OECD's PISA has also provoked the construction of new reference societies or reference systems for national schooling systems (Sellar & Lingard, 2013). From 2000 to 2009, Finland was the PISA poster child because of its outstanding PISA performance, resulting in enhanced educational tourism to Finland by *policy makers* from around the world. (p. 611)

The idea behind the reference societies has added a new product to the rapidly expanding Brazilian EdTechs market. EdTechs begin to offer "immersion experiences" into societies that should be seen as models of education. Silicon Valley – not surprisingly – has been targeted by EdTechs that sell private school managers and teachers tour packages to learn from the "best"[8]. Another case is Finland, which has also gained a lot of attention from Brazilian education institutions and also from Brazilian think tanks (OLIVEIRA, 2017; STHEM Brasil, 2020). One of the best examples of this context of education think tanks and reference societies is the partnership between the Ayrton Senna Institute, Finland and Singapore (AYRTON SENNA INSTITUTE, 2018).

FINAL CONSIDERATIONS

It should be clear that the narratives constructed based on an interpretation of PISA results have catalyzed specific educational trends. These trends are in line with a perspective that is very much in vogue in the context of the Global Education Reform Movement (GERM) and OECD, in which education it is given as a commodity: better PISA results lead to an improvement in economy. So more investment in STEM education would be the solution for economy development, regardless of being in rich or poor countries, both from the northern or southern hemisphere. In this sense, STEM education is one of those trends that is, at the same time, corroborating and being corroborated by certain technical discourses and disseminated as a definitive solution to the problems pointed out by PISA.

Although education programs, methodologies, curricula and new strategies for education systems are indeed important, as well as data and comparisons about them, it is even more important that decision-making based on the data is done in an appropriate, contextualized way and consistent in relation to each school reality that we intend to transform. STEM and other trends in the Brazilian private educational market are being widely adopted not under the rationality of the benefit for the teaching/learning processes in Brazilian schools, but much more by an idealization of what seems to be working out there - in the case of STEM education, focusing on the model that is done in the United States. However, as already demonstrated by other authors, the "success" of 20 years of STEM education in the United States is quite questionable (BLACKLEY & HOWELL, 2015; ZEIDLER, 2016; HOEG & BENCZE, 2017; BENCZE et al. 2018). Not to mention that the trajectory and reception of STEM there, very little reflects the issues and challenges observed here.

In this sense, OECD's regime of external evaluations and narrative construction about model countries seems, at times, to confuse or induce decisions based on an idealization of a perfect education system. Or based on the idea that one must first look outside and ignore what we have inside our schools. An inversion happens: instead of serving as an indicator added to other local indicators, PISA becomes the most important parameter – sometimes the only one. External

[8] One example among many others: https://www.siliconvalley.com.br/

education assessment gains more credibility than internal assessments, which have even undergone systematic cuts and become increasingly lean. Hence, it becomes more important to rank Brazil in relation to Western Europe or the Nordic countries (e.g. Finland) and Asian countries (e.g. Singapore and South Korea). These countries have little or nothing similar to Brazilian reality, whose educational, cultural and economic systems are completely different. Thus, such comparisons must be carefully interpreted.

The logic seems to make sense to someone who is unaware of the needs of education system itself: by imitating a certain foreign model, it may be true that another country will achieve certain goals for education. However, it hides the fact that the PISA experience or proposals such as STEM will contribute in some way to the Brazilian education reality only if combined with education policies that are sensitive to the needs of Brazilian public schools, in addition to a deep knowledge of education managers mentality in thousands of municipalities across the country.

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AUTHORS' CONTRIBUTION

Author 1 - Author of the research, data collection and analysis, and writing of the text.
Author 2 - Research supervision, active participation in the data analysis and revision of the final writing.

CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest involved in the preparation of this paper. This publication is the result of doctoral research, conducted by the main author at the Faculty of Education, University of São Paulo, whose results were published in the doctoral thesis.

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