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ICT Appropriation by Mexican Students Whose Parents are Professionals

Apropiación de las TIC por estudiantes mexicanos cuyos padres son profesionales

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Abstract

This study examines the influence of parents' occupations on their children's ICT proficiency in Mexico, highlighting its importance for academic success and social integration in a digitalized educational environment. Using data from PISA 2018, the study analyzes the responses of 1,043 students who have at least one professional parent. By focusing on professional parents who are heavy ICT users, the study aims to identify the social and cultural factors that influence the transfer to children. The research employs partial least squares structural equation modeling (PLS-SEM) to validate a second-order construct that integrates ICT use frequency and ICT usage, skills and autonomy in ICT use, and ICT as a topic in social interaction. This methodological approach allows for a nuanced analysis of the relationships between these constructs and their impact on children's ICT proficiency. The study also explores variations based on different combinations of one professional parent and other occupations for the second parent, highlighting a gender effect on domestic support of children, moderated by the gender division of ICT use within occupational settings and evolving patterns of parenting. This occupational approach to acquisition processes, rarely addressed by research, offers some original insights for reflection and action.

Keywords: parent education, ICT, technology transfer, educational management

Resumen

Este estudio examina la incidencia de la ocupación de los padres sobre el dominio de las TIC por sus hijos en México y destaca su importancia para el éxito académico y la integración social en un entorno educativo digitalizado. Se utilizan datos de PISA de 2018 para analizar las respuestas de 1,043 estudiantes que cuentan con al menos un padre profesional. Al centrarse en padres profesionales que son usuarios intensivos de las TIC, el estudio busca identificar los factores sociales y culturales que influyen en el proceso de transferencia a los hijos. La investigación emplea el modelado de ecuaciones estructurales de mínimos cuadrados parciales (PLS-SEM) para validar un constructo de segundo orden que integra la frecuencia y el uso de las TIC, las habilidades y la autonomía en el uso de las

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TIC y las TIC como tema en la interacción social. Este enfoque metodológico permite un análisis matizado de las relaciones entre estos constructos y su impacto sobre el dominio de las TIC por parte de los hijos. Además, se analizan variaciones basadas en diferentes combinaciones en las que uno de los padres es profesional y el otro ejerce otro tipo de ocupación, lo cual pone de relieve un efecto de género en el apoyo doméstico de los hijos, moderado por la división por género del uso de las TIC en entornos laborales y la evolución de los patrones de crianza. Este enfoque basado en las ocupaciones y aplicado a los procesos de adquisición, pocas veces abordado por la investigación, ofrece unos aspectos originales para la reflexión y la acción.

Palabras clave: educación de los padres, TIC, transferencia de tecnología, gestión educativa

I. Introduction

ICT proficiency has become a critical factor for the academic success and social integration of new generations of students in an increasingly digitalized school environment. In this context, the appropriation and effective use of ICT are not only indicators of digital literacy but also factors affecting school performance, reflecting persistent socioeconomic inequalities in society (Hübner et al., 2023; Keen & France, 2024; Ragnedda, 2017).

Unlike parental education, which has been explored by Ren et al. (2022) and Loh et al. (2023), the socio-professional status of parents has rarely been analyzed in isolation, as in the studies examined by Scherer and Siddiq (2019), and even less so as a categorical variable influencing the processes of ICT transmission to children. Beyond the additive or subtractive logic in the multidimensional structuring of the socioeconomic indicator, socio-professional status seems more deeply rooted in social theory through a Weberian tradition of social classes, renewed by scholars such as Antonoplis (2022).

This study aims to analytically link transmission processes to the gender division in labor-related ICT use and domestic support of children's ICT use (Caparrós, 2021; Gómez et al., 2014; Qazi et al., 2022; Yuen et al., 2018). Gender perspectives in this regard are also mediated by the evolution of parenting patterns, which reflect a redefinition of the contributions of both parents (Hark, 2023). Together, these epistemological interests direct research towards social and professional groups that use ICTs intensively and effectively, such as professional parents.

This investigation examines how the professional occupation of one or both parents moderates causal relationships in a second-order research model of ICT appropriation by children, structured around frequency of ICT use, autonomy in ICT use, ICT self-efficacy, ICT skills, and ICT usage. Since the ICT Engagement Questionnaire of the Programme for International Student Assessment (PISA) was not administered in Mexico in 2022, the research utilizes PISA 2018 data to explore the transmission of ICT appropriation by parents. The findings aim to contribute to ICT literacy and social reproduction theory and have practical implications for designing educational and social policies promoting equitable and effective digital inclusion.

1.1 Theoretical Framework and Hypotheses

ICT Use Frequency, ICT Usage, and Skills

Frequency and type of ICT use are fundamental constructs to understand user interaction with technological artifacts and services (Scheerder et al., 2017). For students, interactions occur in both school and home environments, which differ significantly in terms of usage patterns, appropriation strategies, and influences on teaching and learning processes (Hori & Fujii, 2021; Kunina-Habenicht & Goldhammer, 2020). Social and contextual factors, along with normative considerations distinguishing recreational from educational use, are crucial. Weber and Becker (2019) and Toudert (2025) argue that frequency of ICT use is often associated with increased recreational use outside of school, particularly among students from families with lower social and cultural capital (Chiao & Chiu, 2018; Hori & Fujii, 2021; Micheli, 2015). However, Kunina-Habenicht and Goldhammer (2020) emphasize that attachment to ICTs underpins both frequency and type of use, while Weber and Becker (2019) note a transversality of recreational use across all social strata, with notable advantages for the more affluent (Ren et al., 2022).

Ragnedda (2017) correlates the prevalence of ICT use with ICT competency development in environments that cultivate digital disparities due to variations in use. Investigations

conducted by Ren et al. (2022) demonstrate the influence of cultural assets, practices, and proactive mediation on digital competencies, innovative capabilities, and educational applications, which will be scrutinized in the following section. While Ojo et al. (2019) and Toudert (2024), in conjunction with Zhang et al. (2023), substantiated the effect of utilization skills on ICT engagement, only the last of these authors delineated a reverse correlation within an indirect effect framework, warranting further inquiry.

The frequency of ICT engagement affects autonomy in ICT use, mirroring a student's self-assessment of control over ICT application, which has been associated with an improved outcome (Hori & Fujii, 2021; Gruchel et al., 2024). Student attainment of autonomy, also discussed under the ICT self-efficacy paradigm (Ma & Qin, 2021; Loh et al., 2023), manifests as a form of ICT appropriation associated with unequal educational performance. Loh et al. (2023) stated that students from high socioeconomic strata have access to superior resources and exhibit informed and socialized use in high-efficiency environments. This is evident in contexts characterized by consistent parental endorsement and effects stemming from the interplay between ICT literacy and self-efficacy (Ma & Qin, 2021).

Based on the above theoretical discussion, the following hypotheses are proposed:

H1: Frequency of ICT use has a positive impact on ICT skills.

H2: Frequency of ICT use has a positive impact on autonomy in ICT use.

H3: Frequency of ICT use has a positive impact on ICT usage.

H4: ICT usage has a positive impact on ICT skills.

Social Interaction, Autonomy in ICT Use, and ICT Skills

In considering how to stimulate ICT skills in students, Kunina-Habenicht and Goldhammer (2020) observed a high correlation between ICT competence and perceived ICT autonomy, influenced by gender and country background factors. They also found a positive relationship between perceived ICT autonomy and mathematics achievement, highlighting the influential role of self-efficacy in students' self-evaluation of their ICT skills (Zelalem et al., 2022). Kunina-Habenicht and Goldhammer (2020) noted that perceived ICT autonomy was included in the PISA 2015 questionnaire to measure students' perceived control and potential to direct interaction with ICT devices and services.

The phenomenon of adoption and use of ICT, defined as a subject of social interaction, segments ICT users by establishing social interconnections among individuals who share analogous interests in technological topics (Kunina-Habenicht & Goldhammer, 2020; Ma & Qin, 2021). Research conducted by Kunina-Habenicht and Goldhammer (2020) elucidated that ICT, in the context of social interaction, serves as a predictor variable for various forms of utilization and exhibits a negative correlation with reading proficiency. Furthermore, their study substantiated the moderating effects of gender and nationality concerning ICT as a subject of social interaction, revealing a robust association with entertainment-related activities pertinent to ICT learning beyond the academic environment. In a similar vein, Ma and Qin (2021) cited studies that establish a relationship between social interaction and a decline in academic achievement. In contrast to autonomy in ICT use, which is frequently linked to enhanced academic productivity (Kunina-Habenicht & Goldhammer, 2020; Gruchel et al., 2024), ICT as a subject of social interaction appears to facilitate ICT learning via entertainment activities undertaken in collaboration with peers and family members (Toudert, 2025).

Based on the reviewed literature, the following hypotheses will be tested:

H5: ICT as a topic of social interaction positively impacts autonomy in ICT use.

H6: Autonomy in ICT use positively impacts ICT skills.

Parental Occupation as a Moderating Factor

Social status, as conceptualized by Weber, sought to detach the political dimension from the Marxist perspective, aligning instead with an understanding of capital that is transferrable through its economic, social, and cultural dimensions (Keen & France, 2024). This multidimensional approach gained relative acceptance through the works of Antonoplis (2022) and Wright (2005), amid a broader lack of consensus on a definitive theory of social classes. Within this framework, a seven-category classification of socio-professional occupations, mentioned by Nico (2021), emerged as a robust and pragmatic alternative. However, critical empiricism, particularly studies utilizing PISA data, identified the index of economic, social, and cultural status (ESCS) and its derivatives, such as students' socio-economic status (SES), as more potent indicators (Avvisati, 2020; Hübner et al., 2023; Li & Zhu, 2023; Ren et al., 2022; Scherer & Siddiq, 2019).

Considering the complex and multifaceted characteristics of the socioeconomic status (SES) indicator, the aspects of parental income, educational attainment, and occupational standing have garnered heightened scrutiny within academic research. Comprehensive meta-analyses, such as that conducted by Scherer and Siddiq (2019), substantiate the importance of these relationships, wherein measures of SES capital—most notably income—exhibit the strongest correlation, followed by professional occupational status. This trend is apparent in research focusing on discrete components within the student milieu. For instance, Loh et al. (2023) discerned a noteworthy relationship between students' access to ICT resources and their academic performance in both mathematics and reading, whereas Ren et al. (2022) demonstrated a beneficial correlation between familial cultural capital and digital competencies. Nevertheless, the influence of parental professional occupation on students' appropriation of ICT remains inadequately examined (Scherer & Siddiq, 2019).

Research focused on the general population, including studies by Yates and Lockley (2018), reveals that individuals occupying higher socio-professional categories demonstrate higher levels of ICT use for both occupational purposes and non-digital cultural consumption, a phenomenon also recognized by Ragnedda (2017). Comparable disparities are observed within families with high social and cultural capital, which subsequently affects children's academic achievements and their appropriation of ICT (Keen & France, 2024; Yuen et al., 2018). This inequality extends to professional ICT engagement, with blue-collar workers less likely to employ ICT tools and services within their occupational environments (Caparrós, 2021).

The socio-professional standing of parents, whether of the father, mother, or both, exerts a substantial influence on these dynamics, a matter that merits further scholarly investigation. This interplay establishes a link between the dissemination of ICT competencies and the gendered distribution of domestic support afforded to children, which is influenced, among other factors, by the gendered division of labor associated with the use of ICT artifacts and services (Gómez et al., 2014; Caparrós, 2021).

II. Data and Research Methodology

2.1 Sampling and Data Collection

The data for this study were obtained from the Programme for International Student Assessment (PISA) of the Organisation for Economic Co-operation and Development (OECD), specifically the 2018 PISA ICT Engagement Questionnaire, the most recent version of this questionnaire administered in Mexico (OECD, 2019).

In 2018, PISA interviewed a total of 7,299 Mexican students from 286 schools, representing a target population of 1,689,087 students (OECD, 2020). From those interviewed, 1,043 students were selected who reported that their parents were employed as professionals according to the 2008 version of the International Standard Classification of Occupations. This includes science and engineering professionals; health professionals; teaching professionals; business and administration professionals; information and communications technology professionals; and legal, social, and cultural professionals (ILO, 2023). As a socio-professional category, professionals are generally identified as more intensive and effective users of ICT than other occupations (Toudert, 2025).

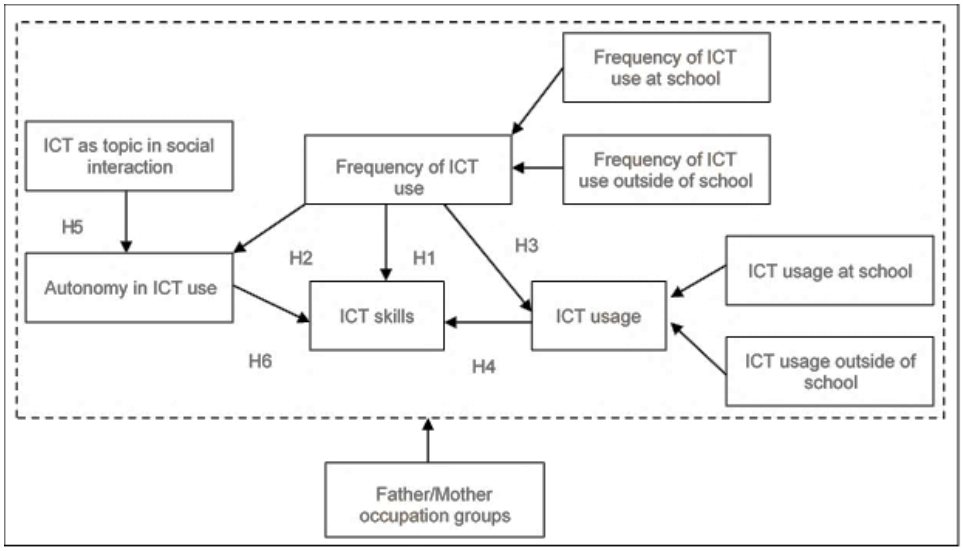
2.2 Measurement Variables and Scales

The research model used in this study, illustrated in Figure 1, comprises two second-order constructs: frequency of ICT use and ICT usage. These are linked to three first-order constructs: ICT as a topic in social interaction, autonomy in ICT use, and use skills. The second-order constructs are reflective-formative, and the hierarchical model of latent variables was validated using a two-stage approach with repeated indicators in the first stage (Becker et al., 2012). Initially, 13 formative items were used to form the second-order constructs and 13 reflective items detailed in tables 2 and 3. The research model was assessed and analyzed with SEM-PLS (partial least squares structural equation modeling), following the guidelines by Hair et al. (2022). For the model assessment with combinations of professional parents, only pairs with 39 or more cases were selected to ensure sufficient statistical power to detect moderating effects (Hair et al., 2022). The estimate of necessary cases for the model in Figure 1 requires a minimum of 38 cases for 80% statistical power, a 5% significance level, and a minimum R2 of 0.5. Under these conditions, only ten combinations of professional fathers and/or mothers had the necessary number of cases (see Table 1). The significance of differences in the six hypotheses for each of the ten occupation combinations was determined using the multigroup analysis method (MGA-PLS) with a bootstrap resampling of 5,000 (Matthews, 2017).

Items included in the study were selected following an exploratory procedure, initially including a large dataset that was gradually reduced to the variables in Table 2, mainly due to non-compliance with model validation guidelines as specified in the results section. The items of the different constructs were designed following an ordinal approach and integrating the OECD (2019) dataset fields, as used in previous studies associating PISA data and SEM modeling (Chen et al., 2024; Chiu, 2020; Hori & Fujii, 2021; Kunina-Habenicht & Goldhammer, 2020; Li & Zhu, 2023). For formative constructs, the original five incremental categories (from 1 to 5) were used for the frequency of use at school with fields IC011Q05TA and IC011Q10HA, and for frequency of use outside school with IC008Q01TA, IC008Q03TA, IC008Q09TA, and IC010Q01TA. This logic was also applied to ICT usage outside school with the average of IC008Q03TA, IC008Q04TA, IC008Q08TA, IC008Q09TA, and IC008Q10TA, and for ICT usage at school with IC011Q03TA, IC011Q06TA, and IC011Q07TA (Chiu, 2020; Kunina-Habenicht & Goldhammer, 2020; Li & Zhu, 2023).

For reflective constructs, ICT skills were characterized by the original five categories of IC010Q07TA, the average of IC010Q01TA and IC011Q05TA, IC010Q03TA, and IC010Q11HA (Chen et al., 2024; Kunina-Habenicht & Goldhammer, 2020; Li & Zhu, 2023). Autonomy in ICT use included four categories: IC015Q02NA, IC015Q03NA, IC015Q05NA, IC015Q07NA, and IC015Q09NA (Kunina-Habenicht & Goldhammer, 2020; Li & Zhu, 2023). ICT as a topic in social interaction included IC016Q01NA, IC016Q05NA, IC016Q07NA, and IC016Q02NA (Kunina-Habenicht & Goldhammer, 2020).

Figure 1. Proposed Conceptual Model and Hypotheses



III. Results

A quarter of the 1,043 cases analyzed come from families with both parents employed as professionals, while 16% have professional fathers and housewife mothers. Other occupation combinations involved professional fathers with mothers who are technicians and associate professionals, in 8% of cases, and mothers who are services and sales workers, in 7%. The remaining occupation combinations each represent less than 7% of total cases, as shown in Table 1.

Table 1. Summary Statistics of Sample

Gender	%	Father/mother occupation (Education level 5A*) (Cases)	%
Male	52.54	12- Managers/Professionals (89.74%/89.74%) (39 cases)	3.74
Female	47.46	22- Professionals/Professionals (90.38%/91.15%) (260 cases)	24.93
Age (years)		23- Professionals/Technicians and assoc. professionals (77.38%/45.24%) (84 cases)	8.05
16	100	24- Professionals/Clerical support workers (82.98%/42.55%) (47 cases)	4.51
Residence		25- Professionals/Services and sales workers (73.33%/21.33%) (75 cases)	7.19
Village, hamlet or rural area	1.73	32- Technicians and assoc. professionals/Professionals (58.57%/88.57%) (70 cases)	6.71
Small town	7.9	52- Services and sales workers/Professionals (35.21%/80.28%) (71 cases)	6.81
Town	17.15	72- Craft and related trades workers/Professionals (14%/74%) (50 cases)	4.79
City	37.28	82- Plant and machine operators and assemblers/Professionals (9.76%/75.61%) (41 cases)	3.93
Large city	35.93	211- Professionals/Housewives (72.78%/23.67%) (169 cases)	16.2
Semester of enrollment		Others	13.14

2nd semester	0.96	Students from socioeconomically disadvantaged homes	
3rd semester	9.3	Village, hamlet or rural area	73.94
4th semester	89.26	Small town	57.05
5th semester	0.48	Town	36.03
Categories of schools		City	25.78
Public	70.04	Large city	25.44
Private	29.96	Total desired target population	1,689,087

Note: * Education level 5A (Unesco, 2012).

The assessment of the second-stage model fit for both the total cases and the ten occupation combinations analyzed reveals d_G and d_{ULS} discrepancies below the current model at the 95% level and a standardized root mean square residual (SRMR) value less than the accepted limit of 0.08, indicating an adequate fit (Becker et al., 2023; Hair et al., 2022).

Measurement model evaluation during the first stage, for the total cases and the different occupation combinations, shown in Table 2, demonstrates internal consistency of the reflective constructs validated via composite reliability rho (A) with satisfactory values above 0.7 (Becker et al., 2023; Hair et al., 2022). For the same constructs, convergent validity was established by average variance extracted (AVE) with values close to or above 0.5 (Hair et al., 2022). For formative constructs, the weights and signs were appropriate for the general model, with significant items and variance inflation factor (VIF) values ruling out multicollinearity issues (Henseler et al., 2015).

The measurement model assessment during the second stage shows, in Table 3, a satisfactory composite reliability rho (A) and average variance extracted (AVE) values for the reflective constructs, with significant loading values (Hair et al., 2022; Becker et al., 2023). For the formative constructs, the weights of the total model and combinations are largely significant, with appropriate signs and no VIFs indicating multicollinearity risks (Henseler et al., 2015).

The coefficient of determination (R^2), indicating the proportion of variance in a dependent variable explained by the independent variables, shows relevant predictive power through the endogenous variables. Continuing the structural analysis, Table 4 shows the strength of the relationships for the six hypotheses in the research model and their variability based on the professional occupation combinations of both parents. For the total model, all hypotheses were significant except for hypothesis H4, which was rejected. At the combination level, hypothesis H3 was supported in all cases, while H6 was not supported in any combination. Hypothesis H5 failed only in combinations 25 and 32, while H2 was supported only for 24 and 25. Hypothesis H4 was significant in just one combination (52), hypothesis H1 in four (22, 23, 25, and 211), and hypothesis H2 in combinations 24 and 25.

Table 2. First-Stage Indicator Validation for Overall Model and Groups

Formative latent variables	Total		12		22		23		24		25		32		52		72		82		211	
	α	VIF	α	VIF	α	VIF	α	VIF	α	VIF	α	VIF	α	VIF	α	VIF	α	VIF	α	VIF	α	VIF
Frequency of ICT																						
use at school																						
Posting work on the school's website	0.26	1.575	0.272	2.202	0.253	1.659	0.314	1.827	0.269	1.493	0.245	2.076	0.373	1.373	0.215	1.763	0.408	1.373	0.335	2.042	0.268	1.481
Using learning apps or websites	0.366	1.548	0.230	1.918	0.343	1.519	0.501	1.829	0.163	1.400	0.369	2.024	0.032	1.405	0.453	1.907	0.149	1.553	0.182	2.702	0.496	1.361
use outside of school																						
Playing one-player games	0.076	1.142	0.309	1.137	0.062	1.119	0.193	1.221	0.089	1.173	0.24	1.137	0.149	1.161	0.079	1.269	0.133	1.380	-0.056	1.108	0.054	1.193
Using email	0.164	1.278	-0.221	2.137	0.200	1.465	0.07	1.235	0.325	1.433	0.024	1.267	0.174	1.222	0.057	1.315	0.286	1.169	0.306	1.466	0.198	1.224
Reading news on the Internet	0.412	1.16	0.333	1.922	0.381	1.196	0.309	1.15	0.372	1.303	0.243	1.159	0.661	1.084	0.500	1.548	0.316	1.424	0.389	1.724	0.282	1.136
Browsing the Internet for schoolwork	0.33	1.136	0.518	1.479	0.325	1.178	0.189	1.129	0.441	1.271	0.467	1.270	0.308	1.058	0.233	1.219	0.405	1.567	0.361	1.23	0.313	1.162
ICT usage																						
usage outside of school																						
Using email/chat online	0.204	1.308	0.011	2.106	0.235	1.458	0.143	1.799	0.26	2.425	0.023	1.255	0.273	1.194	0.068	1.862	0.326	1.314	0.416	1.54	0.253	1.232
Browsing the Internet for fun	0.086	1.423	-0.161	2.331	0.085	1.439	-0.021	2.885	0.094	1.45	0.321	1.268	0.063	1.362	-0.021	2.128	0.058	1.435	0.096	1.337	0.083	1.472
Reading news on the Internet	0.37	1.73	0.719	2.811	0.265	1.826	0.108	1.68	0.432	1.765	0.235	1.866	0.657	1.816	0.461	2.328	0.375	1.624	0.357	2.186	0.247	2.106
Obtaining practical information from the Internet	0.143	1.866	0.022	2.173	0.185	1.946	0.413	3.14	0.261	2.281	0.123	2.048	0.116	2.012	0.171	2.018	0.237	1.314	-0.009	2.819	0.098	2.154
usage at school																						
Browsing the Internet for schoolwork	0.34	2.345	0.031	4.391	0.337	2.219	0.657	2.548	0.256	3.705	0.417	3.546	0.042	3.347	0.219	2.751	0.228	1.904	0.187	2.893	0.392	2.273
Playing simulations at school	0.265	1.654	0.646	2.139	0.160	1.540	0.195	1.395	0.269	1.652	0.400	1.917	0.370	1.664	0.249	2.048	0.219	2.631	0.465	1.735	0.395	1.741
Practicing and drilling, foreign	0.149	2.394	0.042	3.888	0.252	2.394	0.057	2.757	-0.06	2.385	0.079	3.695	0.043	2.551	0.322	2.747	0.070	3.188	0.055	2.377	0.108	2.34

language learning or math																					
Reflective latent variables	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR
ICT skills	0.659	0.853	0.67	0.86	0.674	0.856	0.647	0.861	0.665	0.881	0.72	0.875	0.492	0.751	0.676	0.851	0.655	0.862	0.653	0.846	0.674	0.854
Autonomy in ICT use	0.64	0.876	0.712	0.905	0.562	0.831	0.58	0.847	0.519	0.85	0.664	0.897	0.607	0.9	0.734	**0.898**	0.702	0.914	0.542	0.814	0.703	0.861
ICT as a topic in social interaction	0.697	0.856	0.714	0.936	0.667	0.839	0.694	0.883	0.651	0.837	0.707	0.931	0.704	0.972	0.704	0.863	0.624	0.817	0.661	0.851	0.722	0.947

Note: Bold: significant at $p < .05$. α: weights. VIF: Variance inflation factor. AVE: Average variance extracted. CR: Composite reliability rho(A). Groups defined in Table 1.

Table 3. Second-Stage Indicator Validation for Overall Model and Groups

Reflective latent variables	Total		12		22		23		24		25		32		52		72		82		211	
	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR
ICT skills	0.659	0.857	0.667	0.893	0.674	0.858	0.646	0.871	0.665	0.883	0.719	0.881	0.492	0.76	0.675	0.855	0.655	0.861	0.653	0.854	0.673	0.856
	α		α		α		α		α		α		α		α		α		α		α	
Operational skills	0.808		0.859		0.823		0.803		0.846		0.89		0.645		0.799		0.752		0.847		0.799	
Strategic skills	0.773		0.748		0.784		0.760		0.789		0.794		0.689		0.843		0.865		0.783		0.788	
Social skills	0.830		0.878		0.832		0.853		0.751		0.894		0.83		0.752		0.800		0.835		0.851	
Informational skills	0.835		0.775		0.842		0.797		0.871		0.809		0.797		0.887		0.815		0.765		0.842	
	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR
Autonomy in ICT use	0.64	0.876	0.711	0.907	0.562	0.831	0.58	0.848	0.52	0.848	0.664	0.902	0.606	0.923	0.734	0.899	0.702	0.914	0.54	0.815	0.722	0.942
	α		α		α		α		α		α		α		α		α		α		α	
If I need new software, I install it by myself	0.819		0.83		0.765		0.805		0.738		0.746		0.777		0.911		0.789		0.731		0.898	
I read information about digital devices to be independent	0.821		0.736		0.737		0.840		0.713		0.882		0.681		0.902		0.790		0.796		0.882	
I use digital devices as I want to use them	0.803		0.899		0.744		0.774		0.765		0.828		0.856		0.853		0.867		0.717		0.792	
If I have a problem with digital devices, I start to solve it	0.808		0.925		0.811		0.732		0.642		0.838		0.830		0.809		0.898		0.778		0.848	
If I need a new application, I choose it by myself	0.747		0.814		0.685		0.643		0.739		0.772		0.736		0.804		0.840		0.648		0.825	
	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR	AVE	CR
ICT as a topic in social interaction	0.697	0.856	0.715	0.932	0.667	0.839	0.694	0.883	0.651	0.838	0.707	0.93	0.701	0.998	0.704	0.863	0.624	0.817	0.661	0.851	0.703	0.862
	α		α		α		α		α		α		α		α		α		α		α	
To learn something new about digital devices, I like to talk about them with my friends	0.818		0.764		0.79		0.799		0.723		0.792		0.661		0.851		0.743		0.787		0.837	
I like to share information about digital devices with my friends	0.845		0.865		0.844		0.824		0.862		0.918		0.815		0.834		0.769		0.849		0.789	
I learn a lot about digital media by talking with my friends and relatives	0.829		0.877		0.806		0.875		0.799		0.877		0.952		0.826		0.831		0.750		0.850	
I like to exchange solutions to problems with digital devices with others on the Internet	0.848		0.871		0.824		0.831		0.838		0.766		0.893		0.846		0.813		0.861		0.874	
Formative latent variables	α	VIF	α	VIF	α	VIF	α	VIF	α	VIF	α	VIF	α	VIF	α	VIF	α	VIF	α	VIF	α	VIF
Frequency of use at school	**0.598**	1.102	0.423	1.396	**0.567**	1.153	**0.752**	1.001	0.332	1.131	**0.579**	1.134	**0.565**	1.012	**0.608**	1.042	**0.524**	1.13	0.558	1.175	**0.748**	1.103
Frequency of ICT use outside school	**0.64**	1.102	**0.708**	1.396	**0.643**	1.153	**0.641**	1.001	**0.837**	1.131	**0.64**	1.134	**0.765**	1.012	**0.681**	1.042	**0.693**	1.13	0.642	1.175	**0.473**	1.103
ICT usage																						
ICT usage at school	**0.698**	1.04	**0.643**	1.105	**0.681**	1.063	**0.834**	1.02	0.408	1.012	**0.74**	1.014	**0.611**	1.002	**0.73**	1.038	**0.527**	1.116	0.654	1.124	**0.822**	1.03
ICT usage outside of school	**0.592**	1.04	**0.593**	1.105	**0.584**	1.063	**0.534**	1.06	**0.869**	1.012	**0.591**	1.014	**0.767**	1.002	**0.558**	1.038	**0.697**	1.116	0.57	1.124	**0.447**	1.03

Note: Bold: significant at $p < .05$. α: weights. VIF: Variance inflation factor. AVE: Average variance extracted. CR: Composite reliability rho(A). Groups defined in Table 1

Table 4. Significance of Structural Model Relationships

Model relationships	Total	12	22	23	24	25	32	52	72	82	211
Second-order hypothesis	β	β	β	β	β	β	β	β	β	β	β
H1: Frequency of ICT use -> ICT skills	**0.671**	0.821	**0.653**	**0.957**	0.558	**0.682**	0.593	0.244	0.496	1.319	**0.665**
H2: Frequency of ICT use -> Autonomy in ICT use	**0.149**	0.31	0.087	0.1	**0.337**	**0.376**	0.299	0.195	0.129	-0.166	0.041
H3: Frequency of ICT use -> ICT usage	**0.875**	**0.904**	**0.867**	**0.869**	**0.852**	**0.912**	**0.794**	**0.873**	**0.874**	**0.89**	**0.897**
H4: ICT usage -> ICT skills	0.034	-0.124	0.081	-0.426	0.096	0.117	-0.092	**0.48**	0.213	-0.593	0.047
H5: ICT as a topic in social interaction -> Autonomy in ICT use	**0.429**	**0.428**	**0.448**	**0.504**	**0.478**	0.312	-0.184	**0.528**	**0.501**	**0.579**	**0.516**
H6: Autonomy of ICT use -> ICT skills	**0.071**	0.047	0.074	0.094	0.063	0.109	0.128	0.108	0.32	-0.068	0.004
Indirect effects	Total	12	22	23	24	25	32	52	72	82	211
ICT as a topic in social interaction -> Autonomy in ICT use	**0.031**	0.02	0.033	0.047	0.03	0.034	-0.024	0.057	0.16	-0.039	0.002
Frequency of ICT use-> ICT usage-> ICT skills	0.03	-0.112	0.07	-0.37	0.082	0.107	-0.073	0.419	0.186	-0.528	0.042
Frequency of ICT use-> Autonomy in ICT use -> ICT skills	**0.011**	0.014	0.006	0.009	0.021	0.041	0.038	0.021	0.041	0.011	0

Note: β: Path coefficient. Bold: significant at $p < .05$. Groups defined in Table 1.

The significance of the differences between the analyzed occupation combinations was estimated using the multigroup analysis method with 5,000 bootstrap resamples (Matthews, 2017). The findings show in Table 5 that except for occupation combinations 25 with 211, significant hypotheses are observed in pairs of fathers with other professional mothers. The results also indicate that hypotheses H3 and H6 were non-significant for all combinations analyzed. Hypothesis H1 was significant only for 23 and 52, and H2 for 24 and 82, 25 and 82, and 25 and 211. Hypothesis H5 was significant for combinations 22 and 32, 23 and 32, and 24 and 32. Hypothesis H4 was significant for combinations 23 with 52, largely favoring a couple with a professional mother (52).

Table 5. Multigroup Analysis. Test Results

Second-order hypothesis	22-32	23-32	23-52	24-32	24-82	25-82	25-211
H1: Frequency of ICT use -> ICT skills	0.06	0.363	0.713	-0.035	-0.761	-0.637	0.018
H2: Frequency of ICT use -> Autonomy in ICT use	-0.212	-0.199	-0.095	0.039	0.504	0.543	0.336
H3: Frequency of ICT use -> ICT usage	0.073	0.075	-0.004	0.057	-0.038	0.023	0.015
H4: ICT usage -> ICT skills	0.172	-0.334	-0.906	0.188	0.69	0.71	0.07
H5: ICT as a topic in social interaction -> Autonomy in ICT use	0.632	0.689	-0.024	0.662	-0.101	-0.267	-0.204
H6: Autonomy of ICT use -> ICT Skills	-0.054	-0.035	-0.014	0.065	0.131	0.176	0.104

Note: Bold: Two-tailed significance at $p < .05$. Groups defined in Table 1.

IV. Discussion and implications

Several studies have demonstrated an association between indicators of students' ICT appropriation and their families' socio-economic status (Granato & Schnepf, 2025; Keen & France, 2024; Ren et al., 2022; Scherer & Siddiq, 2019; Zhao & Chen, 2023). This relationship underscores the validity of incorporating parental educational level or using arithmetic syntheses, such as the ESCS, as noted in Avvisati (2020), Li and Zhu (2023), Loh et al. (2023), and Ren et al. (2022). However, research on the influence of parents' professional occupation, as discussed by Zhao and Chen (2023) and Scherer and Siddiq (2019), remains limited, even though the results could provide valuable insights for both reflection and action.

The results shown in Table 4 for the total model support the hypothesis that ICT usage depends on the frequency of ICT use, while ICT usage does not seem to impact the development of ICT skills. The impact of the frequency of ICT use on ICT usage is consistent with the findings of Hori and Fujii (2021), who associate this more with entertainment activities, as well as Hong et al. (2024), who link it to school efficiency from greater teacher use of ICT. Gruchel et al. (2024) associate ICT use for homework with intrinsic motivation stimulated by the quality of parental support.

However, contrary to Ojo et al. (2019), who concluded that digital skills were the most significant predictor of Internet use, and Zhang et al. (2023), who found an indirect effect, the present research did not find the link significant. The independence of this relationship is probably due to the disconnect between the use of sophisticated skills and the mediation of relative socioeconomic status in repetitive digital activities with low parental control (Ren et al., 2022). Indeed, the stimulation of ICT skills through frequency of use, which in turn slightly impacts autonomy of use, also subtly affects ICT skills, which points to basic digital competences acquired through digital uses focused on leisure, as mentioned by Hori and Fujii (2021) and Ren et al. (2022).

In this context, compared to the frequency of ICT use, autonomy in ICT use appears to be three times more strongly influenced by ICT as a topic in social interaction, which Panigrahi et al. (2022) associate with behavioral engagement incident to learning effectiveness. In fact, contrary to the polarization thesis of recreational use in the lower classes and productive use in the upper classes (Chiao & Chiu, 2018; Correa et al., 2020; Ren et al., 2022; Weber and Becker, 2019), differences in socioeconomic status concern the use of ICT for school activities and favor the better-off.

Some occupation combinations analyzed in Table 4 exhibit significantly different behavior relative to the total model hypotheses. These differences cannot be attributed exclusively to student interaction with ICTs. Indeed, for H1, combinations of professional fathers with white-collar or housewife mothers have a greater impact on ICT skills than a combination of two professional parents. This finding indicates that ICT skills are mostly stimulated by professional fathers in a context that combines a high paternal educational level (Diogo et al., 2018; Silva et al., 2015), the gender division of parental support (Keen & France, 2024; Yuen et al., 2018), gendered use of digital technologies in the workplace (Gómez et al., 2014; Caparrós, 2021), and an evolution of parenting patterns (Hark, 2023).

For other occupations, mothers working in clerical support or services and sales (24 or 25) have a significant influence in H2, although occupations 25 and 32 do not have an effective impact in H5. From this perspective, students in combination 24 mobilize both frequency of use and social interaction to reinforce autonomy of use, whereas students in combination 25 fail to achieve the same impact. These behaviors can probably be explained by the impact of frequency of use on autonomy of use, which seems to yield a greater benefit in the case

of clerical support worker mothers than for those employed in services and sales, whose children exhibit notably lower ICT use outside school. In this context, maternal occupation with higher ICT use intensity appears to strengthen children's autonomy of use. As mentioned in Diogo et al. (2018), Keen and France (2024), Silva et al. (2015), and Yuen et al. (2018), this is probably due to cognitive support mainly characterized by a strategic use of ICT to search for information.

The strength of this impact decreases drastically with hypothesis H6, for which it is barely detectable in the total model, suggesting an attitudinal predisposition independent of services and sales workers that bears more relation to frequency of ICT use. This construct, according to Hori and Fujii (2021) and Ren et al. (2022), involves elementary skills for recreational use. Meanwhile, H4 shows a significant combination of fathers engaged in services and sales work and professional mothers (52), characterizing students with higher in-school and out-of-school use. This atypical combination with professional mothers impacts ICT skills through ICT usage and not the frequency of ICT use, as occurs with H1 with professional parents, perhaps due to the predisposition of highly educated mothers to engage in complex school tasks (Diogo et al., 2018; Silva et al., 2015). Even when mothers possess a low level of education, as in the case of professional fathers and housewife mothers (211), maternal availability for extracurricular activities and control of digital activity outside school favors the mobilization of frequency of ICT use and ICT as a topic in social interaction, significantly strengthening ICT usage, ICT skills, and autonomy in ICT use, as observed in H1, H3, and H5.

The differences between combinations presented in Table 5 reveal a contrast between white- and blue-collar workers, observed by Dodel (2015). In this sense, except for the 25-211 difference characterized by low rates of mothers with education level 5A, the other comparisons contrast the combinations of professional fathers with those of professional mothers.

This finding, in addition to showing parental gender differences in the appropriation of ICTs by children of a parent in a high-level occupation, also highlights the influence of the division of digital support in the nuclear family, as discussed by Keen and France (2024) and Yuen et al. (2018). Of course, with equivalent occupations, gender differences between combinations may point to a different relationship with ICT at work and at home, as well as a division of domestic support as noted above (Caparrós, 2021; Gómez et al., 2014; Keen and France, 2024; Yuen et al., 2018).

In fact, when one parent is a professional, the comparison between combinations favors professional fathers, who show a higher rate of attainment of education level 5A. This behavior is observed in the only significant difference for hypothesis H1, 23-52, which shows a disadvantage for combinations of fathers working in services and sales and professional mothers, with a 13% difference in the attainment of education level 5A, favoring combination 23. Thus, a high-level paternal white-collar occupation and maternal technical specialization appear to result in a greater impact of frequency of ICT use on ICT skills. For hypothesis H2, differences in combinations with professional fathers exhibit a significantly higher impact of frequency of ICT use on autonomy in ICT use, compared to housewife or professional mothers with blue-collar fathers, emphasizing the gender perspective of the construct, evidenced by Kunina-Habenicht and Goldhammer (2020), Li and Zhu (2023), and Ma and Qin (2021).

However, even when both parents are white-collar (professional mother with immediate subordinate occupation father: 32), the results for H5 show that the significant impact on autonomy in ICT use by ICT as a topic in social interaction is largely in favor of white-collar

but professional father combinations. This behavior suggests a need to pay greater attention to the consistent parental vehicle for transmitting social and cultural capital through ICT appropriation (Keen & France, 2024; Ren et al., 2022; Yuen et al., 2018). Of course, this should be mediated by the evolution of parenting patterns, as mentioned by Hark (2023), and, in particular, gendered changes in digital support in the home.

V. Conclusion

This research analyzed the influence of the professional occupation of one or both parents on the appropriation of ICT by their student children. The findings indicate that parents' occupation, and thus their education level, have a significant impact on children's ICT skills and on ICT as a topic in social interaction, emulated by complex logics such as the parental gender division of technological support at home. In this context, the findings of this study highlight the close relationship between students' digital skills and their parents' occupational status, while showing that a high maternal education level encourages support for children's digital activities. Furthermore, in combinations where one parent is a professional and the other has a lower-status but white-collar occupation, a higher influence of ICT frequency and use was evident, suggesting a gender division of digital support in the home.

The study found that students whose parents have white-collar occupations tended to use ICT predominantly for all activities, including school and work, while those from a blue-collar background favored recreational and social use. Overall, these results appear to confirm the existence of qualitative segmentation in the transfer of ICT use to children by parents who, in the literature, are generally considered effective transmitters. Besides highlighting the inherent contrasts in the social and cultural status of parents, this research emphasizes the need to reconsider the importance of gender division in domestic support, which appears to be an offshoot of gender division in labor use of ICTs, even in the case of high-level professional mothers.

Although the research benefited from a large set of data that allowed statistical segmentation and, therefore, an analysis of the impact of different socio-professional statuses, two limitations must be considered. Firstly, the behavior difference between the total sample and group samples may indicate a need to expand the population to increase the statistical sensitivity of the operators used. A second limiting factor concerns the socio-cultural specificities of the target population, which may place the study in the realm of contextual research. Replication of this study in other countries is therefore recommended to validate the findings presented here.

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The author declares no conflict of interest.

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