BULGARIAN ACADEMY OF SCIENCES

PROBLEMS OF ENGINEERING CYBERNETICS AND ROBOTICS • 2025 • Vol. **83**, pp. 3-17 p-ISSN: 2738-7356; e-ISSN: 2738-7364 https://doi.org/10.7546/PECR.83.25.01

Use of Digital Devices by Digital Immigrants and Digital Natives

Viktoriya Muchanova

Institute of Information and Communication Technologies, Bulgarian Academy of Sciences, Sofia, Bulgaria Email: viktoriya.muchanova@iict.bas.bg

Abstract: The aim of this study is to examine the perceptions and habits of Bulgarian users in the context of the use of digital devices and technologies, as well as user experience (UX). The research was conducted from September 2020 to February 2023, with 197 individuals living in Bulgaria, primarily students, as well as a small number of adults. Two types of surveys were used to collect data: the first focuses on the use of information and communication technologies and UX evaluation, while the second focuses on the use of digital devices in everyday life and their significance for education and entertainment. The results show differences between age and educational groups in terms of device usage habits, work and entertainment habits, and perceptions of UX for technologies such as virtual reality (VR).

Keywords: digital devices, user experience, information and communication technologies, virtual reality, educational technologies, user habits.

1. Introduction

In recent decades, technology has significantly transformed people's lives, with digitalization impacting more and more areas of our daily lives. Research in the field of user experience (UX), focusing on digital devices [1-3], is essential for understanding how different user groups interact with new technologies. The UX definitely relies on a variety of icons and that is why special attention is to be paid to images used as icons [4]. In this regard, it is worth mentioning the proposed two-stage approach to studying the excessive use of smart technologies [5]. The adoption of digital technologies depends on various factors such as age, education,

social environment, and personal preferences. According to Mark Prensky, in his work "Digital Natives, Digital Immigrants," the way the brain functions physically depends on how individuals grow up. The brain of a person born in the 1980s works differently from that of someone born after 2000. He argues that the very pattern of information processing differs, introducing the following terms that will be used in this study: "digital natives" – those born after the advent of digital technologies, and "digital immigrants" – people who lived before that [6].

The aim of this study is to analyse the differences in the use of digital devices between students, pupils, and adults in Bulgaria. The research focuses on two main areas: the use of technology for education and entertainment, and the evaluation of user experience with new technologies such as virtual and augmented reality. The obtained results from the conducted survey could give information about how digital technologies are used by different age groups and how these technologies impact users' daily lives.

2. Methodology and Surveys

The study was conducted in two phases. In the first phase, from September 27, 2020, to December 3, 2021, the author surveyed 27 students from the University of Library Studies and Information Technologies (UniBIT), using a questionnaire that included 22 questions related to the use of information and communication technologies and user experience – Survey 1. In the second phase, from January 13, 2023, to February 3, 2023, 130 students aged 10 to 19 and 40 adults aged 20-55+ years were surveyed, using a questionnaire that included 29 questions focusing on the use of digital devices in everyday life – Survey 2.

2.1. Survey structure

The surveys were structured into four main sections:

- *Identification*: Age, education, occupation, place of residence.
- *Digital devices as part of everyday life*: How users interact with technologies in different everyday situations.
- User experience and established habits: Users' habits for using digital devices and their perception of the convenience and efficiency of these devices.
- User experience with new technologies: Users' impressions of innovations such as virtual reality (VR) and augmented reality (AR).

2.2. Survey results

The survey results show a clear division in digital device usage depending on age. While all students actively use digital technologies for education (Fig. 1), half of the younger students (ages 10-19) prefer traditional learning methods (Fig. 2). Among adults, the use of digital technologies for work and education is more

widespread, with an average of 8 hours per day spent on devices for these purposes.

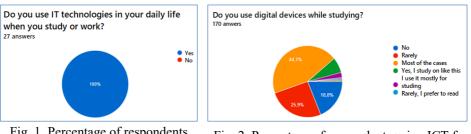


Fig. 1. Percentage of respondents using ICT for work or learning (Survey 1)

Fig. 2. Percentage of respondents using ICT for work or learning (Survey 2)

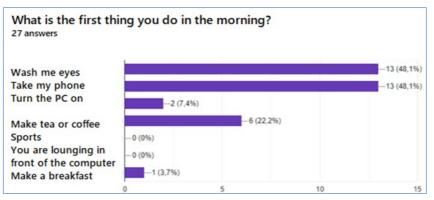


Fig. 3. Morning habits of respondents from (Survey 1)

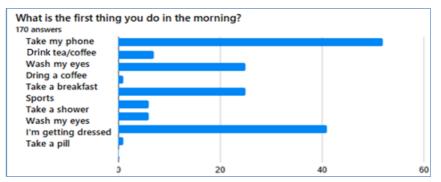


Fig. 4. Morning habits of respondents from (Survey 2)

The study shows that 30% of the respondents start their day by using their mobile phones, indicating a high level of dependence on mobile technologies right from the start of the day (Fig. 3) and (Fig. 4). For many users, the smartphone is

the primary means of accessing information and communication, demonstrating how integrated this device is in the daily life of young people.

User ratings for app customization are presented in (Fig. 5) and (Fig. 6). The results show that over 80% of all users prefer apps that can be personalized.

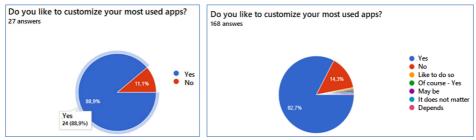
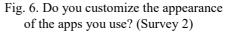


Fig. 5. Do you customize the appearance of the apps you use? (Survey 1)



Our study is consistent with other research that shows that the effectiveness of people's interactions with digital devices is influenced by various characteristics of an individual's cognitive style. Cognitive styles influence users' effectiveness, success, and satisfaction when interacting with digital devices [7].

Another part of the study focuses on the use of digital devices supplemented with virtual technologies. Virtual reality for educational technology is applied to bring real-life experiences into the classroom, while emphasizing the ability of technology to inspire and capture students' attention [8].

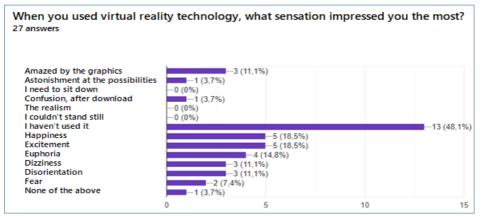


Fig. 7. Impressions of VR technology (Survey 1)

Although 62.9% of the surveyed students and 60.1% of the pupils expressed positive impressions of using virtual reality (VR), not all groups have easy access to this technology (Fig. 7) and (Fig. 8).

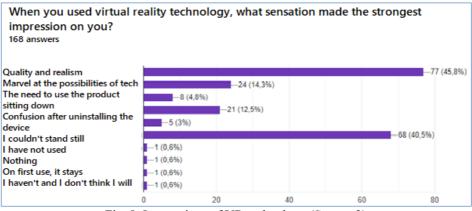


Fig. 8. Impressions of VR technology (Survey 2)

Only about half of the students have used VR technologies, which may be related to their higher educational background and the availability of equipment.

According to more than 70% of the respondents, the two most important criteria for a quality product are: "The product should be useful" and "The product should be easy to use" (Fig. 9) and (Fig. 10). This is one of the reasons these two criteria are prioritized among the seven criteria for good UX design of products [9].

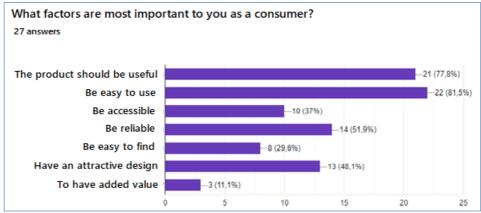


Fig. 9. What factors contribute to UX, according to respondents (Survey 1)

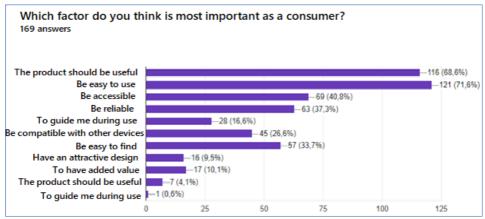


Fig. 10. What factors contribute to UX, according to respondents (Survey 2)

3. Analysis of Results

When considering the age distribution of responses, it becomes evident that students, who are digital immigrants, have integrated into the technological ecosystem and use more technological solutions for a wider range of purposes in their daily lives compared to pupils. Among digital natives, aged between 10 and 15 years, technology usage is primarily for entertainment and communication. As a general conclusion, it is observed that the time spent using digital devices and the variety of applications used over a 24-hour period increase with age.

There is a clear trend in the preferences for software personalization among both students and pupils, indicating that this is a key criterion for user experience when using digital devices.

The study found that around 50% of all respondents had used virtual reality (VR) technologies and had positive impressions. Improving accessibility to this technology will increase the number of users.

Regarding education, students use digital technologies not only for academic purposes but also for work, while pupils often prefer other forms of learning that do not require extensive digitalization. The conclusion that can be drawn is that the digitalization of education is advanced in universities, but there are still many areas for development of the digital infrastructure in secondary schools.

4. Conclusion

The study concludes that digital technologies and devices play an important role in the lives of users in Bulgaria, as they are used in various contexts – from education to entertainment. The studied groups – pupils, students, and adults –

show differences in their digital device usage habits, with adults spending more time on work and learning, while young people spend more time on entertainment. Furthermore, user experience is central to the choice of devices and technologies, with the most used devices being smartphones and laptops due to their mobility and easy accessibility. Positive impressions of virtual and augmented reality technologies indicate the growing importance of innovations in users' everyday lives, but access to these technologies is still limited.

The findings of this study can be useful for the development of new technologies and educational platforms that meet the needs and habits of different age groups and offer a better user experience.

References

- Van der Linden, J., Hellemans, C., Amadieu, F., Vayre, E., & van de Leemput, C.: User Experience (UX) with Mobile Devices: A Comprehensive Model to Demonstrate the Relative Importance of Instrumental, Non-Instrumental, and Emotional Components on User Satisfaction. International Journal of Human– Computer Interaction, 1–12 (2024).
- 2. Okonkwo, C.: Assessment of User Experience (UX) Design Trends in Mobile Applications. Journal of Technology and Systems, 6(5), 29–41 (2024).
- Chikurteva, A., Spasova, N., Chikurtev, D.: E-learning: technologies, application and challenges. In: 2020 XXIX International Scientific Conference Electronics (ET), Sozopol, Bulgaria, pp. 1–4 (2020).
- Buhtiyarov, N., Borissova, D.: An approach for visualizing SVG sprites systems. In: Rocha, Á., Ferrás, C., Ibarra, W. (eds) Information Technology and Systems. ICITS 2023. Lecture Notes in Networks and Systems, 692, 397–407 (2023).
- 5. Borissova, D., Dimitrova, Z., Garvanova, M., Garvanov, I., Cvetkova, P., Dimitrov, V., Pandulis, A.: Two-stage decision-making approach to survey the excessive usage of smart technologies. Problems of Engineering Cybernetics and Robotics, 73, 3–16 (2020).
- Prensky, M.: Digital Natives, Digital Immigrants Part 1, On the Horizon, 9(5), 1– 6 (2001).
- Bakanova, N., Bakanov, A., Atanasova, T.: Modelling human-computer interactions based on cognitive styles within collective decision-making. Advances in Science, Technology and Engineering Systems Journal, 6(1), 631– 635 (2021).
- Petrov, P., Atanasova, T.: An overview of virtual and augmented realities in STEM education, In: 33rd annual European Simulation and Modelling Conference ESM®'2019 -EUROSIS-ETI, Universitat de les Illes Balears Palma de Mallorca – Spain, pp.123–128 (2019).
- 9. Interaction Design Foundation, https://www.interaction-design.org/, last accessed 2024/11/12.

Appendix I

Survey "User Experience (UX) Evaluation Survey Combined with Information and Communication Technologies" - Appendix No. 1 Number of respondents: 27 students in "Computer Science" and "Information Technologies" Total number of questions: 22 1. Which age group do you belong to? \Box Under 18 years 40-55 years Over 55 years 18 - 29 years 30-40 years 2. Education level? Primary education Master's Secondary education Doctorate Bachelor's 3. In which field do you work? □ Information Technologies Management Medicine Finance □ Marketing and Advertising Hospitality and Tourism □ Library Sciences Music Art 4. Where do you live in Bulgaria? In a city In a small settlement In a large settlement 5. Do you use IT technologies in your daily life for entertainment, learning, or work? □ Yes □ No 6. Do you perceive instructions better when they include images? No Rather ves Rather not Yes Neutral 7. How would you categorize UX as part of the product development process? Using UX is essential for □ Considering UX is useful when developing a successful building a service/product service/product □ Using UX is an unnecessary Using UX is an important investment of time and money factor during the creation of a

service/product

taste? □ Yes Other □ No 10. What are the first two things you do when you wake up? \Box Wash your face Lounge in front of the Take your phone computer with phone and Turn on the computer coffee Make coffee/tea □ Other Exercise 11. Have you experienced discomfort when using devices that add 3D effects to objects: glasses or headsets? Yes, I prefer headsets, glasses give me a headache realism it achieves I've only used glasses, without I haven't used them discomfort 12. When using a device/product, what is most important to you? The product should be useful The product should be The product should be ready to use immediately The product should guide me during use a specific company The product should be beautiful

and comfortable

13. When you've used a virtual reality system, what impressed you most?

- Amazement at the graphics
- Surprise at the possibilities of the product
- The need to use the product while seated
- Confusion after removing the product
- 14. Do you like applications with augmented reality for various landmarks that provide additional information about them?
 - Yes

- 8. Which factors are most important to you as users? (mark 3)
 - The product should be useful
 - It should be easy and convenient to use
 - It should be accessible
 - It should be reliable
- 9. Do you like to customize the most frequently used applications to your

- No. I use them and I like the
 - compatible with other devices
 - The product should be licensed
 - The product should come from
 - the latest technologies

- It should be easy to find
- It should be attractive, based on innovative technologies
- It should have added value

- The product should integrate

 - Other

- - Realism made me smile
 - I couldn't sit still, but I was afraid to move my legs
 - □ I haven't used it
 - □ Other

	Yes, I really like it and find it useful I wouldn't install such apps on my phone		No, I prefer to enjoy the place rather than looking at my phone Other
 15. Do you have an IT brand/company whose services/products you prefer because they pay special attention to your experience while using them? Please provide an example. The answer to this question is open			
 16. Are there services/products you stopped using because they didn't meet your needs? Please provide an example. The answer to this question is open			
17. Do you regularly use any of the technologies listed in question 17 in			
	our daily life? Augmented Reality Virtual Reality	_	3D Technologies No
18. If you use any of the technologies listed in question 17, please specify the			
re	eason.		
	For pleasure For work	[☐ For learning
19. In your opinion, do the technologies listed in question 17:			
	Make our lives easier Complicate our lives	[I cannot answer
20. Do you like to visit museums virtually through 360-degree photos?			
	Yes		No, because if the
	Yes, I like that I can view		movement isn't realistic, I
	everything calmly in detail No		get disoriented Other
 21. When do you update the IT technologies you use? □ They update automatically □ When the new solution is 			
	Immediately when I can	L	easy and convenient to use
	When the new solution	Г	When circumstances
	increases the usefulness of		demand it
	the technology	[When the technology is no longer in use

Survey "Digital Devices Usage Survey" - No. 2

Number of respondents: 170 Bulgarian citizens living in the Republic of Bulgaria Total number of questions: 29

1. Which age group do you belong to?

- □ Under 10 years old
- \Box 10 15 years old
- 16-18 years old
- \Box 19 29 years old

2. What is your level of education?

- \Box No education
- □ Primary education
- □ Secondary education
- \Box High school education

3. What is your occupation?

- □ Student
- □ University student
- □ Teacher
- □ Parent
- □ Unemployed

4. In which field do you work?

- □ Information Technology
- □ Medicine
- □ Marketing and Advertising
- □ Education
- □ Management
- □ Finance

5. What is the first thing you do in the morning?

- \Box Wash my face
- D Pick up my phone
- Take a shower
- Drink coffee/tea

- $\begin{array}{ll} \hline & 30 39 \text{ years old} \\ \hline & 40 55 \text{ years old} \end{array}$
- $\Box \quad 40 = 35 \text{ years old}$
- □ Over 55 years old
- Vocational high school education
- Bachelor's degree
- □ Master's degree
- Doctorate
- □ Worker/Employee
- □ I hold a managerial position in a company
- □ Other
- Hospitality and Restaurant Industry
- □ Culture
- □ I do not work
- Other
- ☐ Have breakfast
- Get dressed
- Exercise
- □ Other

6. How much time do you spend on electronic devices while working/studying?

- \Box 0 hours
- \Box Up to 30 minutes
- \Box Up to 60 minutes
- \Box Up to 2 hours
- Up to 4 hours

7. Since when have you been using digital devices?

□ Since I can remember

- Up to 6 hours
- \Box Up to 12 hours

For 1 year

- □ More
- □ Other

- For 5 years For 10 years 8. Do you use electronic devices for learning? \square No Rarely, I prefer reading In most cases 9. What digital devices and technologies do you use? Phone 3D glasses Smartwatch Augmented reality apps □ Tablet Desktop computer **10.How do you make payments?** I mainly use a debit card Only with cash I use my phone With a smartwatch No Rather not No opinion The product should be useful It should be compatible with It should be easy and other devices convenient to use It should be easy to find It should be accessible It should be attractive based on innovative technologies It should have added value The product should guide me during use No, I prefer not to use it Yes, to check traffic conditions Sometimes Yes, as soon as I get in the car
- 14.Do you have an IT brand/company whose services/products you prefer because they pay special attention to your experience while using them? Please give an example.
 - □ This question has an open-ended answer

15. When do you stop using a service or product?

- When the competition offers something better
- When they stop updating it
- When they become paid

- Xbox
- Laptop
- GPS locator
- Virtual reality glasses
- VR gloves
- Other
 - Small amounts in cash, larger ones with a card
 - Someone else pays

11.Do you understand instructions better when they are presented with pictures?

12. Which of the following factors are most important to you as a consumer?

- □ It should be reliable
- 13.Do you use navigation when traveling?

 - Only abroad

- Rather yes Yes

- Yes, I only learn on electronic devices
- For 20 years
- Since they appeared

- □ When I like one company, I □ Other don't change it
- **16.Do you like to customize your most used apps to your liking?**

17. What will you do if you forget your phone and you won't be returning for 2 days?

- □ I will immediately go back as soon as I realize it's missing
- I will continue with my plan, I have another device through which I can communicate
- □ I won't go back, it must have been meant to be

18. How do you entertain yourself?

- □ I exercise
- □ I watch TV/movies
- \Box I watch sports events
- □ I play video games
- □ I study interesting things
- \Box I meet with friends
- □ I travel
- □ I play team outdoor games

19. What type of games do you play?

- □ Virtual
- □ Board games
- □ Strategy games
- □ Shooting games

- □ I will order it to be sent to me because I can't go back
- I will log into my account from another device and post on social media so all my friends and followers know
- □ I will panic
- □ Other
- □ I dance
- □ I draw
- □ I read books
- □ I read social media posts
- On my phone
- □ I listen to music
- □ I play a musical instrument
- Other
- □ Racing games
- \Box Team games
- □ Other

20. How much time do you spend on entertainment through digital devices per day?

- I don't entertain myself by playing digital games
- \Box Less than 1 hour
- At least 2 hours a day
- Between 2 and 6 hours
 Between 6 and 12 hours
- □ More than 12 hours

21.Do you have friends you met online and communicate only with them this way?

- □ No
- □ I cannot be friends with someone I haven't met in person
- Yes, but I wouldn't call them friends
- Of course, I have many friends I met online
- \Box Yes, but they are few
- □ Other

22. How do you feel after playing electronic games? Overexcited

- Tired
- Nervous
- □ Energized
- □ Happy

23. What is your favorite mobile app?

- YouTube
- Facebook
- □ Spotify
- Twitter
- Waze
- □ ePay
- Netflix

24.Do you like apps with augmented reality for various landmarks that give additional information about them?

- Yes
- Yes, I really like them, and they are useful
- They are good when done well
- I wouldn't install apps on my phone
- No, I prefer enjoying the place rather than looking at my phone
- I think audio guides are very useful, but not augmented reality
- Other

25.Do you like exploring objects through virtual tours?

- Yes Yes, I like that I can explore everything calmly, in detail
- No
- No, because if the movement is not realistic, I get disoriented

26. Have you experienced discomfort using devices that add 3D effects to objects: glasses or headsets?

- Yes, I prefer headsets
- I've only tried glasses
- I don't feel well when using such devices
- I've used glasses only at the cinema without discomfort
- No, I use them and I like the realism they achieve
- I haven't used them

27. When you've used a virtual reality system, what sensation impressed you the most?

- The quality and realism of the graphics
- Amazement at the product's capabilities
- The need to use the product sitting
- Confusion after removing the product
- I couldn't stay in one place, but I was afraid to move my feet
- I haven't used it
- Other

Revolut

Stiff Other

WhatsApp

Unhappy

- Kaufland
- LinkedIn
- Viber
- □ Other

28. How often do you make online posts?

- □ Never
- □ Very rarely
- \Box Once a month

- $\Box \quad At least one post per week$
- □ I post interesting things every day
- Every two weeks
- □ Other

- Easier
- □ Safer
- □ More interesting
- □ More complicated

- □ Lazier
- □ More sedentary
- □ Happier
- □ Other