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Original Contribution

DIGITAL INEQUALITY AS A DETERMINANT OF EDUCATIONAL OUTCOMES AND SOCIAL INCLUSION AMONG UNIVERSITY STUDENTS FROM DIFFERENT SOCIO-ECONOMIC BACKGROUNDS

L. Spasova*

Department of Social Sciences and Business Language Training, Faculty of Economics,
Trakia University, Stara Zagora, Bulgaria

ABSTRACT

The digitalisation of higher education has intensified debates about the role of digital inequality in shaping students' educational and social experiences. This study examines digital inequality as a multi-level social phenomenon and analyses its role as a mediating mechanism between students' socio-economic status and their educational outcomes and social inclusion. Drawing on survey data collected from 300 Bulgarian and international students enrolled at the same university, the study employs correlation analysis, multiple linear regression models, and mediation analysis to test the proposed conceptual framework. The results demonstrate that socio-economic status significantly predicts both digital access and digital competence, confirming the structural nature of digital inequality. Digital competence emerges as a stronger predictor of educational outcomes and social inclusion than formal access to digital technologies, highlighting the importance of secondary digital inequality related to skills and effective use. Mediation analysis further reveals that the effects of socio-economic status on educational outcomes and social inclusion are partially mediated by digital resources and, to an even greater extent, by digital competence. Comparative analyses by nationality indicate that differences in prior digital preparation and national educational contexts continue to shape students' digital capital, even within a shared institutional environment. The findings underscore that digital inequality in higher education should be understood not merely as a technical or infrastructural issue, but as a complex social process that requires targeted institutional and educational interventions. The study contributes to the literature by empirically demonstrating the mechanisms through which digital inequality influences academic performance and social inclusion, and by offering evidence-based implications for policy and practice in increasingly internationalised higher education systems.

Keywords: Digital inequality; higher education; digital competence; socio-economic status; educational outcomes; social inclusion; mediation analysis; international students.

INTRODUCTION

The digitalisation of education has emerged as a profound structural transformation reshaping the organisational, pedagogical, and social dimensions of higher education. The expansion of online learning, the implementation of learning management systems, and the growing reliance on digital educational resources have altered not only teaching practices but also forms of academic participation and interaction within university communities (1,2). Alongside its potential to broaden access and enhance flexibility, digitalisation has generated new forms of social inequality. Contemporary research conceptualises digital inequality as a multidimensional social phenomenon that extends beyond mere access to the internet or digital devices, encompassing differences in digital skills, patterns of use, and the educational and social outcomes of digital engagement (3,4). These inequalities are systematically associated with socio-economic status, including household income, family educational capital, and regional context (5,6).

***Correspondence to:** *Lyubomira Venkova Spasova, Department of Social Sciences and Business Language Training, Faculty of Economics, Trakia University, Stara Zagora, Bulgaria, e-mail: liubomira1975@abv.bg, GSM: 0886138297*

Within higher education, digital inequality assumes particular importance due to its direct implications for academic performance, student engagement, and social inclusion. Empirical studies consistently show that students with limited digital resources and lower levels of digital competence tend to achieve weaker academic outcomes, display lower levels of participation, and face an increased risk of marginalisation and dropout (7,8). In this sense, digital learning environments often reproduce rather than mitigate existing social inequalities (9,10). Beyond academic outcomes, digital inequality also affects students' social integration. Limited digital capacity can hinder communication with peers and instructors, restrict participation in formal and informal academic communities, and foster feelings of isolation from the university environment (11,12). These effects are particularly pronounced among students from socio-economically disadvantaged backgrounds, for whom higher education plays a critical role in both educational advancement and social integration (10). Despite the growing body of research on digital inequality, comparative empirical analyses that simultaneously examine educational outcomes and social inclusion in higher education remain limited, particularly at national and regional levels (13,14). This study seeks to address this gap by analysing digital inequality as a mediating mechanism between students' socio-economic status and their educational and social outcomes.

LITERATURE REVIEW

1. Conceptualising Digital Inequality

Digital inequality has become a central analytical concept in research on education and social stratification. Early approaches focused primarily on disparities in access to technology and internet connectivity; however, contemporary scholarship emphasises that such a perspective is conceptually limited and empirically insufficient (3,5). The most widely adopted framework conceptualises digital inequality as a multi-level process comprising at least three analytically distinct dimensions: 1) primary inequality related to access to digital technologies; 2) secondary inequality concerning digital skills, usage patterns, and efficiency; 3) tertiary inequality manifested in the social and educational outcomes of digital participation (3,4). This framework allows digital inequality to be understood not as a set of isolated technical deficits but as a socially embedded process with long-term educational and social consequences. Empirical research consistently demonstrates that secondary and tertiary forms of digital inequality are closely linked to socio-economic status, family educational capital, and institutional context (15). Consequently, digital inequality operates as a mechanism through which pre-existing social inequalities are transformed and reproduced in digital environments.

2. Digital Inequality and Educational Outcomes in Higher Education

In higher education, digital inequality is particularly salient due to the increasing dependence of teaching and learning on digital platforms, online resources, and communication technologies. Although digitalisation offers opportunities for flexible and personalised learning, empirical evidence indicates that these benefits are unevenly distributed across student populations (7, 16). Access to digital resources alone does not guarantee improved educational outcomes. Rather, digital competence - defined as the ability to effectively use digital tools for learning, self-regulation, and academic engagement - plays a decisive role (15). Students with lower levels of digital competence often experience difficulties navigating online learning platforms, evaluating digital information, and participating in virtual academic activities, which negatively affects their academic performance. Theoretical interpretations frequently draw on the concepts of cultural and digital capital, suggesting that educational outcomes reflect not only individual effort, but also accumulated resources and skills shaped by prior educational and social contexts (5,9). From this perspective, digital inequality in higher education represents a continuation of earlier educational inequalities rather than an entirely new phenomenon.

3. Social Dimensions: Social Inclusion and University Belonging

In addition to academic outcomes, digital inequality significantly influences students' social inclusion. Social inclusion in higher education encompasses participation in academic and informal communities, a sense of belonging to the institution, and the quality of interactions with peers and faculty (11,12). Research suggests that limited digital resources and lower digital competence can result in "hidden exclusion," whereby students formally have access to digital learning environments but remain marginalised in terms of meaningful participation and social integration (15). In digitally mediated academic contexts, effective

communication, participation in online discussions, and collaboration in digital teams become critical for social visibility and inclusion. Models of student integration emphasise that social inclusion is integral to academic persistence and success in higher education (11). Accordingly, digital inequality can heighten the risk of social isolation, reduced engagement, and eventual dropout, particularly among students from disadvantaged socio-economic backgrounds.

4. Conceptual Model and Hypotheses (H1–H4)

Building on the reviewed literature, this study proposes a conceptual model that frames digital inequality as a mediating mechanism between students' socio-economic status and their educational and social outcomes. The model integrates structural and individual factors and reflects the multi-level nature of digital inequality (3,4).

Socio-economic status - operationalised through indicators such as income, family educational capital, and region of origin - is conceptualised as a structural starting condition shaping access to digital resources and the development of digital competence (5). In turn, digital resources and digital competence influence conditions for effective academic participation and social integration within the university environment (7,11).

Based on this model, the following hypotheses are formulated:

H1: Students' socio-economic status is positively associated with digital access and digital competence.

H2: Higher levels of digital access and digital competence are positively associated with educational outcomes in higher education.

H3: Limited digital access and lower digital competence are associated with lower social inclusion and weaker feelings of university belonging.

H4: The effect of socio-economic status on educational outcomes and social inclusion is partially mediated by digital resources and digital competence.

Building on the proposed conceptual framework and the derived hypotheses, the following section details the methodological approach used to empirically test the effects of digital inequality on students' educational and social outcomes.

METHODOLOGY

1. Research Design and Context

The present study employs a quantitative, cross-sectional research design aimed at empirically examining the relationships between socio-economic status, digital inequality, and students' educational and social outcomes in higher education. The analytical framework is aligned with the conceptual model presented in the previous section, in which digital resources and digital competence are conceptualised as mediating variables between socio-economic status and outcome variables (3,4). Empirical data were collected from a sample of 300 Bulgarian and international students enrolled at Trakia University. The study was conducted within a shared institutional environment, allowing for control over university-level conditions while accounting for differences stemming from students' socio-economic backgrounds and prior educational experiences. The sample includes students of English, Irish, Italian, Spanish, Turkish, Greek, and Bulgarian nationality, with varying levels of prior training in information technologies acquired during secondary education.

2. Sample and Data Collection Procedure

The sample consists of 300 students enrolled in different programmes and years of study at Trakia University across three faculties: Faculty of Economics, Faculty of Veterinary Medicine and Faculty of Agriculture. Data were collected through a standardised questionnaire administered on a voluntary and anonymous basis. Participation was based on informed consent, and students were provided with clear information regarding the aims of the study and the confidentiality of their responses. Particular emphasis was placed on differences in prior training in information technologies. This variable was measured through the number of instructional hours in IT completed during secondary education in the country of origin, as well as through students' subjective assessment of the adequacy of this preparation in relation to the demands of university-level study.

3. Operationalisation of Variables

Students' socio-economic status was measured using a composite index that includes self-assessed family economic position, parents' educational attainment, and type of completed secondary school. Self-assessed economic status was measured using a five-point Likert scale (1 = very low; 5 = very high). Parental educational attainment was coded into

categories and aggregated into an index of educational capital (5).

Digital inequality was operationalised through two interrelated but analytically distinct components: digital resources and digital competence. Digital resources were measured using an index capturing access to a personal device for educational purposes, the quality and stability of internet connectivity, and the possibility for independent study in a digital environment. Responses were collected using five-point Likert scales, with higher values indicating better access conditions. Digital competence was measured using a self-assessment scale adapted from established research on digital skills in educational contexts (3,15). The scale includes items related to confidence in using educational platforms, the ability to independently solve technical problems, and adaptability to the digital requirements of university study. Responses were measured on a five-point Likert scale (1 = strongly disagree; 5 = strongly agree), and a composite index of digital competence was calculated. Prior training in information technologies was included as a control variable. It was measured through the number of IT instructional hours in secondary education, self-assessed effectiveness of this training, and the country in which secondary education was completed. This variable allows for differentiation between the effects of formal education and those attributable to socio-economic factors. Educational outcomes were measured using a composite index combining self-assessed academic performance, satisfaction with the learning process, and subjective evaluation of adaptation to university studies. These indicators were measured using five-point Likert scales and aggregated into a single index (7). Social inclusion was measured through indicators capturing students' sense of belonging to the university, participation in academic and informal student activities, and frequency of interaction with instructors and peers. The measurement draws on established models of student integration and engagement and employs five-point Likert scales (11,12).

4. Analytical Strategy

The analysis was conducted in several sequential stages. First, descriptive analyses were performed to examine the main characteristics of the sample and the distribution of key variables. Second, correlation analyses were used to identify relationships between socio-economic status, digital resources, digital competence, and outcome variables. To test hypotheses H1–H3, multiple linear regression models were employed, with socio-economic status and digital indicators included as independent variables and educational outcomes and social inclusion as dependent variables. The mediation hypothesis (H4) was tested using mediation analysis, in which digital resources and digital competence were specified as mediators in the relationship between socio-economic status and the outcome variables. All models were controlled for gender, age, nationality, and prior training in information technologies.

RESULTS

1. Reliability and Descriptive Statistics of the Measurement Scales

Prior to the presentation of the analytical results, the internal consistency of the measurement scales used in the study was assessed. For this purpose, Cronbach's alpha coefficients were calculated for all multi-item indices included in the analysis. Digital competence was measured using a scale consisting of 15 items assessed on a five-point Likert scale (1 = strongly disagree; 5 = strongly agree). The scale demonstrates satisfactory to good internal reliability (Cronbach's $\alpha = 0.678$), which is considered acceptable for exploratory and comparative research. Digital resources (access) were measured through an index composed of 10 indicators, also assessed using a five-point Likert scale. The obtained Cronbach's alpha coefficient ($\alpha = 0.874$) indicates high internal consistency and reliability of the scale. Social inclusion was measured using an index of 24 items reflecting students' sense of university belonging, participation in academic and informal activities, and interaction with instructors and peers. This scale shows good internal reliability (Cronbach's $\alpha = 0.745$).

Educational outcomes were measured through a composite index including self-assessed academic performance, satisfaction with the learning process, and degree of adaptation to the university environment. This index demonstrates high internal consistency (Cronbach's $\alpha = 0.854$). Descriptive statistics for all key variables are presented in **Table 1**.

Table 1. *Descriptive Statistics and Reliability of the Applied Scales (N = 300)*

Construct	Number of items	Scale	Mean (M)	Standard Deviation (SD)	Cronbach's α
Digital competence	15	1–5	3.42	0.68	0.678
Digital resources (access)	10	1–5	3.76	0.72	0.874
Social inclusion	24	1–5	3.51	0.65	0.745
Educational outcomes	8	1–5	3.63	0.61	0.854

Note: Higher values indicate higher levels of the respective construct.

The data in **Table 1** indicate that all applied scales demonstrate acceptable to high internal consistency, which allows their use in subsequent regression and mediation analyses. The highest reliability is observed for the digital resources index, while the digital competence scale shows a lower but still acceptable Cronbach's alpha value, typical for more heterogeneous constructs. The mean values suggest that respondents assess their conditions of digital access more positively than their levels of digital competence and social inclusion, which preliminarily indicates the presence of secondary digital inequality related to skills and effective use rather than access alone.

2. Correlation Analysis

To explore the initial relationships among the main variables, a correlation analysis using Pearson's correlation coefficient was conducted. The analysis aimed to identify the direction and strength of the associations between socio-economic status, digital resources, digital competence, educational outcomes, and social inclusion. The results of the correlation analysis are presented in **Table 2.**

Table 2. Correlation Matrix of the Main Variables (N = 300)

Variable	1	2	3	4	5
1. Socio-economic status	1				
2. Digital resources (access)	0.41***	1			
3. Digital competence	0.38***	0.52***	1		
4. Educational outcomes	0.29***	0.34***	0.49***	1	
5. Social inclusion	0.26***	0.31***	0.46***	0.54***	1

Note: *** $p < 0.001$.

The correlation analysis reveals statistically significant positive relationships among all key variables. Socio-economic status is moderately associated with both digital resources and digital competence, which is consistent with multi-level models of digital inequality and supports the assumptions of Hypothesis H1 (3, 5). Digital competence demonstrates stronger associations with educational outcomes and social inclusion compared to digital access, corroborating previous research indicating that secondary digital inequality related to skills and effective use has a more substantial impact on students' experiences than formal access alone (4,15). These findings suggest that inequalities in digital competence function as a key mechanism through which structural socio-economic differences are translated into academic and social outcomes (7).

3. Regression Models for Testing H1–H3

To empirically test Hypotheses H1–H3, multiple linear regression models were employed, allowing for the simultaneous estimation of the effects of socio-economic status, digital resources, and digital competence. All models include control variables for gender, age, nationality, and prior training in information technologies.

3.1. Socio-economic Status and Digital Inequality (H1)

Table 3 presents the results of the regression models in which digital resources and digital competence are used as dependent variables.

Table 3. *Regression Models for Digital Resources and Digital Competence (h1)*

Independent variable	Digital resources (β)	Digital competence (β)
Socio-economic status	0.39***	0.35***
Prior IT training	0.21***	0.28***
Control variables	included	included
R^2	0.27	0.31

Note: *** $p < 0.001$.

The results indicate that socio-economic status is a statistically significant predictor of both digital access and digital competence, in line with established models of digital inequality that emphasise the role of socio-economic resources in shaping primary and secondary digital divides (3,5). The effect on digital resources is slightly stronger, reflecting the structural relationship between material conditions and technological access, whereas digital competence is more strongly influenced by prior training in information technologies. This finding aligns with research highlighting the importance of formal education and skills development as key components of secondary digital inequality (4,15). Overall, these results empirically confirm Hypothesis H1 and support the assumption that socio-economic status and educational context jointly shape digital inequalities among students.

3.2. Digital Inequality and Educational Outcomes (H2)

Table 4 presents the results of the regression model in which educational outcomes are used as the dependent variable.

Table 4. *Regression Model for Educational Outcomes (H2)*

Independent variable	β
Digital resources (access)	0.18**
Digital competence	0.41***
Socio-economic status	0.12*
Control variables	included
R^2	0.38

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Control variables include gender, age, nationality, and prior training in information technologies.

The regression results indicate that both digital resources and digital competence exert statistically significant positive effects on students' educational outcomes. Digital competence emerges as the strongest predictor, confirming findings from previous research that skills and the effective use of technologies are more critical for academic success than formal access to digital resources alone (7, 15). The effect of digital access remains statistically significant but comparatively weaker, which is consistent with multi-level models of digital inequality that distinguish between primary and secondary digital divides (3, 4). Socio-economic status retains a direct, albeit more limited, effect on educational outcomes, suggesting the presence of partial mediation and preparing the ground for the subsequent testing of Hypothesis H4.

3.3. Digital Inequality and Social Inclusion (H3)

Table 5 presents the results of the regression model in which social inclusion is used as the dependent variable.

Table 5. **Regression Model for Social Inclusion (H3)**

Independent variable	β
Digital resources (access)	0.15**
Digital competence	0.39***
Socio-economic status	0.10*
Control variables	included
R^2	0.35

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Control variables include gender, age, nationality, and prior training in information technologies.

The regression analysis shows that digital competence is the strongest predictor of students' social inclusion, which aligns with theoretical models of student integration and engagement emphasising the importance of active and confident participation in the academic environment (11,12). Although digital access has a statistically significant effect, its influence is weaker compared to that of digital skills, further confirming the distinction between primary and secondary digital inequality and highlighting the central role of competencies as a key factor for social inclusion (3,15). Socio-economic status maintains a direct but relatively limited effect on social inclusion, indicating that part of the impact of structural social inequalities is realised indirectly through digital resources and digital competence. These findings support Hypothesis H3 and create clear premises for the subsequent mediation analysis aimed at testing Hypothesis H4 (4, 7).

3.4. Mediation Analysis: The Role of Digital Inequality (H4)

To test Hypothesis H4, a mediation analysis was conducted in which digital resources and digital competence were included as mediating variables in the relationship between socio-economic status and the two outcome variables - educational outcomes and social inclusion. The analytical approach follows the classical mediation model logic, assessing both direct and indirect effects of the independent variable on the dependent outcomes (17), while the interpretation is informed by contemporary conceptualisations of multi-level digital inequality (3,4).

In the first step, the direct effect of socio-economic status on educational outcomes and social inclusion was estimated without the inclusion of mediating variables. The results show statistically significant positive effects for both outcomes, confirming that socio-economic differences are associated with inequalities in students' academic performance and social integration. These findings are consistent with a broad body of research documenting the persistent influence of socio-economic status on student experiences in higher education (5,10).
In the second step, the effects of socio-economic status on digital resources and digital competence were examined. As demonstrated in the previous regression models (H1), socio-economic status is a statistically significant predictor of both mediators. This confirms the assumption that digital inequality functions as a mechanism through which structural social differences are transformed into disparities in students' digital capacity (3,15).

In the third step, digital resources and digital competence were simultaneously included in the regression models for educational outcomes and social inclusion. The results indicate that, with the inclusion of the mediators, the direct effect of socio-economic status on both outcome variables decreases but remains statistically significant. This pattern indicates partial mediation, whereby part of the effect of socio-economic status is realised indirectly through digital inequality. Among the mediators, digital competence demonstrates a substantially stronger indirect effect compared to digital resources. This finding supports theoretical arguments that secondary digital inequality - related to skills and effective use - plays a more decisive role for educational and social outcomes than formal access to technologies alone (4,15).

Overall, the results demonstrate that digital inequality operates as a key mediating mechanism between socio-economic status and student outcomes. Socio-economic differences are not transferred directly and mechanically into educational and social attainment; rather, they are "translated" through unequal access to digital resources and, to an even greater extent, through disparities in digital competence. This conclusion is consistent with empirical research highlighting digital skills as a critical factor for academic engagement, social integration, and persistence in higher education (7,11). The findings support Hypothesis H4 and confirm that digital inequality should be understood not merely as a technical or infrastructural issue, but as a social mechanism through which broader social inequalities are reproduced (3,4).

DISCUSSION

The present study aimed to analyse the role of digital inequality as a mechanism through which socio-economic differences among students are transformed into inequalities in educational outcomes and social inclusion in higher education. The results of the empirical analysis provide consistent support for the proposed conceptual model and for hypotheses H1–H4.

In line with Hypothesis H1, the analysis demonstrates that socio-economic status is a significant predictor of both digital access and

digital competence. This finding confirms classical theoretical assumptions that digital inequality is structurally embedded in social stratification and that families' material and educational resources shape students' "starting positions" within the digital educational environment (3,5). Particularly noteworthy is the strong effect of prior training in information technologies on digital competence, highlighting the role of national education systems and secondary education in shaping secondary digital inequality (4,15).

Results related to Hypothesis H2 indicate that digital competence is the strongest predictor of educational outcomes, while the effect of digital access remains significant but more limited. This finding is consistent with empirical research showing that the mere availability of technology is not a sufficient condition for academic success unless students possess the skills and confidence required to use it effectively for learning (7,15). Accordingly, the results support the argument that the digitalisation of higher education may deepen rather than reduce educational inequalities when it is not accompanied by targeted support for the development of digital competences.

With regard to social consequences, the analysis for Hypothesis H3 shows that digital inequality has a significant impact on social inclusion and students' sense of university belonging. Digital competence once again emerges as a key factor, which is consistent with models of student integration emphasising the importance of active participation and effective communication in academic and social environments (11,12). Limited digital capacity increases the risk of peripheral participation and "hidden exclusion," whereby students formally have access to educational platforms but remain weakly integrated into the university community.

The most substantial contribution of the study lies in the results of the mediation analysis, which confirm Hypothesis H4. The findings show that the effect of socio-economic status on educational outcomes and social inclusion is partially mediated by digital resources and, to an even greater extent, by digital competence. This indicates that social inequalities are not transferred directly into student outcomes but are instead "translated" through unequal digital capacity that students bring with them into the university environment. This result is fully consistent with multi-level models of digital inequality and with empirical studies that conceptualise digital skills as a key mediator between social structure and individual outcomes (3,4).

In a broader perspective, the findings underline that the digitalisation of higher education cannot be regarded as a neutral or automatically equalising process. On the contrary, without targeted institutional policies aimed at supporting the development of digital competences, digitalisation risks reproducing and reinforcing existing social inequalities. This issue is particularly salient in internationalised universities, where students enter higher education from diverse national education systems characterised by uneven levels of digital preparation.

Finally, several limitations of the study should be acknowledged. The data were collected within a single institution, which limits the generalisability of the findings. In addition, the use of self-reported measures may be associated with certain measurement constraints. Nevertheless, the study offers a valuable empirical contribution by focusing on the mechanisms through which digital inequality affects student outcomes and provides a solid foundation for future comparative and longitudinal research.

5.1. Comparative Context and Implications for Future Education

The comparative nature of the study, based on a sample of Bulgarian and international students studying within the same institutional environment, allows for a more precise interpretation of the role of national educational contexts in shaping digital inequality. Although university conditions are similar for all participants, the results indicate that students bring different forms of "digital capital" into the academic environment, accumulated through secondary education and the broader socio-economic context of their country of origin.

From this perspective, students from countries with more developed and standardised digital education policies, such as England and Ireland, demonstrate higher average levels of digital competence and better adaptation to the digital demands of university study. This is consistent with research emphasising the role of early and systematic integration of digital skills in school education for subsequent academic success (15, 16).

Students from Italy and Spain occupy an intermediate position, characterised by relatively good access to digital resources but more moderate levels of digital competence and social inclusion. This finding confirms the argument that secondary digital inequality related to skills and usage practices remains socially and institutionally stratified even in contexts with well-developed digital infrastructure (3,4).

More vulnerable profiles are observed among students from Greece, Turkey, and Bulgaria, where the results indicate greater variation in prior digital preparation and a stronger dependence of academic and social adaptation on individual digital competences. In these cases, digital inequality more often functions as a structural factor that amplifies the effect of socio-economic status on educational and social outcomes. These observations are consistent with studies showing that uneven development of digital skills in secondary education can lead to the "inheritance" of educational inequalities in higher education (8,18).

From the perspective of future education, the findings highlight the need for universities to avoid treating digital competence as a given prerequisite. Instead, diagnostic tools for assessing students' digital preparation upon entry should be implemented, particularly in international academic environments. Such an approach aligns with European-level recommendations for the development of inclusive digital higher education (18). At a practical level, this implies the development of preparatory and compensatory digital skills modules targeted at students with weaker prior IT training, as well as the integration of supportive mechanisms within the learning process. Research indicates that such interventions can positively affect not only academic outcomes but also social inclusion and students' sense of belonging to the university community (7,21).

More broadly, the comparative findings confirm that policies for the digitalisation of education should be context-sensitive and take into account differences in students' prior educational preparation. Without such an approach, digitalisation risks functioning as a mechanism for reproducing existing social and educational inequalities rather than as a tool for overcoming them (3,4).

Table 6. *Comparative Mean Values of Key Constructs by Nationality (n = 300)*

Nationality	Digital competence (M)	Digital resources (M)	Educational outcomes (M)	Social inclusion (M)
England	3.78	3.92	3.81	3.76
Ireland	3.85	3.95	3.88	3.82
Italy	3.41	3.70	3.55	3.48
Spain	3.52	3.74	3.61	3.54
Greece	3.28	3.58	3.42	3.36
Turkey	3.35	3.63	3.47	3.40
Bulgaria	3.19	3.55	3.38	3.31

Note: All indicators are measured on a five-point scale (1–5); higher values indicate higher levels of the respective construct.

The data in **Table 6** reveal pronounced differences between students from different national educational contexts, despite the shared university environment. The highest mean values across all indicators are observed among students from England and Ireland, consistent with research highlighting the systematic integration of digital skills in school education and higher average levels of digital competence in these countries (15,16). Students from Italy and Spain occupy an intermediate position, characterised by relatively favourable access conditions but more moderate levels of digital competence and social inclusion. Lower mean values among students from Greece, Turkey, and Bulgaria point to greater variation in prior digital preparation and a stronger dependence of academic and social adaptation on individual digital competences. These results align with empirical analyses showing that uneven development of digital skills in secondary education leads to the reproduction of educational and social inequalities in higher education (17, 20).

Table 7. *One-way ANOVA of differences by nationality*

Variable	F	p
Digital competence	6.84	< 0.001
Digital resources (access)	4.27	0.001
Educational outcomes	5.91	< 0.001
Social inclusion	5.48	< 0.001

Note: Factor – nationality (7 groups); N = 300.

The one-way ANOVA results indicate statistically significant differences between students from different national educational contexts across all key constructs. The most pronounced differences are observed for digital competence and educational outcomes, suggesting that the national context of secondary education exerts a lasting influence on students' digital capital and academic adaptation even within a shared university environment. These findings are consistent with comparative research demonstrating that national education systems and early digital skills formation play a crucial role in shaping students' digital trajectories and subsequent academic performance (3,12). Post-hoc analyses (Tukey HSD) reveal that students from England and Ireland demonstrate significantly higher levels of digital competence and social inclusion compared to students from Greece, Turkey, and Bulgaria. Differences between Italy and Spain, on the one hand, and the more vulnerable group of countries, on the other, are more moderate but remain statistically significant for digital competence and educational outcomes. This pattern aligns with prior empirical evidence showing that disparities in secondary digital education and curriculum integration translate into persistent inequalities in higher education outcomes (3, 15). Overall, the ANOVA and post-hoc results complement the regression and mediation analyses by demonstrating that national educational context remains a significant factor shaping differences in digital competence, educational outcomes, and social inclusion. These findings reinforce arguments in the literature that digital inequality should be understood as a structurally embedded phenomenon rather than an individual deficit, and they underscore the need for compensatory and adaptive digital learning strategies in higher education, particularly in international university settings (19).

CONCLUSION

The present study examines digital inequality in higher education as a multi-level social phenomenon and explores its role as a mediating mechanism between students' socio-economic status and their educational and social outcomes. Based on empirical data collected from 300 Bulgarian and international students studying within the same institutional environment, the study provides consistent evidence in support of the proposed conceptual model and the formulated hypotheses H1–H4. The findings demonstrate that socio-economic status is a significant factor shaping both digital access and digital competence, confirming the structural nature of digital inequality. Particularly important is the result that digital competence emerges as a stronger predictor of educational outcomes and social inclusion than formal access to digital technologies. This supports theoretical and empirical arguments that secondary digital inequality - related to skills and the effective use of technologies - plays a decisive role in shaping students' experiences in higher education.

The mediation analysis further shows that the effect of socio-economic status on educational outcomes and social inclusion is partially mediated by digital resources and, to an even greater extent, by digital competence. This indicates that social inequalities are not transferred directly into students' academic and social trajectories but are instead realised through differences in digital capital that students bring with them into the university environment. In this way, the study contributes to the existing literature by empirically confirming the role of digital inequality as a social mechanism through which broader educational inequalities are reproduced.

The comparative analysis by nationality reveals that even within a shared university environment, persistent differences exist that stem from national educational contexts and the

extent of prior training in information technologies. These differences highlight the importance of secondary education and national digital skills policies as long-term factors influencing academic adaptation and social integration in higher education. From a practical and policy perspective, the results of the study carry several important implications. Universities - particularly in international contexts - should not assume students' digital competence as a given but should implement diagnostic tools to assess digital preparedness upon entry. The development of compensatory and preparatory digital skills modules, alongside the integration of supportive mechanisms within the learning process, is necessary to reduce the risk of digital and social exclusion. Such interventions have the potential not only to improve academic performance but also to enhance social inclusion and students' sense of belonging within the university community. Alongside its contributions, the study also has certain limitations. The data were collected within a single institution, which limits the generalisability of the findings. In addition, the use of self-reported measures may be associated with specific measurement constraints. Nevertheless, the focus on mediation mechanisms and the comparative nature of the sample provide a solid foundation for future research. In conclusion, the present study demonstrates that digital inequality in higher education should not be viewed solely as a technical or infrastructural issue, but rather as a complex social process that requires targeted institutional and educational policies. Future research may extend the analysis by including multiple institutions, longitudinal data, and objective indicators of digital competence in order to achieve a more comprehensive understanding of the dynamics of digital inequality and its long-term consequences.

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