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# Social hierarchy of objects in the field of education: early childhood education and digital information and communication technologies

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**ABSTRACT.** This study is part of a broader research series that uses a database to analyze the distribution of scientific capital within a social hierarchy of academic objects, following Pierre Bourdieu's sociological framework. More specifically, this research examines scientific capital in a metadatabase composed of dissertations defended between 1996 and 2016 in the field of education in Brazil. The topics analyzed were early childhood education and digital information and communication technologies (DICT). Using the concept of social hierarchy of objects and scientometric indices to analyze social networks, the hierarchical relationship of the symbolic capital of the chosen topic in the field of education was measured and a description of the resulting network and an analysis of the results found was made. The analyses have shown that although early childhood education and DICT are objects with a high symbolic capital in the field of education, the two terms do not connect or exchange symbolic capital with each other. Possible explanations for this include the specificity of early childhood education, which tends not to use DICT in its pedagogical practice, and the training of educators, which generally does not address the use of DICT. The timeframe until 2016 is another important factor, as it corresponds to a time before the COVID-19 pandemic and before the enforced use of DICT in all areas of education.

**Keywords:** early childhood education; digital information and communication technologies (DICT); sociology of science; social hierarchy of objects; scientific capital.

## Hierarquia social dos objetos no campo da educação: a Educação Infantil e as tecnologias digitais de informação e comunicação

**RESUMO.** Esta investigação é parte de uma série de trabalhos que utiliza uma base de dados para mensurar a distribuição de capital científico em uma hierarquia social de objetos segundo parâmetros da sociologia da ciência de Pierre Bourdieu. Mais precisamente, neste trabalho se investiga o capital científico em uma base de metadados composta de teses defendidas no campo da Educação no Brasil entre 1996 e 2016. O recorte de análise foram os temas da Educação Infantil e das Tecnologias Digitais de Informação e Comunicação (TDIC). Usando do conceito da Hierarquia Social dos Objetos e índices cientométricos de análises de redes sociais, procurou-se medir a relação hierárquica de capital simbólico dentro do campo da Educação da temática escolhida e descrever a rede encontrada, bem como uma análise com inferências para os resultados encontrados. As análises mostraram que apesar de Educação Infantil e TDIC serem objetos de alto teor de capital simbólico no campo, os dois termos não fazem ligações ou trocas de capital simbólico entre si. Possíveis explicações seriam a especificidade da Educação Infantil que tende a não usar TDIC na sua prática pedagógica e a formação do pedagogo que geralmente não contempla o uso de TDIC. Outro fator importante é o recorte temporal até 2016, período pré-pandemia de COVID-19 antes do uso forçado de TDIC em todas as áreas da Educação.

**Palavras-chave:** educação infantil; tecnologias digitais de informação e comunicação (TDIC); sociologia da ciência; hierarquia social dos objetos; capital científico.

## Jerarquía social de objetos en el campo de la educación: educación infantil y las tecnologías digitales de la información y la comunicación

**RESUMEN.** Esta investigación forma parte de una serie de trabajos que utilizan una base de datos para medir la distribución del capital científico en una jerarquía social de objetos según parámetros de la

sociología de la ciencia de Pierre Bourdieu. Más precisamente, esta investigación investiga el capital científico en una base de metadatos compuesta por tesis defendidas en el campo de la Educación en Brasil entre 1996 y 2016. El recorte de análisis fueron los temas de Educación Infantil y Tecnologías Digitales de Información y Comunicación (TDIC). Utilizando el concepto de Jerarquía Social de Objetos e índices cienciométricos de análisis de redes sociales, se intentó medir la relación jerárquica de capital simbólico dentro del campo de la Educación del tema elegido y describir la red encontrada, así como inferenciais de los resultados encontrados. Los análisis mostraron que, aunque Educación Infantil y TDIC son objetos con un alto nivel de capital simbólico en el campo, los dos términos no se vinculan ni intercambian capital simbólico entre sí. Posibles explicaciones serían la especificidad de la Educación Infantil que tiende a no utilizar las TIC en su práctica pedagógica y la formación de pedagogos que generalmente no contempla el uso de las TIC. Otro factor importante es el marco temporal hasta 2016, periodo anterior a la pandemia de COVID-19 antes del uso forzado de las TIC en todos los ámbitos de la Educación.

**Palabras-clave:** educación infantil; tecnologías digitales de la información y la comunicación (TDIC); sociología de la ciencia; jerarquía social de objetos; capital científico.

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## Introduction

This work aims to investigate the position of early childhood education in the social hierarchy of objects (SHO) in the field of education and its relationship with digital information and communication technologies (DICT) through empirical tests and from the perspective of sociology of science. The field of data collection refers to the scientific field of education and the tests are carried out on a section of the entire field (the works on early childhood education) in order to analyze, with the help of SHO, which terms bring more symbolic capital to the actors and the concentration of this capital in relation to DICT and early childhood education (Corrêa & Mill, 2020b).

SHO is a concept introduced by Pierre Bourdieu (2007) for the scientific field. For the author, the scientific field is a social field permeated by struggles and confrontations between its actors, characterized by strategies for the accumulation of scientific capital, leading to a hierarchy of objects within the field itself. The fields are microcosms structured by the positions taken by different actors and have relatively specific laws embedded in a macrocosm constituted by and influenced by the global social space (Scartezini, 2012).

It is a ratio of the potential return on symbolic capital that each object in the scientific field has, which can be more or less high (Corrêa & Mill, 2020b). This hierarchical arrangement in the field shows that less prestigious objects are forgotten and/or abandoned by researchers over time. That is, scientific capital, refers to the symbolic capital composed of the recognition and credit received from the set of competing peers within the scientific field in which scientists search for strategies to accumulate scientific authority – what Bourdieu called habitus (2007).

In order to empirically assess the SHO of early childhood education in the scientific field of Education and its relationship to DICT, we used the methodology of social network analysis to test the extent to which the symbolic capital of these objects – early childhood education and DICT – can flow back to the actors in the education sector.

The methodology of social network analysis refers to an organizational design in the sense of an organizational pattern composed of numerous elements that are spatially dispersed but in some way interconnected. These networks are the subject of the analysis as they make it possible to visualize the connections between their elements.

In this context, a previously existing database was used that contains metadata from online repositories of theses defended in Brazilian postgraduate programs in education (PPGE) with a grade of five or higher between 1996 and 2016. In total, there are 6,396 theses in the complete database and their analysis can be found in the article entitled: Digital information and communication technologies and social hierarchy of objects in education: empirical tests (Corrêa & Mill, 2020a). For this purpose, the keywords of these theses were considered as elements of the network (objects in Bourdieusian terms) and the connection between them when those terms appear together in the same thesis.

A total of 10,481 keywords were found, which were reduced to 9,268 after filtering through a separate thesaurus – that was needed in some cases, for example when there were terms in the plural and singular form and/or with a different spelling that were counted twice.

The metadata that make up the database were collected in 2017 and the relationships between the keywords were analyzed using some social network indicators: (a) average degree centrality of the network – refers to the amount that each term connects to other terms in the network; (b) weighted average degree – deals with the number of uses of a keyword in the network; (c) density – it is a ratio of the existing number of connections between terms to the total possible connections; and (d) diameter – is the largest distance between two indirectly connected terms (Borgatti et al., 2013; Corrêa, 2020; Corrêa & Mill, 2020a).

In addition to these indicators, the software programs Vantage Point and Gephi were used to process the metadata and calculate the indicators respectively. The two software programs enabled us to create an array with the number of links between the keywords and an image of the network in graph format.

The data collected were compared with the theoretical framework that considers the training of teachers to teach early childhood education in order to empirically test the weight of early childhood education in the field of education and its relationship with DICT in SHO.

The SHO indicators of the complete basis were compared with the SHO indicators of the early childhood education segment and their relationship to the DICT.

## The Early Childhood Education Professional

In order to analyze the SHO of early childhood education, the subfield of educational science that is dealt within this paper, it is necessary to delineate the professional profile of the early childhood educator as well as this field of education in itself.

Early childhood education was institutionalized by the Law on the Guidelines and Foundations of National Education – LDB No. 9394/1996 – as the first stage of basic education, with the aim of the integral development of the child between the ages of zero and five in its physical, affective, intellectual, linguistic and social aspects, complementary to the action of the family and the community. This legal recognition of early childhood education as a stage of the educational process also stipulated that the training of pedagogical professionals should be at a higher level (Law No. 9.394, 1996).

In this context, the Pedagogy degree program appears as a higher-level initial vocational training offer, with the aim of preparing professionals to work in early childhood education and the first years of elementary school, as well as in the areas of pedagogical coordination, supervision and school administration. It is an undergraduate degree program offered in person and/or by distance learning in public or private institutions, with a focus on teachers formation – both theoretical and practical (Law No. 9.394, 1996; Vargas, 2016).

Introduced in 1939 in the Brazilian higher education system, the Pedagogy degree program underwent successive changes in its curriculum and a lack of definition in relation to the identity of the trained professional, the educator. As Vargas (2016) notes, since its institutionalization, the course has fluctuated between different faces, objectives and professional profiles, based on legislation that sometimes gave priority to the training of education specialists, sometimes tried to reconcile the preparation of teachers and specialists, and sometimes emphasized training for teaching.

In 2006, the adoption of the National Curriculum Guidelines for Pedagogy (DCNP), which set out the objectives and structure of Pedagogy courses, established teacher training as a central objective of the course. From then on, higher education institutions faced the challenge of restructuring the curriculum to meet the legislation guidelines, taking into account the needs and requirements of the Brazilian education system, as well as the context and specificities of the institutions (Vargas, 2016).

In addition, the institutionalization of distance education (DE) in Brazil contributed to the growing demand for pedagogy courses in this modality. A milestone was the creation of the Open University of Brazil (UAB) system, which formalized the offering of distance education courses by public higher education institutions. The distance education guidelines, which allow higher education institutions to operate in distance education, have been strongly followed by private universities, with the Pedagogy degree program having one of the highest enrollments in distance education nationwide (Bahia, 2015).

However, studies carried out to investigate the curricular matrices of pedagogy courses in public and private institutions, and analyzed by Vargas (2016), have shown that, in general, the initial training offered lacks a link between theory and practice. The theoretical approaches are little deepened and lack content related to early childhood education and primary education, which are essential knowledge for the professional practice of teaching. As a result, the training of teachers is inadequate for the content they are supposed to teach, which contributes to the problem of the Brazilian education system, which

has unsatisfactory levels of student performance. Therefore, these studies note that there are still inconsistencies in the training of educators and point to the urgent need to reformulate the curricula of pedagogy courses.

Furthermore, factors not directly related to teacher performance in this context reflect the uncertainties of initial teacher education. Distance learning raises criticisms: It can be a simplified training to the detriment of a thorough one, which ultimately results in feelings of uncertainty about the validity of the course, the low attractiveness of the teaching profession in terms of remuneration and social prestige, and low competition for access to the public higher education system (Bahia, 2015; Vargas, 2016).

In relation to DICT, Vargas (2016) also noted in his study that the disciplines dedicated to technologies are completely absent from the curricula of pedagogy courses. This fact indicates that this professional training does not yet promote the exploration of the use of DICT, which contributes to the uncertainties in initial teacher training.

Given this panorama, which helps to understand the scenario of professional training for educators in Brazil and the profile of its graduates, we can now analyse the scientific production of the educational field on the subject.

## SHO Analysis of Early Childhood Education

It is only possible to analyse a network segment or an SHO if there is a reference for comparison. Since the field consists of objective relations, we must always consider the object of our analysis with another similar object as a reference in order to be able to make an analysis or statement. So, to understand the SHO of early childhood education, we will make comparisons with the whole SHO of the complete dataset. More specifically, with its core.

In his analysis of SHO in education, Corrêa (2020) identified three different segments of this network, which he considers to be essentially observable. These segments are distinguished by the number of links between their objects and, consequently, by the distribution and concentration of scientific capital. These are: a) the fringe, which consists of concepts that are not connected to each other and/or to the other segments of the network. They have a very low centrality; b) satellite terms, which are not so much at the center of the network, but are linked to objects that form the center; c) the core or even hard core, i.e. the 50 most frequently used keywords. They thus represent the highest concentration of scientific capital within the field. They are the objects with the greatest centrality and the highest weighted degree in the network. They are the ones that, from the point of view of the sociology of science, could bring more symbolic gains (wich translates to scientific authority) to the actors in the field. Corrêa's (2020) analyses have shown that the flow of scientific capital in the field is very much concentrated in the core of SHOs – and where there is more competition as one approaches the edge an increase in controversy provides for an increasing dispersion or entropy of scientific capital. We compare the target segments of this study – the SHO of early childhood education and its core – with the SHO core of the field as a whole. This choice of references is made because the core is the maximum concentration of capital one can find in the field of education.

The HSO of the subnetwork for early childhood education consists of 657 nodes and establishes 2,955 connections. The average degree centrality is 9.009 and the weighted degree is 19.939. The density of the network is 0.014. Table 1 shows the indices described in this paragraph.

**Table 1.** Degree of centrality, weighting and density of SHO Early Childhood Education.

| | |
|---|---|
| Average degree of centrality | 9.009 |
| Weighted average grade | 19.939 |
| Density | 0.014 |

Source: Data analyzed by the author in the Grupo Horizonte database.

When comparing with the SHO core of the whole field, i.e. the 50 keywords that occur most frequently, witch are at the center of the whole network and concentrate the largest symbolic capital measured so far in Education, we find that the SHO of early childhood education is much less dense and has lower average values for centrality and weighted degree. This shows that early childhood education is still a field with a relatively low concentration of scientific capital. Table 2 shows the indexes of the two network segments.

**Table 2.** Comparison of the indicators of the core area of SHO Total with the sub-area of early childhood education.

| | Core of Total SHO | Early childhood education SHO | Growth in % |
|---|---|---|---|
| Average degree of centrality | 31.04 | 9.009 | -70.97% |
| Weighted average grade | 271.92 | 19.939 | -92.66% |
| Density | 0.633 | 0.014 | -97.78% |

Source: Data analyzed by the authors in the Grupo Horizonte database.

A look at the growth indicators shows that the indexes of the sub-network for early childhood education are declining. In other words, compared to the core of the entire field, early childhood education shows deviations of -70.97% in the degree of centrality, -92.66% in the average degree and -97.78% in density, which underpins the low concentration of symbolic capital.

However, when dividing the core network of the entire field into clusters of nodes that are more connected to each other than to others, the Early Childhood Education node is the most central on in a clusters that represents 20% of the network's connections, meaning that the object of early childhood education is at the center of the field's attention, even though it brings less scientific capital to the scientific actors than its most central topic of all: teachers formation. Figure 1 shows an illustration with a graph of the SHO core in the field of education. In the figure, the keywords become nodes. They are therefore the objects of the network. The larger the size of the node in the figure, the greater its weighted degree. In other words, the larger a node is, the more frequently it is used as a keyword. The further away the node is from the center of the figure, the lower its degree of centrality gets. This means that the closest it is to the center of the image, the more connections it makes with other nodes. Finally, the Gephi software has divided the graph's connections into sub-networks or clusters. These clusters are represented by different colors.

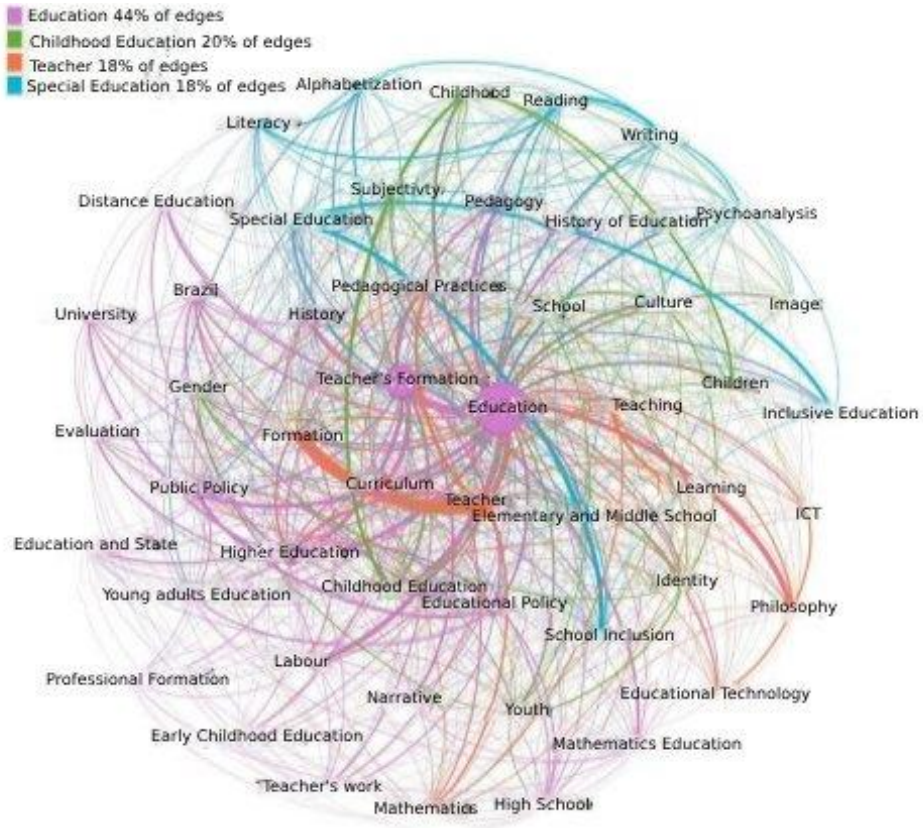


**Figure 1.** Graph representing the core of the complete SHO of Education.
Source: Corrêa and Mill (2020b).

For a better analysis of the SHO of early childhood education, we als have extracted the core of its network of keywords. The core of the SHO of early childhood education represents the 50 keywords – or objects - that can provide the field’s agents with the greatest return on scientific capital and are the focus of attention in this extract of the scientific domain of Education. Table 3 shows us the comparison between the SHO indexes for early childhood education and its hard core.

**Table 3.** Comparison of the indicators of the SHO Early Childhood Education sub-network with its core.

| | Early Childhood Education SHO | Early Childhood Education SHO Core | Growth in % |
|---|---|---|---|
| Average degree of centrality | 9.009 | 10.76 | 19.43% |
| Weighted average grade | 19.939 | 40.64 | 103.82% |
| Density | 0.014 | 0.22 | 1471.42% |

Source: Data analyzed by the authors in the Grupo Horizonte database.

The SHO core "Early Childhood Education" shows a significant increase in the weighted grade average, with the node "Early Childhood Education" present 416 times in this subnetwork. The centrality and density averages relative to the overall Early Childhood Education subnetwork have also increased. These values are not as high as those of the Total SHO core, but show that a concentration of symbolic capital in objects of the core can also be observed within this sub-set data base.

These indicators show that within the SHO of early childhood education, the core has a higher density and the nodes that connect more with each other than among others are: Early Childhood Education, Teacher, Continuing Teacher Formation, Primary Education and Child Education, which are represented in the graph by the colors pink, green, blue, red and dark green, respectively, as shown in Figure 2. These are the topics that are at the center of the subnetwork.

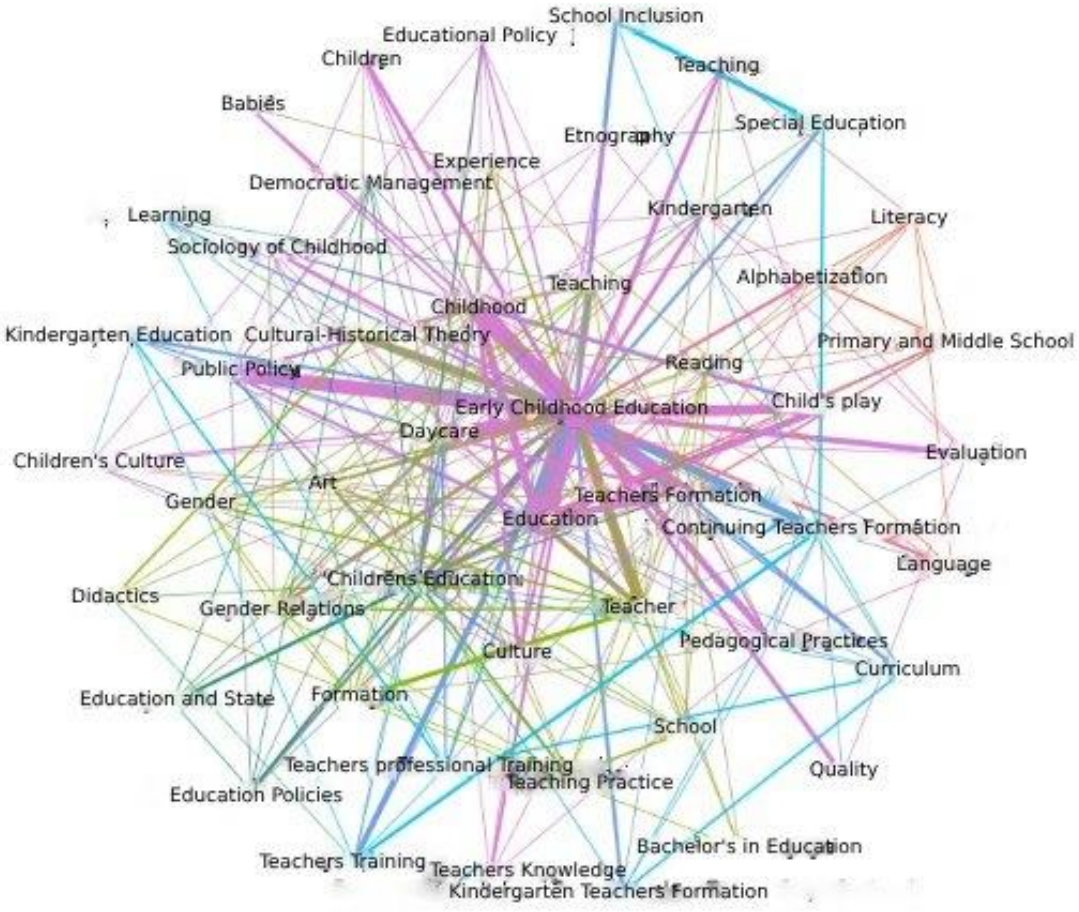


**Figure 2.** Graph representing the core of the Early Childhood Education SHO.

Source: Data analyzed by the authors from the research carried out by Corrêa (2020) in the private Grupo Horizonte database.

As far as DICT is concerned, it can be noted that the SHO for early childhood education does not mention these technologies, i.e. no key words appear in this context. This indicates that DICTs receive less attention in the Early Childhood Education sub-network and consequently the scientific capital is not focused on these topics. This is a fact that draws attention as DICTs have been part of the center of the total SHO of the field of Education from the moment they emerge – the end of the twentieth century (Corrêa & Mill, 2020a). So what would be a possible explanation for the fact that an object that concentrates so much symbolic capital in the whole field of Education does not have the same concentration in the sub-network of early childhood education?

The lack of terms related to DICT in the field of early childhood education can be explained by the fact that there are conflicts and disagreements about the constitution of the pedagogy degree program. Vargas (2016), when analyzing some curricular matrices of the pedagogy degree program in some universities, found that there are no disciplines that deal with technologies, which assigns a secondary importance to this topic in the initial formation of educators.

In contrast, distance education is an important mechanism for expanding access to higher education, and distance education pedagogy courses in Brazil are reported to be one of the largest in terms of the number of students enrolled (Bahia, 2015), suggesting that DICT could be better explored when it comes to teachers formation. However, as Vargas (2016) notes, the lack of DICT is understandable in part because education majors require a very diverse professional preparation, which leads to curriculum bloat and a lack of space for even more disciplines.

Another point that should be highlighted and that can illustrate the low concentration of scientific capital in the field of early childhood education is the fact that in the studies analyzed by Vargas (2016), it was found that early childhood education was not included in about 29% of the curricula of pedagogy degree programs, which represents a significant gap in the formation of educators. Looking at the core of the SHO of early childhood education, it can be seen that the term ‘pedagogy course' is located at the periphery of this subnetwork and, consequently, concentrates less scientific capital in the SHO, although it participates in its core. In this sense, the author's research shows that pedagogy training is less important for early childhood education and the lower concentration of scientific capital for this subnetwork found in our research seems to be somewhat in line with Vargas' (2016) statements.

## Final considerations

In the present study, we investigated the SHO excerpt from our complete database dealing specifically with early childhood education and its relationship with DICT, i.e. the exchange of scientific capital between these two objects. Through the method of analyzing social networks and metadata collected from this already existing database, it was possible to examine the extent to which it is possible for symbolic capital from objects related to early childhood education to flow scientific capital back to actors in the field of education and their relationship with the DICT.

The context presented by the data analysis shows that early childhood education, despite being at the center of attention of the total field, is still somewhat fragmented in some ways, as it has a low density compared to the core of the whole network, where there is a large concentration of scientific capital. In looking at the core of the SHO of Early Childhood Education, we found that in terms of average degree of centrality, it is about a third of the core of the total network. That is, to the extent that each term is connected to other terms in the network. As in the total network, teachers and their training are at the center of the core of the SHO of early childhood education, but they have a low concentration of symbolic capital in this modality.

The analysis of the segment of early childhood education with regard to DICT has shown that there was no exchange of scientific capital between these two objects in the examined time window of 21 years. A possible explanation for this lack of interaction may be related to the context of uncertainties in initial teacher training, particularly in relation to pedagogy courses, and to the criticisms and prejudices that distance education entails, since the teaching and learning processes offered by distance education are necessarily mediated by digital technologies.

Perhaps a survey conducted with more recent data from 2020 to 2022 could reveal a different scenario, given the confrontation with the COVID-19 pandemic, in which Brazilian education systems were forced to (re)think about education and resort to the introduction of distance learning to carry out classes. This sudden change required rapid adaptation, especially from teachers, who had to (re)learn to teach with the support of DICT to enable students to learn during this time. A hypothesis that could be put to the test in future studies.

Without wishing to exhaust the subject, but with the aim of contributing to studies on the existence of the social hierarchy of objects in the sense of Bourdieu's concepts, it is expected that the present work will contribute to the sociology of science in general as well as to research in Education in order to promote the necessary discussions and reflections for those fields of research.

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**NOTE:**
The authors were responsible for analyzing and interpreting the data, writing and critically reviewing the content of the manuscript, and approving the final version. Author 2 was responsible for the design of the paper.

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We point out that the data used in the research are part of a private database of Grupo Horizonte, collected for the research by Corrêa (2020). The data can be requested at https://www.grupohorizonte.ufscar.br/