Apropiación del Capital Tecnológico de los docentes durante la pandemia de Covid-19

Teachers' Appropriation of Technological Capital during the Covid-19 pandemic

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Resumen

La pandemia de Covid-19 provocó la suspensión de clases presenciales. Los limitados recursos y capacidades del país para generar procesos de educación no presencial, la desigualdad educativa y la brecha digital, marcó desafíos para dar continuidad a la educación utilizando las TIC. El estudio tuvo como objetivo analizar las formas y niveles de apropiación de Capital Tecnológico en su estado: objetivado, incorporado e institucionalizado y su aplicación en el proceso de enseñanza-aprendizaje.

La investigación es de enfoque cuantitativo y se realizó en las Unidades Educativas: Abdón Calderón, Alto Cenepa y Rafael Alvarado (Quito-Ecuador) desde septiembre de 2020 a enero de 2021. El método de recolección de datos fue la encuesta. El cuestionario de 38 preguntas se aplicó a 109 docentes. Los resultados demostraron que la media del capital tecnológico incorporado de los docentes es 11,1 % Avanzado, 20,4 % Intermedio, 21,8 % Medio, 27,1 % Básico, y un 13,1 % Nulo. En los últimos 6 meses previos al estudio, el 72 % de docentes recibió un certificado de capacitación sobre competencias digitales. Las formas dominantes de capital objetivado son laptop y *smartphone*. El 35,8 % de 10 a 20 megabytes, el 34,9 % de 1.5 a 5 megabytes y el 22,9 % de 30 a 40 megabytes en la velocidad de internet.

La educación es una responsabilidad del Estado, y debe destinar los recursos necesarios para dotar a los docentes de herramientas tecnológicas, capacitarlos y certificarlos en el uso de las TIC de forma gratuita, permanente y oportuna.

Palabras clave

Apropiación, capital tecnológico, competencias, incorporado, institucionalizado,objetivado.

Abstract

The Covid-19 pandemic led to the suspension of face-to-face classes. The country's limited resources and capacities to generate non-face-to-face education processes, educational inequality and the digital divide, posed challenges to the continuity of education using ICTs. The objective of the study was to analyze the forms and levels of appropriation of Technological Capital in its state: objectified, incorporated and institutionalized, and its application in the teaching-learning process.

The research has a quantitative approach and was conducted in the Educational Units: Abdón Calderón, Alto Cenepa and Rafael Alvarado (Quito-Ecuador) from September 2020 to January 2021. The data collection method was the survey. The 38-question questionnaire was applied to 109 teachers. The results showed that the average embodied technological capital of teachers is 11.1% Advanced, 20.4% Intermediate, 21.8% Medium, 27.1% Basic, and 13.1% Null. In the last 6 months prior to the study, 72% of teachers received a training certificate on digital competencies. The dominant forms of objectified capital are laptop and smartphone. 35.8 % from 10 to 20 megabytes, 34.9 % from 1.5 to 5 megabytes and 22.9 % from 30 to 40 megabytes in internet speed.

Education is a responsibility of the State, and it must allocate the necessary resources to provide teachers with technological tools, train them and certify them in the use of ICTs free of charge, permanently and in a timely manner.

Keywords

Appropriation, technological capital, competencies, embedded, institutionalized, objectified.

1. Introduction

The World Health Organization (WHO) declared Covid-19 a pandemic in March 2020. This led to the suspension of on-site classes and posed challenges to the continuity of learning. According to the UN (2020) "closures of schools and other educational facilities have affected 94% of students worldwide" (p. 2). The pandemic has exacerbated inequality in access to the education system. According to this international organization, 40% of the poorest countries have not been able to implement effective public policies to guarantee the right to education during the health crisis. The most affected students and teachers are those in vulnerable situations, among which are those who have "fewer digital skills and less access to connectivity and computer equipment" (UN, 2020, p. 8).

To give continuity to education through non-face-to-face means, according to ECLAC-UNESCO (2020) "requires taking into account the characteristics of national curricula (...), the resources and capacities of the country to generate distance education processes, the levels of segregation and educational inequality in the country" (p. 3). In Ecuador, according to the Multipurpose Survey, referring to ICTs, yielded the following results at the national level; only 45.5% of households have access to the Internet and only 23.3% nationally use a

desktop computer in their homes. The most used social network is WhatsApp, however, only 24.3 % of economic income quintile one uses it (INEC, 2019, p. 1-40). According to ECLAC-UNESCO (2020) out of 33 countries analyzed only 14 countries considered necessary "teacher training, especially in tools for the use and management of information and communication technologies (ICT)" (p. 3). This study affirmed that teacher training in the use and application of ICTs in Ecuador had major limitations, simplifying teacher training to the mere execution of a self-learning course called My Online Classroom.

The application made by teachers of ICT, in the teaching process, enables variations in learning outcomes, according to Botello and Guerrero (2014), "the joint use of ICT allows increasing the average score of students in the PISA test between 5 % and 6 % (...) when ICT are used within the classroom" (p. 10).

In this scenario, ICT and the knowledge about them, becomes a new kind of Cultural Capital that has been called Technological Capital. According to Ramirez and Casillas (2014) from the perspective of Pierre Bourdieu state that:

> Technological capital (kt) comprises all knowledge, know-how and know-how to use in the learning process (...). Its possession is an attribute that differentiates individuals and allows them to compete better in many different fields and social spaces (p. 14).

For this reason, it is important to analyze the appropriation of the Technological Capital of teachers and its application in the teaching-learning process, in order to show the challenges faced by the educational system in the midst of a pandemic, which has deepened the existing difficulties and has created others in education.

The content of the article is a study of the Technological Capital of teachers working in the Abdón Calderón Educational Unit, a public institution; the Alto Cenepa Educational Unit, a private institution, and the Rafael Alvarado Educational Unit, a municipal institution in the Metropolitan District of Quito, Ecuador, from September 2020 to January 2021. The study made it possible to analyze the forms and levels of appropriation of Technological Capital in its state: objectified, incorporated, and institutionalized by teachers, and its application in the teaching-learning process.

The obstacles of the study were the legal and factual limitations in the application of the instrument. There is distrust among the respondents when answering questions about their work space. The reasons are different, but, mainly, distrust of reprisals due to the visibility of the lack of training, implementation and endowment in terms of technological capital.

The structure of the article consists of the introduction, which formulates and justifies the research problem, the object, objectives, and limitations presented during the study. Likewise, the contribution of the article to education is established. In the literature review, the concept of Technological Capital is developed, detailing the objectified, incorporated and institutionalized state. We end with the presentation of the statistical data, the discussion of results, and present the conclusions of the research.

2. Literature review

The beginning of the 21st century is marked by the explosive development of Information and Communication Technologies (UNESCO, 2013, p. 10). So much so, that society has been transformed into a digital panopticon, where "internet, smartphone, and Google glass, (...) dominates the appearance of freedom and unlimited communication" (Han, 2014, p. 33). On the other hand, Castells states that we are in a network society "whose social structure is

composed of activated networks of digital communication and information technologies based on microelectronics" (Castells, 2009, p. 49). As a sample, in 2017 in "Ecuador 80% of young people between the ages of 18 to 24 use the internet" (UNESCO, 2017, p. 11). Although "this does not mean, (...) that people all over the world participate in networks. In fact, for now, most do not" (Castells, 2009, p. 51). For example, in the country only 38% of income quintile one accesses an internet network (UNESCO, 2017, p.10), for reasons of geographic location or socio-economic status.

In the framework of the network society, the pedagogical theory of connectivism conceives education as a process of "transmitting and stimulating (...) resources through the use of technological tools, generating a faster and more efficient product" (Krüger, 2006, para. 17). However, education "is not only about the use of devices. Behind a device and a platform is a set of factors that give meaning to its use (...)" (Mendoza, 2020, p. 347).

During the pandemic, educational actors have more frequently applied technologies in teaching because "(...) they favor non-presential contact between people and the discovery of knowledge (...)" (Uzcátegui and Albarrán, 2020, p. 44). Although this process is not mechanical, because,

> intelligent technologies such as the Internet cannot be considered simple vehicles that transport information, but rather, by broadening and complexifying the process of accessing, processing and expressing knowledge, they substantially modify the way in which the individual constructs himself, understands the context and understands himself (Pérez, 2013, p. 55).

2.1 Technological capital (KT)

Cultural Capital is constituted by "cultural factors of class and economic factors" (Bourdieu, 2003, p. 33). Therefore, for Bourdieu this means "a break with the assumptions inherent in both the common vision that considers school success or failure as the result of natural aptitudes" (Bourdieu, 2012, p. 11). In the framework of the network society, from the perspective of Cultural Capital, the concept of Technological Capital has been developed, which allows,

> to understand how the practice in the use of digital technology is constituted in the occurrence of individuals, within an institutional framework, (...) being, as indicated by the roles, goals, social representations and habitus of the agents involved, which will ultimately generate or not, a transformation in the educational process mediated by ICT (Salado, Velázquez and Ochoa, 2014, p. 217).

Technological Capital is constituted and represented in the following states: objectified, incorporated and institutionalized.

2.2 Objectified technological capital

In its objectified state, the Technological Capital is the,

> set of technological objects that are appropriated in their materiality and symbolic meaning. Technological devices, connectivity resources, software (original/pirata), degree of updating (version) and is observed through equipment, connectivity and expenditure or investment in (...) technology inputs (Salado-Rodríguez and Ramírez-Martinell, 2018, p. 129).

In the educational process, the objectified capital is important because, for example; "while in a classroom the teacher has the immediacy of communication with his students, in a distance event the interaction depends on connections, data transmission speed, video and audio quality" (Mendoza, 2020, p. 348) and other factors that affect job performance.

2.3 Built-in technology capital

In its embodied state, Technological Capital is constituted "by the knowledge (...): mastery of software and programs, as well as other ICT-related skills" (Salado-Rodríguez and Ramírez-Martinell, 2018, p. 130). However, this definition under the conditions of the network society, is incomplete and insufficient, due to its excessive generality and ambiguity that does not allow us to be certain which are those specific skills that teachers have to know and apply in the teaching process.

To complement the incorporated state of Technological Capital and provide certainty about those skills that the teacher should apprehend in terms of ICT, we refer to the concept of digital competence; which consists of "skills, knowledge (...) to create and manage information (...) and ability to use ICT, which are primary tools for information management" (UNESCO, 2019, p. 60).

According to the United Nations specialized agency, teachers should incorporate six aspects of Technological Capital in their professional practice, which are: "1. Understanding the role of ICT in educational policies; 2. Curriculum and evaluation; 3. Pedagogy; 4. Application of digital competencies; 5. Organization and administration; 6. Professional learning of teachers" (UNESCO, 2019, p. 10), in order to develop the teaching-learning process and enhance their own professional development.

Built-in technology capital

Aspects	Teachers' Competence
Understanding the role of ICT in educational policies	Determine how and to what extent their teaching practices correspond to institutional and/or national policies and support their achievement.
Curriculum and evaluation	Analyze curricular standards and determine the possible pedagogical use of ICT to meet these standards.
Pedagogy	Appropriately select ICT to support specific teaching and learning methodologies.
Application of digital competencies	Know the functions of computer hardware components and the most common productivity programs, and be able to use them.
Organization and administration	Organize the physical environment in such a way that technology is at the service of different learning methodologies in an inclusive manner.
Professional learning of teachers	Use ICT for their own professional development.

Table 1. Digital aspects and competencies of Embodied Technology Capital (UNESCO, 2019, pp. 28-33)

2.4 Institutionalized technological capital

In its institutionalized state, the Technological Capital is constituted by the,

> set of degrees, diplomas and certificates that validate, institute and recognize knowledge, skills and abilities that cover a symbolic value to the diploma (institution factor, degree of prestige) and defines a hierarchical status by the type of knowledge and is measured in terms of the number of courses and diplomas and certificates (Casillas, Ramirez and Ortiz, 2013, p. 7).

The institutionalized Technological Capital fulfills the function of being "perceived by social agents whose categories of perception are such that they are able to know it (perceive it) and recognize it, give it value" (Bourdieu, 2001, p. 116), in the middle of a network society, where the use of ICT according to Vein "is influencing employment both as an industry that creates jobs and as a tool that allows workers to access new forms of work, in a new and more flexible way" (2003, para. 8).

3. Methodology

The research was based on the quantitative approach. The data collection method was the survey and the instrument was the questionnaire. The process followed to obtain the data is detailed below:

1. **Selection of the research area**: The pandemic, partial mobility restriction, and non face-to-face teaching were limitations for the selected study area. The research was carried out in the educational institutions that provided us with the facilities and permissions to carry it out. The selected areas were the Abdón Calderón Educational Unit, a public institution, located in the parish of Calderón; the Alto Cenepa Educational Unit, a private institution, located in the parish of Calderón; and the Rafael Alvarado Municipal Educational Unit, a municipal institution, located in the parish of Tumbaco.
2. **Population**: We worked with the universe of teachers of the three educational institutions. The total population was 109 teachers, ranging in age from 20 years old to over 60 years old. The population of teachers of the Unidad Educativa Abdón Calderón was 69 teachers; the Unidad Educativa Municipal Rafael Alvarado was 24 teachers, and the Unidad Educativa Particular Alto Cenepa was 16 teachers.
3. **Design and application of the research instruments**: The instrument applied for data collection was the questionnaire elaborated in the Microsoft Forms tool of Microsoft Office 365. It was done in this application for security reasons and easy access, at the same time, it is of general knowledge for teachers, because the Ministry of Education provided institutional Office accounts to all teachers in the public sector, in addition, educators from other institutions also handle institutional emails, for this reason, the tool was not new to them.
4. **Validation of the instrument**: To determine its legitimacy, the validation of the questionnaire was requested from three experts: a teacher from the Universidad Andina Simón Bolívar; another teacher from the Universidad Central del Ecuador and a teacher belonging to the Ministry of Education.
5. **Data analysis**: the data obtained were interpreted using Microsoft Excel. The data from the three educational institutions were unified in order to carry out an in-depth analysis of the Technological Capital, objectified, incorporated and institutionalized.

3.1 Technological Capital analysis questionnaire for teachers

The questionnaire that was applied to teachers of educational institutions; public, private and municipal consists of thirty-eight questions. From question one to question four, we inquired about the informative data of the teachers; from question five to question thirty-eight, we explored the three states that comprise technological capital, which are detailed below:

From question five to question twenty-eight, we inquire about objectified technological capital; from question twenty-nine to question thirty-three, we inquire about embodied technological capital; finally, from question thirty-four to question thirty-eight, we inquire about institutionalized technological capital.

3.2 Reliability of Likert-type questionnaire (ordinal polytomous)

To determine the reliability of the questionnaire, we calculated Cronbach's alpha ($\propto$), which "describe or explain the significance of the alpha statistic in various ways" (Taber, 2017, p. 3). In addition, it is a measure of reliability of surveys conducted in scientific research studies in education. The formula for calculating Cronbach's alpha is found in Equation 1, and is as follows.:

$$\propto = \frac{K}{K-1}\left[1 - \frac{\Sigma_{i=1}^{k}\,\sigma_{Yi}^2}{\sigma_X^2}\right]$$

Equation 1

$\propto$ = Cronbanch's Alpha.

K = Number of questions. In this research, three were applied with Likert scale, with a total of 45 items, each with a five-choice scale.

σ_{Yi}^2 = Variance of the scores of question i.

σ_X^2 = Variance of the observed scores of the individuals. In our research, the 109 survey responses.

The calculation of Cronbanch's alpha ($\propto$) was 1, this allows us to have a high degree of reliability of the questionnaire used to know the digital competencies of the teachers, in reference to the incorporated Technological Capital.

3.3 Data collection

Thirty-four questions of the questionnaire are multiple choice. Three questions have been elaborated under the Likert scale (ordinal polytomous qualitative) corresponding to a scale of skills perception (advanced, intermediate, medium, basic and null); one question has been structured under the Likert scale (dichotomous quantitative) with the option of yes and no.

The survey was conducted during the first quarter of the Sierra Regime school year at the Abdón Calderón Educational Unit (Public - Calderón), Rafael Alvarado Municipal Educational Unit (Municipal - Tumbaco) and Alto Cenepa Private Educational Unit (Private - Calderón).

3.4 Population

The completion of the questionnaire was voluntary (the teachers were notified by the authorities of the institutions about this research to their institutional e-mails, clarifying that the completion was free and voluntary) the link to the Microsoft Forms survey was sent to the institutional e-mails of the main authorities of the educational institutions. The total number of teachers surveyed from the three institutions was 109, including men and women.

4. Methodology

4.1. Data collection

A total of 109 teachers participated in the study, each with the following informative data:

	U.E. A. C	U.E.M R. A	U.E. P. A. C	%
Gender				
Female	45	21	8	68
Male	24	3	8	32,1
Other	0	0	0	0,0
Total	69	24	16	100,0
Age range				
Between 20 to 30 years old	4	0	3	6,4
Between 31 to 40 years old	20	7	7	31,2
Between 41 to 50 years old	22	11	4	33,9
Between 51 to 60 years old	21	5	1	24,8
Between 60 years and over	2	1	1	3,7
Total	69	24	16	100,0
Level that teaches				
Initial I and II	0	0	0	0,0
High School	0	0	2	1,8
Elementary General Basic Education	0	0	2	1,8
Middle Basic General Education	0	2	2	3,7
Higher General Basic Education	30	11	5	42,2
Baccalaureate	39	11	5	50,5
Total	69	24	16	100,0
Level of economic income				
Less than 400	7	2	1	9,2
From 401 to 600	11	0	7	16,5
From 601 to 800	23	5	2	27,5
From 801 to 1000	22	11	2	32,1
More than 1000	6	6	4	14,7
Total	69	24	16	100,0

Table 2. Informative data of the teachers of the three educational institutions.

4.2.   Targeted Technological Capital

The teachers of the three educational institutions in question 5, about the electronic equipment they have at home, were asked to select several options. The three options with the highest number of choices were a laptop, printer with scanner and radio. In question 6, the teachers responded that 89.9% have broadband or fiber optic internet, the other 7.3% have internet access from a neighbor or close relative, and 1.8% have access through telephone recharges. In question 7 on the type of speed of their internet 34.9 % responded that they have 1.5 to 5 mbps, 35.8 % 10 to 20 mbps, 22.9 % 30 to 40 mbps, 5.5 % 80 to 100 mbps and 0.9 % 200 mbps and more. In question 8 of How much time do you spend using the Internet for personal distraction or surfing social networks? 68 % answered from 30 minutes to 1 hour, 21.1 % from 2 to 3 hours, 6.4 % from 4 to 6 hours and 4.6 % more than 6 hours. In the next question about what types of social networks do they frequent for distraction? The top three included Facebook, WhatsApp and YouTube.

Question 10 referring to How much time do you use to plan your classes, 10.1 % from 30 minutes to 1 hour, 50 % from 2 to 3 hours, 19.3 % from 4 to 6 hours and 20.2 % more than 6 hours. In question 11 on How much time do you spend teaching your students using digital platforms? 39.4 % from 40 minutes to 1 hour, 12.8 % 1 hour, 47.7 % from 4 to 6 hours. On question 12 on What digital platforms do you use to teach your subjects? 101 teachers responded that the most used platform is Zoom Meeting. On question 13 on What type of digital tools do you use to teach your classes? They answered that 94.5% use synchronous tools and 5.5% use asynchronous tools. In question 14 on What type of digital resources do you use to plan your classes, 89 teachers use educational platforms, 59 teachers use gamification resources and 49 teachers on online assessments. Question 15 on What types of educational platforms do you use to assign homework to your students? Responded 39 % Google Classroom, 22 % Moodle, 19 % Microsoft Office 365 package, 15 % the institution's own platform and 6 % Edmodo. Next, question 16 asks What types of educational platforms do you use to apply assessments to your students? 35 % responded that they use Google Classroom, 22 % Moodle, 20 % the institution's own platform, 17 % use Microsoft Office 365 Package and 6 % Edmodo.

Question 17 asks about the technological equipment used by teachers to teach their classes. Here we ask whether the teacher knows that the educational platforms (creation of virtual learning environments -EVA- such as MOODLE, FirtsClass or own creation) used in the teaching-learning process, are licensed. Sixty-eight percent answered that it was free, 17% paid by the institution and 16% paid by the teacher. Question 18 asks whether the teacher knows if the institution where he/she works has its own educational platform, 58% answered No, 26% said Yes and 17% said they did not know. In question 19, what is the medium you use to teach your virtual classes? 89 % answered Laptop, 10.1 % use desktop computer and 0.9 % a Tablet. Question 20 is about The technological equipment you use in your classes is? And teachers answered 59 % a desktop computer, 18 % a laptop, 14 % a tablet and 9 % smartphone. Question 21 asks whether the technological equipment you use to teach your online classes was provided by the educational institution where you work? 57 % of teachers answered Yes and 43 % answered No. In question 22, is the Internet service you use to teach online classes to your students financed by the educational institution where you work? 99% of the teachers answered No and 1% answered Yes.

Question 23 asks about the technological specifications of the electronic equipment In your electronic equipment such as desktop or laptop computers, what operating system do you have installed? 99.1% answered that the operating system is Windows and 0.9% Mac Os. In question 24 in your electronic equipment such as smartphone, what operating system do you have installed? They answered 92 % that the operating system of their smartphone is

Android and 8 % have iOS (Apple brand) installed. Question 25 asks whether the programs (e.g. Word, Excel, Power Point and Antivirus) installed on their electronic equipment such as personal computers or laptops are licensed, unlicensed or unknown. Thirty-four percent have a license, 33% do not have a license and the other 33% do not know. Question 26 asked about which of the following methods do you use to communicate with your friends and family? 62 % answered that they make calls via WhatsApp, 33 % cellular calls directly from their smartphone and 5 % make phone calls from a local home phone. Question 27 asks about Which of the following means do you make use of to organize collaborative work in your classes? 76 % answered that they make use of group meetings via ZOOM, Teams or Skype, 21 % Group chats via WhatsApp, 2 % Collaborative files on Google Drive and 1 % Facebook Groups. In question 28 Which of the following means do you use to coordinate activities with your students' legal representatives? 52 % answered group chats via WhatsApp, 43 % group meetings via ZOOM, Teams or Skype and 5 % emails.

4.3.   Incorporated Technological Capital

From question 29 to question 33, the questionnaire asked about the Technological Capital incorporated.

Question 29 asks whether teachers make use of the following ways to access academic information on the web pages, through a dichotomous quantitative Likert scale composed of the following variables.

29.Answer with yes or no, if you make use of the following ways to access academic information on the websites			
Ítems	**Yes%**	**No %**	**Total %**
Advanced search through search engines such as: Google, Bing Baidu and more.	90,8	9,2	100
Search in Google Scholar, Redalyc, Dialnet, SciELO and more.	46,8	53,2	100
Check specialized and recognized websites in education such as: EDUTEKA, EDUCARED, MINEDUC.	79,8	20,2	100
Search in blogs or anonymous web pages	23,9	76,1	100
Search only in the first 10 pages recommended by your search engine.	43,1	56,9	100
Cites bibliographic sources in your academic files using Zotero/Mendeley or Word citation tools	53,2	46,8	100
Recognizes reliable sources of information	78,0	22,0	100
Makes use of anti-plagiarism websites to review students' academic papers	23,9	76,1	100
Visits digital repositories of universities or academic institutes	55,0	45,0	100
Uses metasearch engines	26,6	73,4	100
Search for digital books or journals	88,1	11,9	100

Table 3. You make use of the following ways to access academic information on web pages.

As can be seen in Table 3, teachers have developed technological skills in searching and accessing academic information on web pages. In the advanced search through search engines such as: Google, Bing, Baidu and more, answered 90.8 % Yes and 9.2 % No; in reference to Google Academic Search, Redalyc, Dialnet, SciELO and more 46.8 % Yes and 53.2 % No; reviews specialized and recognized web pages in education such as: EDUTEKA, EDUCARED, MINEDUC answered 79.8 % Yes and 20.18 % No; searches in blogs or anonymous web pages answered 76.1 % No and 23.9 % Yes; searches only in the first 10 pages recommended by their search engine 56.9 % answered No and 43.1 % Yes; cites in their academic files bibliographic sources using Zotero/Mendeley or Word tools for citing, 53.2 % answered Yes and 46.8 % No; recognizes reliable sources of information, 78 % answered Yes and 22 % No; makes use of anti-plagiarism web pages to review the academic work of their students 76.1 % answered No and 23.9 % Yes; visits digital repositories of universities or academic institutes 55 % answered Yes and 45 % No; uses meta-search engines 73.4 % No and 26.6 % Yes; searches digital books or journals 88.1 % answered Yes and 11.9 % answered No. These data give us a clear picture of how teachers during the period of the pandemic have been trained, either institutionally or personally, to develop technological skills and competencies on various tools, such as access to information on web pages.

In question 30 about which of the following devices do you mostly do your searches on web pages? They answered 78 % on a laptop, 11 % computer, 10 % smartphone, and 1 % a tablet. In questions 31 and 32 on the digital competencies that teachers have in the area of information, information literacy and data processing, the following results were obtained:

	Questions 31: Digital Competencies I	Advanced %	Intermediate %	Middle %	Básic %	Null %
1	Transferring audio, video and photos from device to computer	14,7	24,8	33,0	24,8	2,8
2	Editing of video, audio, images or bitmaps and vector images	7,3	14,7	22,9	36,7	18,3
3	Audio format conversion	9,2	13,8	22,9	31,2	22,9
4	Video format conversion	10,1	16,5	20,2	34,9	18,3
5	Image format conversion	11,0	12,8	29,4	34,9	11,9
6	Scanning and copying your documents	20,2	25,7	23,9	28,4	1,8
7	Downloading files from web pages	21,1	29,4	29,4	18,3	1,8
8	Creating digital resources for classroom presentations	13,8	27,5	35,8	22,9	0,0
9	Using educational platforms	12,8	30,3	33,0	22,9	0,9
10	Uploading files to clouds such as Google Drive or OneDrive	16,5	17,4	33,0	25,7	7,3
11	Compress and decompress files in ZIP or RAR formats	13,8	18,3	27,5	29,4	11,0
12	Convert Word, Power Point and Excel files to PDF	21,1	23,9	22,9	27,5	4,6
13	Upload Word, PDF or jpg files to educational platforms such as Moodle	11,0	28,4	24,8	24,8	11,0
14	Back up your accounts such as Whatsapp, photos and phone contacts	12,8	22,0	22,9	28,4	13,8

15	Organize meetings on communication platforms such as Zoom, Teams, GoToMeeting	15,6	27,5	27,5	19,3	10,1
16	Make online purchases	11,9	22,9	17,4	22,0	25,7
17	Using email	22,9	26,6	13,8	22,9	13,8
18	Upload videos to platforms such as Youtube	13,8	14,7	24,8	24,8	22,0
19	Downloading games or programs on your smartphone either from Play Store or App Store	4,6	17,4	18,3	32,1	27,5
20	Using bibliographic citation managers such as: Zotero and Mendeley	8,3	8,3	16,5	34,9	32,1

Table 4. Digital competencies I

	Question 32: Digital compentencies II	Advanced %	Intermediate %	Middle %	Básic %	Null %
21	Using educational platforms (e.g. Moodle, Edmodo, Google Classroom and more)	11,9	24,8	23,9	21,1	18,3
22	Creating online games	4,6	11,9	17,4	24,8	41,3
23	Designing online graphic organizers	8,3	13,8	19,3	33,9	24,8
24	Creation of online courses -MOOC	3,7	11,9	13,8	24,8	45,9
25	Use of interactive whiteboards	10,1	10,1	18,3	25,7	35,8
26	Creation of online assessment tools	8,3	21,1	20,2	33,0	17,4
27	Design of interactive presentations	9,2	17,4	26,6	33,9	12,8
28	Infographics and graphic design	6,4	15,6	18,3	36,7	22,9
29	Animated explanatory videos	9,2	9,2	17,4	34,9	29,4
30	Creation of online evaluations	6,4	24,8	18,3	29,4	21,1
31	Creation of online avatars	2,8	11,9	17,4	29,4	38,5
32	Designing online comics	3,7	11,0	16,5	22,0	46,8
33	Creating forums, assigning tasks, assessments and uploading files to platforms such as Moodle, Edmodo, Google Classroom and more.	14,7	20,2	19,3	22,0	23,9
34	Using Zoom and Teams resources such as creating a whiteboard, screen recording and sharing function	14,7	30,3	18,3	24,8	11,9
35	Create Whatsapp gifs and stickers.	6,4	15,6	19,3	22,0	36,7

Table 5. Digital competencies II

In the case of digital competencies in reference to the area of digital content creation; communication and collaboration of teachers can be seen in Table 4 and 5, where it is possible to denote that the predominant scale of competence is Intermediate and medium, basic and null, of the 35 different items proposed in the questionnaire. During the pandemic, many of the teachers were exposed to training in the mastery of various digital competencies to be able to teach virtual classes to their students and continue with the correct teaching-learning process.

In order to know the standard deviation, mean and confidence level of questions 31 and 32, where the digital competencies that teachers have in reference to the incorporated technological capital are analyzed. In question 31 and in relation to Table 4 on the Digital Competences I.

Question 31	Media	Standard deviation	Confidence level
Advanced	13,6	4,9	2,29
Intermediate	21,1	6,4	3,02
Intermediate	25,0	6,1	2,84
Basic	27,3	5,4	2,53
Null	12,9	9,6	4,51

Table 6. Descriptive analysis, Digital competencies I

The statistical trend on the average level of digital competencies incorporated by teachers, in the Advanced level of mastery has an average of 13.6 %; Intermediate 21.1 %; Medium 25.0 %; Basic 27.3 % and Null 12.9 %.

In question 32, which is related to Table 5 on Digital Competencies II:

Question 32	Media	Standard deviation	Confidence level
Advanced	8,0	3,7	2,1
Intermediate	16,6	6,3	3,5
Intermediate	19,0	3,0	1,7
Basic	27,9	5,4	3,0
Null	28,5	11,6	6,4

Table 7. Descriptive analysis, Digital competencies II

The statistical trend on the mean of the level of digital competencies incorporated by the teachers, in the Advanced level of mastery has a mean of 8.0 %; Intermediate 16.6 %; Medium 19.0 %; Basic 27.9 % and Null 28.5 %. The mean that has the highest frequency on the level of mastery of digital competences, has the highest representativeness the Basic level, which has a tendency of 27%.

In question 33 on the level of appropriation of digital competences in the area of information and digital literacy by means of a Likert scale, the results are as follows:

Question 33: Level of appropriation of the digital competencies that you consider you have mastered in the following items	Advanced %	Intermediate %	Middle %	Básic %	Null %
1 Use of word processor (e.g. Word)	25,7	36,7	20,2	13,8	3,7
2 Use of presentation processor (e.g. Power Point)	21,1	42,2	20,2	11,9	4,6
3 Use of spreadsheets (e.g. Excel)	13,8	33,0	23,9	21,1	8,3
4 Use of statistical analysis programs (e.g. SPSS)	5,5	14,7	11,0	33,9	34,9
5 Use in Microsoft Office 365 the Teams application for team building and video calls	9,2	22,0	23,9	33,9	11,0

6	Use in Microsoft Office 365 the Forms application to create questionnaires or forms	6,4	19,3	22,0	36,7	15,6
7	Use in Microsoft Office 365 the SharePoint application to create team work and document management	2,8	17,4	15,6	23,9	40,4
8	Use in Microsoft Office 365 the OneNote application to take notes and collect information	4,6	14,7	16,5	24,8	39,4
9	Use in Microsoft Office 365 the Outlook application to send and receive e-mails	11,9	27,5	25,7	22,9	11,9
1 0	Use in Microsoft Office 365 the OneDrive application to host information in the cloud	6,4	18,3	15,6	33,0	26,6

Table 8. Level of skills you consider you have mastered

Among the level of appropriation of the competencies, according to the scale, it is evident that teachers have a higher percentage of appropriation in items 1, 5 and 6. In addition, the level of null appropriation has a higher percentage in items 3, 4 and 7. The Intermediate level of appropriation, with higher percentages, is found in items 2, 8, 9 and 10.

4.4. Institutionalized technological capital

The survey space to learn about the institutionalized technological capital of teachers was established from question 34 to 38.

In question 34, which asked about the level of skills in the management of office automation tools and Microsoft Office 365, the results obtained were as follows:

In question 34, before the Covid-19 pandemic, in your educational institution did you receive trainings on the use of technological tools? The response items were yes and no; with 31 % answering yes and 69 % answering no. In question 35 on Did you use platforms such as Zoom, Teams or Moodle before the Covid-19 pandemic? 69% answered Yes and 31% answered No.

In question 36, Do you have any type of certificate or academic degree on digital competencies in the use of ICT or management of computer tools, the teachers answered 55 % No and 45 % Yes.
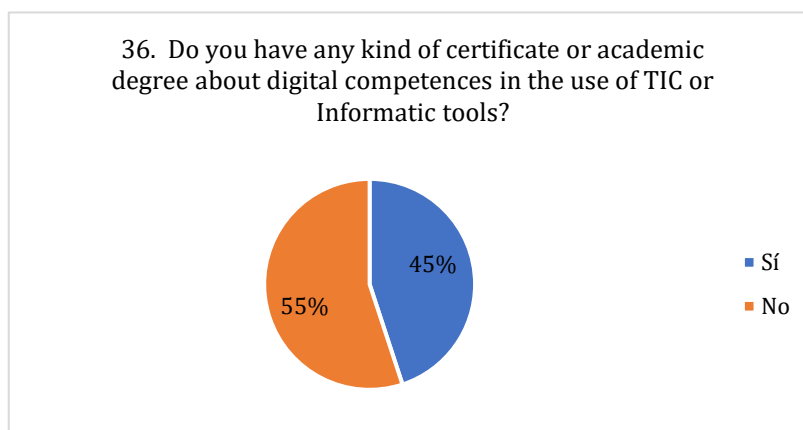

Figure 1. Do you have any type of certificate or academic degree on the use of ICT?

Questions 37 and 38 are related to each other. Question 37: "During the last 6 months, have you received any training on technological competencies in the use of technological tools? 72% answered Yes and 28% No. Next, in question 38, only those who selected the Yes option in question 37 had to answer and select the type of training, a total of 65 teachers mentioned that they were free, 18 teachers that they were paid courses, and 5 teachers that they were co-financed courses.

5. Discussion of the results

All of the teachers surveyed possess a certain form of objectified technological capital, which is mostly expressed in desktop computer, laptop, printer with scanner, smartphone and radio. For example, of the 109 respondents, 103 teachers answered that they have a laptop, 63 teachers have printer with scanner and 59 teachers have radio. However, this is determined by their socioeconomic status. Thus, for example, in question 21, which states: Was the technological equipment you use to teach your online classes provided by the educational institution where you work? In this regard, 57% of respondents answered in the affirmative, while 43% answered in the negative. We can infer that there has been limited support from the Ministry of Education towards teachers, even though the United Nations has urged States, stating that "teachers and students need free and open source technologies for teaching and learning" (UN, 2020, p.27).

The aspect of Understanding the role of ICT in educational policies of digital competencies established by UNESCO, guides that teaching practices are in harmony with educational policies. In this regard, question 11 of the instrument asked: How much time do you spend teaching your students through the use of digital platforms? Forty-eight percent of respondents answered that they spend 4 to 6 hours, 39% 40 minutes and 13% 1 hour. This evidences that only the teaching activity of 52 % of respondents is in accordance with the Educational Plan "we learn together at home" where the work time is regulated, establishing the following guidelines "(120) one hundred and twenty minutes for academic activities and (30) thirty minutes for homework or reinforcement, for students of EGB superior; 16 years old: two hours" (MINEDUC, 2020, p. 19).

The pedagogical and curricular aspect of the incorporated Technological Capital is oriented to "teachers integrating technologies, tools and digital content to enhance teaching" (p. 29). Thus, for example, question 15 asked; What types of educational platforms do you use to assign homework to your students? Thirty-nine percent of respondents use Google Classroom, 22% use Moodle, 19% use Microsoft Office 365, 15% use the institution's own platform and 6% use Edmodo. Likewise, question 16 asked; What types of educational platforms do you use to apply assessments to your students? 35% of respondents use Google Classroom, 22% use Moodle, 20% use the institution's own platform, 17% use the Microsoft Office 365 package and 6% use Edmodo. From the compared questions we can observe a standard deviation of 11 %, which shows a dispersion or variability among the respondents' answers. We can infer that teachers do not use digital platforms in a mechanical way, on the contrary, they do it according to the needs demanded by certain educational activities, such as evaluation and assignment of tasks.

Regarding the application of the embedded Technological Capital where "teachers use computers, mobile devices, accessible software, and networks, for teaching, learning and management purposes (...)" (UNESCO, 2019, p. 30). The teachers surveyed, in question 31 in item 17 that questioned about the use of email responded that 22.9% of respondents have an Advanced level, 26.6% Intermediate, 13.8% Medium, 22.9% Basic and 13.8% Null. Likewise, in item 7 of question 32 that asks about the design of interactive presentations,

9.2 % of respondents have an Advanced level, 17.4 % Intermediate, 26.6 % Intermediate, 33.9 % Basic and 12.8 % Null. Furthermore, in question 33 item 1 that refers to the Use of a word processor to create documents, 25.7 % of teachers have an Advanced level, 36.7 % Intermediate, 20.2 % Intermediate, 13.8 % Basic and 3.7 % Null. According to the descriptive statistical analysis of the three questions in correspondence to a total of 45 items, the average level of incorporation of these digital competences corresponds to 11.1 % Advanced, 20.4 % Intermediate, 21.8 % Medium, 27.1 % Basic and 13.1 % Null. Therefore, from the data discussed we can affirm that most teachers have a Medium level in terms of management and use of incorporated technological capital.

In reference to the Technological Capital in its institutionalized state, understood as the whole set of elements that cover the symbolic value of acquired knowledge. In question 36, which asked: Do you have any type of certificate or academic degree on digital competencies in the use of ICT or management of computer tools? 55% of teachers answered No and the remaining 45% answered Yes. Likewise, in question 37 which asked; During the last 6 months have you received any training on technological competencies in the use of technological tools? 72 % of teachers answered Yes and the remaining 28 % No. From which we can deduce that despite the mastery of digital competencies there is no correspondence with certificates and diplomas that accredit their incorporated technological capital.

6. Conclusions

Teachers possess Technological Capital. In their objectified state they possess to a greater extent the following forms of KT; desktop computer, laptop, smartphone, smart TV, printer with scanner and radio. However, it should be noted that most of these instruments have been acquired by teacher self-financing. In their embedded state, they have a Medium level of KT appropriation, which allows them to develop and apply the six ICT competencies in education to strengthen the teaching process. In their institutionalized state, more than half of the teachers have participated in training courses, obtaining a certificate accrediting their embedded knowledge. However, the training processes increased due to the demands caused by the pandemic. Before the pandemic, training levels were lower.

International organizations such as the UN, UNICEF, ECLAC and UNESCO have urged States to protect and increase public investment in education to guarantee the exercise of this right during the pandemic. In addition, by constitutional mandate, the Ecuadorian State through the Ministry of Education is obliged to generate public policies and services that guarantee quality education, among these public policies is the expansion of the technological capital of teachers with the perspective of applying ICT skills in a critical, reflective and dynamic way.

There are no antecedents in the country on specific studies of Technological Capital applied in education, therefore, this research constitutes an axis of discussion on Technological Capital, its appropriation, application and influence in the teaching-learning process. Finally, a new study on the appropriation of technological capital of teachers in educational institutions located in rural cantons and/or parishes is expected to be carried out in the medium term, where the data presented in this research can be compared with new results, in order to make visible a posteriori the development, levels and forms of appropriation of technological capital: objectified, institutionalized and incorporated.

Acknowledgments

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