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Research Article

Confronting the First-Level Digital Divide in the Digital Age: A Comparison Between Public and Private University Students in Turkiye

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ABSTRACT

Although access to ICT tools is improving worldwide, the first-level digital divide is still one of the major problems for university students. The inequality that can be seen in the level of access to ICT tools among university students shows that there is more to be said about this problem in the field of higher education. This paper discusses the problem through the example of university students in Turkey. The variables are fixed broadband subscription, ownership of smart TV and paid smart TV applications, a personal computer, and paid mobile applications for ICT access. As a result of the survey given to 2,206 respondents, it showed that private university students have more access to ICTs than public university students, - this difference does not depend only on income level. Additionally, it was determined that there is a significant relationship between income level, parents' education level, where a student lives and ICT ownership. This is significant because as higher education opportunities in Turkey are spread all over the country many students do not have equal access to ICT tools. This study analyzed the effects of the first-level digital divide in Turkey by using a quantitative method.

Keywords: Digitalization, First-level digital divide, undergraduate students, digital inequality, educational inequality

1. Introduction

With its unique nature, digital technologies have created an unusual world, with new jobs, relationships, and ways of working. However, some traditional patterns, like inequalities, continue to exist and become more extreme. According to optimistic scholars, while computers and the Internet are revolutions that diminish social distance, democratize knowledge, and increase social participation, according to critical ones they increase current economic, social, and cultural inequalities. So, the digital divide refers to inequality patterns regarding the distribution of digital technologies and resources. In stratified societies where all resources are distributed unfairly, it is not possible for digital technologies to be shared fairly. For this reason, the digital divide is defined as the unequal distribution of access to and users' skills in information and communication technologies (ICT) among countries and societal strata.

The digital divide generally consists of three levels: access, usage skills, and creating income or benefits. According to this classification, even if the Internet access problem is solved, the skill inequality arising from income, gender, education, age, and other differences cannot be eliminated. Therefore, the digital divide is a multi-dimensional issue. In the literature, there are many studies on second- and third-level digital divides in developed countries. This creates the impression that the first-level digital divide is resolved worldwide. However, the first-level digital divide still requires attention because, having or not having an Internet connection, differences in material access must be considered (Van Deursen & Van Dijk, 2019, p. 355). Thus, this article focuses on the first-level digital divide between undergraduates at private and public universities in Turkey. Turkey is among those countries that have not yet overcome the first dimension of the digital divide. The data from TURKSTAT and OECD that we present below is the clearest indicator of this situation. However, there is not enough research on the first level of the digital divide in Turkey, especially among the young population and undergraduate students.

For this purpose, we compare students in terms of various variables:

- students' personal computer, internet, mobile phone, smart TV, and paid applications ownership (ICT access)
- education level of students' parents, and whether or not they use ICT
- students' residential conditions/patterns (city center, town, countryside)

2. Theoretical Framework: Types of Digital Divide and Educational Inequality

The starting point of the discussions on "the digital divide" is the emergence of ICT, especially computers, mobile phones, and the Internet. Researchers (Dimaggio et al., 2004; Hargittai, 2001; Ragnedda, 2020; Ragnedda & Muschert, 2013, Van Deursen & Van Dijk, 2011; Van Dijk, 2006; Van Dijk & Hacker, 2003; Zillien and Hargittai, 2009) have deeply analyzed the digital divide since the 2000s. The main point of these analyses is inequalities. Accordingly, digital inequalities are reflections of social inequalities. Not only income, but also age, gender, education, race, and location are factors in the emergence of the digital divide. Therefore, if we want to understand the advent and persistence of digital inequalities, we need to comprehend the reproduction of current social inequalities (Ragnedda, 2020, p. 12).

The digital divide consists of three levels, as stated above. The first level is regarding whether or not individuals have access to ICT. Most Marxist scholars (Fuchs, 2015; Fuchs, 2017; Zizek, 2010) think that the digital divide derives from class divisions. Member of the ruling class have higher income levels, are the owners of the means of production, and have digital technologies that are means of production. However, member of the working class, or poor people, have no

access to ICT. Moreover, these inequalities are reproduced in various variables such as age, gender, race, and education. This is evidence that the distribution of digital technologies has created new forms of poverty and exclusion as well as reproducing existing inequalities and social division (Wessels, 2013, p. 18). Ragnedda (2020, p. 41) conceptualizes this new category as "the digital underclass" (underprivileged and disadvantaged class) who access and use the Internet less than others. The digital underclass is highly excluded from knowledge societies because they cannot use social, economic, and cultural resources. Most of them are elderly, unemployed, disabled, less-educated, and lower-income, and lack digital skills. Therefore, they have less access to elementary digital experiments (mental access) and digital skills (skill access), fewer possessions like computers and Internet connections (material access), and fewer usage opportunities (usage access) (Van Dijk & Hacker, 2003, p. 315-316). Based on all this, it can be said that digital and social inequalities intertwine and generate a first-level digital divide.

The second level of the digital divide regards usage or the ability to use. Even though many people think that the digital divide is about accessing or having computers, an Internet connection, and other digital devices, this is not the only problem. When provide everyone a computer and an Internet connection, we can solve access problems, however usage differentiation problems or usage inequity remains because, as Sorj (2013, p. 109) states, "access does not indicate the types of uses [or usage skills]." Indeed, access can hide the usage disparity. According to Hargittai (2001);

> …it becomes less and less useful to merely look at demographic differences in who is online when discussing questions of inequality in relation to the Internet. Rather, we need to start looking at differences in how those who are online use the medium.

The reasons for inequalities of access also apply to inequalities of use. The problem is not access, but it is inequalities. As long as social, economic, and cultural inequalities exist, there will be a digital divide. Therefore, Van Dijk (2005; 2020) suggests a categorical model that makes us understand the digital divide. He proposes a "relational and networked approach" rather than methodological individualism to explore the digital divide. The cause of digital inequalities is not individuals, but the social position of individuals and the relationships between them. Therefore, both access and usage inequality could be understood in the framework of social categories such as white/black, high income/low income, male/female, citizen/foreigner, urban/rural, employer/(un)employed, manager/employee, high-level education/low-level education, old/young, and parents/children.

Although the spread of digital technologies eliminates access inequalities, new differentiations are emerging in most countries, especially in developed ones. The main reason for these differences, as Van Dijk states (2020, p. 40), is that individuals do not have sufficient hardware and software knowledge, and technology literacy and "information capita" are insufficient. The unequal distribution of usage skills results from the categorical binary divisions listed above. Which side of the binary divisions a person is on can determine his/her ability to use digital technology. For example, while those between 18 and 26 years old with higher levels of education use the internet for more "enhancing capita" (Hargittai & Hinnant, 2008), individuals with low education use it for entertainment or chatting, online gaming, reviewing audiovisual programs, social networking, and trading (Van Deursen & Van Dijk, 2011). According to OECD data (2021a), home computer access is 50% in Turkey and 97.6% in the Netherlands. Moreover, while the Internet

usage rate among women is 80%, it is 90% for men in Turkey (TURKSTAT, 2022a). These rates, however, include smart phone possession and usage. Thus, they do not cover ownership of other ICT tools. Considering ownership of other ICT tools, these high rates are overly optimistic figures.

It is known that categorical inequalities (such as young/old, higher education/lower education, and higher-income/lower-income) cause unequal distribution of useful skills. The unequal distribution of skills causes a decrease in the income of all disadvantaged people and a decrease in their participation in social life.

The third component of the digital divide refers to benefits that result from usage skills. As Ragnedda (2020, p. 48) notes,

> individuals do not get the same benefits from the use of the Internet; but in order to capitalize their use of ICTs and "transform" this usage into externally observable outcomes of digital experiences, individuals need both strong offline capital (social-cultural–economic-political–personal) and digital capital.

Accordingly, those who are in stronger positions in society have access to digital technologies and components. Therefore, their usage skills are high due to their education level and digital equipment. Therefore, individuals with strong social backgrounds also have information-related, operational, and content-related internet skills such as information processing, self-direction, problem-solving, and communication. Hence, socio-economic and socio-demographic factors affect users in terms of both access and skills and benefits/outcomes/earnings in favor of individuals with strong socio-economic backgrounds. Therefore, digital capital, defined as accessing and using digital tools, includes economic, social, and cultural capital because digital capital is related to the digital ecosystem. Digital exclusion processes also reflect the digital capital ecosystem. Digital capital helps us understand how and why there are varying degrees of usage and benefits amongst users when given the same technology. It is not enough for individuals to have digital tools; they also need to have the skills to use them -that is, they need digital cultural capital. Therefore, it is essential that they have been brought up or lived in a socio-cultural environment where they will acquire this information (Ruiu & Ragnedda, 2020; Park, 2017).

As we mentioned above, the starting point of the digital divide is access to digital tools such as smart phones, desktop computers, laptops, smart TV, digital applications, and the Internet. The most important point to explain the digital divide is to reveal advantaged and disadvantaged groups in society and to determine how they are affected by these conditions, because only computers and the Internet offer great opportunities for individuals to participate in the knowledge economy (Hsieh et. al., 2008). In addition, this division deepens as information technologies become widespread and expand. Disadvantaged groups are excluded from social, economic, and cultural areas. However, it is known that access to digital tools increases the participation of individuals in the social, political, and economic dimensions of life (Nishijima et. al., 2017). Due to the cost of digital tools, low-income people are deprived of high-skilled employment, economic resources, social inclusion, and quality education opportunities. In particular, access to EIT is so important for high school undergraduate students to participate in decent jobs and employment. In this sense, the marketization and digitalization of education has an increasing effect on the digital divide. Those who access EIT tools have an advantage in terms of every angle, compared

to those who do not access them (Gonzales et. al., 2018). Thus, the digital divide should be considered a matter of concern for scholars, teachers, politicians, and students, because education inequality is a violation of human rights (Soomro et. al., 2020).

Theories about the digital divide aim to explain why people own, access, and use digital tools at different levels. Initially, the digital age was welcomed by academia, politicians, and commentators, as it was thought that it would reduce inequalities and facilitate easy and widespread access to education (Selwyn, 2004, p. 342). As Castells (1999, p. 403) showed, however, the information age has transformed into an age of stepped-up inequality. As a result, developed and developing countries are now experiencing a digital divide in various forms. The most obvious form of this is the first-level digital divide.

Turkey lags behind OECD countries in terms of many variables, such as access to computers from home, speed tiers or Internet speed, employment in the ICT sectors, the evolution of the share of ICT in total employment and value added by the ICT sector, exporting of ICT goods and services, and the expenditure of research and development on the ICT sector (OECD Digital Economy Outlook 2017 Report, 2017). Additionally, the proportion of fixed broadband subscriptions with download speeds of 256 kbit/s or greater is just 20.1% as of 2020 (OECD, 2021b). The OECD average of this proportion is 33.2%. All these indicators show that Turkey has an access and usage gap on a macro scale. According to the Turkish Statistical Institution "Survey on Information and Communication Technology (ICT) Usage in Households (2020)" report, the desktop computer ownership proportion is 16.8%, portable computer (laptop, notebook, etc.) ownership is 36.7%, and fixed broadband subscription is 61.9% (TURKSTAT, 2021a). These rates did not increase, indeed they decreased in 2022 (TURKSTAT, 2022b). According to these data, it can be said that there is both an access and usage gap in Turkey. Nevertheless, smart phone ownership and usage are quite widespread. According to an OECD report, Internet access has reached 90.7%, which is similar to TURKSTAT's data (92%).

While there is no shortage of smart phone ownership, the lack of ownership of other digital tools is notable. While Turkey struggled with inequality of access, it also tried to reduce usage differences. Although access inequalities have decreased at certain points compared to previous years, the inequalities regarding usage have continued depending on valuables such as education, income, and age. This paper analyzes by income groups the access and usage differentiations of university students who are at the same education level and age group. In particular, the differentiation between public and private university students and reasons for and dimensions of the differentiations are key issues in this study.

3. Research Hypotheses

As shown by statistics above, it is seen that there is a first-level digital divide in Turkey. The aim of this study is to demonstrate the extent of this divide between private and public university students. Based on the theoretical framework, this research developed three hypotheses to test the effect of the first-level digital divide (level 1) on public and private university students:

H1: Private university students have more ICT ownership and access than public university students.

H2: As the income level of students increases, their ownership and access to ICT increases.

H3: The housing location of students has an impact on their ICT ownership and access.

4. Method

4.1. Data

This research was conducted to analyze the first-level digital divide between undergraduate students studying at public and private universities in Turkey. Between March 2021 and July 2021, 77.7% (N = 1713) of the students participating in the research were public university students and 22.3% (N = 493) were private university students. In addition, 70.6% (N = 1557) of the students participating in the research were female and 29.4% (N = 649) were male.

The universe consists of 2,435,303 active undergraduate students from 204 universities in the fall and spring terms of 2020-2021. 129 of these universities are public, with 2,024,828 students, and 75 are private, with 410,475 students. Those 2,206 participants who formed the sample group were reached by respondent-driven sampling (RDS). Respondent-driven sampling (RDS), a new network-based (i.e., snowball type) sampling method, has been proposed as a way to sample hidden populations that overcomes the venue bias associated with time–space sampling (Wejnert & Heckathorn, 2008, p. 106). Researchers tried to reach all universities in Turkey with an online questionnaire. So, the sample group was formed of participants from 70 public and 30 private universities on a voluntary basis. 1,713 of participants were students in public universities (equal to 0.08 of the public category) and 493 were in private universities (equal to 0.12 of the private category). Ethics committee approval was obtained from the Zonguldak Bülent Ecevit University Human Research Ethics committee.

There is a difference in income level between students studying at public and private universities. Of course, it would not be wrong to say that the biggest difference in terms of the digital divide is income level. However, other variables should not be ignored. As we mentioned earlier, our research focuses specifically on the first level of the digital divide. For this reason, the possibilities of students having and accessing internet and computer technologies were examined. Ownership of ICT tools is limited to three tools. These are smart phones, PC (desktop and laptop), and smart TV. Although other smart technologies are becoming increasingly widespread, they were excluded from the study because there is not a high rate of ownership of these tools in Turkey yet.

Among these three tools, the smart phone is the most widely used tool by 98.1% (N= 2165). It is seen that smart phone ownership is at similar levels both in the world and in Turkey. However, such a high rate makes it impossible to treat smart phone ownership as a variable. Therefore, only (71.7%, N= 1,581) personal computers and (55.6% N= 1,226) smart televisions were included in the ownership category, and the relationship between smart phone ownership and other variables was not analyzed. Access to ICT tools is as important as ownership. Therefore, students' access to fixed broadband was also examined. Although accessing an internet connection would seem easy, there are locational differences in the case of Turkey. In addition, the usage levels of paid applications on mobile phones were also examined. Paid application usage is another factor that indicates both ownership and access to ICT tools, because these applications gradually become embedded in the daily life practices of students. Thus, students' ownership and access to ICT tools were examined based on usage levels of personal computers, smart television, internet access, and paid mobile applications.

Toward this goal, first, comparative descriptive statistics about these variables were accessed, and then the dependent variables were determined, and binary logistic regression analysis was performed. "Logistic regression is a method for examining the association of a categorical outcome with many independent variables" (Lee and Forthofer, 2005, p. 66). Since the variables used in this study included two response categories, binary logistic regression analysis was applied.

4.2. Findings

When examining the distribution of students with fixed broadband subscriptions at home according to their university type, it is seen that the ownership rate is high in both groups. However, it should be noted that ownership is slightly lower among public university students in comparison with private university students. This difference is significant in terms of the relationship between university type and fixed broadband ownership (N=2,206, p=0). Another point to be considered is the rate of students who have fixed broadband or updated their internet services during the pandemic period. This group's rate is 40% within all fixed broadband owners. So, we can relate the higher ownership of fixed broadband and closing of the gap between the two types of university students to pandemic period necessities. Connection speed and quality are other variables that have to be discussed.

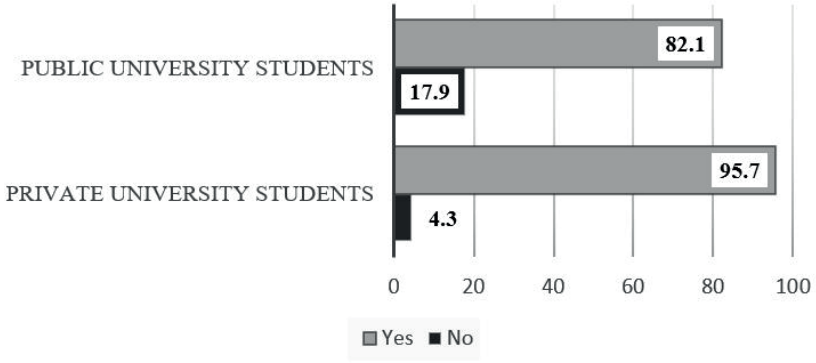

Figure 1: Fixed Broadband Ownership

This situation presents a structure in which public university students are at a disadvantage in fixed broadband access. This corresponds to the idea that the first level of the digital divide is about access to ICT and is based on class division. In connection with this, convenient access to fixed broadband can be seen as the first step towards academic success and competitiveness in employment. Fixed broadband ownership as a priory condition for access to the digital world also becomes a priory condition for a higher income and benefits.

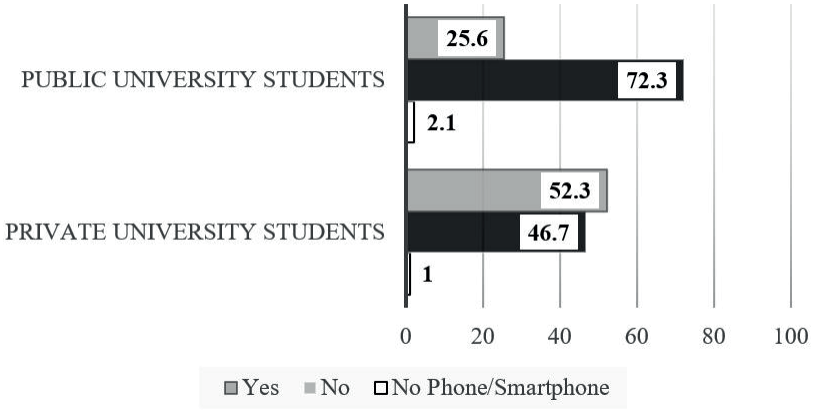

Figure 2: Paid Mobile Application Ownership

Mobile applications that pave the way for reaching current and professional audio and video content or joining networks related to certain interests may sometimes require payment for more effective and detailed use. Purchasing power is necessary for users to access more content or make social and professional connections. In this context, when mobile application ownership is taken into account, it is seen that there is a huge gap between private and public university students.

One of every two private university students can pay for a mobile application, but among public university students, this rate is one in four. University type is significantly related to ownership of mobile applications and the difference is almost half for the two types (N=2,206, p=0). 38.9% of the public university students who stated that they do not use paid mobile applications justified economic issues as the reason for not using them. 25.9% of private university students stated that they do not use paid mobile applications for economic reasons. It is clear that public university students have some disadvantages. These disadvantages cause a situation where some students are uninformed about current content on the internet. This situation does not make sense on its own, but if we think of mobile applications as a part of ICT, access to some knowledge will be incomplete without it.

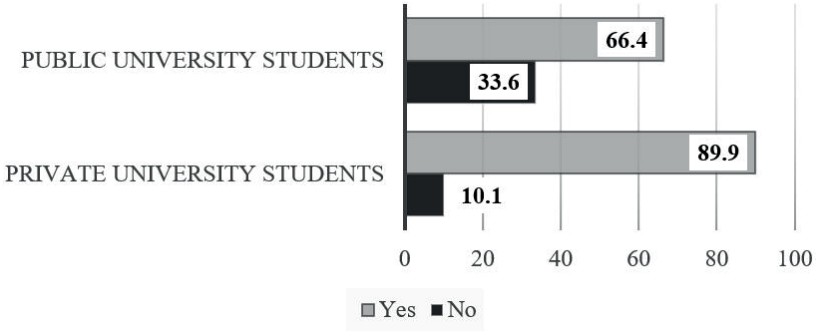

Figure 3: Personal Computer Ownership of Students

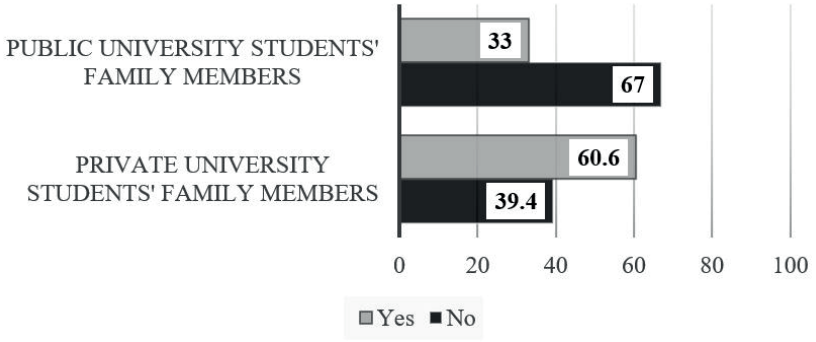

Figure 4: Personal Computer Ownership of Students' Family Members

It is useful to consider these two crosstabs together, as they provide important data on access to ICT. One of every three students in public universities does not have a personal computer (33.6%), but in private universities, one of every ten students do not (10.1%). This divide is visible again in family members' computer ownership. 67% of family members of public university students do not have a personal computer, and the rate is 39.4% for private university students. The relation between type of university attended and ownership of a personal computer is significant for both crosstabs (N=2,206, p=0 both).

When we discuss the data in more detail, it can be seen that 62.1% of public university students have to share their personal computers with family members. This rate is 34.8% among private university students. This data is a substantial indicator for determining the relationship between purchasing power and ICT access. Shared use may make it difficult to access a computer and accordingly, knowledge. In this case, the students who can use a personal computer and access knowledge whenever it is necessary will have a chance to step forward in both academic success and professional life. Personal computer ownership, which provides access to knowledge, also allows the owner to reproduce their class privilege. Students who have problems in accessing a computer stand in an underprivileged position, which means they are part of the digital underclass, as discussed above.

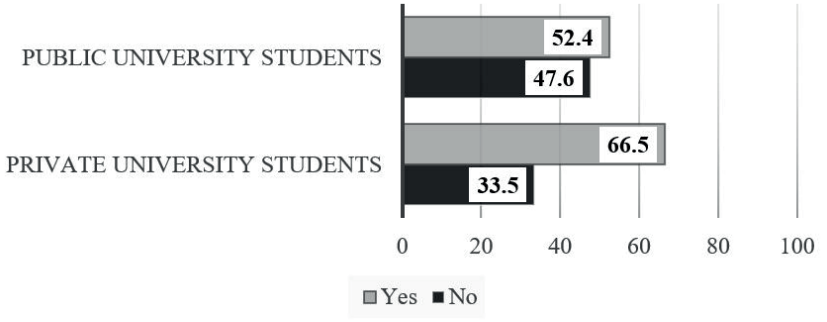

Figure 5: Smart TV Ownership

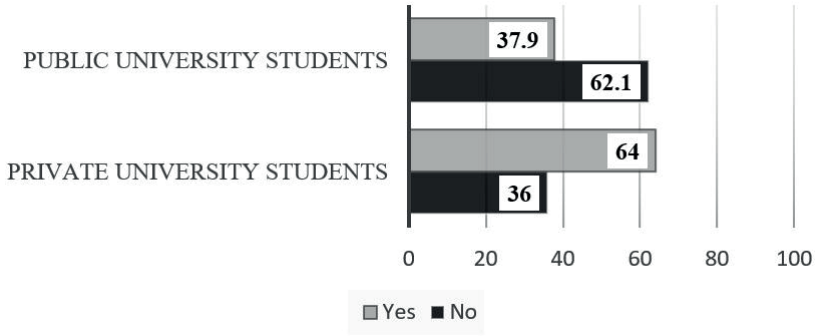

Figure 6: Paid Smart TV Application Ownership

When the ownership of both smart TV and paid smart TV applications is examined, the clear difference between public and private university students reappears. The difference is slightly lower in the smart TV ownership rate (public 52.4%/private 66.5%) but it can be seen that private university students use paid applications on smart TVs much more. The paid smart TV application ownership rate is 37.9% for public and 64% for private university students, and this reveals a huge gap between the two groups. Type of university attended is significantly related with ownership of smart TVs and paid smart TV applications (N=2,206, p=0).

4.3. Multivariate Analysis

4.3.1. Dependent Variables

Four dependent variables were used to analyze the first level of the digital divide. These variables are personal computer ownership, fixed broadband subscription, smart TV ownership, and mobile paid application usage. First, the variables are intended to be computed into a single variable that defines the first level of the digital divide and thus represents the ownership and access of students. However, the Cronbach's Alpha value showing the reliability analysis was not at the desired level. For this reason, it was decided to consider the variables one by one. In addition, the use of paid applications is handled only on mobile devices. Paid applications on a smart TV are not used by almost half of the sample because smart TV ownership is not very common. Therefore, it was used in the descriptive statistics above only to present a comparison, but it was not considered as a dependent variable or combined with the variable of using paid applications on mobile devices.

4.3.2. Control Variables

Based on the literature, two statistical control variables were included in the data analysis. Gender is a dichotomous variable with 0 = female and 1 = male. Parents' educational level can affect students' access to and use of ICT tools. However, since our study focuses on the first-level digital divide, it is thought that the effect of parents' educational level on ICT ownership and access is indirect, not direct. The parents' educational level was created by considering both the parents' education levels together to understand this indirect effect. Thus, the fathers' educational level and mothers' educational level variables were computed. The two-item index was found to be extremely reliable (Cronbach's Alpha = .804).

4.3.3. Independent Variables

This study aims to analyze the first level of the digital divide through public and private university students. There is a huge difference in tuition fees between these universities in Turkey. Therefore, the income level of the students studying at these universities is also different. For this reason, university type and income level were considered as independent variables. Income level is a scale variable from 0 = lower income to 5 = higher income. Based on the literature about the digital divide, location also affects digital inequality (Ragnedda, 2020). Thus, students' residential location is used as an independent variable. Residential location is used as a categorical variable with 0 = village (reference category), 1 = county, and 2 = city. Parents' educational level was constructed to understand both father and mother's educational level's affect on students' ICT ownership. Thus, the fathers' educational level and mothers' educational level variables were computed. The two-item index was found to be extremely reliable (Cronbach's Alpha = .804).

Table 1. Descriptive Statistics (N = 2206)

Variables	N	Percentage
Female	1557	70.6%
Male	649	29.4%
Residential Location (Village) (ref)	318	14.4%
Residential Location (County)	807	36.6%
Residential Location (City)	1081	49.0%
Public University Students	493	22.3%
Public University Students	1713	77.7%
Personal Computer Ownership (No)	625	28.3%
Personal Computer Ownership (Yes)	1581	71.7%
Fixed Broadband Ownership (No)	327	14.8%
Fixed Broadband Ownership (Yes)	1879	85.2%
Smart TV Ownership (No)	980	44.4%
Smart TV Ownership (Yes)	1226	55.6%
Paid Mobile Application Using (No)	1468	67.8%
Paid Mobile Application Using (Yes)	697	32.2%
	M	**SD**
Income	1.59	1.44
Parent's Education Level	6.49	3.13

In our study, gender and parents' educational level were used as a control variable. It is also seen from Table 2 that gender affects all dependent variables. Accordingly, the use of personal computer ownership and paid applications is higher among male students than female students. However, when we look at fixed broadband and smart TV ownership, it is seen that the ownership level of female students is higher than that of male students. The parents' education level is effective on three other variables except for smart TV ownership. This situation can be understood through the odds ratio (OR) value. "More crucial to the interpretation of logistic regression is the value of the odds ratio, which is an indicator of the change in odds resulting from a unit change in the predictor" (Field, 2009, p. 270). As the parents' educational level increases, students' personal computer ownership ($b = .177$, $p < 001$. OR = 1.19), fixed broadband ownership ($b = .257$, $p < 001$. OR = 1.29) and paid application use ($b = .072$, $p < 001$. OR = 1.07) increase.

Table 2. Binary Logistic Regression

Variables	Personal Computer Ownership	Fixed Broadband Ownership	Smart TV Ownership	Paid Mobile Application Usage
	B(SE) - OR	B(SE) - OR	B(SE) - OR	B(SE) - OR
Gender	.292 (.023)** - 1.33	-.400 (.149)** -.67	-.564 (.099)*** -.569	.239 (.108)* - 1.27
Parent's Education Level	.177 (.023)*** - 1.19	.257 (.033)*** - 1.29	.030 (.018)† - 1.03	.072 (.019)*** - 1.07
Residential Location (Village) (ref)				
Residential Location (County)	.453 (.148)** - 1.57	.908 (.167)*** - 2.47	.281 (.141)* - 1.32	.351 (.189)† - 1.42
Residential Location (City)	.458 (.150)** - 1.61	1.348 (.181)*** - 3.83	.366 (.142)** - 1.44	.743(.186)*** - 2.10
Income	.469 (.055)*** - 1.59	.703 (.088)*** - 2.04	.303 (.039)*** - 1.35	.287 (.040)*** - 1.33
University Type	-.604 (.171)*** - .547	-.296 (.255)† - .744	-.148 (.122)† - .863	-.514 (.122)*** - .598
Nagelkerke R^2	.246	.333	.100	.178
N	2206	2206	2206	2206

Notes: †p < .10. *p < .05. **p < .01. ***p < .001.

Table 2 shows the logistic regression models created to estimate the factors affecting ICT ownership and access among students studying at public and private universities. As mentioned before, ICT ownership and access are analyzed using four variables. The first of these is personal computer ownership. Table 2 indicates that there is a significant relationship between personal computer ownership and students' socio-economic conditions. Ownership increases as income status increases (b = .469, p < 001. OR = 1.59). Students residing in villages have approximately 1.6 times lower PC ownership than students residing in counties (b = .453, p < 01. OR = 1.57) and cities (b = .458, p < 01. OR = 1.61). Personal computer ownership also differs among students studying at private and public universities (b = -.604, p < 001. OR = .547). Personal computer ownership of students studying at a public university is 45% lower on average than private university students.

Table 2 indicates similar results for fixed broadband ownership. Income status (b = .703, p < 001. OR = 2.04) influences internet ownership. However, the most striking indicator of this part of the table is undoubtedly the residential location. Those residing in counties (b = .908, p < 001. OR = 2.47) and cities (b = 1.348, p < 001. OR = 3.83) have higher fixed broadband ownership than those residing in villages. Since this variable shows both ownership and access, according to Table 2, it can be said that those residing in districts have approximately 2.5 times more internet access than those residing in villages. Those residing in cities have 3.83 times more access than those residing in villages. Therefore, residential location is an important variable for the digital divide. However, there was no significant relationship between internet ownership and access and the type of university.

There is a significant relationship between smart television ownership and income level (b = .303, p < 001. OR = 1.35) and residential location (b = .281, p < 05. OR = 1.32) (b = .366, p < 01. OR = 1.44) variables. However, no significant relationship was found between university type and smart TV ownership.

According to Table 2, paid application usage shows similar results with personal computer ownership and fixed broadband ownership. The use of paid applications increases as income level increases (b = .287, p < 001. OR = 1.33). The use of paid applications (b = .743, p < 001. OR = 2.10) of the students residing in cities is 2.10 times higher than the students residing in villages. Using paid applications also differs among students studying at private and public universities (b = -.514, p < 001. OR = .598). The use of paid applications by students studying at state universities is about 40% lower than students at private universities.

Finally, it can be said that the most important factors affecting ICT ownership and access are income level and residential location. The difference between ICT ownership and access between public and private university students is significant for PC ownership and paid application use. Although such a difference is observed for fixed broadcasting ownership and smart TV ownership, this is not statistically significant, but it is to be expected. Based on these results regarding ICT ownership and access, all hypotheses are supported by analysis of the data.

5. Conclusion and Discussion

The institutional arrangement of education is a fundamental right. Moreover, equal access to education is granted by the Constitution. Despite these guarantees, everyone does not access good quality education because of various disadvantages such as socio-economic status, gender, residential conditions, income level, ethnicity, and so on. For these reasons, education has featured as an "inequality-creating phenomenon" (Winker and Degele, 2011). The digital divide is a different dimension of these disparities regarding access to digital education materials. Economic disadvantages, especially, are the determining factor on educational inequalities and affect students' capabilities. Just like the inequalities in access to education are predominantly determined by poverty and by the disadvantaged background of students (Akkan and Buğra, 2021), the access to digital education materials is also determined by their income level and by disadvantaged backgrounds.

When we separate quintiles for annual equivalized household disposable income, while the highest income group has 47.5% of annual income, the lowest one has 5.9% in 2020 in Turkey (TURKSTAT, 2021b). These rates are 46.7% and 6.1% in 2021 (TURKSTAT, 2022c). While the poorest households can spend just 0.2% of their income (where mean annual income is 14,575 Turkish Lira) on education, the wealthiest ones (where mean annual income is 217,649 Turkish Lira) spend 4.2% (TURKSTAT, 2020a; 2020b). When we observe that the Gini coefficient was 0.410 in 2020 and 0.401 in 2021 (TURKSTAT, 2021b; 2022c), it can be said that the wealthiest households can spend much more on education than the poorest ones. Therefore, it is clear that the first-level digital divide is very deep. According to current TURKSTAT data, while the households in the first quintiles spend 5.2% of their income on education, the last quintiles spend 64.5% in Turkey. (TURKSTAT, 2020b).

As shown above, the gap between income levels reflects access to digital technologies. As these research findings show, income level relates to personal computer ownership, fixed broadband access, smart TV ownership, and paid mobile application ownership. Private university students are at higher income levels than those studying in public universities. The first digital divide between the public and private university students concerning access reproduces itself because of skills, capabilities, and competencies. As Nikolaos and others (2019) argue, as socio-economic status affects access, it is also decisive in the acquisition of digital skills.

As of 2012, Turkey ranks 52nd among 142 countries according to the Network Readiness Index values, and 69th and 79th, respectively, according to the Knowledge Index and Knowledge

Economy Index values (Gürcan, 2015). In their research, Baran and Erdem (2017) indicate that there is a deep digital divide in Turkey, especially in view of possession and usage differentiation. According to their data, 21.6% of households in Turkey have a desktop computer, 33.5% a portable computer, 28% a tablet, and 96.6% a mobile phone. Only 20% of these households use desktop computers and 38.8% use portable computers. Connecting to the Internet via TV is seen only in 14.8% of the households. Income, age, gender, location, and education affect this differentiation. The research, however, does not analyze data on undergraduate students. In other qualitative research on university students by Nerse (2020, 1), it is seen that "the individual and family characteristics of the participants, the environment and financial resources of schools, development, emancipation and acculturation factors interactively have effects on inequality, as well as rural-urban segregation and socioeconomic differentiation are evident in digital education inequality." Demir and Bodur's research (2017) on undergraduates in Burdur also shows that the lowest digital divide is regarding mobile phone ownership. However, because this study does not measure the ownership of other ICT tools, it does not offer data about this issue. In the article based on Eurostat data, Yurdakul (2023) states that Turkey ranks last in Europe in fixed broadband internet access, with 51% having access (the EU average is 75%). On the other hand, Turkey is in last place in Europe in terms of average broadband internet speed, with 11.58 Mbps. According to Yurdakul, internet access in Turkey is mostly realized through mobile broadband.

According to the findings of this study, public university students have fewer personal computers, paid-mobile applications, paid smart TV applications, and fixed-broadband subscriptions than private university students. Although there are no data on undergraduate students in Turkey, similar results have been obtained in other countries before. For example, Ricoy and others (2013) allege that university freshmen suffer from various digital tools deficiencies in Spain. In the same way, other research (Mcnaught, Lam and Ho, 2009) carried out in Hong Kong showed that the ICT ownership did not present homogenous distribution between undergraduates. Azionya and Nhedzi (2021, p. 164), in their research on university students in South Africa, state that "network coverage, device type, time of day, socio-economic status and digital competence negatively affect synchronous lecture participation and attendance" of marginalized students more than privileged ones. In their quantitative research, Reisdorf and colleagues (2020) claim that laptop ownership can affect university achievement. Moreover, Helsper and Reisdorfs' (2016) research shows that those individuals who suffer from digital exclusion are generally in disadvantaged groups, especially low-income groups. Accordingly, the situation of not having digital capital starts with a lack of economic capital and then turns into a lack of cultural capital through not having access to knowledge, and into the lack of social capital by not having social ties (Calderón Gómez, 2020). Indeed, while even the quality of the physical-digital tools affects the success of students (Gonzales et. al., 2018), the disadvantages, inequality, and gap caused by being deprived of any of these tools, especially a personal computer and Internet connection, will, of course, be quite large.

Research conducted in the USA (Jaggars et al. 2021), similar to ours, firstly examines how much college students have digital technologies. In research based on income level, race, and resident type, those who are low-income, non-white, and residing outside the city center have fewer digital technologies, as expected (Jaggars et al., 2021, p. 3-6). Unlike our research, however, this research measured the students' perception of success. Accordingly, the students with inadequate technology perceived themselves as less successful than advantaged ones (Jaggars et al., 2021, p. 7). Also, in Jaggars and friends' research, as we emphasize in our research, it is observed that there is a significant correlation between residential settings and ICT ownership and usage

skills. For example, the fixed broadband proportion (ADSL, cable, optic fiber, etc.) of households in Turkey by Statistical Region is 42.5% in southeast Anatolia, 39.5% in central east Anatolia, and 34.3% in northeast Anatolia, but 79% in İstanbul, 59.5% in the western Marmara region, 63.3% in the Aegean region, and 69% in western Anatolia (TURKSTAT, 2022d). These values show that the proportion of those with a subscription to fixed broadband changes with place of residence.

Our three research hypotheses were tested with the findings. It is seen that our three hypotheses are supported by the binary logistic regression analysis. Our first hypothesis claims that (H1) private university students have more ICT ownership and access than students studying at public universities. It can be concluded that only income level difference reveals this situation. However, our study draws attention to the effect of residential location (also H3) in addition to income level. Private universities are located only in large cities in Turkey. Therefore, the residential location variable, as well as income, is an important factor in accessing ICT tools.

Our second hypothesis claims that (H2) as the income level of students increases, their ownership and access to ICT increases. As stated in the literature (Ragnedda, 2020), income level is the most important factor affecting the digital divide. The distinction between public and private universities, which we used in this study, is based on income inequality. However, based on this distinction, we did not want to classify students only as high-income and low-income, because we thought that such a presupposition could lead to a wrong conclusion. While there are low-income students who study in private universities because they receive scholarships, there are also high-income students who choose to study at public universities. Therefore, the income level differs between both state and private university students.

Our third hypothesis claims that (H3) the residential location of students' living has an impact on their ICT ownership and Access. The data we obtained show that residential location is one of the most important factors affecting access to and ownership of ICT tools in Turkey. Access to and ownership of ICT tools decrease as one moves from large cities to districts and villages. This decline is not specific to a particular region. In general, there is a dramatic decrease in the level of access to and ownership of ICT tools with distance from the city center.

In our regression analysis, one of the variables related to ICT ownership is the education level of the students' parents. This is an important variable, but since it is used as a control variable, no hypothesis has been established. Parents' educational level affects students' access to and ownership of ICT tools. Parents can motivate students to access and own ICT tools. However, when evaluated in terms of the first level of the digital divide, this effect lags behind income level and residential location. If the second level of the digital divide had been taken into consideration, the effects of this variable would undoubtedly be discussed much more. We think that parents' educational level has a more direct impact on acquisition of ICT skills than access and ownership. Therefore, methodologically, we did not want to establish such a hypothesis. However, this does not prevent us from having a brief discussion about the importance of the parents' educational level in our dataset. It is reminiscent of Bourdieu's concept of cultural capital to say that the parents' educational level influences access to and ownership of ICT tools. Educational level has a favorable impact on employment, income, and the motivational aspects associated with digital technology. This situation reflects ICT ownership and gives shape to the habitus of young members of households or, as Gomez (Calderón Gómez, 2020) said, it is useful for understanding the social reproduction of inequalities. Hence, it is not surprising that students with high ICT ownership and use acquire these characteristics through cultural transfer. Our research includes data supporting previous research (Nikolaos et al., 2019; Dimaggio et al., 2004; Zillien and Hargittai,

2009; Kaya, 2017) on this subject. These studies demonstrate that parents' ICT usage habits and competencies directly affect their children. The high income level of the households makes it possible for these households to have ICT and increases usage skills. As a result of this, the economic, cultural and social capital obtained increases, and this habitus is transferred to other members of the household. Individuals who are deprived of economic and cultural capital specific to ICT have to overcome more barriers than individuals who have access to ICT. In countries that do not have widespread institutional support and economic power, these barriers can reach insurmountable heights. As Ragnedda states, referring to Bourdieu, "those with a stronger social or economic capital will more likely exploit and get the most out of the digital experience than those who do not have an initially strong socio-economic background." (2020, p. 49).

There are countless studies, articles, reports, and books on the digital divide and inequalities. Most researchers acknowledge the inequalities in access and usage. The crucial point is how to solve this problem. The answer is multi-dimensional and exceeds the scope of this study. Some of these solutions are regulating distribution relations, expanding ICT ownership, providing equal opportunities in education, accepting access to ICT as a human right, and disseminating ICT-based vocational training. This multi-dimensional problem can only be solved with multi-dimensional solutions.

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