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Strengthening Policies for Education, Innovation, and Digitization Through Teacher Training: Evaluating ProFuturo's Open Model in Ecuador

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Résumé de l'article

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Abstract

Teacher training and a commitment to innovation in teaching are determining factors in the success of technology adoption processes. This article presents a study on the opportunities produced through the collaboration of the Ecuadorian Ministry of Education and the ProFuturo program, which arose during the COVID-19 pandemic. This collaboration resulted in the improvement of digital competency among teachers and pupils and in transference to educational practise. It also strengthened the existing limited capabilities for developing mass training programs for teachers in the country. The research was conducted through an online survey, with a cross-sectional, quantitative, and non-experimental focus from two data sources. A total of 3,565 teachers answered the digital survey for teachers trained using the Open Model in Ecuador between 2020 and 2022. On the other hand, 7,257 teachers answered the ProFuturo Self-Assessment of Digital Skills of Teachers (https://competencyassessment.profuturo.education/?lang=en). The results show an improvement in the competency of teachers following their participation in the program and confirm that they considered digital transformation in the classroom to be of great utility. Teacher training remains a cornerstone of high-quality education and research as this contribution proves a positive impact on learning experiences, where there was a significant transference, driven by an improvement in digital skills applied to the teaching process.

Keywords: digital competence, education policies, institutional strengthening, teaching innovation, teaching role

Introduction

Globally, educational institutions undertake continuous commitment to training and supporting their teaching staff, in a context conditioned by digital adoption in all spheres of activity, both work-related and personal. This shift entails continuous innovation in all processes connected to teaching and learning. Among other changes, adoption of technology in educational institutions has resulted in profound transformation, not only for managing educational projects, planning, implementation, and assessment, but also for instruction, thereby facilitating the acquisition of skills assigned to the different stages of the curriculum, as well as those needed in a social context determined precisely by digital transformation (Falode, 2019; Falode & Mohammed, 2023; Sangrà et al., 2023).

Thus, teacher training is one of the determining factors for technology adoption processes that meet the needs of learners and the society of a region as a whole. In fact, a large part of the scientific literature has focused specifically on identifying a framework that would facilitate training designs that encourage staff innovation and modernization. In this respect, studies, including those by Martin et al. (2021) and Muñoz-Carril et al. (2013), have emphasized the variety of roles a teacher must perform in technology-mediated education, given that, in addition to acting as an expert in their field, they must also carry out roles such as these:

- **technologist**: expert in the technological environments and digital media involved in the teaching process
- **researcher**: commits to continuing education over the course of their lives, understands trends that develop in response to societal challenges, and frequently bridges generation gaps
- **manager/administrator**: organizes all media and resources, groups students together, and plans or structures processes
- **mentor/facilitator**: attends to students' personal and social-emotional needs, in addition to those of a purely academic nature
- **instructional designer**: chooses the methods, techniques, and activities best suited to the specific needs of students and aligns them with learning objectives
- **assessor**: coordinates the processes of continuous, formative, and summative assessment of students, in addition to evaluating the process to improve its quality

Based on this analysis, training teachers to manage the integration of technology in educational contexts involves careful planning in order to provide training in areas as diverse as management, research, methodology, individualized attention, and technology (Maile Cutri & Mena, 2020). This complexity is reflected in benchmark initiatives, such as one by UNESCO which recognizes that training and evaluating teachers is a cornerstone of high-quality education and a means of achieving the educational objectives of the 2030 Agenda (UNESCO, 2020). The EDUCAUSE Horizon 2020, 2021, and 2022 reports, which predict trends and priorities for educational contexts, emphasized the need to provide high quality online education, hybrid teaching models, and teacher training to enable interventions in both modalities (Brown et al., 2020; Pelletier et al., 2021; Pelletier et al., 2022).

Furthermore, in order to provide a reference framework to channel and reinforce national, regional, and local efforts to develop the digital competence of educators, the European Commission, in line with other areas of competence, have designed the European Framework for the Digital Competence of Educators, thereby promoting innovation in education (Redecker, 2017). In the same vein, UNESCO's 2023 Global Education Monitoring Report on technology in education analyzes the suitability, scalability, and sustainability of the use of technology in education throughout the world.

All digital training initiatives run since the start of the 21st century became even more meaningful in the face of the regrettable global crisis caused by the COVID-19 pandemic, which affected 1.6 billion students in more than 190 countries. The pandemic gave rise to a global, forced, and accelerated redesign of the 20th-century school structure, in addition to the digitization of education. The challenges varied by country, depending primarily on their degree of digitalization. For example, the Zoomification of teaching (Tullett et al., 2022) in more developed countries was able to support 80%–85% of students, compared to coverage of less than 50% experienced in countries with fewer resources, according to data from UNESCO. This was due to the lack of computers or Internet in homes and schools, which sadly demonstrates the social injustice caused by a digital divide that has not been globally addressed (Dreesen et al., 2020; García Aretio, 2021).

In the context of the pandemic, it became clear that there was a pressing need to train teaching staff; while in many cases, platforms and digital media managed to provide an emergency solution to continue schooling, in each and every context, the urgent need to train teachers became evident, both in order to fulfill the technologist role mentioned previously and to develop the variety of teaching roles needed in virtual environments (Martin et al., 2021; Prieto et al., 2018).

In this sense, as a consequence of the pandemic, some countries were forced to accelerate the digitization of educational processes, adopting training in a virtual mode in order to continue the schooling of their students and adding a range of technologies, such as digital OER content, instant messaging, and video conferencing tools, in the service of educational processes, while they simultaneously attempted, with varying levels of success, to address the increasing issues arising from the educator remaining the articulator of these experiences (Scarlat et al., 2022). On the other hand, in many contexts, the conditions for connectivity, technological equipment, planning, or necessary teacher training programs (García Aretio, 2021) were non-existent. Some countries adopted accelerated digitization programs, betting on high investments in technology adoption without taking into account the lessons learned and widely published in studies, which have concluded that in order to ensure learning, it is necessary to employ educational strategies that incorporate training plans which interrelate the relevant curriculum framework, pedagogical lines, and the technology available (González-Sanmamed et al., 2020; Hernández-Sellés, et al. 2019; Hodges et al., 2020). In this respect, it is important to note that these digital acceleration processes have not been limited to emergency contexts; there have also been policies to adopt these decisions without previous experience or studies which, as we have noted, can now serve as guides to successful processes. Therefore, in spite of the abundance of literature and previous experience in different contexts, when there are ongoing educational digital processes on a macro national level, there are still evident challenges in adopting policies that promote quality of education.

In the case of Ecuador, the emergency forced practically all educational activities to cease, as these were predominantly in-person and the country did not have the required infrastructure to continue in virtual formats. In August 2020, Ecuador subscribed to the Inter-institutional Cooperation Framework

Agreement between the Ministry of Education and Fundación Telefónica Ecuador for three years, to establish a cooperation framework for implementing projects and processes focused on strengthening the digital skills and abilities of the educational community. As part of this framework agreement, the ProFuturo program ran seven online training sessions, provided 198 courses, and certified 200,000 teachers who completed training between 2020 and 2022.

ProFuturo is a digital education program promoted by Fundación Telefónica and the Fundación "la Caixa" in line with objective 4 of the 2030 Agenda for the United Nations Sustainable Development Goals (SDG4): quality education. It focuses on reducing the education gap and promoting high quality education. With a presence in 45 countries in Latin America, the Caribbean, Africa, and Asia, the program has trained over 1.4 million teachers and benefited 28 million children in these four regions.

At the same time, Fundación Telefónica Ecuador has developed initiatives through the ProFuturo program that serve as a basis for building a global learning community in Ecuador. The three most pertinent are: (a) the digital environment run through a private Facebook group named Comunidad de aprendizaje—Docentes ProFuturo [Learning Community—ProFuturo Teachers] which had over 19,000 members in 2023, with an average of 13 publications and a reach of over 6,000 teachers each week, and an average of 3,000 interactions each year; aimed at improving interaction among teachers and sharing learning guides and micro-content about the use of technology and digital education (the source and data are public in Facebook; analysis were provided to authors by Fundación Telefónica Ecuador); (b) the Festival de Ideas Educativas "Ideas de 10" [Festival of Educational Ideas] which has taken place on three occasions; and (c) the teaching community built around the Project Based Learning pilot training project developed in 2022.

ProFuturo works to improve the conditions of educational systems in vulnerable areas. To this end, they have created three models of intervention:

- **comprehensive model**: based on teacher development (training and support), a digital solution (that includes technological equipment and a Learning Management System that works online and offline); high quality digital educational resources; and a monitoring and evaluation system

- **refugee model**: complements the previous model, by including psychosocial support, safe spaces for learning, and food aid and/or health care

- **massive open model**: provides virtual or in-person training for teachers.

The massive open model focuses on innovative educational training for teachers, based on leadership, communication, and planning in the classroom. It provides online courses in innovation and Information and Communication Technology (ICT), pedagogical and teaching skills, and digital competence. The model is accessible to all countries and offered to teachers through the use of free educational resources.

In this study, we analyzed the collaboration between the public education system in Ecuador and the ProFuturo program during the years of the pandemic, starting from August 2020 and continuing over the course of three years, from two perspectives: first, as a model for collaborative interventions during emergencies, and second, as a means of demonstrating the impact of this type of collaboration on teacher training, improving digital competence, and transference to educational practice.

Methodology

Objectives

We analyzed ProFuturo's intervention in Ecuador during the pandemic years, starting in August 2020 and spanning three years. Our analysis focused on the perception of the teaching staff who participated in ProFuturo's open model, with particular attention to:

- the utility of the digital training provided by ProFuturo's open model for improving teacher learning
- the improvement in competence associated with the training received
- transference of the training to the classroom environment, resulting in innovative methodological practise.

Study Design

We designed an ex post facto study based on an online survey method, with a cross-sectional, quantitative, and non-experimental focus (Hai-Jew, 2020). A non-probabilistic, accidental, or convenience sampling technique was used (McMillan & Schumacher, 2006) to count the informants according to their availability or accessibility. Further on, descriptive analyses were carried out. We present partial results of the data obtained from two sources:

- The digital survey for teachers trained using the open model in Ecuador between 2020 and 2022 and, in particular, the questions related to the teacher training offered and its level of transference. In respect to instrument design, the questionnaire was reviewed by seven specialist judges in digital education and teacher training processes and three research methodology specialists. A pilot study with teachers from several different countries was also carried out.
- The test Autoevaluación de Competencias Digitales para Profesoras y Profesores [Self-Assessment of Digital Skills of Teachers], which was self-assessed by teachers in the country, enabled ex-post measurement of the impact of the ProFuturo training on the level of teacher competence, comparing teachers who had previously received ProFuturo training with those who had not. It was based on the teacher self-assessment survey designed by the Centro de Inovação para a Educação Brasileira (CIEB) [Brazilian Centre for Educational Innovation] which is used in the region, particularly in Brazil, as a reliable tool for measuring competence. This is a free online tool with two main objectives: (a) to encourage teachers to reflect on their own knowledge and the use of digital technology; and (b) to provide information for education networks, regarding the aggregate profile of digital competence among teachers, in order to develop more effective teacher training. It includes 23 questions which evaluate 12 skills, distributed across three areas.

The instruments measured:

- the level of utility perceived by teachers in improving learning for their students and the frequency of modification of educational activities after participating in the courses, all arranged by hours of training, gender, age, educational stage, and school funding,

- the level of transference to educational practise,
- the level of improvement in competency associated with the training received, and
- the percentage of improvement by number of training hours, according to the following variables: gender, age, studies undertaken, and specialty.

Description of the Intervention Context

Fundación Telefónica has been working in Ecuador since 2008 to promote and develop educational competence through responsible use of ICT in educational processes, including both teachers and the student body. Through the ProFuturo program, it has worked in 24 provinces and 1,133 schools in the country, training more than 85,000 teachers and benefiting more than two million children since 2017. In April 2020, training courses were launched through the Fundación Telefónica website and the educational resource and planning portal on the Ministry of Education website. The courses were designed to develop digital skills, educational methodologies, educational strategies, gamification, mathematics, leadership, and digital citizenship, with lengths ranging from 5 to 40 hours each. Table 1 includes a summary of examination sessions, courses, hours of training, registrants, passing grades and certified teachers, to portray the training scope. In that year, 30% of the courses related to pedagogy and pedagogical methodologies, 26% to digital skills for teachers, and 13% to digital citizenship.

Table 1

Summary of Examination Sessions 2020–2022

Examination session	Duration	Courses ***n***	Hours of training ***n***	Registrants ***n***	Passing grades		Teachers certified ***n***
					n	%	
2020_1st	March–September	23	537	146,376	129,764	88.65	129,754
2021_1st	Dec 2020–May 2021	38	813	391,464	207,863	52.08	59,733
2021_2nd	May–July	7	233	23,567	11,594	49.20	8,164
2021_3rd	July–December	47	861	339,005	106,876	31.53	15,107
2021_5th	October–December	40	993	21,800	12,927	59.30	777
2022_1st	April–December	32	651	197,275	45,084	22.85	4,519
2022_2nd	September–December	11	212	121,724	49,307	40.05	8,081
Total		198	4,300	1,241,211	563,415		218,054

Note. This information has been provided by Fundación Telefónica Ecuador. The Ministry of Ecuador offered certificates only if a certain hour of study and full itineraries were fulfilled, that is what explains the discrepancy between the number of teachers who received a passing grade and the number of certifications.

In 2021, ProFuturo launched four sessions that were published in the Fundación Telefónica website and its social networks, as well as in the MeCapacito section of the Ministry of Education website. This resulted in a total of 776,230 registrations with a pass rate of 43.74%. A total of 133 courses were developed, divided across 13 skills, 21 itineraries, and six levels. The courses were built around the areas of (a) digital competence for teachers, where 33.29% of the students completed the courses, (b)

pedagogy and pedagogical methodologies, where 18.28% of teachers completed the training, and (c) digital citizenship, where 14.36% of teachers received training that year.

For 2022, the program was designed to align with the digital education agenda, defining the training as a means of strengthening digital competence among teachers.

A total of 43 courses was provided, distributed across four areas, three skills, four itineraries, and six levels. Courses related to digital competence for teachers continued to be the most frequently offered (37.21%) and the most in-demand (45% of registrants). However, courses related to social-emotional and communication skills had the highest passing grade rate per registrant (with 37.25% and 32.52% respectively).

During 2020, training was divided into the areas of competence shown in Table 2.

Table 2

ProFuturo Open Model Courses by Area of Competence, 2020

Teaching competence	Courses *n*	Proportion of all courses %	Registrants *n*	Passing grades *n*	Passing grade per session %	Passing grade per registrant %
Pedagogy	7	30.43	42,732	38,134	29.39	89.24
Digital skills for teachers	6	26.09	57,353	50,749	39.11	88.49
Digital citizenship	3	13.04	8,147	7,652	5.90	93.92
Communication skills	2	8.70	13,084	11,146	8.59	85.19
Direction and management skills	2	8.70	7,384	6,306	4.86	85.40
Collaboration skills	1	4.35	5,210	4,428	3.41	84.99
Mathematical competence	1	4.35	6,534	5,727	4.41	87.65
Social-emotional skills	1	4.35	5,932	5,622	4.33	94.77
Total	23	100.00	146,376	129,764	100.00	

Note. Based on data from ProFuturo.

Some of this content was offered over 3 consecutive years. See Table 3.

Table 3

ProFuturo Open Model Courses That Ran Consecutively 2020–2022

Course name and code	Examination sessions ***n***			
	2020	2021	2022	Total
Project-Based Learning	1	4	2	7
Action Against Cyberbullying	1	3	2	6
Cooperative Learning	1	3	2	6

Digital Skills for Teachers I D	1	3	2	6
Digital Skills for Teachers II	1	3	2	6
Digital Skills for Teachers III	1	3	2	6
Affective Communication in the Classroom	1	4	1	6
Skills for a Life of Peace	1	3	2	6
Learning Difficulties	1	3	2	6
School Bullying: Prevention, Detection, and Action	1	2	1	4
Dyslexia in the Classroom	1	2	1	4

Education in Ecuador is regulated by four types of models according to the type of funding: public (managed by public administration), fiscomisional (which receives funding from both public and private sources), municipal (public management with part of the education specific to the municipality that governs it), and private. The distribution of students, during the research, by type of establishment is shown in Table 4.

Table 4

Distribution of Students in Ecuador by Funding and Establishment Type 2019–2022

Type of funding	Students					
	2019–2020		2020–2021		2021–2022	
	n	%	*n*	%	*n*	%
Public	3,219,939	73.06	3,297,505	76.42	3,324,405	77.15
Fiscomisional	286,382	6.50	269,742	6.25	259,054	6.01
Municipal	35,191	0.80	34,173	0.79	33,652	0.78
Private	865,518	19.64	713,357	16.53	692,028	16.06
Total	4,407,030	100.00	4,314,777	100.00	4,309,139	100.00

Note. Based on data from ProFuturo.

The school age population in 2021–2022 was more than 4,300,000. The majority of students received a public education (approximately 77%), followed by private (16%), fiscomisional (6%), and municipal (less than 1%).

During the study period, approximately 70% of the educational institutions in the country were public or state schools, followed by 20% which were private schools. Fiscomisional schools (equivalent to state-subsidized) represented 4% of all institutions, and only 0.7% of schools were municipally-funded. See Table 5.

Table 5

Distribution of Educational Institutions in Ecuador by Type of Financing 2019–2022

Type of funding	Educational institutions					
	2019–2020		2020–2021		2021–2022	
	n	%	*n*	%	*n*	%
Public	12,385	75.41	12,383	76.40	12,367	76.84
Fiscomisional	669	4.07	652	4.02	645	4.01
Municipal	113	0.69	109	0.67	108	0.67
Private	3,256	19.83	3,065	18.91	2,975	18.48
Total	16,423	100.00	16,209	100.00	16,095	100.00

Note. Based on data from ProFuturo.

Reflecting this distribution, the majority of teachers during the study period received public funding (more than 70%), followed by private funding (more than 20%), with the remaining number divided between fiscomisional (6%) and municipal (less than 1%). See Table 6.

Table 6

Distribution of Teachers in Ecuador by Institution Type 2019–2022

Type of funding	Teachers					
	2019–2020		2020–2021		2021–2022	
	n	%	*n*	%	*n*	%
Public	152,149	69.16	148,156	71.62	144,625	71.04
Fiscomisional	14,009	6.37	13,365	6.46	13,074	6.42
Municipal	1,812	0.82	1,803	0.87	1,816	0.89
Private	52,025	23.65	43,551	21.05	44,080	21.65
Total	219,995	100.00	206,875	100.00	203,595	100.00

Note. Based on data from ProFuturo.

Learning Communities

Participants and Procedure

From the digital survey for teachers trained using the open model in Ecuador between 2020 and 2022, we obtained 3,565 responses, which constitutes 4.42% of teachers who completed at least one course. In terms of statistical representation, this resulted in a sampling error of ± 1.6%, a confidence level of 95%, and a worst-case scenario for sampling variability of: $p = q = 0.5$ (Hai-Jew, 2020).

The sample was analyzed according to several characteristics: number of training hours completed, gender, age, educational stage, and school funding. See tables 7, 8, and 9.

Gender

As regards ProFuturo's Self-Assessment of Digital Skills of Teachers, we analyzed the results of 7,257 teachers who used the self-assessment tool, of which 3,162 had completed at least one ProFuturo course before completing the test.

Results

First, we present the results obtained from the digital survey of teachers who were trained as part of the open model in Ecuador between 2020 and 2022. Disaggregated data are presented in tables 7, 8, and 9, which demonstrate the respondents' views on (a) the usefulness of technological resources in improving learning for their students, (b) how often they made changes to educational activities after participating in the courses, and (c) the frequency and type of transference of their new skills to their educational practices.

Table 7

Level of Utility Perceived by Teachers in Improving Student Learning by Hours of Training, Gender, Age, Educational Stage, and School Funding

Demographic characteristic		Usefulness of technology for improving student learning			
		Very useful %	Quite useful %	Not very useful %	Not at all useful %
Hours of training completed	< 50	73.03	25.84	1.12	0.00
	50–100	67.71	31.25	1.04	0.00
	100–150	72.33	27.04	0.63	0.00
	150–250	70.43	28.40	0.78	0.39
	> 250	71.53	27.01	0.73	0.73
Gender	Male	74.10	25.00	0.20	0.70
	Female	69.30	29.40	1.20	0.10
Age	< 30	78.26	19.54	2.20	0.00
	30–39	72.85	26.32	0.60	0.23
	40–49	69.77	28.97	0.50	0.76
	> 50	69.70	29.00	1.30	0.00
Educational stage	Early education	74.65	23.90	1.40	0.05
	EGB (Grade 1–6)	72.30	26.40	1.30	0.00
	EGB (Grade 7–10)	71.04	28.20	0.40	0.36
	High school	69.79	29.40	0.40	0.41
	Higher education	69.62	26.60	2.50	1.28
Funding	Public	69.70	29.10	0.80	0.40
	Fiscomisional	74.80	24.30	0.90	0.00

	Private	84.40	13.33	2.20	0.07
	Municipal	80.00	20.00	0.00	0.00
Average		71.00	27.80	0.80	0.30

Upon analyzing the teachers' perceived utility of both technology and digital resources in the classroom for improving student learning, no significant differences were observed between hours of training, gender, age, and educational stage. However, there was a favourable difference between private schools, with 84.4% of teachers awarding the highest value compared to teachers from public schools, who did this to a lesser extent, with 69.7%.

In the overall assessment, we found that "very useful" and "quite useful" were the two most frequent responses, adding up to 98.8% of the assessments, and 71% of teachers considered the use of technology and resources to be "very useful," representing a significant proportion of the teachers surveyed.

Table 8

Frequency of Modification of Educational Activities After Participating in the Courses by Number of Training Hours, Gender*, Age, Educational Stage, and School Funding*

Demographic characteristic		Frequency of modification in educational activities			
		Very often %	Somewhat often %	Not very often %	Never %
Hours of training completed	< 50	20.5	53.0	23.8	2.74
	50–100	30.8	47.2	21.5	0.48
	100–150	22.0	57.3	20.1	0.56
	150–250	17.9	56.3	24.0	1.87
	> 250	28.9	53.1	17.2	0.77
Gender	Male	28.6	50.50	19.1	1.75
	Female	22.4	55.10	21.6	0.85
Age	< 30	21.7	47.80	26.1	4.37
	30–39	23.2	54.60	21.1	1.08
	40–49	27.0	50.40	21.1	1.46
	< 50	23.9	55.90	19.5	0.75
Educational stage	Early education	27.4	45.2	24.7	2.74
	EGB (Grade 1–6)	24.3	53.5	21.5	0.62
	EGB (Grade 7–10)	21.3	57.7	20.6	0.37
	High school	26.9	52.6	19.6	0.84
	Higher education	21.0	50.6	21.0	7.41
Funding	Public	23.80	53.50	21.50	1.20
	Fiscomisional	33.90	50.80	15.30	0.00
	Private	24.40	60.00	13.30	2.30

	Municipal	18.20	48.50	27.30	6.00
Average		24.70	53.40	20.70	1.20

With regards to transference resulting from the training, upon analyzing the frequency of modification of educational activities after completing the courses, we saw statistically significant differences in some categories.

First, we noted the relationship between the number of training hours completed and the frequency with which teachers attested to having changed their pedagogical activities. On the one hand, those who completed between 50 and 100 hours of training and those who completed over 250 hours most often reported modifying their means of working with their class (30.8% and 28.9% respectively). On the other hand, only 17.9% of teachers who completed between 150 and 250 hours of training stated that they often changed their educational activities.

Second, when we analyzed the results by gender, 28.6% of male teachers "very often" changed their means of working after training, compared to 22.4% of female teachers, the majority of which (55.1%) stated having done this "somewhat often."

There were no significant differences by age or educational stage.

In the overall assessment, the most frequent responses were "very often" and "somewhat often," which represented a combined total of 78.1% of all teachers.

Table 9 shows the level of transference to educational practices. The most often used practice, according to 86.2% of teachers, was "collaborative methodology and group learning." "Research activities" came in second place. In general, the degree of transference by activity type was high, except for activities where students create and produce digital resources, which had a transference level of only 61.3%.

Table 9

Level of Transference to Educational Practise as Reported by Participants

Level of transference to educational practise	Frequency %
Research activities	83.50
Collaborative methodology or group learning	86.20
Project-based learning methodology	80.50
Activities using existing digital resources and online content	81.60
Activities using self-made digital resources	78.80
Activities where students create and produce digital resources	61.30

In Table 10, we present our analysis of the teacher self-assessment tool in 2020, 2021, and 2022.

We analyzed the impact of the ProFuturo training on the level of teacher competence, through a non-experimental comparison of the results obtained from teachers without ProFuturo training and those who had received more than 150 hours of training before using the tool.

Table 10

Teacher Self-Reported Competence With and Without Training Disaggregated by Sex, Age, Education Level, and Discipline

Demographic characteristic	Score		
	> 150 hours of training	Without training	Improvement %
Gender			
Male	37.03	34.60	7.03
Female	35.11	33.18	5.80
Age			
< 30	36.34	36.22	0.35
30–40	38.51	35.73	7.78
40–50	35.67	33.24	7.32
> 50	33.01	29.94	10.26
Education level			
Postgraduate university studies	37.43	35.84	4.44
University graduate (undergraduate degree)	35.55	33.44	6.30
Technical training graduate	32.16	32.72	-1.71
Compulsory education and high school graduate	35.11	31.46	11.58
Discipline			
Arts	35.83	33.65	6.47
Sciences	36.05	33.57	7.37
Citizenship	36.65	33.85	8.25
Physical education	35.20	34.09	3.25
Tutor	32.46	31.13	4.27
Languages	35.36	33.44	5.75
Mathematics	39.89	35.57	12.13
Technology/IT	37.62	35.91	4.77

Male teachers demonstrated greater improvement than female teachers after training. When comparing males who were untrained with those who had 150 or more training hours, there was an improvement of 7.03%.

In terms of age, individuals over the age of 50 appeared to benefit most from the training, exhibiting a score increase of 10.26%. Notably, the group under 30 saw practically no improvement (0.35%).

When analyzing improvement in terms of the level of previous education attained by teachers, the compulsory education and high school graduate group showed the greatest level of improvement

(11.58%). The technical training graduate group were also noteworthy here, showing, not surprisingly, no improvement (-1.71%).

In terms of discipline, the greatest improvements were for those teaching mathematics (12.13%), citizenship (8.25%), and sciences (7.37%).

Conclusions and Implications

In analyzing the utility perceived by teachers regarding the use of technology and digital resources in the classroom for improving student learning, we found that up to 98.8% of the assessments indicated the usefulness of the model implemented by ProFuturo in Ecuador, which uses technology as a tool for improving quality in education. From this, we can infer that teachers are aware of the utility of digital transformation in the classroom as a means of improving the learning experience. This demonstrates the necessity for training in order to facilitate digital transition through the competence required. On the other hand, it is important to remember that perceived utility and satisfaction are key factors in explaining users' intentions to remain in technology-mediated studies (Tiyar & Khoshsima, 2015; Yu, 2022; Zhou, 2017).

With regards to the transference promoted by the training, we found that teachers with more training hours made the most changes, and when asked specifically about the level of transference for specific educational practices, the degree of transference was generally high, with values above 78.8%, except for activities in which students create and produce digital resources, which had a transference level of 61.3%. These levels of transference to the classroom attest to teachers' conviction in the utility of these practices, both for improving the digital abilities of students and for improving curriculum skills. In this respect, there are numerous studies regarding the need to invest in training at the same time as making the technological investments required to address educational digitization plans. These studies invite us to learn from the challenges and uncertainties raised by emergency contexts, such as the COVID-19 pandemic and similar scenarios (García Aretio, 2021).

With regards to the level of improvement in competence associated with the training received, the results of the self-assessment tool show significant differences in the level of digital competence in teachers who completed over 150 hours of training compared to those who did not participate in the training process, demonstrating the benefits of the program and the pivotal role of teacher training for change and innovation in digital transformation contexts which, in this case, resulted from an emergency context, and for strengthening national policies and systems for teacher training.

A key approach for digital transformation is having experienced partners to structure plans and providing them with the necessary infrastructure to train students. However, teachers must also be trained to successfully handle the virtualization stage of lessons, and this should be presented not only as an emergency solution, but also as a means of improving skills in the short and medium term, given that such globalizing transformations will involve changes which apply also to the macro or institutional level, resulting in national and transnational reform of policies (Van Dijck et al., 2018).

In the case analyzed, ProFuturo's intervention in Ecuador brought the necessary experience and infrastructure to address a serious issue in the country, which was faced with the weakness of existing structures for providing training through digital channels on a massive scale in an emergency context,

in much the same way as most other places in the world in this period. The teacher training proposal incorporated digital training, without disregarding innovation or methodology. Our results suggest that in addition to mitigating the risks inherent in the pandemic, this strategy served to improve competence and transference to the classroom.

Given that the strength of technologies, content, and training systems in a country cannot be rapidly improved, a good means of addressing unanticipated need is through collaboration with specialized organizations, not only as a means of responding to the emergent situation, but also to begin the process of institutional learning through collaboration, with the goal of strengthening and training the system, and thereby leaving the country with necessary capacity and autonomy to manage themselves. In an ideal world, governments and educational institutions would learn from this experience and employ pre-crisis planning which leads to the transformation of the educational process (Burns, 2020).

These processes entail profound structural changes for countries and regions. Such changes are not simple to articulate, since they require the design of complex strategies involving many actors within a system, including ministries of education, public and private institutions, parents, school directors, teachers, and students. In this sense, it is important to remember that unless those responsible for developing educational policies take advantage of the potential benefits of research, development, and innovation, and make the necessary efforts to correctly deploy these projects, the global education gap will continue to grow.

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