

Digital Technologies of Information and Communication and the Social Hierarchy of Objects in the field of Education: empirical tests¹

Tecnologias Digitais de Informação e Comunicação e Hierarquia Social dos Objetos no campo da Educação: testes empíricos

André Garcia Corrêa*
Daniel Ribeiro Silva Mill**

ABSTRACT

This article reports an empirical investigation on scientific production in Education using bibliometric and scientometric data, which were analyzed based on concepts created by Pierre Bourdieu for the sociology of science, relying on a historical and philosophical framework. Using metadata from more than 6000 theses presented between 1996 and 2016 in graduate education programs in Brazil with scores of five and above, the Social Hierarchy of Objects in the field of Education was mapped. We also tried to test empirically the statement about research in Education that there was a loss of the object of research in this field in postmodernity and the importance in terms of scientific capital of Digital Information and Communication Technologies (DICT). The data indicated that the hierarchy of objects is very fragmented, but with a core that concentrates a lot of scientific capital and this concentration grew with the field, which can be explained by the high degree of heteronomy in the field and post-modern phenomena. However,

1 Translation by Fabielle Rocha Cruz. E-mail : fabielle.cruz@gmail.com

* Instituto Federal de Educação, Ciência e Tecnologia. São Carlos, São Paulo, Brasil. E-mail: andregcorrea@ifsp.edu.br - <http://orcid.org/0000-0001-5044-1961>

** Universidade Federal de São Carlos. São Carlos, São Paulo, Brasil. E-mail: mill@ufscar.br - <https://orcid.org/0000-0002-8336-3645>

it was possible to map that there are objects that bring more return of scientific capital to the agents of the field: the teacher and their education. Therefore, there was no loss of the object. It was also possible to observe that words related to digital technologies grew and became part of the core in the hierarchy of objects, in the field, at the beginning of the 21st century. Digital technologies are part of the core of the Social Hierarchy of Objects in the field of Education, mainly related to Distance Education.

Keywords: Education. Sociology of science. DTIC. History of Brazilian education.

RESUMO

O presente artigo traz o relatório de uma investigação empírica sobre a produção científica em Educação usando de dados bibliométricos e cientométricos analisados com base em conceitos criados por Pierre Bourdieu para a sociologia da ciência com o auxílio de um referencial histórico e filosófico. Utilizando de metadados de mais de 6000 teses defendidas entre 1996 e 2016 nos programas de pós-graduação em educação no Brasil com notas cinco e superior, gerou-se um mapa da Hierarquia Social dos Objetos no campo da Educação. Também procurou-se testar empiricamente a afirmação acerca da pesquisa em Educação de que houve a perda do objeto de pesquisa na pós-modernidade e a importância em termos de capital científico das Tecnologias Digitais de Informação e Comunicação (TDIC). Os dados mostraram que a hierarquia dos objetos é muito pulverizada, mas com um núcleo que concentra muito capital científico e que tal concentração cresceu com o campo. O que pode ser explicado pelo alto grau de heteronomia do campo e fenômenos da pós-modernidade. No entanto foi possível mapear que existem objetos que trazem mais retorno de capital científico aos agentes do campo: o professor e sua formação. Portanto, não houve perda do objeto. Também foi possível observar que palavras relacionadas a tecnologias digitais cresceram e se tornaram parte do núcleo da hierarquia de objetos do campo no início do séc. XXI. As Tecnologias digitais fazem parte do núcleo da Hierarquia Social de Objetos do campo da Educação relacionados principalmente à Educação a Distância.

Palavras-chave: Educação. Sociologia da ciência. TDIC. História da Educação brasileira.

Introduction

This investigation presents empirical tests with a specific concept introduced by Pierre Bourdieu for a scientific field: the Social Hierarchy of Objects (SHO). The purpose of these tests was to delimit a hierarchy of objects in the scientific field of Education, identifying which ones give more return on symbolic capital to their agents, and verifying the concentration of symbolic capital of terms related to Digital Information and Communication Technologies (DICT). In other words, are objects related to DICT relevant to the field of Education? How to measure this relevance?

For Bourdieu (2007), the scientific field is social and within it, there are struggles and disputes between its agents who develop strategies aimed at the accumulation of scientific capital, which results in what he called the *Social Hierarchy of Objects*. The author describes scientific capital as a symbolic capital that consists of the recognition or credit attributed by the set of competing peers within the scientific field itself (BOURDIEU, 2004). If the scientific field is a place of struggle and dispute among its agents, who occupy unequal positions, the strategies of scientists aim to accumulate the symbolic capital that can be understood as a scientific authority (ÁVILA, 1997). Scientific disciplines do not ignore the hierarchical dispositions of the field, which makes scholars move away from less prestigious objects in a given time window. Using the social network analysis methodology, the investigation sought to empirically evaluate this SHO concept.

Costa *et al.* (2003) describe the network as a metaphor widely used in our time to define the structure of our society, just as in the period before contemporary times, the machine was the most used metaphor to describe the society. Simply, the network, for these authors, could be defined as an organizational design with a large number of spatially dispersed elements and with some connection between them. The authors mainly attribute to DICT this current characteristic of the society of the organization in networks, as they disseminate information almost instantly, even over long distances. Even though the term organization is used to describe social networks, it is not in the sense of an institution or entity, but in the sense of an organizational pattern.

In this way, the present investigation analyzed the objects in the field of Education, as part of a network, based on metadata collected in thesis repositories available online. Using keywords as elements of the network, the connection between them occurs when used together in the same thesis. To determine the hierarchy between these objects, the number of links between certain elements and the number of times each keyword appears were both used as indicators.

For this purpose, the metadata of 6,396 theses was collected from the repositories of their respective institutions, which were presented in Postgraduate Programs in Education (PPE, *Programas de Pós-Graduação em Educação* in Portuguese) from all over Brazil, with a score of five or higher, between 1996 and 2016. These theses added up to a total of 10,481 keywords that, when filtered by a thesaurus of their elaboration, were reduced to 9268 terms². The relation between these keywords was analyzed with various social media indicators as described by Borgatti, Everett and Johnson (2013):

- a) Average degree of network centrality - how many other network nodes does each node connect to?
- b) Weighted average grade - how many times does a keyword appear on the network?
- c) Density - how many connections between the nodes are there compared to the total possible connections?³
- d) Diameter - what is the greatest distance between two indirectly connected nodes?

Data analysis was performed with *Vantage Point*® and *Gephi*® software. The first one manipulated the metadata to generate a matrix with the number of links between the terms. The second one made the calculations of the indicators and generated an image in the graph format. The analysis was divided into three parts. With the complete SHO, with all the terms cataloged and of the most used keywords, here named as the core of the network, and those indirectly linked to the core. Thus, the empirical test sought to verify whether there is even a hierarchy of themes within the field. These data were compared with the theoretical framework, that takes into account the sociological and historical factor of research in Education for analyzes that go beyond the mere description of the network. Next, the analysis relied on a statement by Bittar (2009), in the sense that there would be a loss of the object in Education also in the same period⁴. Finally, the focus of the analysis is on DICT. We looked for terms related to digital technologies among the most used ones and the ones that make the most connections, to determine if they have a high degree of scientific capital and what the evolution of this concentration is over the time window.

2 Often, the keywords had very similar spelling or appeared in the plural and singular, etc.

3 The network density is found by dividing the number of network connections by the number of possible connections. The formula for the possible number of connections is $n(n-1)/2$, as n is the number of nodes. The closer to 1 the result, the denser the network and the more connections there are (BORGATTI; EVERETT; JOHNSON, 2013).

4 Some preliminary analyzes were published in Corrêa and Mill (2018), Corrêa, Veloso and Mill (2018), and Corrêa (2020). However, the data filtering and analysis process has been updated and improved since then. Therefore, some results presented in this text are more accurate in the quantitative scope without qualitative changes in the results.

SHO in the Education area

For the total network, we found 9,268 nodes with 48,633 connections between them. The average degree of centrality of this network is 10.49, and the weighted average degree is 25. The density of the network is 0.001 and the length of its diameter is 8. These data show a very pulverized network, because, even though the SHO is composed of a universe of many words, the average connection between them is very low. Considering all terms, 6,754 (72.87%) are used only once.

What could be the explanation for such a widespread SHO? If the scientific field of Education is a social field along the lines of Bourdieu's (2004) theses, it is a microsome, which is inserted in a macrocosm. Zago (2013) argues that by separating the different spheres of reality, there is an impoverishment of the perception of the real by losing the notion of the whole. With that said, there are different ways to view the total, some of which are more comprehensive than others. The level of generalization achieved by thinking and the objective of each situation will determine the degree to be considered. In the context of this investigation, we consider that the most comprehensive totality would be the current context of postmodernity. Below this, it is the academic field, where all the scientific fields are inserted and, next, the Social Sciences that, finally, contain the field of Education.

What would be the effects of postmodernity that would explain the spread of SHO in the field, then? For Bauman (2001), our time, called by the author of *Liquid Modernity*, is marked by thinking of consumption logic, instead of the production logic of the previous modern era. The author claims that there is a strong individualization in liquid modernity. Problems previously seen as a collective have become individual. This mentality will permeate all facets of society, including scientific production. Bauman (2001) argues that we live in an era of lighter capitalism – the software era – marked by DICT and great mobility of capital and information; in contrast to the modern period, with heavy capitalism – the hardware era – with large factories, with capital geographically trapped and very dependent on its local workforce.

Bauman (1999) introduces the concept of ambivalence in liquid modernity. To control nature and make it predictable, it is necessary to classify and categorize it. Ambivalence occurs when it is possible to give an object or event more than one category, which requires more precise categorization. This implies a gradual abstraction from reality, generating categories incessantly.

Bauman's statements are consistent with the understanding of the Brazilian philosopher Álvaro Vieira Pinto, who analyzed the term technology according to categories of historical materialism. For Pinto (2005), technological development goes through moments of quantitative accumulation, but it generates qualitative leaps eventually. Precisely because they cause changes in the material world, altering the reality that surrounds human beings and impacting their social relationships and knowledge about nature, these qualitative leaps alter social reality or – in Bourdieu's terms – the macrocosm.

Lévy (1994) analyzed the impact that technologies have always had on the ability to perceive the world. From the telescope and the microscope, through the x-ray and simulations made on computers and their algorithms, technologies have always brought conditions to human perception that were out of reach previously, whether in increasing sensory perception or the case of many digital technologies, increased data processing, and analysis. DICT, for Lévy, is meta-scientific, as, in addition to objects of study, they enable new methodologies and procedures.

In addition to seeking to understand the macrocosm of research sociologically, we also seek theoretical foundations in the field of epistemology and theory of knowledge. Epistemologically, this investigation seeks an explanation in Kant (2015) and his transcendental idealism. The philosopher considers that all knowledge begins with experience, perceived by the senses, and is processed by understanding, transforming into a phenomenon, which would be the abstraction of the perception of objective reality, so that later it can be manipulated by reason, which processes concepts and makes syllogisms. Without going through this process of abstraction, the object belongs to the world of noumenon: which is not perceived and, therefore, cannot be processed by human understanding. In other words, even though they are part of the objective reality, the noumena cannot be perceived by the senses and abstracted, which implies the possibility of understanding and the reason for processing them.

The DICT, according to our understanding based on the statements of the authors above, can bring different objects from the social world to the scope of the phenomena by expanding the capacity of human perception and helping in the data processing. DICT has the power to be extensions of the human faculties of comprehension and intuition in the theory of Kantian knowledge.

In this way, we understand that the characteristics of the macrocosm that surround the social field of Education are, largely, conditions of the intense fragmentation of the field. In a dialectical process, the transformations that DICT causes in social relations become an object of study, as stated by Lévy when calling DICT meta-scientific. At the same time, DICT brings to light phenomena that were part of objective reality, but was previously imperceptible, like the SHO

investigated here. Meanwhile, the extreme individualization of Net Modernity and ambivalence increasingly create new categories and fragment explanatory theories and objects to pulverize the SHO of the field and, consequently, itself.

Thus, we believe that the increase in theses submitted in 1996 (40) and 2016 (441) – a growth of 1,000% – contributed to the fragmentation of the field and they show the ambivalence described by Bauman. Further, in the data on SHO, we will show the existence of communities and subnets, or subfields. The increase in scientific production in the field will inevitably generate more abstraction, as more and more explanatory categories and theories are created while DICT allows for faster scientific production and the perception of phenomena or the manipulation of data that were beyond our reach, feeding this process.

In the same way, we try to analyze the network as inserted in cuttings of totality below the liquid modernity. For Hey (2008), the scientific fields are contained in the academic field. Even though the different disciplines have relative autonomy, they all share a common *ethos* within the academic field, which makes it a totality concerning these. Hey (2008) considers that associations, such as the National Association of Graduate Studies and Research in Social Sciences (ANPOCS, *Associação Nacional de Pós-Graduação e Pesquisa em Ciências Sociais* in Portuguese) and the National Association of Graduate Studies and Research in Education (ANPED, *Associação Nacional de Pós-Graduação e Pesquisa em Educação*, in Portuguese) are examples of spaces in this academic field, as they disseminate scientific production and give the force of collective work to singular statements. She highlights the fact that ANPOCS is older than ANPED, and has an Education WG (HEY, 2008). This relationship places Education as belonging to the Social Sciences.

Another research by Hey and Rodrigues (2017) on the Brazilian Academy of Sciences (ABC, *Academia Brasileira de Ciências*, in Portuguese) goes in the same direction and shows that Social Sciences is a large area with internal ramifications. Education is not treated as a specific field within ABC. The social sciences became an area of specialization within ABC only in 2000, but they were not absent before that, being composed of professionals from other dilettante areas and curious about knowledge beyond their training (HEY; RODRIGUES, 2017). The investigations by Hey (2008), and Hey and Rodrigues (2017) describe Education as a scientific field that has its origin and is subordinated to Social Sciences. Therefore, if the Social Sciences enjoy little relative autonomy within the macrocosm - due to the nature of their objects – this heteronomy would be even more accentuated in Education because it is subordinate to the same Social Sciences, thus sharpening the pulverization of the field, as many external forces determine their flow of symbolic capital.

An analysis of the historical process of research in Education helps understand the heteronomy of the field. Bittar (2009) says that the creation of PPE at PUC from both Rio de Janeiro (1965) and São Paulo (1968) was a watershed in the history of the Education field and, before that, the main theoretical basis for research was the sociology. Vieira (2003) highlights the importance of Anísio Teixeira at the beginning of the 20th century for the field that understood that psychology, sociology, and anthropology, would dedicate themselves to the research of educational phenomena while educators should produce the art of educating. Because of this vision from Anísio Teixeira, we have the process of implanting research in Education in Brazil at the beginning of the last century, which was not associated with the formation of researchers directly linked to the educational area.

Education, before being a field, was an object⁵. Even today, it is within the Social Sciences, using its methods and theoretical references and several researchers from different areas are working on the theme. This characteristic has always been present in its history and removes the autonomy of the field, which we believe reinforces its pulverization. Bittar (2009) goes so far as to say that in postmodernity, there was a loss of the object in Education, such was its fragmentation. This statement will be tested in the next empirical analyzes of SHO. After this broader analysis of the field that helps us understand its dynamics of the distribution of symbolic capital, we can test the importance of DICT within it.

Analysis from SHO segments

To proceed with the analysis of the network formed by the keywords, the investigation divided it into three distinct segments.

- a) Edge: keywords that are not directly or indirectly connected to the core;
- b) Satellite words: not directly part of the core, but are linked to it;
- c) Hardcore: 50 most frequent terms, located in the center of the network.

⁵ Bauman's ambivalent process also helps to understand how the continuous abstraction about the object led to the creation of its own scientific field.

The satellite words

Satellite words are those that are not part of the hardcore but are linked to it. Therefore, to find them, it is necessary to find it first. The *Vantage Point*® software generated a matrix with all cataloged keywords, listing how many times a term is accompanied by another or other terms. In the investigation, we consider the core as the 50 words with the highest weighted degree. Then, using the same software, we generate a second matrix, this time excluding words not linked to the core.

The network that includes satellite words is still very widespread, but its indicators point to an increase in relations. There are 5,694 nodes (61.43% of the SHO total), that make 3,317 connections between them (69.32% of all SHO connections). Next, in Table 1, we present the indicators of the total network side by side compared to the nucleus and its satellite words.

TABLE 1 – COMPARISON OF SHO TOTAL NETWORK INDICATORS WITH THE CORE AND THEIR SATELLITE WORDS

	SHO total	Core + Satellite words	Variation
Average degree of centrality	10,49	11,84	12,86%
Weighted average grade	25	29,55	18,2%
Density	0,001	0,002	100%
Diameter	8	4	-50%

SOURCE: Created by authors from collected data.

What can be inferred from these data is that, although the SHO without the border remains very pulverized, there is a tendency of concentration of connections and an increase in all indicators. In other words, as you advance towards the core, there is a densification of the network and the keywords are used more often on average, as well. Around 69% of calls are in 61% of keywords. The first signs of a hierarchy of objects begin to appear.

The hardcore

For the extraction of the hard core, the procedure was different. With the matrix generated with all keywords, an extraction, of what would be a network composed only of the first 50 rows, and columns of this matrix, was conducted. In other words, only the links between the nodes with a higher weighted degree among themselves, completely excluding the nodes from the satellite words.

When looking at the core of SHO, the situation differs greatly from what we have presented so far. Considering the cutout of the core as a network in itself, the results show a much greater relationship between the nodes for all indicators, as we compiled in Table 2.

TABLE 2 – COMPARISON OF SHO TOTAL NETWORK INDICATORS WITH THE CORE WITHOUT SATELLITE WORDS

	SHO total	SHO core	Variation
Average degree of centrality	10,49	31,04	195,9%
Weighted average grade	25	271,92	987,68%
Network Density	0,001	0,633	63200%
Diameter	8	2	-75%

SOURCE: Created by authors from collected data.

The concentration of the network density and the increase in all indicators is striking. The average number of connections that a node makes with others is around 31 in a universe of 50 nodes. A density of 0.633 indicates that 63.3% of the number of possible connections was made. When departing from any node *A* towards any node *B*, there is a 63.3% chance that they are directly connected. The drop in the diameter of the network to just 2 indicates a large density.

An algorithm developed by Blondel *et al.* (2008) and used by the software *Gephi*® divided nodes into communities. It breaks the network down into groups of nodes that connect more than to others. Four communities were identified by the software in our core, led by *Education*, *Teacher*, *Early Childhood*, and *Special Education* nodes. Figure 1 illustrates all of this information, in a graph format, with the SHO core.

The net can be very pulverized, but its core is dense. The words that appear here are often used and strongly linked together. Even though the field is pulverized to the point that it seems to have lost its object the core demonstrates that, at least in the observed temporal window, there are, indeed, objects that are at the center of its hierarchy of interests that revolve, mainly, around the teacher and their training. However, there was multiplication in many objects, explained in part by the phenomenon of Bauman's ambivalence, and in part by the high degree of heteronomy of the field concerning its macrocosm. It is in Liquid Modernity or Post-Modernity that the transformation of the Education object into a scientific field takes place, since PPE appeared in the post-war period, in the 1960s. The field of Education was not only affected by post-modernity, but it is the fruit of it, in a sense. It is possible to argue that the ambivalence movement itself contributed to transforming Education from an object to its field.

Therefore, in this first observation of the SHO of the field and its core, the importance of DICT as objects became evident. The core, which is where most of the symbolic capital is concentrated, as it has terms related to technological issues. The meta-scientific character of DICT described by Lévy (1994) is the first argument to explain this concentration of scientific capital. Nevertheless, this overall picture provides more superficial evidence and our analysis will focus on the symbolic capital of TDIC for the next topic.

The evolution of SHO in the field of Education and the scientific capital of DICT: an analysis of the hardcore

In the first examination of the hardcore, it was possible to observe the relevance of DICT for the field of Education, with three keywords in the center of the network that forms the SHO. However, in this first examination, we observed the center of the network in the window from 1996 to 2016. Therefore, we decided to look at the core at different times to map when the DICT arrived at the center of the SHO field. Thus, we repeat the analysis in three segments of 7 years each: *Period 1* from 1996 to 2002, *Period 2* from 2003 to 2009, and *Period 3* from 2010 to 2016.

First analysis period

In Period 1, firstly, there is a field that is still small concerning the total period: there are 477 theses (7.46% of the total) with 943 keywords on the subject. It was expected that the core of Period 1 would be smaller in the degrees of centrality and weighted since the segment comprises fewer theses and fewer keywords. However, the density of the network is also lower, while the diameter is larger, showing less cohesion between the objects of the network and less concentration of scientific capital.

As shown in Figure 2 and Table 3, the numbers show that a node connects, on average, and in comparison with the total field SHO, less often with other nucleus nodes, and the number of connections made is much smaller, among the possible outcome. There is only a 20.9% chance of leaving any node *A* and arriving at any node *B* in the Period 1 Core. The smaller diameter of the total SHO Nucleus shows more direct connections between nodes. Proportionally, the core of Period 1 is less concentrated in symbolic capital than the core of total SHO. No DICT related keywords have yet to appear. This indicates that, at the end of the 20th century, the technological theme did not yet concentrate enough scientific capital to be at the core of the HSO.

TABLE 3 – COMPARISON OF SHO CORE INDICATORS WITH THE PERIOD 1 CORE

	SHO core	Period 1 Core	Variation
Average degree of centrality	31,04	10,24	-67,01%
Weighted average grade	271,92	34,16	-87,43%
Network Density	0,633	0,209	-66,98%
Diameter	2	4	100%

SOURCE: Created by authors from collected data.

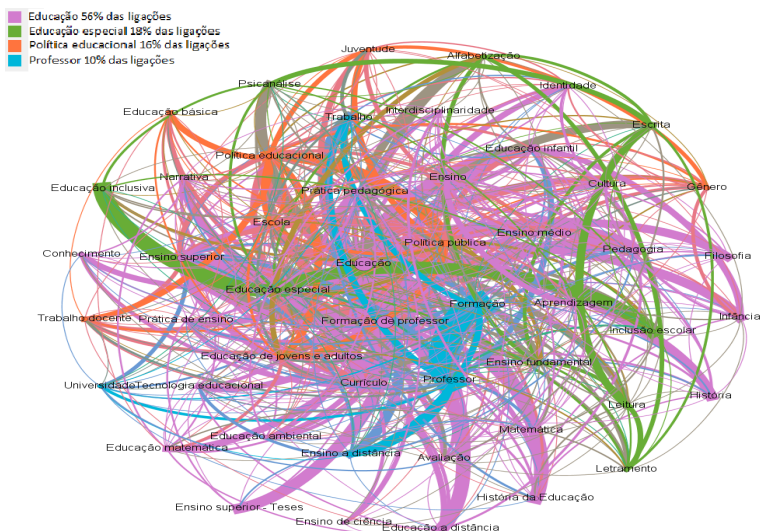
The terms Distance Education and Educational Technology showed an increase in centrality and weighted degrees in Period 3 in relation to Period 2. Distance Education lost its centrality, being replaced by the term Distance Education. This indicates a greater concentration of symbolic capital for these terms, showing an increase in the importance of DICT in the field's SHO. Table 5 and Figure 4 illustrate this information, while Table 6 shows the increase in indicators of terms related to DTIC that signal a concentration of scientific capital.

TABLE 5 – COMPARISON OF SHO CORE INDICATORS WITH THE PERIOD 3 CORE

	HSO Core	Period 3 Core	Variation
Average degree of centrality	31,04	23,68	-23,71%
Weighted average grade	271,92	152,64	-43,86%
Network Density	0,633	0,483	-23,69%
Diameter	2	2	-

SOURCE: Created by authors from collected data.

FIGURE 4 – SHO CORE FOR PERIOD 1



SOURCE: Created by authors from collected data.

TABLE 6 – EVOLUTION OF INDICATORS BETWEEN TERMS RELATED TO DICTURES BETWEEN PERIOD 2 AND PERIOD 3

	Period 2	Period 3	Variation
Degree of centrality Distance Education	14	15	7,14%
Weighted degree Distance Education	66	96	45,45%
Degree of centrality Educational Technology	13	24	84,61%
Weighted Degree Educational Technology	64	82	28,12%

SOURCE: Created by authors from collected data.

Regarding the terms related to the distance modality highlighted, this could be explained by the fact that distance education necessarily uses technologies and techniques for communication because teaching is separated temporally and/or geographically from learning (MOORE; KEARSLEY, 2010). The strong relationship between distance education and DICT placed the modality as one of the objects that concentrate scientific capital in SHO. In a dialectical movement, DICT and Distance Education gain space at SHO for their intrinsic relationship at the beginning of this century.

Terms related to teacher training also stand out in the concentration of symbolic capital. Investigations, such as those by Mishra and Koehler (2006), talk about the category of technological knowledge that has become part of the knowledge base for teaching. This indicates that teacher training, as well as distance education, is linked to the use of DICT, helping to explain the concentration of scientific capital in objects involving digital technologies.

Conclusion

The purpose of this article was to test empirically the existence of a Social Hierarchy of Objects along the lines of Bourdieu's theses and the concentration of scientific capital in terms related to DICT. With the method of analysis of networks and scientometric metadata collected from a universe of more than 6,000 theses, in a window of 21 years and with the help of *Gephi®* e *Vantage Point®* software, we believe to have taken the SHO out of the world of noumenon in the field of Education and it was possible to show the concentration of symbolic capital for the field DICT in their SHO.

Our data showed a great dispersion of the field due to a deep growth in scientific production. However, SHO's analysis showed there is hardcore that accumulates a large amount of symbolic capital, mainly around the teacher and their education. Furthermore, the hardcore influences much of the rest of the keywords because their terms link directly and indirectly to the SHO segment that has been called *satellite words*.

Possible explanations for this pulverization are the effects of Liquid Modernity described by Bauman, mainly the phenomenon of ambivalence, which forces a constant abstraction of the field and leads to its fragmentation. The high degree of heteronomy in the field of Education, which for most of the 20th century was the object of Social Sciences and, even today, this degree is subject to them, contributed to this state.

Analyzing the core in different periods, it was possible to verify that the teacher and their formation are present in the center of the core since the beginning. We show that the scientific capital was concentrated as the field grew. Terms related to DICT appear in the core from Period 2 and the increases in degrees of centrality and weighted terms such as Distance Education and Educational Technology, in Period 3, show that DICT gained importance in the field at the beginning of the 21st century. This relevance was concentrated in distance education due to its intrinsic relationship with DICT at the same time that research on teacher education shows concern in the field between teaching-learning and technologies. Further research can focus on the DICT-Teacher training and DICT-DE relationships at SHO and measure more deeply this exchange of scientific capital between such objects.

REFERENCES

- ÁVILA, Patrícia. A distribuição do capital científico: diversidade interna e permeabilidade externa no campo científico. *Sociologia-problemas e práticas*, Lisboa, Portugal, n. 25, p. 9-49, 1997.
- BAUMAN, Zygmunt. *Modernidade e ambivalência*. Rio de Janeiro: Zahar, 1999. 334 p.
- BAUMAN, Zygmunt. *Modernidade líquida*. Rio de Janeiro: Zahar, 2001. 280 p.
- BLONDEL, Vincent D. *et al.* Fast unfolding of communities in large networks. *Journal of Statistical Mechanics: Theory and Experiment*, Trieste, Itália, n. 10, p. 1-12, 2008.
- BITTAR, Marisa. A pesquisa em educação no Brasil e a constituição do campo científico. *Revista HISTEDBR online*, Campinas, SP, n. 33, p. 3-22, 2009. Available from: http://www.histedbr.fe.unicamp.br/revista/edicoes/33/art01_33.pdf. Access on: may, 2017.
- BORGATTI, Sthephen P.; EVERETT, Martin G.; JOHNSON, Jeffrey C. *Analyzing Social Networks*. Londres: SAGE, 2013. 296 p.
- BOURDIEU, Pierre. Método científico e hierarquia social dos objetos. In: NOGUEIRA, Maria Alice; CATANI, Afrânio (org.). *Escritos de Educação*. Petrópolis, RJ: Vozes, 2007. p. 33-38.
- BOURDIEU, Pierre. *Os usos sociais da ciência: por uma sociologia clínica do campo científico*. São Paulo: Editora Unesp, 2004. 88 p.
- CORRÊA, André Garcia; MILL, Daniel Ribeiro Silva. Produção científica em educação sobre tecnologias digitais de informação e comunicação: análise de teses defendidas entre 1996 e 2016. In: CONGRESSO INTERNACIONAL DE EDUCAÇÃO E TECNOLOGIAS; ENCONTRO DE PESQUISADORES EM EDUCAÇÃO A DISTÂNCIA, 4., 2018, São Carlos. *Anais [...]*. São Carlos: UFSCar, 2018. Available from: <https://cietenped.ufscar.br/submissao/index.php/2018/article/view/595/671>. Access on: apr. 10, 2020.
- CORRÊA, André Garcia. *Tecnologias Digitais no campo da Educação no Brasil: distribuição do capital científico entre 1996 e 2016*. 2020. 226 f. Tese (Doutorado em Educação) - Universidade Federal de São Carlos, São Carlos, 2020.
- CORRÊA, André Garcia; VELOSO, Braian Garrito; MILL, Daniel Ribeiro Silva. Análises bibliométricas sobre educação a distância e trabalho docente: primeiros olhares. In: CONGRESSO INTERNACIONAL DE EDUCAÇÃO E TECNOLOGIAS; ENCONTRO DE PESQUISADORES EM EDUCAÇÃO A DISTÂNCIA, 4., 2018, São Carlos. *Anais [...]*. São Carlos: UFSCar, 2018. Available from: <https://cietenped.ufscar.br/submissao/index.php/2018/article/view/313/379>. Access on: apr. 10, 2020.
- COSTA, Larissa *et al.* *Redes: uma introdução às dinâmicas da conectividade e da auto-organização*. Brasília, DF: WWF-Brasil, 2003. 91 p.

HEY, Ana Paula. *Esboço de uma sociologia do campo acadêmico: a educação superior no Brasil*. São Carlos: EdUFSCar, 2008. 177 p.

HEY, Ana Paula; RODRIGUES, Lidiane Soares. Elites acadêmicas: as ciências sociais na Academia Brasileira de Letras. *Tempo Social, Revista de Sociologia da USP*, São Paulo, v. 29, n. 3, p. 9-33, dez. 2017.

KANT, Immanuel. *Crítica da razão pura*. 4. ed. Petrópolis, RJ: Vozes; Bragança Paulista: Editora Universitária São Francisco, 2015. 621 p.

LÉVY, Pierre. *A máquina universo: criação, cognição e cultura informática*. Lisboa: Instituto Piaget, 1994. 245 p.

MISHRA, Punya; KOEHLER, Matthew J. Technological Pedagogical Content Knowledge: A framework for teacher knowledge. *Teachers College Record*, Columbia, v. 108, n. 6, p. 1017-1054, 2006.

MOORE Michael; KEARSLEY, Greg. *Educação a distância: uma visão integrada*. Tradução Roberto Galman. São Paulo: Cengage Learning, 2010. 398 p.

PINTO, Álvaro Vieira. *O conceito de tecnologia*. Rio de Janeiro: Contraponto, 2005. v. 1. 531 p.

VIEIRA, Carlos Eduardo. Anísio Teixeira e a pesquisa em educação no Brasil: ensaio sobre o processo de formação do campo. *Série-Estudos*, Campo Grande, MS, n. 15, p. 167-178, jan./jun. 2003. Available from: <http://www.serie-estudos.ucdb.br/index.php/serie-estudos/article/view/535>. Access on: may, 2017.

ZAGO, Luis Henrique. O método dialético e a análise do real. *Kriterion*, Belo Horizonte, v. 54, n. 127, p. 109-124, jun. 2013. Available from: <http://www.scielo.br/pdf/kr/v54n127/n127a06.pdf>. Access on: june, 2019.

Text received on 08/09/2020.

Text approved on 01/09/2020.