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# Mapping Surveillance Capitalism in South American Higher Education

## Mapeo del Capitalismo de Vigilancia en la Educación Superior Sudamericana

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**Abstract**: We are currently witnessing a global increase in the provision of software platforms and services, offered at «no cost» by large corporations, to higher education. The business model behind these services is largely based on the collection and analysis of massive quantities of user data and metadata, collected through educational packages, which include e-mail, video-conferencing, groupware, file sharing, and other integrated services. The penetration of these services in higher education worldwide is largely unknown. In this study we discuss a methodology and a software script developed to collected new data for all 448 public higher education institutions in all 13 countries in South America. The data show that for every ten higher education institutions in the region, eight have services and platforms offered by such businesses. We contend that the adoption of these services is largely due to disinvestment in public education, and threaten the operational autonomy of institutions in regards to research and teaching, while leading to concerns in regards to data control, privacy, and transparency for teachers, administrators and students.

**Keywords**: Artificial intelligence, Higher education, Metadata, Privacy, Public policy.

**Resumen**: Actualmente asistimos a un aumento global de la provisión de plataformas y servicios de software, ofrecidos «sin costes» por grandes empresas, a la educación superior. El modelo de negocio que subyace a estos servicios se basa en gran medida en la recopilación y el análisis de cantidades masivas de datos y metadatos de usuarios, recogidos a través de paquetes educativos, que incluyen correo electrónico, videoconferencias, groupware, intercambio de archivos y otros servicios integrados. Se desconoce, en gran medida, la penetración de estos servicios en la enseñanza superior a nivel mundial. En este estudio discutimos una metodología y un script de software desarrollado para recolectar datos inéditos para todas las 448 instituciones públicas de educación superior en los 13 países de América del Sur. Los datos muestran que por cada diez instituciones de educación superior en la región, ocho tienen servicios y plataformas ofrecidas por estas empresas. Sostenemos que la adopción de estos servicios se debe en gran medida a la desinversión en la educación pública, y amenazan la autonomía operativa de las instituciones en lo que respecta a la investigación y la enseñanza, al tiempo que generan preocupaciones en cuanto al control de los datos, la privacidad y la transparencia para los profesores, administradores y estudiantes.

**Palabras clave**: Inteligencia artificial, Educación superior, Metadatos, Privacidad, Política pública.

## 1. Introduction

Advances of artificial intelligence (AI) techniques in the context of big data have unearthed debates regarding the concentration of economic power in large corporate conglomerates that counter the promises of an open and free internet for all. Researchers and activists in favor of Open Science and Open Education, in the context of a free and open web, have been closely monitoring this phenomenon. This has been termed «platform society» by van Dijck, Poell and de Waal (2018), who use it to designate how everyday life, in both economic and social coexistence, are modulated by a global ecosystem of online platforms, driven by AI through algorithms powered by vast amounts of user data and metadata.

The increased digitization of social relations, guided by market models, directs our sociability towards digital platforms: environments with a «programmable architecture designed to organize interactions between users« and produced toward «the systematic collection, algorithmic processing, circulation, and monetization of user data« (van Dijck et al., 2018, pp. 4–9). This process is the basis of the datafication of society: the translation of our social relations into instrumental qualities and quantifiable data (Dijck, 2014; Mayer-Schonberger & Cukier, 2013). Platformization and datafication are threatening the original principles and imagined futures of the liberal digital culture that inspired the origins of the internet, as engagement of every kind is increasingly mediated by various platforms and services in the realm of work, leisure, and importantly for our discussion, in education and scientific production (Amiel & Soares, 2015).

Among the many important purposes of higher education institutions, two of the most central are to educate and to engage in scientific production and dissemination. These two fields have been undergoing considerable change in the last two decades under the banner of 'openness'. Open Science has emerged as a powerful force, and has been used to question and change existing practices and promote new perspectives on how science is done, who participates in these processes, and how outcomes are communicated and used.

Though there is now a general consensus on the positive value of Open Science, particularly in public higher education institutions, there is still limited work being done to promote the necessary technical ecosystem to make it flourish, particularly in poorer nations. As Fecher and Friesike (2014) point out: «Open science appears to be somewhat like the proverbial electric car – an indeed sensible but expenseful thing which would do better to be parked in the neighbor's garage; an idea everybody agrees upon but urges others to take the first step for» (p. 44). The authors note that «infrastructure« is an essential component, a «school of thought» in the field of Open Science. It is clear that in order to support changes in how science is produced, shared and preserved present substantial infrastructural challenges.

The recent UNESCO Recommendation on Open Science (2021) highlights the need for investing in open science infrastructure and services. Member states are «...encouraged to promote non-commercial open science infrastructures and ensure adequate investment...» (p. 23) which includes:

> «Non-commercial infrastructures, including computing facilities and digital public infrastructure and services supporting the open science approach. These should facilitate ensuring the long-term preservation, stewardship and community control of research products, including scientific information, data, source code and hardware specifications, co-operation among researchers and the sharing and reuse of research products. Any research-supporting infrastructure or service should have a strong community-led base and ensure interoperability and inclusivity. Digital infrastructures for open science should be based, as far as possible, on open source software stacks. These open infrastructures could be supported by direct funding and through an earmarked percentage of each funded grant.» (p. 23).

While the South American region benefits from a substantial track record in Open Access repositories (such as REDALYC and Scielo), there is still limited infrastructure necessary to fully promote Open Science (including open data repositories, collaborative research spaces, preprint and preservation archives, etc.). The tension in promoting open infrastructure and services for science is highlighted by Albagli (2015):

> «The open science movement is part of this tense scenario between, on the one hand, new forms of collaborative and interactive and shared production of information, knowledge, and culture. And, on the other hand, mechanisms that capture and privatize this knowledge that is collectively and socially produced» (p. 13, our translation).

For Guggenberger (2021), some digital platforms have become essential infrastructure for digital citizenship. Among these public interest platforms are those applied to the context of education, health, and urban mobility. The author compares platforms to the railroads of the modern era. Building bridges and tunnels were essential to reach certain destinations and sometimes entire regions. Control over rail networks allowed the formation of monopolies and the exclusion of competitors in markets crucial to economic development. In an attempt to solve the problem, the author cites a US law that gave competitors access to infrastructure previously limited to monopolies. This is a form of power being exercised by large digital platforms that can be characterized as 'infrastructural power'. As such, the regulation of science and education platforms could be viewed from the perspective of infrastructures (Busch, 2021).

The movement towards the privatization of open scientific knowledge can lead to serious difficulties, evidenced, for example, in the field of health and health research. Massive data collection with limited public scrutiny (and access) can be used to produce biased analyses (through algorithms) and profiling used in decision making (Wilbanks and Topol, 2016). Further more, as the authors point out: «Many of the largest tech corporations have come to resemble small nations in their own right: they have enormous 'natural resources' (data and computing power) and global interests to pursue and protect.» (p. 348).

As Open Science tries to struggle with these issues, in the field of education, Open Education has become a global movement which advocates for knowledge as a common good, and believes in enabling open (and free) access to educational resources making use of open technologies, especially within the public sphere. Open Education can be seen as focusing on two particular challenges. The first is to challenge

traditional notions of copyright, ownership and authorship as a goal to eliminate barriers the access to knowledge. This is done initially through the use of open licenses and open formats for educational resources (Open Educational Resources, or OER) and promoting Open Educational Practices (OEP). The second is to provide these contents not only for free (as in cost), but with an attention to freedoms, aligning itself with the ethics of the Free Software movement. Contrary to common conceptions, open and free are not synonymous. This is an especially important distinction in the context of the platformization of education, where 'free' has become a full fledged business model. Here, access to courses, content, and other educational resources is actually paid for with 'data' and 'metadata' provided by teachers, students, administrators and other actors. In this regard, the goals of Open Education challenge and help define new principles for the future since platforms and services have become de facto necessities for inclusion and participation. It has a direct connection with the promotion of recognized human rights — privacy and data protection — in the digital environment.

As in science, within the field of education there has been emerging concern in regards to 'free services', in light of the business models which guide these corporations. Zuboff (2019) defines this as «surveillance capitalism», or a «new economic order that claims human experience as free raw material for hidden commercial practices of extraction, prediction, and sales» (p. 8). The author also includes, as part of this definition, concerns over the unprecedented concentration of power of these corporations, and their forms of dominance over society, based on behavioral modification (Zuboff, 2019). Businesses associated with surveillance capitalism derive value from the growing digitization of our lives. Progressively, labor relations, sociability, citizenship and consumption are being transferred to the digital environment. This accelerated codification of our reality is what the sociologist Laymert Garcia dos Santos (2003) calls the «cybernetic turn»: an advance of instrumental rationality, supported by mathematical calculation, by the cybernetic notion of information, the data processing and transmission capacity of digital technologies, and the expansion of liberal markets. The digitization of social relations is therefore associated with political and economic processes that are part of the development of contemporary capitalism (Fuchs, 2020; Morozov, 2013, 2018; Santos, 2003). Nowadays, these businesses offer solutions to economic, political, and social problems, or what Morozov has termed 'technological solutionism' (2013).

Driven by the COVID-19 pandemic, institutions and governments from around the world have scrambled to identify and implement solutions for what became known, in many regions of the world, as 'remote teaching', making use of a legacy technologies such as TV and radio, but also of internet-based systems and platforms, in order to provide diverse channels of communication (Dreesen et al., 2020). For those countries and regions with significant internet access, we have seen the advance of private cloud-based PaaS and SaaS (Platform or Software as a Service) in both public school systems and higher education institutions. Though this trend is not new, there is evidence of increase of adoption during the pandemic (Fiebig et al., 2021).

Most of the adopted PaaS and SaaS solutions in education have been offered by large software and media companies and through proprietary software. The acronym GAFAM (Google, Apple, Facebook, Amazon and Microsoft) is used to indicate the most prominent of these mediators of our daily lives (Smyrnaios, 2016) In common, these businesses engage in extensive collection and extraction of metadata and data from users through AI techniques. This scenario is particularly alarming and evident in the

field of education. Within this group, two companies are of particular interest due to their offerings targeted at the educational market: Google, which offers a product for educational institutions termed Google Workplace for Education[1] (previously known as GSuite for Education); and Microsoft which offers 365 Education[2] (also known as Office 365)[3]. These companies have been providing these platforms and services 'free of charge' to eligible educational institutions and systems. This is a form of philanthrocapitalism, or «new ways of donating where what is given is monetized through the importation of corporate logic in charitable investment» (Saura, 2020, p. 16, our translation). These high-cost, high-availability services, which include video-conferencing, file hosting, classroom management, collaborative document editing, and e-mail services, have been offered for 'free' to whole public school systems (municipalities, districts, and states) and higher education institutions, often numbering on the thousands or hundred of thousands of users[4].

These digital platforms have become hegemonic on the internet (Cassino et al., 2019; da Silveira, 2017; Decuypere et al., 2021), by presenting digital solutions to individual and collective issues: «Digital technologies are both the cause of present societal challenges and the solution for future society's needs» (McGarr & Engen, 2021, p. 3). For each new 'solution' a novel avenue for data capture is opened.

The solving of problems through the digitization of education is taking place mostly through digital education platforms. These environments mediate educational relationships in spaces that benefit users through the integration of various services while collecting, processing, circulating and explicitly (e.g., through ads), or implicitly (e.g. through product improvement) monetizing user metadata and data. Built through a network formed by large and small companies, the platformization of education enables the datafication of relationships that were previously performed, for the most part, without the mediation of data technologies and systems (Decuypere et al., 2021). On the one hand, educational practices have become raw material for surveillance capitalism; on the other, educational relationships become objectified through these novel prospects presented by data surveillance and algorithmic classification, and predictive analysis techniques that, in turn, point to new imperatives for pedagogical practices (Perrotta & Selwyn, 2020; Williamson, 2019; Williamson et al., 2020).

Previous studies of contracts and agreements between Brazilian public education institutions and platforms associated with surveillance capitalism, provide evidence that these technologies are presented as a technical and economic solution to the inability of public educational institutions to manage their own information systems (Parra et al., 2018). Missing from much of this discourse is that the declining capacity to sustain technical infrastructure in higher education is a direct result of financial austerity policies and the lack of public investment in education (Cruz & Venturini, 2020).

In order to verify the extent of the platformization of higher education and its scenario during the COVID-19 pandemic, we partnered with a number of institutions to

[1] Google Workspace for Education Overview. https://edu.google.com/intl/en_ALL/products/workspace-for-education. Accessed 12 Feb 2022.
[2] Microsoft 365 Education. https://www.microsoft.com/en-us/education/buy-license/microsoft365. Accessed 12 Feb 2022.
[3] Companies such as Amazon usually offer PaaS (Platform as a Service) and IaaS (Infrastructure as a Service) as evidenced by products such as Amazon Web Service (AWS). Such services are outside the scope of this discussion.
[4] According to Javier Soltero, the company's vice president, in March 2020, Google's educational service already had 100 million active users. See: https://www.bloombergquint.com/business/google-widens-lead-in-education-market-as-students-rush-online

map 550 institutional email domains from 448 public higher education institutions in all South American countries.

In this article, we begin by presenting a novel methodology and a software script created to automatically identify and tabulate information regarding the allocation for specific hosts and domains (Domain Name Server, or DNS; MX addresses). Based on previous studies, it is known that, with this information, one is able to ascertain, with a very large degree of confidence, that an institution has an agreement to use private, commercial platforms from businesses such as Google and Microsoft. We continue with a presentation of the results of a exhaustive mapping of these relationships in public higher education institutions in South America[5].

## 2. Method

In order to identify the scope of the established relationships between businesses associated with surveillance capitalism in South America, we identified what entity is responsible for a basic service: email communications. Previous research on higher education institutions has indicated that email infrastructure is a mandatory service as part of service packages offered to educational institutions by GAFAM businesses, and one of the major factors that lead technical/managerial staff to suggest or accept the adoption of the larger suite of services (Parra et al., 2018; see also Oddone, 2021).

The next step involved identifying the e-mail providers for South American higher education public institutions. Considering that there was no reliable and publicly available list of these institutions' e-mail addresses, the data had to be collected and compiled manually. A network of researchers from South America were mobilized for this project: researchers from Colombia were responsible for identifying high educational institutions in Colombia, Venezuela, Guyanas, and Suriname; a researcher from Bolivia responsible for data from the countries of Bolivia, Peru and Ecuador; and a researcher from Uruguay collected data from Argentina, Chile, Paraguay, and Uruguay. Data from Brazil was available from our previous research and was verified and updated.

Identifying public higher education institutions of South American countries is not a trivial task – many countries in the region do not have this information available in governmental sites. Once identified, only public institutions were included. Here, public is defined as those who are at least partially maintained with public funds. Finally, researchers identified and listed the primary email domains of each institution. The e-mail domain data served as input for a software script specially developed to verify which businesses are associated with these e-mail domains. Online spreadsheets were organized for each country including the name of the institution, its website, and its email domains. Once the spreadsheets were completed, the domain lists were utilized in the script, and the data was collected and interpreted for this study.

A total of 448 institutions and 550 email domains were identified (Table 1). This occurs since some institutions have more than one email domain. In general, this is the case for institutions where decision-making in regards information technology (IT) is decentralized and distributed in sub units such as centers, faculties, and departments

[5] The results are also presented as open data in an publicly available website that allows for navigation through a map and searchable data. See: https://educacaovigiada.org.br

within the institution. For example, Uruguay has only one public university, Udelar (Universidad de La República; University of the Republic), and its IT sector is distributed to different units. On the other hand, a university can have different email domains for specific classes of actors, such as students and faculty. An example is the Brazilian university, Universidade Federal do ABC (UFABC; Federal University of ABC), where the domain for faculty e-mail is 'ufabc.edu.br' and for students is 'aluno.ufabc.edu.br'.

**Table 1**. Institutions by country.

| Country | Institutions |
|---|---|
| Argentina | 49 |
| Bolivia | 15 |
| Brazil | 144 |
| Chile | 18 |
| Colombia | 75 |
| Ecuador | 29 |
| Guyana | 3 |
| French Guyana | 1 |
| Paraguay | 9 |
| Peru | 64 |
| Suriname | 2 |
| Uruguay | 13 |
| Venezuela | 26 |
| *Total* | 448 |

### *2.1. Script*

A script[6] (Saraiva, 2019) was developed in python 3 and is available as a free/open source software under the mit license. The script takes advantage of the host command, present in several GNU/Linux distributions. It is is part of the bind package, a popular DNS server developed and provided by the Internet Systems Consortium. The command host is a tool to perform DNS lookup, allowing to verify which is the computer responsible for services behind some specific domain, among other features.

When someone sends an email to, for example, somebody@someserver.com, the email is sent to the computer responsible for hosting and managing the email services related to someserver.com. Importantly, different services related to a single domain can be provided by different servers. For example, a specific computer can be accountable for someserver.com website, while a different computer can manage someserver.com e-mail hosting.

When one runs the host command for a domain, for example, the domain utilized by the Brazilian university Federal University of Pará (UFPA, Universidade Federal do Pará, ufpa.br), one receives the follow output:

[6] See: https://gitlab.com/ccsl-ufpa/get-mx-universities

```
$ host ufpa.br
ufpa.br has address 200.239.64.17
ufpa.br mail is handled by 10 ALT4.ASPMX.L.GOOGLE.COM.
ufpa.br mail is handled by 1 ASPMX.L.GOOGLE.COM.
ufpa.br mail is handled by 5 ALT2.ASPMX.L.GOOGLE.COM.
ufpa.br mail is handled by 5 ALT1.ASPMX.L.GOOGLE.COM.
ufpa.br mail is handled by 10 ALT3.ASPMX.L.GOOGLE.COM.
```

The first line of the output, «ufpa.br has address 200.239.64.17«, presents the IP address of the computer responsible for hosting UFPA's website. The other lines indicate the servers which are responsible for managing e-mail related to ufpa.br domain, where the segment «google.com« indicates that Google is the company behind the management of e-mail communication of UFPA.

As an additional example, if one runs the command with the domain of the University of Buenos Aires (UBA, Universidad de Buenos Aires, uba.ar) from Argentina, one would get the following response:

```
$ host uba.ar
uba.ar has address 157.92.5.15
uba.ar mail is handled by 0 uba-ar.mail.protection.outlook.com.
```

The response indicates that UBA's e-mail domains are managed by a server hosted at «outlook.com«, a service associated with Microsoft.

As a final example, if one runs the command with the domain of the Federal University of Rio de Janeiro (UFRJ, Universidade Federal do Rio de Janeiro), another Brazilian university, one gets a response which indicates the e-mails are stored in the institution's own servers:

```
$ host ufrj.br
ufrj.br has address 146.164.84.216
ufrj.br mail is handled by 9 smtp.ufrj.br.
```

The script automates this host command by replacing the domain parameter with a list of domains presented in a text file. In response, it provides a text file with the MX addresses of the domains (the line «... mail is handled by ...« from the command's response) and a summary with the percentage of Microsoft, Google and Other servers for each list. With this result, we can identify which company is responsible for e-mail services for each listed institution.

The reliability of the script was measured in parallel studies (Cruz et al., 2019; Amiel et al., 2021), where data were collected from a sample of Brazilian higher education and state public education systems using the script. The study made use of the script in tandem with confirmatory LAI (Lei de Acesso à Informação, similar to the Freedom of Information Act in the United States of America) requests, which were sent to these same institutions petitioning (1) information on the organizations that were responsible for their e-mail services, and (2) specifically, whether they had contracts with either Google or Microsoft. The results showed that using e-mail domain has a very strong (nearly perfect) correlation with institutional contracts with these corporations. In other words, the script provides reliable results and these results (associated with institutional e-mail domains) indicate whether there is an associated SaaS or PaaS service such as Microsoft 365 Education or Google Workplace for Education at the institution. As such, the migration of institutional e-mails to private businesses is a very strong indication that the institution has made an agreement to

use an educational platform/service of that same business, since the creation of an institutional e-mail managed by the company is one of the requirements for their services.

## 3. Results

Google and Microsoft are the only major GAFAM companies to offer educational SaaS and PaaS to public higher education institutions in South America (we will refer to these business as GAFAM throughout). Together, they represent 79% of the analyzed institutions. Only 21% of the related institutions manage their own e-mail services. In other words, for every ten higher education institutions located in South America, eight have agreements with big tech companies. In absolute numbers, GAFAM is represented in 353 institutions from the total of 448. Consequently, only 95 institutions in South America do not have agreements with Google or Microsoft services (Figure 1).

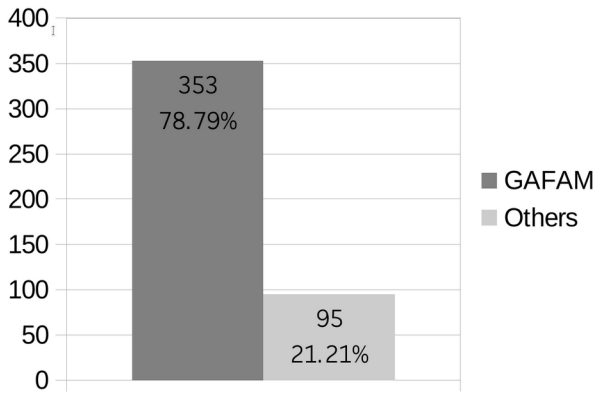


**Figure 1**. Percentage and quantity of e-mails servers hosted by GAFAM.

A closer look at the data indicates a market dominance by Google (Figure 2). The company reaches 63% of higher education institutions (N=283), while Microsoft has 16% of the market share (N=70).

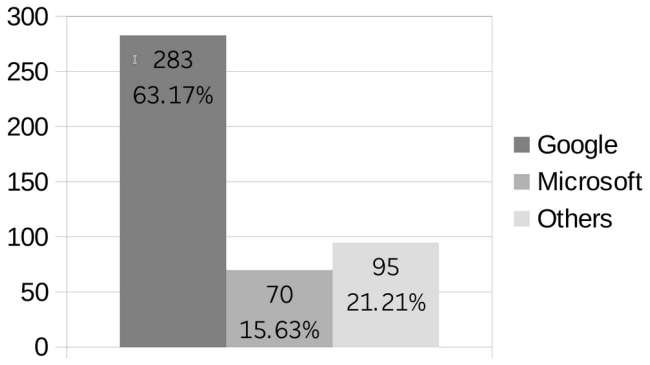


**Figure 2**. Quantity of e-mails servers hosted by Google, Microsoft, and others.

In South America, the only countries that have a proportionally higher quantity of institutions that strictly use their own servers are Uruguay, which has only one large

public education institution, with 92% of its faculties, or 12 total; Venezuela (58%, N=15), Argentina (53%, N=26) and French Guyana (with only 1 institution). Chile, Ecuador and Suriname are the countries that presents the highest number of email domains stored and managed in GAFAM private data centers (100% of the institutional email domains), followed by Colombia (99%), and Peru (97%). Ecuador is the only country where services are controlled nearly equally by the two businesses, while also having the largest number of identified Microsoft servers (52%, N=15). In all other countries where GAFAM services are prevalent, Google has the majority of the market, particularly in Peru (83%, N=53) and Chile (83%, N=15). In absolute numbers, Brazil is the country with the largest quantity of institutions whose institutional e-mails are stored on Google servers (N=103), which represents 36% of the company's operations in the continent (Figure 3).

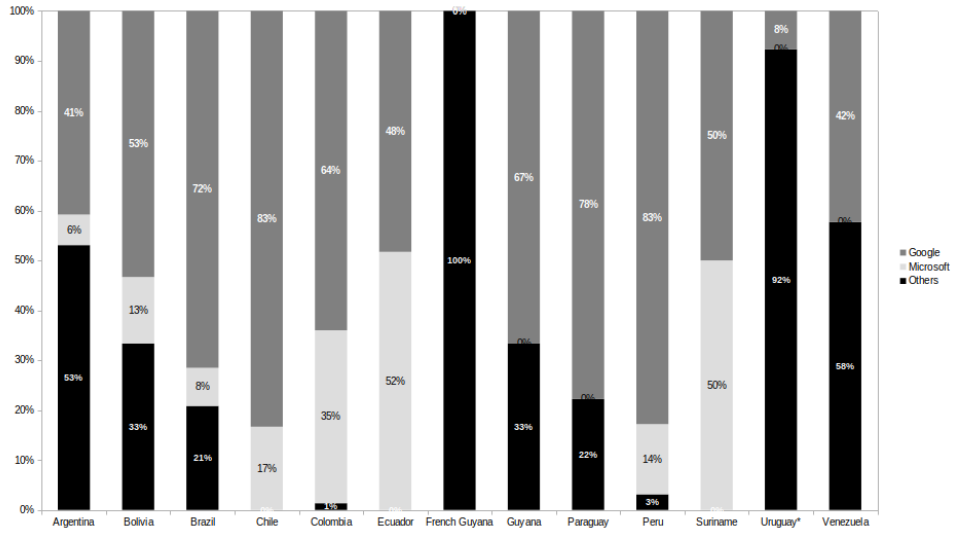


**Figure 3**. Percentage of institutions using Google, Microsoft and others services, for each country.

Figure 4 shows a chart with the quantity of institutions using Google, Microsoft and other server, for each analyzed country. This information is of particular interest because countries in South America vary greatly in population size and number of institutions. As such, despite the fact that some countries have the totality of their institutions associated (or not) with GAFAM, this data can represent only one institution (as is the case for French Guiana). The data is presented, from left to right, from smaller to higher value for services provided by «others». Finally, Table 2 summarizes the obtained data presenting both quantity and percentage of institutions using Google, Microsoft or other services, for each country.

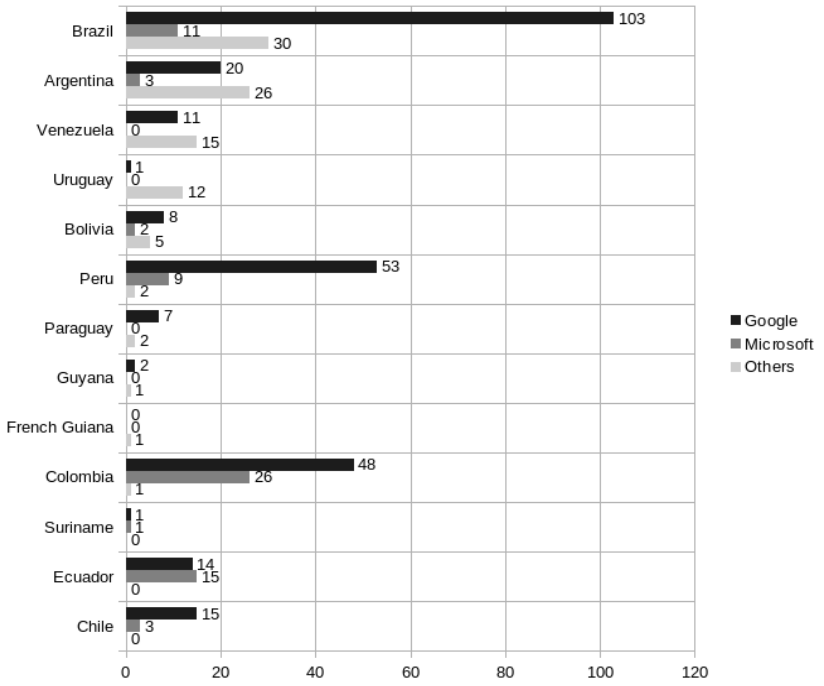


**Figure 4**. Institutions using Google, Microsoft and Others, for each country

**Table 2**. Relationship to businesses, by country.

| Country | Google | Microsoft | Others | Total |
|---|---|---|---|---|
| Argentina | 20 (41%) | 3 (6%) | 26 (53%) | 49 |
| Bolivia | 8 (53%) | 2 (13%) | 5 (33%) | 15 |
| Brazil | 103 (72%) | 11 (8%) | 30 (21%) | 144 |
| Chile | 15 (83%) | 3 (17%) | 0 | 18 |
| Colombia | 48 (64%) | 26 (35%) | 1 (1%) | 75 |
| Ecuador | 14 (48%) | 15 (52%) | 0 | 29 |
| Guyana | 2 (67%) | 0 | 1 (33%) | 3 |
| French Guyana | 0 | 0 | 1 (100%) | 1 |
| Paraguay | 7 (78%) | 0 | 2 (22%) | 9 |
| Peru | 53 (83%) | 9 (14%) | 2 (3%) | 64 |
| Suriname | 1 (50%) | 1 (50%) | 0 | 2 |
| Uruguay[7] | 1 (8%) | 0 | 12 (92%) | 13 |
| Venezuela | 11 (42%) | 0 | 15 (58%) | 26 |
| *Total* | 283 (63%) | 70 (16%) | 95 (21%) | 448 |

[7] There is only one public university in Uruguay. The data collected from the country refers to faculties and institutes within the institution.

While the aggregated data provides an overall perspective on the continent, there are significant differences for each country. A succinct analysis of each is presented below.

*Argentina*

In Argentina, 83 email domains from 49 public higher education institutions were collected. The decision to contract PaaS/SaaS services is decentralized, being the responsibility of each institution, and sometimes it is more granular, decided by specific colleges and schools. As an example, the School of Economics of the University of Buenos Aires uses its own e-mail server, while the School of Agronomy uses a Google service. Of the total surveyed universities, 26 institutions (53%) use their own solutions for storing institutional email. Argentina is one of the three South American countries with the largest number of institutions using internal services for e-mail, behind Uruguay and Venezuela. Among the corporate e-mail services, 20 institutions (41% of the total) have at least one institutional address stored in Google servers and only three (6%) use Microsoft services.

*Bolivia*

In Bolivia, 15 public institutions of higher education were surveyed. Of these, 10 (67%) use a corporate solution for storing institutional emails. Google's services are present in 8 analyzed institutions (53%).

*Brazil*

Brazil is the country with the largest number of public higher education institutions in South America. A total of 155 email domains from 144 institutions were collected. Only 21% of public higher education institutions use email storage solutions not associated with GAFAM. On the other hand, 72% of surveyed Brazilian institutions use Google's solutions (the second highest percentage in South America) and a total of 8% use Microsoft's solutions. In absolute numbers, of the 283 institutions using Google's solutions in South America, 103 (36%) are Brazilian.

*Chile*

In Chile, 39 email domains in 18 public higher education institutions were surveyed. Although a few schools and colleges use their own servers and some universities have a hybrid storage model (such as the Universidad de Talca, which maintains the utalca.cl domain in its own data center and the alumnos.utalca.cl domain served by Microsoft), all Chilean public universities have at least one email domain in GAFAM data centers. Of the 18 public institutions surveyed, 15 (83%) use services from Google.

*Colombia*

Of the 75 institutions analyzed in Colombia, only one – the National Army Logistics School – does not use Google or Microsoft services for storing its institutional email. In absolute numbers, it is the country where Microsoft is most prevalent with a total of 26 institutions (37% of those in South America).

*Ecuador*

With the exception of French Guiana, which has only one public university, Ecuador is the only country in South America where all public higher education institutions (29 in total) exclusively use corporate solutions for storing institutional email. Ecuador is also the only country in South America where Microsoft's services (52%) are more present in universities than Google's (48%).

*French Guiana*

Only 1 public institution of higher education was identified in French Guiana, and it has its own email storage service.

*Guyana*

Guyana has a small number of public higher education institutions. Of the three universities surveyed, two use Google services.

*Paraguay*

In Paraguay, 30 email domains were collected from 9 public universities. 7 surveyed institutions had their email domains stored in Google, and 2 other institutions utilizes their own mail services.

*Peru*

In Peru, 64 higher education institutions were analyzed. Among them, 53 (83%) had email domains stored on Google and 9 (14%) on Microsoft servers.

*Uruguay*

In South America, Uruguay is the country (excepting French Guiana) whose public higher education institutions have the highest percentage of their own e-mail services (92%). There is only one public university in Uruguay (Udelar). However, decisions about agreements with big tech companies are decentralized, at the level of faculties. Of the 13 faculties surveyed, only one has an institutional email domain on Google servers.

*Suriname*

In Suriname there are only two higher public education institutions. They use, respectively, solutions from Microsoft and Google.

*Venezuela*

Of the 26 public higher education institutions analyzed in Venezuela, 15 (58% of the total) use their own servers exclusively to store their institutional email. With the exception of French Guyana, which has only one public university, it is the second country in percentage of public universities with their own servers. The remaining 11 surveyed institutions, 42% of the total, use Google's services.

## 4. Discussion

Offering prediction and projection is at the core of a data-driven economy, since «collecting, storing, processing, and interpreting personal data is the fundamental means for the expansion of a corporate power unprecedented in the history of capitalism« (Abramovay, 2018). As a societal reaction to this excessive control of data by technology companies, the European Union's General Data Protection Regulation (GDPR), enacted May 2018, was the first wide-ranging regulation on data privacy and commercialization (GDPR, 2016). Its principles inspired the Brazilian General Data Protection Law (LGPD) enacted in 2020 (Lei Geral de Proteção de Dados Pessoais, 2018).

Although the intention is to enable citizens to have more control and decision-making in regards the use of their data, these regulations have limited impact, due, in significant part, to a lack of knowledge about how prevalent data collection and processing is, and how the processes of datafication work and affect our daily lives. To many, the exchange of data for convenience, following existing models of data extraction, seems commonplace and valuable. Augmented and targeted search results and customized feeds hide the processing of user behavioral metadata, information which is not consciously conceded by the user, as is evident when one uploads pictures and movies (Amiel, 2020).

As shown by the data presented here, the business model focused on the collection, analysis, and commercialization of data has a broad domain over the management and storage of educational, academic, and administrative data from public universities in South America. A similar trend can be evidenced in other regions of the world.

Lindh & Nolin (2016) analyzed the reduction, and sometime complete outsourcing, of the digital communications infrastructure of educational institutions and associated substitution of these services by those offered by businesses in surveillance capitalism. Moreover, the authors highlight how these processes are connected with the political and economic imperatives of a liberal economic outlook, as they analyzed the penetration of Google's educational services in Swedish public education. The authors indicate that the increasing presence of data companies offering services traditionally provided by the state should be understood as the result of a decades-long effort to transfer public goods and services to private enterprises, aiming at the continued reduction of social spending. Kwet (2017) analyzed a school-focused program in South Africa. The author shows how stakeholders ignore important considerations related to privacy and data collection in these partnerships: technological advancement and 'innovation' take precedent.

In Brazil, recent studies (Parra et al., 2018; Cruz & Venturini, 2021; Oddone, 2021) show how those responsible for the adoption of SaaS and PaaS services in both higher education institutions and public school systems also seem to dismiss concerns in regards to this partnerships, mainly through economic arguments. When asked for contract and agreements that establish these partnerships, many institutions and school systems respond that none exist. In many cases these agreement are 'accepted' when whole institutions and systems adhere to these services using the 'standard terms of service' made available by the corporations in standard, generic online form.

Others point to the 'gratuity' of the service to indicate that no contract or agreement is actually needed.

Couldry and Mejias (2019), meanwhile, associate the manner in which big data companies – largely based on the rich capitalist nations – operate with historical colonialist processes based on the extraction of value from economies located on the periphery of global capitalism, which can be characterized as 'data colonialism'. The role that large technology companies play in poor nations is grounded in a long process of inequality in the technical and economic development of global capitalism. Much as in the past, the activities of these businesses are based on the extraction of valuable resources from the countries of the Global South for the enhancement and enrichment of the central countries market.

The central role that companies from rich countries play in the market and production in poor countries greatly reduce any possibility of local economic development and technological autonomy, creating a (historical) condition of dependence and underdevelopment. A similar argument is used by Evangelista and Firmino (2020), who relate Zuboff's surveillance capitalism to unequal flows of knowledge and economic surplus as part of international markets. This dynamic involves rich economies of the Global North – where these corporations are headquartered – and the dependent economies of the Global South (Evangelista, 2019). These dynamics are particularly evident in the data and should cause concern in regards to data sovereignty and autonomy, at a national level.

Within the context of education, globally, these dynamics are also evident in a 'new professionalism', which includes data-driven management and public-private partnerships: «...these reforms are creating a 'new professionalism' across all public sectors that is the result of a transfer of private sector logics into the public sector and the replacement of an ethos of public service with the discipline of the market…» (Anderson & Herr, 2015, p. 3). While the use of data for decision making and the association with private entities might in itself not be problematic in certain modalities, the role of large software companies expand beyond the purchase of a product or a service. Issues such as privacy, fake news, profiling, targeted advertising, and the like, which have been the focus of societal scrutiny, can become a substantial concern when these same free services are offered and targeted specifically to education, particularly when involving younger students.

Educational institutions and governments need to understand the economic models behind datafication processes, whether dealing with 'free' products – where these issues are exacerbated – but also in commercial offerings, payed for by the public. The use of educational and communication platforms empower businesses to use collected data to better understand their consumers/audience, great enhance targeted advertising and profiling, and also to feed artificial intelligence (AI), increasing the data processing capabilities, performance, and the precision of the resulting models. As more and more institutions and school systems provide users to GAFAM, the more the public sphere helps improve these private services.

There are emerging alternatives to these challenges. First and foremost, issues related to privacy, data collection and processing, and the use of these data must be part of procurement processes that are transparent and participatory. This should apply to any service, whether paid for, or provided as a donation to the public. Emerging

privacy regulation in Brazil (LGPD) and elsewhere (e.g. GDPR in Europe) are aimed at protecting the public from excessive data collection and processing practices, with specific clauses targeted at protecting children. Activism has also led the Brazilian Internet Steering Committee (CGI.br) to create a working group specifically focused on educational platforms. The working group is promoting the investigation of how these platforms are used, and identifying infrastructural challenges to promoting alternative services for public use through existing governmental agencies.

Second, it is possible for the public to provide and sustain its own educational services and platforms. These platforms, or more critical parts of these systems, could be provided by a technological government agency or by a consortium of state entities and/or institutions (for example, a pool of universities), in order to share resources and costs, both computational and operational. Many, if not all of these services can also be based in free and open source software alternatives, which are currently used in large scale applications for education. Examples of this can be seen, for example, in Netherlands with SURF[8], which provides a variety of software solutions to its institutional partners, and France with its Renater[9] network, which offers to its public partners a variety of high-quality platforms and services.

## 5. Conclusions

The data resulting from this research shows that a trend previously identified in Brazil is widespread throughout South America: the dominance of Google and Microsoft over the productivity and communication services of public universities in the region, with the substantial market domination of Google. The results of this research should sound an alarm, especially considering that most of the administrative, educational, and research data from public universities are being stored and processed in data centers located outside the continent – for the most part in the United States of America[10] – and are owned by large businesses that generate revenue largely through the collection, analysis, and (in some cases) commercialization of user data and metadata. The advancement of platformization and datafication in public higher education inserts educational and academic communities – teachers, students and administrators – into the a private data market. With external servers and under another country's jurisdiction, institutions have no control over their own data[11]. Given the centralization of this market, the proper functioning of public institutions becomes dependent on these businesses. Moreover, by adhering and supporting their business models, public higher education and research institutions, which usually are centers for the development of these very software systems and platforms, may fail to seek or produce alternative solutions (including those using free and open source software), that could be focused on data security, privacy, transparency, and technological autonomy (Parra et al., 2018).

With this study, we aim to contribute to filling a significant gap in regards to openly available data on the scope of surveillance capitalism in public higher

[8] See: https://www.surf.nl
[9] See: https://www.renater.fr
[10] Discover our data center locations. https://www.google.com/about/datacenters/locations Accessed 12 Feb 2022.
[11] It is important to point out that the transfer of data to the United States of America is one of the main issues involving the actions of US data companies in the European Union. In 2020 Schrems II judgment, the Court of Justice of the European Union (CJEU) declared the European Commission's Privacy Shield Decision, an agreement which allowed companies to transfer customer data from the EU to the US, was not compatible with Europe's general data protection regulations (GDPR) due to concerns about US privacy and security laws (Mildebrath, 2020).

education. Moreover, the methodologies and technologies which were developed here can be adopted by researchers in other countries wishing to collect similar information. By raising awareness in regards to the level of inroads that private, international corporate entities have made into public education, we can contribute to a better understanding of the increasing standing of technology in structuring educational practice and governance.

We invite the interested readers to visit the Education Under Surveillance Observatory[12] to explore a wide range of data and visual representations of these data, so as to get a better sense of the range and scope of the issues raised in this article. Without better awareness of the problems of pervasive data collection and processing in exchange for 'free' services, there is little hope in fostering collective action to envision and create alternative futures.

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[12] See: https://educacaovigiada.org.br/

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