

SUMMARY OF THE THESIS

Anikó Vincze

Learning and school performance in the information society

**The empirical investigation and interpretation of the relationship between
digital inequalities and educational inequalities from the perspective of digital
capital**

Ph.D thesis

Supervisor:

Dr. György Lengyel, DSc

professor

Budapest, 2022

Department of Sociology and Social Policy

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I. Previous research and justification for the topic

In information societies, information and communications technologies (ICT) are among the most important factors in the operation of a given society in various aspects of our lives, be it finding a job or a partner, administrative responsibilities or entertainment, keeping in touch with others or studying. Using ICT devices has become a part of everyday life for today's generation of students. The question of how using these devices impacts the life and career of young people has been investigated from numerous perspectives. This thesis focuses on one of these potential effects: the link between the use of ICT and school performance, interpreted from the perspective of digital capital.

The aim of my thesis is to explore dimensions of inequality in using ICT and its complex relation to school performance in its utmost complexity, for which I rely on both quantitative and qualitative empirical methods.

The theoretical background of my research unites two theoretical frameworks, one for digital inequalities and the other for educational inequalities. In the first part of my thesis, I first locate the use of ICT within the broader context of theories on the information society. These two areas are intricately intertwined; one presumes the other, but they cannot be equated. The information society cannot be reduced to a higher level of ICT penetration and use, for it embraces more than that. The theories discussed elaborate on structural changes in the second half of the 20th century which contributed to a transformation in the mode of operation of society. The classical approaches, Daniel Bell's understanding of post-industrial society (2001) and Manuel Castells' theorizations on the network society (2006), capture the wealth of trends and foci with which the essence of these structural changes may be grasped. Frank Webster's categorizations (2007) may aid one in finding one's way among the various approaches when it comes to theorizations on the information society. In addition to, or in parallel with, the concept of the information society, the concept of the knowledge society has also gained wide recognition as one that captures social formations in which knowledge is overrated and gains a definitive role. The theoretical introduction includes a discussion of the differences between these two concepts in terms of meaning and understanding. The study then concludes that, from the perspective of the current research, these concepts should be linked instead of separated, since using digital devices and developing digital competence are indispensable to acquiring useful knowledge in society.

It must be recognized, however, that within this dimension, major gaps exist with regard to access to and use of ICT devices between and within societies (Bognár and Galács 2004).

This phenomenon may be investigated on different levels of the digital divide. These levels and the attention they receive change among researchers depending on the extent of penetration. The first-level digital divide, or digital gap, initially focused on inequalities in access, only to shift attention to a dichotomy of use later (Norris 2001). With the progress of penetration, and wider access to and use of ICT devices, however, the focus shifted to differences between users and kinds of use. These are in the focus of the approach of the second-level digital divide, or digital inequalities (DiMaggio et al. 2001; DiMaggio and Hargittai 2001). Both types of division are caused primarily by socio-demographic factors. The dissertation places a major emphasis on the dimensions of digital inequalities discussed by DiMaggio and Hargittai, based on which the quantitative analysis is carried out. This system of dimensions considers five aspects in surveying inequalities among ICT users, which are: (1) technical devices, (2) autonomy of use, (3) ICT knowledge and ability, (4) social support for use and (5) purposes of use. The first dimension of digital inequality refers to technical devices. The computer, hardware and software as well as the quality of the internet connection significantly determine use; it may limit it, and it may enhance certain applications. The introduction and spread of broadband internet created a newer type of inequality between users, since it made it possible to access any applications that had been unavailable through a dial-up internet connection. The second dimension of digital inequalities is autonomy of use. Use is significantly influenced by the location where the internet is being used, i.e., whether it is in a public or private place, how much the user needs to travel to access the internet, how regulated the time available and the mode of use are, and how regulated use is. The third dimension involves the skills, knowledge and competence necessary to use the internet, which are factors that define the quality of the experience. The dimension of social support captures how digital inequalities reflect the extent to which individuals are supported by their social environment in their internet use, if someone from the family or circle of friends is able to lend a helping hand if needed, or if one is forced to request formal help. The last dimension refers to the actual mode and purpose of internet use. This may be one of the most important dimensions of all, since the different modes of use may have a direct impact on the social status of the individual. The authors differentiate between two major types of use, one being the expansion of resources and the other being recreation. Internet use may contribute to growth in economic productivity and economic capital, as far as use focuses primarily on improving various skills, finding job opportunities, studying etc. The expansion of political and social capital is made possible by specific modes of use, such as finding and following the news, acquiring information on public issues and

political programmes, and participating in civil forums and in organizing social movements. From the perspective of social inequalities, these are significantly different from ICT use for the purposes of entertainment and consumption. The authors also highlight the fact that the different modes of use are further impacted by social and demographic factors, such as income, education and age (DiMaggio and Hargittai 2001).

A third-level digital divide has also emerged within the last few years in studies in the social sciences on ICT devices. In the second half of the 2000s and the first half of the 2010s, numerous studies were devoted to the social inequalities that had shaped differences in ICT use. However, only a few of them argued that research should move beyond this static approach and rather stress the social consequences and impacts of ICT use (Scheerder, van Deursen and van Dijk 2017). As of the second half of the 2010s, however, a growing number of theorizations and research have been published that use empirical methods to examine the social impact of internet use as part of the third-level digital divide (Gómez 2020; Lutz 2019; Ragnedda 2018; van Deursen and Helsper 2015). A defining element of the theoretical framework of the third-level digital divide is the conceptualization of ICT use as a form of capital. Some authors consider the ability to use ICT as a type of resource and thus a part of cultural capital, i.e. digital cultural capital (Ollier, Malaterre, Jacobs and Rothbard 2019). Others view social advantages gained from ICT use and their connection to social status as a type of separate capital. The literature uses both the terms *technological capital* (Carlson 2018) and *digital capital* (Ragnedda 2018).

This dissertation relies on the concept of digital capital, which creates a theoretical grounding that empirical studies have lacked so far. Drawing on Bourdieu's concept of capital, Ragnedda (2018) defines digital capital as the accumulation of digital competences and digital technologies. Similarly to other types of capital, convertibility is one of its important features. Digital capital may thus be directly or indirectly converted into any other capital, be it economic, social, cultural, human or political. Digital capital actually creates a bridge between online and offline life chances and establishes an interaction between them. The level of the various types of capital an individual possesses (economic, social, cultural, human and political) influences the level of digital capital, which may also be converted into types of offline capital, which influence the social position of that individual. Based on this mechanism, those who were in possession of advantageous kinds of capital from the outset were able to employ them more successfully to increase their digital capital, through which they could develop their original capital further. The same mechanism may operate the other way round. Thus lower-level offline kinds of capital result in a lower level of digital capital,

which strengthens and reproduces the disadvantaged position of the individual. In this study, Ragnedda elaborates on the interaction of digital capital with various types of offline capital. Of these, the interplay between cultural and digital capital is the most central from the perspective of this dissertation. Cultural capital includes the abilities, level of education and knowledge that the individual may utilize in other types of capital, such as digital capital. This interplay, then, will have consequences for life online and offline alike. What are the phenomena in which the interaction between the two types of capital may manifest itself? As a result of positive interaction in the area of secondary digital inequalities, individuals become able to make use of information acquired online as a value, checking the authenticity and reliability of the information and the sources as well as deepening and processing the online information on the third level of the digital divide. Negative interaction, however, results in the opposite (Ragnedda 2018).

Since this research focuses on young people and students, it is also important to examine approaches that consider the differences between generations to be the decisive factor in using digital devices and ICT skills. Of these, the most well-known is the theory that places digital natives and digital immigrants in opposition (Prensky 2001a). This approach maintains that the generation of digital natives that has been socialized among ICT devices processes information and studies very differently from those that came before the spread of computers and the internet. In view of this conceptualization, the dissertation hypothesizes that the use of ICT and the subsequent knowledge and skills one develops have re-shaped traditional learning methods and factors that determine success in school.

Classical theories of educational inequalities point out that educational performance is shaped primarily by the position occupied in the social structure, traditional socio-economic factors, and one's own cultural and social capital (Bernstein 1975; Bourdieu 1974; Coleman 2006). In information societies, digital inequalities are interposed between these factors, which, since they operate as resources, may have an impact on educational inequalities. The concept of digital capital assists in establishing this connection, maintaining a relation between the individual's social status, position among the digital inequalities and school performance, which is reflective of cultural and human capital.

A number of empirical studies have been conducted that measure the use of ICT and school performance, with findings that are sometimes contradictory. Numerous authors have demonstrated the positive influence of internet use on school performance (Delen and Bulut 2011; Eynon and Malmberg 2011; Jackson et al. 2011; Spiezia 2011), while others have

concluded that it may have neutral (Fuchs and Woessmann 2004; Mominó and Meneses 2007), or, in specific modes of use, even negative, effects (Anil and Ozer 2012).

Therefore, one of the goals of this dissertation is to delve deep into these connections in order to draw reliable and valid conclusions on the relationship between digital and educational inequalities. My investigation focuses on the following questions, based on the theory discussed and tied to the concepts and various levels of the digital divide:

RQ1: What is the nature of the relation between ICT use and school performance?

RQ2: In the light of the dimensions of digital inequality, what layers of differences can be detected among the relations between ICT use and school performance?

RQ3: What role do socio-demographic lines of demarcation play in the relation between modes of ICT use and school performance?

RQ4: Do certain aspects of ICT use mediate or compensate for traditional social inequalities?

RQ5: What mechanisms can be found behind the relation between the quality of ICT use and educational success?

Through the combined application of quantitative and qualitative data, the results and conclusions of this dissertation contribute to a more complex understanding of the relation between digital and educational inequalities – primarily in the Hungarian context. Approaching the topic through the concept of digital capital has been missing in Hungarian literature so far, a gap that this dissertation may assist in filling. Moreover, in the current period marked by digital education, it is particularly relevant to learn about the link between social, digital and educational inequalities which my research explores and which may provide assistance for educational experts, parents and teachers in ensuring that ICT technologies can be employed most effectively in teaching young people and enabling them to study.

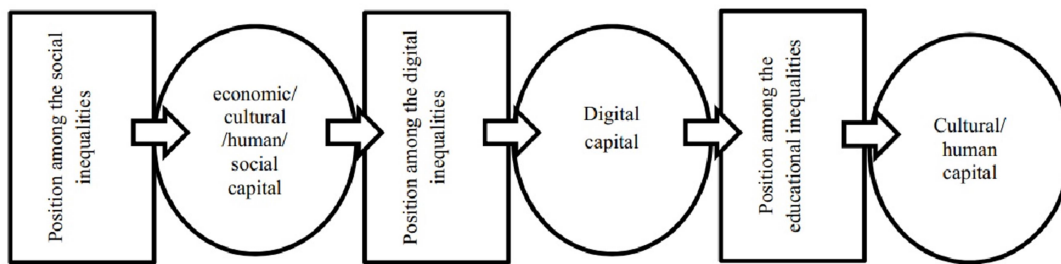
II. Research methods

I aimed to use both quantitative and qualitative methods to investigate the hypotheses tied to the research questions as thoroughly as possible. The hypotheses are the following:

- H1: The relation between ICT use and school performance is basically positive, although complex.
- H2: School performance is affected positively by ICT use that increases resources but negatively by ICT use that is primarily devoted to entertainment
- H3: The socio-economic characteristics of a user impact the relations between ICT use and school performance.
- H4: ICT use primarily plays a mediating role between social background and school performance.
- H5: Knowledge and information acquired through ICT use as well as the abilities and skills it develops contribute directly to achieving better school performance.
- H6: Students who do well in school and are high achievers are able to take advantage of the potential of the internet in order to deepen and expand their knowledge.

The hypotheses tied to the individual research questions may be integrated into the concept of digital capital as illustrated in the following figure (Figure 1).¹

Figure 1. The conceptual embedding of the hypotheses in approaching the concept of digital capital (designed by author).



This figure shows a hypothesized chain of inequalities, in which digital capital links positions within the social structure (family background, economic status, cultural position

¹The rectangles in this figure signify structural positions, while the circles represent the types of capital that derive from them.

etc.), the various kinds of capital derived from these, the position among the educational inequalities, and the cultural and human capital this provides. In this somewhat simplified chart, the social background of the individual, the individual's original economic, cultural, human and social capital, impacts the position the individual occupies within the system of digital inequalities. This is reflected in the characteristics of ICT use, which may contribute to increasing one's digital capital. Resources gained from ICT use, however, have an impact on school performance because of the increased value placed on digital competences, which is one of the signs of cultural and human capital.

During the research, quantitative and qualitative methods were both employed in order to examine the depth and complexity of the research problem, answer the research questions and investigate the hypotheses. The primary source for the quantitative analysis was data provided by PISA (Programme for International Student Assessment) 2015, which supplies parallel information on educational performance, student competences and different dimensions of ICT use. During the analysis, scores on competence tests² in mathematics, reading performance and applied natural sciences constituted the dependent variables. Different dimensions of ICT use represented the independent variables, which correspond to the dimensions of digital inequalities proposed by DiMaggio and Hargittai (2001). Relevant variables were adopted for each dimension from the PISA database. The dimension of technical equipment was investigated through the availability and use of ICT devices in the home. In this regard, I distinguished between personal computers (desktops and laptops) and mobile devices (smart phones and tablets), as it is by the nature of these devices that the former may assist in an expansion of resources, while the latter facilitates recreation. The autonomy of use was captured through the amount of time spent on internet use. It was hypothesized that more regulated ICT use (based on either an internal or external source of control) with a limited time span may contribute to an increase in digital capital as it leaves less opportunity for 'digressions' and distractions. The students' ICT skills were determined on the basis of subjective impressions. In this dimension, it was presumed that the skills of the more confident and independent ICT users contribute to an expansion of resources, since those with higher digital competence are more likely to take advantage of the opportunities offered by ICT devices. Social support for ICT use was analysed based on how characteristic it was for users to talk about ICT with their friends and share information about it with each other. It was hypothesized that a greater extent of social support may contribute to use that

²These scores are not specific test results, but what are known as plausible capability values, which are calculated on the basis of Item Response Theory (IRT), and, within that, the Rasch model.

expands resources. Finally, the goals and modes of internet use were surveyed among 15-year-old Hungarian students based on the frequency of various activities performed via the internet. I analysed general internet activities at home and modes of use which promote studying, completing schoolwork and advancing in one's studies. Modes of use that expand resources include searching for and locating information and use for study purposes, while recreational modes of use include use of social media, entertainment and games.

I processed the Hungarian data for PISA 2015 for the first four research questions (RQ1, RQ2, RQ3 and RQ4). First, I explored the trends within the dimensions of digital inequalities among the students and the relation between these dimensions and socio-demographic factors – namely, the ESCS index which represents gender and family background. Then, I used linear regression models to investigate the impact of the various dimensions of digital inequalities on school performance, first individually and then collectively, in a common model (H1 and H2). When constructing the model, I gradually included the socio-demographic control variables in the analysis in order to see how the correlations change once these background variables are eliminated (H3). I examined the role ICT use played within the close link between family background and school performance by including the interactional impact between the two variables in the regression analysis. During this analysis, I thus examined whether different modes of ICT use modify the impact of family background on school performance. This way, we may gain a picture of whether ICT use mediates or compensates for traditional social inequalities (H4). The mode of ICT use is hypothesized to mediate and strengthen traditional social inequalities if the positive impact of ICT use on school performance also increases with the growth of the ESCS index (Figure 29) or the negative impact of ICT use decreases. A compensatory or balancing effect of mode of ICT use will result if the positive impact of ICT use on school performance drops in tandem with the rise in the ESCS index or if the negative impact of ICT use grows.

The quantitative analysis was supplemented by a qualitative analysis of interviews conducted among students in order to explore deeper and more nuanced links. The semi-structured interviews were conducted among high school students during the 2019–2020 academic year. The main criterion for being included in the sample was high school student status. The sample included both young men and women, living in different parts of the country, in various types of localities, whose school attainment also varied. A total of 20 high school students answered the interview questions, which focused on the links between ICT use and studying and school performance. The interviews thus mapped both the role of ICT use in studying and school performance and the mechanisms of convertibility of digital

capital. In the course of the qualitative research, the aim was not to investigate the link to social background – for which quantitative analysis may prove a more effective tool – but rather to map the reflections of the students as members of the generation of digital natives and the mechanisms behind the points of connection. The interview data collection thus provided information which primarily answered the fifth research question (RQ5) as well as contributing to an examination of hypotheses 5 and 6 (H5 and H6) and supplying a potential further addendum to interpreting the quantitative findings.

III. The findings of the dissertation

Based on an analyses of the Hungarian data in the PISA 2015 database and the opinions outlined in the interviews conducted with students, I have drawn the following conclusions on the research questions and hypotheses of the dissertation:

- On the first level of the digital divide, internet use basically provides resources and creates digital capital, which can be transformed into cultural and human capital through school performance. Students who use the internet outside of school do significantly better at school than their peers who, for some reason, do not use the internet in their homes, independent of the student's gender or social background. Furthermore, according to the majority of the students, internet use represents a tool that facilitates educational success; it is a resource through which one may acquire a great deal of information easily and quickly.
- On the second level of the digital divide, the different dimensions of ICT use have proven to increase resources, independent of family background and gender; that is, the use of PC devices in the home, more regulated ICT use in terms of time and a higher level of subjective ICT skills resulted in better school performance.
- As for the dimensions of digital inequalities, social support for ICT use, which was measured through social communication and interaction via ICT use, indicated a negative effect on school performance. One of the reasons behind this may be that external support for ICT use from the perspective of the quality of use is not so significant for the population under investigation. Moreover, young

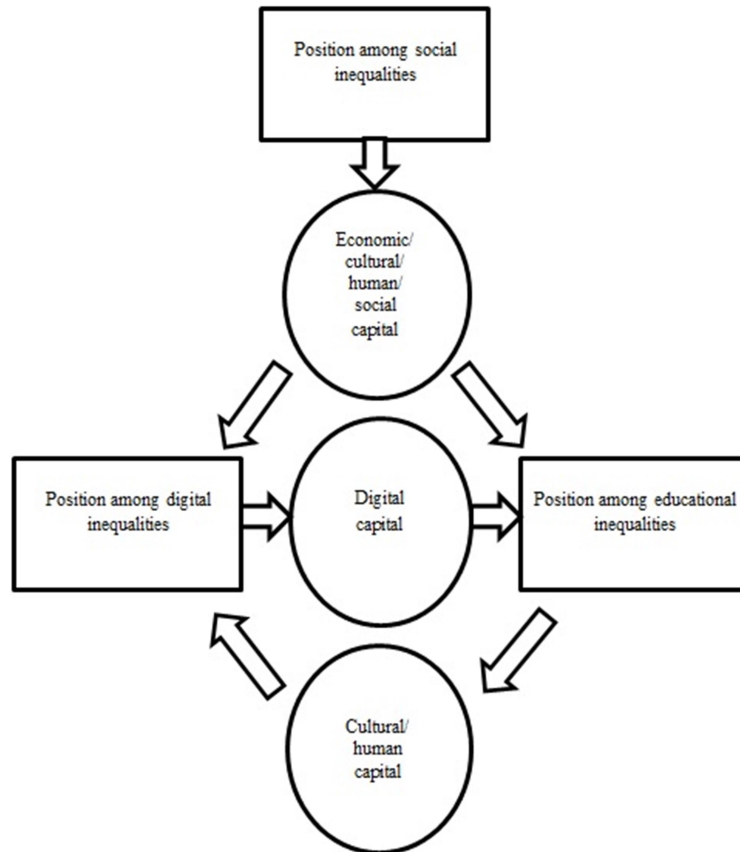
people talking about ICT may be a sign of personal interest and of the importance of ICT devices for individuals rather than of support offered.

- ICT use for entertainment demonstrated a (slightly) negative impact on school performance.
- Contrary to our hypothesis, using the internet for study purposes shows no significant correlation with school performance, and frequent use in connection with school had a significantly negative impact on the results on competence tests.
- A similar contradiction was observed in the qualitative research findings, as less good students relied more on the internet in their schoolwork; in their answers, they emphasize the functions of the internet which aid them in studying, underplay the features that hold them back, and generally feel that the internet helps them personally in studying and in success at school. At the same time, it is clear that, despite all this, they have not become good students and that their school performance does not necessarily reflect the effective help they attribute to the internet in achieving better results.
- Thus, based on the results of the quantitative analysis and the opinions gleaned from the interviews, I conclude that it is not the purpose of use that impacts school performance. It is rather school performance that determines mode of use.
- In each case, family background impacted the link between the dimensions of ICT use and school performance, either relaxing or nullifying it (in the case of mobile device use and the mode of ICT use for acquiring information).
- The analysis of the interactional impacts between modes of internet use and family background seems to support the notion that ICT use plays a rather mediating role. That is, the mode of effective ICT use that is able to produce digital capital depends on the social status of the individual.
- Good students with more advantageous family backgrounds can use digital devices and the internet more effectively, which is thus reflected in their school performance. This model applies the process of Bourdieu's cultural reproduction for the information or digital age, when capital derived from the use of digital devices becomes interposed in the process between the different kinds of capital in the family and the cultural capital that may be acquired through education. In other words, this connection may also be captured through the Matthew effect or

Matthew principle (Merton 1968), which states that a person in possession of a higher level of capital at the outset will have more digital capital to determine the production of cultural and human capital.

- The model of a hypothesized chain of inequalities discussed above (see Figure 1) as regards social position and position among the digital inequalities and educational inequalities, in which various types of capital mediate, is clearly supported by empirical evidence. Based on the empirical results, the relations between the elements of this model should be modified as follows (Figure 2):

Figure 2. Modified model of relations between structural positions and various kinds of capital based on empirical results (designed by Author).



- That is, the potential for internet use may be employed as digital capital by those who are in possession of adequate capital from before and who can use the cultural capital they develop through their school performance in their ICT use in order to increase their resources.

Further directions this research may take include a further analysis and comparison of data from other PISA tests in order to deepen the results and reach further conclusions, placing the Hungarian findings in international context, integrating background factors from the institutional and social realms into the model, and drawing on the views of teachers and parents through qualitative research.

This dissertation investigates a current topic that has not been widely studied in Hungary from the perspective of digital capital. The conclusions reached and stated may contribute to expanding awareness among educational experts, teachers and parents of the relation between young people's ICT use and school performance, which may facilitate their taking more effective action. In addition, it may also serve as a point of departure for social scientists interested in digital and educational inequalities to engage in further studies in the future.

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