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FROM CAUTION TO EXCITEMENT – STUDENTS' ATTITUDES AND EXPERIENCES REGARDING DIGITALIZATION

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ABSTRACT: *The digitalization of social interaction and social life has become a defining feature of the educational process as well as the everyday lives of students. Based on data collected from a survey conducted in 2023 on a sample of 438 students at the University of Novi Sad, Serbia, this paper analyzes students' attitudes and experiences regarding digitalization in everyday life and higher education. The results show that, while students generally have a positive attitude toward digitalization in general and digitalization in higher education, their perceptions and experiences regarding this process are not uniform. While some students feel excitement about the process of digitalization, others express skepticism towards this phenomenon. Additionally, their perceptions and experiences differ due to their socio-demographic and socio-economic characteristics, educational portfolio features, and digital capital.*

KEYWORDS: *students, digitalization, digital capital, higher education, cluster analysis, Serbia*

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INTRODUCTION

The last decades of the 20th century brought significant changes across various spheres of social life (e.g., labor, production, education, culture, and everyday life). These macro- and micro-level changes were influenced by, among other factors, the intensified use of information and communication technologies (ICT) and related content. The mass production of personal computers, the development of the internet and proliferation of personal online accounts not only transformed production but also led to changes in: (a) communication, education, and information innovation; (b) the establishment, maintenance, or breakdown of social relationships; (c) identity formation and affirmation; (d) the establishment of dominance, the strengthening and exercise of power; and (e) mechanisms of social exclusion/inclusion, etc. (Ristić et al. 2014). Therefore, it is not surprising that, in contemporary societies, we now speak of digital transformation and even a digital revolution (Gong–Ribiere 2021; Kraus et al. 2021; Rindfleisch 2020). The 21st century has brought significant growth in ICT, with a major increase in software and application use, infrastructure development, artificial intelligence, the Internet of Things, big data management, and connectivity upgrades. At the same time, addressing risks associated with the cyber domain and the need for security regulation in the cyber world has become a priority.

The analysis of the digital environment in contemporary societies has raised several important questions,[2] one of which is the issue of digital capital. Regardless of its interpretations (Seale 2013; Ragnedda et al. 2020; Verwiebe–Hagemann 2025), digital capital entails possessing and using digital knowledge and skills, as well as devices and tools (Ragnedda 2018; Clamor–Saloma 2023; Čikić–Kišjuhas 2024). It is socially determined and "variable in terms of quantity, quality, adequacy, composition, structure, distribution, etc." (Čikić–Kišjuhas 2024: 362).

Multiple studies have sought to measure and analyze digital capital, particularly in relation to various sources of social inequalities (e.g., age, gender, education, class, settlement type, disability, etc.) (Janschitz–Penker 2022; Ragnedda et al. 2020; Ristić–Kišjuhas 2023). The generational digital divide has been particularly intensively discussed, with no unequivocal conclusions. Some authors (Prensky 2001; Tapscott 1998) have suggested the existence of a

2 E.g., the creation and (mis)use of digital devices and content; the consequences of digitalization in everyday life; the impact of digital technology on identity formation and affirmation; the stimulation or restriction of social contexts for the development of the digital environment; the relationship between digital and social inequalities, etc.

generational digital divide, with younger generations (Millennials, especially Zed and Alpha) being identified as Net generations (Tapscott 1998) or digital natives (Prensky 2001) as they have been deeply immersed in the digital environment in both public and private spheres practically from birth. However, recent analyses have shown that younger generations are not automatically digital natives (Facer–Furlong 2001; Livingstone–Helsper 2007; Kuzmanović 2022). This implies that the relationship between digital gaps and generational affiliation must be viewed intersectionally, combined with other characteristics, such as sex/gender, level of education, income level, (lack of) support from family and friends, previous technical-technological experience, general social characteristics, etc. (Facer–Furlong 2001; Friemel 2016; Janschitz–Penker 2022; Lapa–Cardoso 2013; Ragnedda et al. 2020; van Boekel et al. 2017).

Digital capital "interacts with each single capital, and the fruits of this interaction have consequences both on the digital and on the social realm" (Ragnedda 2018: 2). This issue is particularly important with regard to young people and their online and offline life habits, perceptions, goals, and life chances (DiMaggio–Hargittai 2001; Salza–Samuel 2025). Since young people acquire and use a great deal of their digital capital through education, it is important to address this relationship in terms of the acceptance or rejection of digitalization in HE. Moreover, since young people's acquisition and use of digital capital extend beyond education, it is beneficial to examine the link between their experiences and attitudes towards digitalization in general and the digitalization of HE.

STUDENTS, DIGITAL CAPITAL AND DIGITAL HIGHER EDUCATION: OPPORTUNITIES AND CONSTRAINTS

Contemporary education has undergone important and (un)expected changes due to digitalization, affecting curricula, teaching methods and tools, relationships among various actors (teachers–students, students–students), desired outcomes, access and timing, individualization, flexibility, evaluation, management practices, etc. These issues have been particularly well-explored in the context of higher education (further: HE) (Alenezi 2021; Alexander 2020; Batista et al. 2021; Bosanac 2021; Kaplan ed. 2022; Kalimullina et al. 2021; Zain 2021). Higher education is expected to be a stimulating environment for the accumulation of digital capital (Čikić–Kišjuhas 2024). The digitalization of HE teaching and curricula, as well as academia overall, has been interpreted as a necessity for HE development (Bejinaru 2013). In this context, HE's

capacities and readiness for digitalization have been analyzed (Gkrimpizi et al. 2023; Akour–Alenezi 2022), driven by both internal and external demands (Fernández et al. 2023). Additionally, the COVID-19 pandemic encouraged the practice of and research into HE digital teaching, learning, communication, and management (Arsenijević et al. eds 2021; Fűzi et al. 2022; Osmanović-Zajić et al. 2022; Mospan 2023). Some positive aspects (the flexibility and individualization of the teaching process, flexibility in university operations, digital availability of teaching content, participation in various online events, development of the academic ICT infrastructure) have been observed, but limitations to HE digitalization were also noted (the digital divide among students and professors, additional tasks for professors, difficulty in integrating into the academic community, data protection requirements) (Fűzi et al. 2022; Nicklin et al. 2022).

As (mostly) members of younger generations (RZS – Statistical Office of Republic of Serbia 2023; *www.eurostudent.eu*), students are expected to be digitally literate and active. However, they do not all navigate digital spaces equally well. Namely, students are a socially heterogeneous population (Ilišin ed. 2014; RZS – Statistical Office of Republic of Serbia 2023; *www.eurostudent.eu*). Their personal characteristics (e.g., age, sex, socio-economic status, family support, type of residence) and educational portfolio features (e.g., year of university, excellence criteria) can potentially influence their ability to acquire and obtain digital capital (Janschitz–Penker 2022; Ben et al. 2012; Clamor–Salama 2023; DiMaggio et al. 2003; Čikić–Kišjuhas 2024). The development of students' digital capital and their more positive attitudes towards digitalization are influenced by their "advanced cognitive skills and academic achievement" (Kuzmanović 2022: 66), education for highly specialized professions, and "above-average social origin," i.e., growing up in "families with higher social and cultural capital" (Ilišin ed. 2014: 15) or different educational backgrounds/habitus (Scheerder et al. 2019). Students are also expected to be the "youth (but also future social) avant-garde and elite," meaning they should follow but also initiate social trends, becoming carriers of creative and innovative ideas (Ilišin ed. 2014: 16). They should be, more than other young people, digitally inclined and engaged; they also should be able to competently manipulate digital tools and content for educational, business, cultural, communicational, political, and other purposes – i.e., they should be more "digitally mature" (Schmidt–Tang 2020).

Therefore, an important aspect of contemporary HE research is the analysis of students' attitudes toward HE digitalization, as well as digitalization in general. In this way, it is possible to observe typical patterns in students' behavior and habits (Pohlenz et al. 2023), which can serve as guidelines for further developing digital practices in the academic environment, as well as in educational policies.

There are insufficient findings about this issue in Serbian society, even though "changes towards [the] digital transformation of universities are noticeable and expected (Education Development Strategy 2021)" (Čikić–Kišjuhas 2024: 363). Previous analyses of students' digital capital were mainly focused on single aspects/dimensions (Radovanović et al. 2015; Bradić-Martinović et al. 2020), while a recent attempt was made to obtain a more systematic view of students' digital capital, especially in HE (Čikić–Kišjuhas 2024). The results showed that students had moderate digital capital, both in general and in HE (ibid.), with the HE Digital Capital Index slightly lower than the general digital capital index. Additionally, previous research on students' attitudes towards digitalization of HE showed ambiguous results – from more optimistic (Kaličanin et al. 2020; Kolarski 2022; Marković 2023) to more pessimistic (Savić–Alčaković 2022; Radojević–Drobac 2021; Osmanović-Zajić et al. 2021; Mihajlović et al. 2024). The majority of these studies focused on the specific circumstances of the COVID-19 pandemic. This research aims to clarify previous findings and address the post-pandemic research gap.

Students' experiences and attitudes towards digitalization, in general and in HE, were analyzed based on their relationships with, and experiences using digital technologies and content. Based on previous research (Prensky 2001; Tapscott 1998; Čikić–Kišjuhas 2024), the analysis started from the hypothesis that students (as members of the digital native generation) have positive attitudes and experience towards the use of digital technologies and content, both in general and in the HE. Nevertheless, due to the heterogeneity of the student population (RZS – Statistical Office of Republic of Serbia 2023) and previous research findings (Janschitz–Penker 2022; Ben et al. 2012; Clamor–Saloma 2023; DiMaggio et al. 2003; Čikić–Kišjuhas 2024), the general hypothesis was examined using four additional assumptions:

- students' attitudes towards digital technologies and content in general and in higher education and their user experiences differ by their socio-demographic and socio-economic features (sex, age, settlement, employment during schooling, family financial situation);
- students' attitudes towards digital technologies and content, both in general and in higher education, and their user experiences are shaped by their educational portfolio features (faculty, budget financing, year of study, previous education, previous results in education);
- there is a positive correlation between students' attitudes towards digitalization in general and digitalization in HE teaching;
- the higher the students' digital capital, the more favorable their attitudes toward digitalization, both in general and in HE teaching.

METHOD AND DATA SOURCES

The analysis of students' experiences and attitudes towards digitalization in general and HE teaching is a part of broader research on their digital capital (Čikić–Kišjuhas 2024), which was conducted in November and December 2023 at the University of Novi Sad.[3] Research was approved by the Ethical Committee of the Faculty of Philosophy, University of Novi Sad (No. 02-662/7). All of the respondents were informed of the research subject and goal as well as the research procedure, both in written form and orally. Before they started to answer the questions, respondents gave written consent to participate in the research. No student declined to participate in the research.

A multiphase mixed sampling procedure was applied. First, eight faculties of the University of Novi Sad, Serbia, were selected using a stratified sampling procedure, ensuring that faculties of different scientific fields were represented in the sample. After that, the study programs were selected, followed by study years; finally, students were selected through purposive sampling. A total of 438 bachelor students from eight faculties of the University of Novi Sad participated in the research (Table 1). Nine respondents were excluded from the analysis due to missing data in their questionnaires. Their exclusion did not affect the main characteristics of the sample.

Students answered 32 questions, classified into the three batteries, in a face-to-face survey. The first battery of questions collected general data on respondents and their social background. The second group of questions referred to experiences and attitudes towards studying and education in general. The third group of questions addressed different dimensions of digital capital and students' perceptions of digital technologies and content in everyday life and education. Digital capital was measured by the Index of Students' Digital Capital (ISDC), which consisted of five dimensions: *Quality*, *Devices*, *Protection*, *Tools,* and *Skills* (Cronbach's α=0.732) (Čikić–Kišjuhas 2024). Dimensions were selected based on previous research (Janschitz–Penker 2022; Ragnedda et al. 2020; Clamor–Salama 2023). Each dimension consisted of second-level indicators, "taking into account the distinction between the general and the higher education contexts" (Čikić–Kišjuhas 2024: 365). Besides ISDC, the Index of Students' Digital Capital in education ($ISDC_e$) was also measured. This was based on five dimensions as well, of which three were the same as in ISDC, and two ($Tools_e$

3 The University of Novi Sad (UNS) is the second largest university in Serbia. It comprises 14 faculties and three institutes. UNS offers around 320 accredited study programs at the Bachelor's, Master's, Specialist, and PhD levels. According to the most recent available data, there are more than 48,000 students and 5,000 employees at the UNS (see www.uns.ac.rs).

and *Devices*$_e$) (Cronbach's α=0.709) were specific to the HE context.[4] Some of the questions in this section were based on those from the research of Janschitz and Penker (2022) and Ragnedda et al. (2020), with the necessary modifications to align with the characteristics of the social context of the research.

Table 1. *Sample – general characteristics (%)*

Sex	*%*	*Financing of studies*	*%*
Male	39.3	State-supported	72.6
Female	59.6	Self-financing	27.2
No response	1.1		
Study year	*%*	*Previous education*	*%*
First	50.7	Vocational high school	48.2
Second	26.0	High school	49.5
Third	10.3	College	0.0
Fourth	8.2	Faculty	1.3
Fifth	4.6	No response	0.9
Faculty	*%*	*Growing up in a…*	*%*
Faculty of Philosophy (FoPh)	18.7	Village	21.7
Faculty of Sciences (FoS)	17.4	Peri-urban area	0.7
Faculty of Technical Sciences (FoTS)	17.1	Smaller town	33.1
Faculty of Agriculture (FoA)	9.1	Medium-sized town	19.2
Faculty of Education (FoE)	11.2	City	24.1
Academy of Art (AoA)	3.9	No response	1.1
Faculty of Sport and Physical Education (FoFSPE)	18.5		
Faculty of Medicine (FoM)	4.1		
Previous education results	*%*	*Employment during schooling*	*%*
Excellent (A)	2.5	Yes	24.7
Good (B)	61.4	No	74.7
Satisfactory (C)	32.9	No response	0.7
Barely passed (D)	2.7		
Failed (F)	0.5		

The research was completely anonymous. Data was analyzed using SPSS 26.0 and appropriate statistical methods – descriptive statistics, nonparametric tests, and K-means cluster analysis. Cluster analysis was used to identify relatively homogenous groups within the sample of students. K-means cluster analysis enabled us to establish the most suitable number of clusters during the analysis itself.

4 For further information on ISDC and ISDC$_e$, consult (Čikić–Kišjuhas 2024).

RESULTS

The students' attitudes toward digitalization in general were analyzed based on eight characteristics (Table 2), which identified several aspects of their personal standpoint towards digitalization (e.g., addiction, anxiety, amusement, usefulness, optimism, curiosity, etc.). These characteristics were selected based on previous research (Pfaffinger et al. 2021; Pires et al. 2023; Kasket 2014). The results showed that, although students had a positive experience and attitudes toward digitalization (N=429; M=3.35; SD=0.544, Min=1.63, Max=5.00), there were differences in their perceptions of the process. By applying K-means cluster analysis, students were classified into three clusters – *convinced digital proponents, moderate digital proponents,* and *digital skeptics* – depending on their experiences and attitudes toward digitalization in general (Table 2). Clusters were identified after ten iterations. All relevant variables were significant for cluster identification. Members of clusters statistically significantly differed in all eight analyzed cluster elements. As expected, acceptance of digitalization varied among the identified clusters ($KW\chi^2(2)=235.360$, $p=0.000$) – it was strongest among members of the convinced digital proponents cluster (N=133; M=3.87; SD=0.360) and weakest among digital skeptics (N=136; M=2.91; SD=0.410).

Convinced digital proponents (31.4% of the surveyed students) clearly emphasized that they could not live without the digital world. They used the internet to gather information and entertain themselves, stay in contact with friend, or make new acquaintances. Convinced digital proponents regularly followed innovations in digital hardware and software. They were enthusiastic about the speed of digitalization. For these students, the virtual world was more entertaining than the real one. Although the digital setting was firmly integrated into their daily lives, convinced digital proponents believed they were not addicted to the internet and digital devices.

The second cluster – *moderate digital proponents* – was the largest (36.6%), and it shared many characteristics with the first cluster. Like convinced digital proponents, moderate ones also: (a) cannot imagine life without digital content and devices, (b) primarily use the internet to search for necessary information, and (c) find the virtual world to be helpful for communication and staying informed. Even more than convinced digital proponents, these students believed that digital content was more entertaining than the real world. However, what set them apart and made this cluster moderate in their digital optimism was students' fears of total digitalization and digital addiction. Namely, they had a stronger fear of total digitalization (which made them more like members of the third cluster). Unlike students from the other two clusters, these respondents

clearly stated that they were afraid they were addicted to digital devices.[5]

Table 2. *Students' experiences and attitudes towards digitalization in everyday life (% of students in the cluster)*

Characteristics	Convinced digital proponents	Moderate digital proponents	Digital skeptics
Life without digital content and devices is unimaginable	87.9	78.1	30.2
Keep up-to-date with digital trends	69.2	44.5	9.5
Internet as the first source of information	96.3	94.8	83.4
Excitement with the speed of the digitalization of modern world	64.6	47.1	28.7
Fear of total digitalization	24.0	85.1	78.0
Internet as a channel for communi-cation and information	91.0	87.7	75.8
Digital content is more entertaining than reality	17.3	33.6	5.2
Fear of digital addiction	11.3	74.2	5.9

In contrast to convinced and moderate digital proponents, there were digital skeptics (32.1%). They stated that life without digital content and devices would not pose a major problem. Surprisingly, the majority of digital skeptics also primarily seek necessary information online, which can be explained by established habits, convenience, and the general accessibility of digital information. For most students in this cluster, the digital environment facilitated communication, offered opportunities to discover new content, and establish new contacts. On the other hand, digital skeptics rarely follow digital trends. They were not thrilled by the speed of digitalization in the contemporary world and expressed a fear of total digitalization.[6] For them, reality was still more entertaining than the content offered in the digital world, and they believed they were not addicted to digital devices.

5 Compared to those students, convinced digital proponents and digital skeptics expressed less fear of being addicted to digital devices. This can be explained by their specific perception of digital behavior and habits – they did not perceive their digital habits as threatening or deviant. Thus, they considered that their digital habits would not lead to addiction.

6 Interestingly, fewer digital skeptics than moderate digital proponents expressed a fear of total digitalization (Table 2). This can be explained by their perception that life away from the digital world is possible and their significantly weaker fear of digital addiction.

There were two statistically significant differences[7] in students' characteristics depending on cluster membership (Table 3): (a) sex (χ^2=18.583, p=0.001, Cramer's V=0.148) which showed the highest proportion of male students among convinced proponents, and the highest proportion of female ones among digital skeptics, with (b) members of national minorities (χ^2=6.219, p=0.045, Cramer's V=0.121) being least well represented among convinced digital proponents.

Table 3. *Respondent characteristics and cluster membership (% of students in the cluster)*

Characteristics	Convinced digital proponents	Moderate digital proponents	Digital skeptics
Sex	53.4% male	65.7% female	66.9% female
Age	20.2 years	20 years	21.1 years
Settlement type	30.8% small town	33.5% small town	35.1% small town
Employment during schooling	27.5%	20.6%	28.1%
Excellent financial situation	47.7%	42.6%	39.8%
National minority	1.5%	7.7%	4.4%
Parenthood	0.8%	0.0%	3.0%
Faculty	23.3% FoS	21.9% FoPh	22.8% FoPh
State-supported financing	69.7%	78.7%	70.6%
Year of study	51.5% first	52.3% first	45.6% first
Previous education	52.6% vocational	52.9% grammar	52.2% grammar
Previous educational results	57.1% good (B)	62.6% good (B)	64% good (B)

Results showed weak to moderate statistically significant correlations between ISDC (r=0.407, p=0.000) and $ISDC_e$ (r=0.377, p=0.000) and students' opinions of digitalization in general. The values of both ISDC (KWχ^2=31.095, p=0.000) and $ISDC_e$ (KWχ^2=24.484, p=0.000) differed among the three clusters that were identified. While convinced digital proponents had an above-average ISDC and $ISDC_e$ (57.2 and 54.9), the values of both indexes for moderate digital proponents (52.3 and 50.8) and especially digital skeptics (49.6 and 47.8) were below average[8]. No statistically significant difference was identified in only one dimension of ISDC – *Protection* (KWχ^2=2.942, p=0.230). Other dimensions showed statistically significant differences – *Quality* (KWχ^2=6.825, p=0.033),

7 There was no statistically significant difference in the age of the respondents in the three clusters, residence according to the settlement type, employment during studying, family financial situation, faculty, study financing, type of previous education, or marks in previous school.

8 The average value of ISDC was 52.97, and for $ISDC_e$, 51.1.

Devices ($KW\chi^2$=19.110, p=0.000), *Tools* ($KW\chi^2$=10.655, p=0.005), and *Skills* ($KW\chi^2$=18.928, p=0.000), indicating the best quality of connection and devices, more diversified devices, the use of more digital tools, and more developed digital skills among convinced digital proponents (Table 4). The differences in scores were greatest for the dimensions *Skills* and *Devices*.[9] Differences were also identified in two specific dimensions of $ISDC_e$ – $Devices_e$ ($KW\chi^2$=7.691, p=0.021) and $Tools_e$ ($KW\chi^2$=6.926, p=0.031), in favor of convinced digital proponents.

Table 4. *Scores for ISDC and $ISDC_e$ dimensions according to the three identified clusters*

Cluster	Quality	Devices	Protection	Tools	Skills	$Devices_e$	$Tools_e$
Convinced digital proponents	80.64	43.42	81.58	61.39	42.56	37.97	62.81
Moderate digital proponents	78.31	39.14	78.43	56.75	34.98	34.84	57.68
Digital skeptics	74.36	36.40	81.66	54.98	32.31	33.27	56.67

Students' experiences and attitudes towards digitalization in HE teaching were also generally positive (N=429; M=3.52; Md=3.50; SD=0.453, Min=1.50, Max=4.50). Again, students were not homogeneous. Based on ten features,[10] they were classified into two clusters – students attending digitally less stimulating HE and students attending digitally more stimulating HE (Table 5). Clusters were identified after 13 iterations, with all variables being significant for cluster identification. The clusters statistically differed in eight out of ten analyzed elements – there was no difference in attitudes towards the negative consequences of excessive reliance on the internet on memory and knowledge (χ^2=6,818, p=0.146) and knowing colleagues who used digital devices to cheat on exams (χ^2=6,387, p=0.172).

9 The score for the *Devices* dimension among convinced digital proponents was 19% higher than that for digital skeptics (43.4 and 36.4). The score for the *Skills* dimension among convinced digital proponents was 32% higher than that for digital skeptics (42.6 and 32.3).

10 The features were selected based on previous research (Novikova et al. 2023; Tzafilkou et al. 2021; Gonçalves et al. 2020).

Table 5. *Students' experiences and attitudes towards the digitalization of higher education teaching (% of students in the cluster)*

Characteristics	Digitally MORE stimulating HE	Digitally LESS stimulating HE
Most teaching materials are digitalized	86.0	25.1
There is no substitute for teaching in vivo	61.5	81.4
I have colleagues with poor access to digital connections and devices	14.0	21.2
Software and applications are available as a teaching aid	74.2	28.6
Use of digital devices is allowed during class for teaching purposes	75.5	26.1
I have colleagues who used digital devices to cheat on exams	28.9	39.7
Digital content and technologies make teaching more interesting	80.1	62.8
It is easier to learn from books than from a computer, tablet, or phone	79.6	90.0
Digital content and technologies contribute to learning	58.4	40.7
Students today know less and have poorer memory due to excessive reliance on the Internet	55.2	62.3

The first cluster comprised students (52.6%) who attended digitally more stimulating HE (M=3.67; SD=0.413). They described most of their teaching materials as being digitized. Also, they were offered various digital teaching tools to help with mastering the syllabi. Three-quarters of the students reported being allowed to use digital devices in their classes for educational purposes. The use of digital content and ICT made teaching more interesting for them and helped them learn better. Compared to those in the second cluster, these students were less likely to believe that "live" classes were irreplaceable or that it was easier to learn from printed materials than from digital devices. Moreover, a few students attending classes in more digitally stimulating HE experienced having colleagues who lacked access to digital devices and connection, or who had misused digital devices to cheat on exams.

The second cluster consisted of students (47.4%) who reported that teaching at the faculties they attended was less digitized (M=3.35; SD=0.438). However, it did not seem to pose a significant problem for them. These students reported having fewer digitized teaching materials available and being offered less digital teaching assistance (e.g., software, applications, platforms, digital devices). Additionally, they were less likely to believe that digital content made classes more interesting. In contrast, they predominantly believed that no digital teaching content (e.g., e-books, presentations, online courses, video

materials) can replace "live talk," i.e., in-person contact between the professor and the students. They expressed concern that students today know less and have poorer memories due to their excessive reliance on the internet as a source of information. For the vast majority in this cluster, it was easier to learn from traditional (printed) rather than digital materials, while a smaller portion mentioned that using digital content and technology during classes helped them learn better. Compared to the first cluster, there were more students attending classes in less digitally stimulating HE who had experienced having colleagues who lacked access to digital devices and connections, or misused digital devices to cheat on exams.

The differences in socio-demographic and socio-economic characteristics and educational portfolio features among the members of the two identified clusters were not statistically significant (Table 6), except for the faculty they attended (χ^2=102.773, p=0.000, Cramer's V=0.495) and state-supported financing (χ^2=5.077, p=0.024, Cramer's V=0.110). Students from the more digitally stimulating HE were more likely to study engineering and the sciences, while students from the second cluster, as expected, more frequently attended non-technical faculties. Interestingly, among students in the first cluster, there was also a notable presence of students from the Faculty of Education, i.e., teachers-to-be.

There was a moderate statistically significant correlation between the perception of digitalization in general and the perception of the digitalization of HE teaching (r=0.454, p=0.000), and therefore a difference between belonging to one of the clusters (χ^2=8.059, p=0.018, Cramer's V=0.139). Among those studying in digitally more stimulating HE, 37.2% were convinced digital proponents, 33.9% moderate ones, and only 28.9% were digital skeptics. On the contrary, moderate digital proponents (39.1%) and digital skeptics (36.5%) were in the majority, with less than a quarter of convinced digital proponents among students in the second cluster. Results showed that 62.8% of the convinced digital proponents studied in a digitally more stimulating HE, compared with 46.7% of digital skeptics.

Table 6. *Respondent characteristics and cluster membership (% of students in the cluster)*

Characteristics	Digitally MORE stimulating HE	Digitally LESS stimulating HE
Sex	40.9% male	35.7% male
Age	20.4 year	20.5 year
Settlement type	20.5% rural	24.0% rural
Employment during schooling	23.6%	26.9%
Excellent financial situation	44.4%	40.9%
Faculty	27.1% FoS, 27.1% FoTS, 12.2% FoE	31.2% FoSPE, 25.6% FoPh, 10.6% FoA
State-supported financing	68.6%	78.4%
Year of study	49.5% first	49.7% first
Previous education	52.7% gymnasium	51.0% vocational
Previous education results	66.0% A+B	62.3% A+B
Average marks	8.44	8.50

Data showed weak but positive correlation between students' attitude to digitalization in HE and their ISDC (r=0.148, p=0.000) and $ISDC_e$ (r=0.197, p=0.000). ISDC (t(429)=3.579, p=0.000) and $ISDC_e$ (t(429)=3.870, p=0.000) statistically differed, according to students' cluster's membership. Students studying in a digitally more stimulating HE had greater ISDC and $ISDC_e$ (54.8 and 53.4) than those studying in a digitally less stimulating HE (50.8 and 48.3). The results showed no statistically significant differences in three of five ISDC dimensions – *Quality* (t(429)=0.713, p=0.476), *Devices* (t(429)=1.007, p=0.315), and *Protection* (t(429)=1.156, p=0.248). Statistically significant differences were observed in the dimensions *Tools* (t(429)=4.554, p=0.000) and *Skills* (t(429)=3.595, p=0.000), indicating that students studying in a digitally more stimulating HE used more diversified digital tools and developed more diversified digital skills in general (60.6 and 39.7) than those studying in a digitally less stimulating HE (54.1 and 32.6). Analysis showed there was no statistically significant differences in the dimension $Devices_e$ among students of various clusters (t(429)=1.055, p=0.292), while there was a statistically significant difference in the dimension $Tools_e$ (t(429)=4.271, p=0.000), as students in digitally more stimulating HE used more diversified digital tools for learning purposes than those in digitally less stimulating HE (62.3 to 55.0).

DISCUSSION

The results confirmed the overall positive experiences and attitudes among students at the University of Novi Sad towards digitalization in general, as well as in HE teaching. Findings correspond with some previous studies, both national (Kaličanin et al., 2020; Kolarski 2022) and international (Alam et al. 2023; Arik 2021; Frolova – Rogach 2021; Pohlenz et al. 2023; Schirmer 2024). However, some Serbian authors have found students to be less keen on online teaching in HE (Savić–Alčaković 2022; Radojević–Drobac 2021; Osmanović-Zajić et al. 2021), especially when compared to traditional lecturing. However, these studies were conducted within a specific time frame and context (the beginning of the COVID-19 pandemic and sudden changes in lecturing practices), which must be taken into account when comparing findings. In the post-COVID era, HE has become more digitalized, and students have become more accustomed to online or hybrid teaching and learning practices, which might have altered their experiences and led to more favorable attitudes toward digitalization.

Students' views on digitalization in general and in HE teaching varied depending on certain socio-demographic, socio-economic, and educational portfolio characteristics (e.g., sex, digital capital, minority status, faculty), thereby partially confirming the first and second additional hypotheses. The identified clusters verified that there is no universal experience of 'digital natives' among students, even though they (mainly) belong to the generation among which this would be expected. That aligns with previous findings on intersectionality, which shape heterogeneous standpoints towards digitalization and digital inequalities (Alam et al. 2023; Janschitz–Penker 2022; Radovanović et al. 2015; Ragnedda et al. 2020). The identified clusters, particularly the digital skeptics, can also be understood in the context of Selwyn's findings (2016: 3) on the "more mundane and 'messy' realities of students' engagement with digital technology". Students' different standpoints towards digitalization can also be understood in terms that those "who are constantly confronted with expectations and norms regarding their 'digital functioning' as a form of social pressure may experience more overuse" (Büchi et al. 2019: 1) with an elevated critical awareness of digitalization, both for individual well-being (Büchi et al. 2019) and social life (Montag – Walla 2016).

The results confirmed the third and fourth additional hypotheses, indicating a positive feedback loop between students' digital capital and their standpoints on digitalization. Such results, further influenced by a digitally stimulating setting, align with the previous findings (Hammer et al. 2021; Courtois–Verdegem 2016). Available digital infrastructure, content, and, moreover, digital experts (Stewart 2007; Bakardjieva 2005) facilitate the development of digital capital and positive

views on digitalization. In fact, experience and attitudes towards digitalization could be interpreted as both a major part of and an outcome of digital capital. Rightfully, the question of the influence of HE institutions on the development of students' digital capital and, therefore, on the shaping of their attitudes and experiences of digitalization could be posed. Also, it might be interesting to analyze how students' digital capital and standpoints on digitalization are being transformed into 5Cs.

The identified clusters could also be compared to findings of Pohlenz et al. (2023), who identified three clusters of German students: digital proponents, pragmatics, and skeptics. With the key specifics of that research and our research in mind (timing, German/Serbian experience, variables, and research goals), both surveys indicate distinct digital tracks that students follow, which, although somewhat different, are not necessarily oppositional.

In our case, clusters of students based on their standpoints towards the digitalization of HE teaching revealed two tendencies in the digital transformation of academia. These tendencies are influenced by: (a) the demands of the academic field to which the studied sciences belong; (b) the development of digital academic infrastructure; (c) students' specific digital habits; (d) the readiness of professors to digitalize the HE teaching process; and (e) potentially, the requirements of the labor market regarding professional knowledge and skills. Studying science and engineering proves to be digitally more stimulating than studying the social sciences and humanities. This could be linked to the scope and depth of changes that digitalization has caused in the non-academic work environment and the professional demands of technical and non-technical careers. Additionally, it is interesting to consider the famous (albeit problematic) division into "soft" and "hard" sciences in university teaching and to examine digitalization from the perspective of different "academic tribes" or "epistemic cultures" (Kišjuhas et al. 2025). However, belonging to a particular "tribe" does not necessarily determine a certain level or type of digitalization, as the ways in which ICT and digital content in teaching are being used and perceived "appeared to be shaped by dominant university models of the 'transmission' of learning" (Henderson et al. 2015: 317). Moreover, the assessment of HE as digitally more or less stimulating can be undertaken based on the characteristics of digitally-supported teaching practices, in terms of whether the latter are "creative, collaborative, participatory and hyper-connected" or simply "centered on the completion of set learning tasks in an expedient and/or efficient manner" (Entwistle–Ramsden (1983) cited by Henderson et al. 2017: 1576).

There are a few limitations of this research. First, the sample is focused on a single university and only on BSc students. The experiences and attitudes of graduates and PhD students might differ from those of undergraduates due to a

more individualistic teaching approach, greater teaching and learning demands, perceived differences in digital capital, and their professional enrollment. Also, the anonymity of the collected data prevents the survey from being repeated to measure the impact of HE teaching on potential changes in students' experiences and attitudes towards digitalization. A longitudinal study involving students in both their first and final years of study would allow monitoring of how experiences and attitudes toward the digitalization of HE teaching affect academic efficiency and success, dropout rates, students' willingness to change or continue their studies, and even their future employment prospects. Further, a few more aspects of the issue could be analyzed (e.g., the use of different digital teaching tools).

CONCLUSION

Research results confirmed the main hypothesis and two of the four additional hypotheses.[11] Affirmative attitudes towards digitalization, both in general and in higher education teaching, were expected to be identified, given students' continuous, multiple, and deep integration into a digital environment. The clustering proved to be a useful tool for identifying specific patterns in students' experiences and perceptions of digitalization. The results can serve as a basis for further research on various aspects of HE digitalization (e.g., the digitalization of higher education administration or communication between students and professors). Also, the experiences and attitudes of both students and professors across various aspects of HE digitalization can be analyzed as well (e.g., teaching methods and materials, satisfaction with the teaching process, students' and professors' workloads, achievement of learning outcomes, need for digital knowledge and skills as part of the curriculum, evaluation of teaching work, etc.).

Lastly, students' experiences and attitudes towards the digitalization of HE teaching are important aspects in the creation and analysis of educational policies. This is evidenced by current trends in European higher education policy and conclusions reached at recent ministerial conferences within the European Higher Education Area (Paris Communiqué 2018; Rome Ministerial Communiqué 2020; Tirana Communiqué 2024). In Serbia, the

11 The third and fourth additional hypotheses were confirmed, while the first and second additional hypotheses were partially confirmed.

current strategic framework remains ambiguous regarding digitalization in higher education – e.g., the *Education Development Strategy* (2021) identifies HE digitalization as one of its goals and outlines specific measures (e.g., the introduction of digital platforms, electronic student records, and the development of appropriate legal regulations). However, other relevant documents, including the *Law on Higher Education* (2025), do not address this issue (Kolarski 2022). The relevant Ministry is also tasked with developing guidelines for HE institutions on the introduction of digital platforms and will support institutions in joining and participating in Erasmus initiatives (*Education Development Strategy* 2021). However, the official guidelines for digital competences in teaching and learning within higher education have not yet been clearly defined. This gap calls for urgent attention, particularly given that any policy solution should also deal with the "cultural and social norms around digitization and well-being in an information society" and address specific cultural delays caused by the "rapid introduction of digital tools" and should aim to mitigate digital and social inequalities (Gui–Büchi 2019: 12–13).

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