



Veljko V. Aleksić¹

University of Kragujevac, Faculty of Technical Sciences,
Čačak, Serbia

Dionysios V. Politis

Aristotle University of Thessaloniki, Department of Informatics,
Thessaloniki, Greece

**Original
research paper**

Paper received: Jul 6 2022
Paper accepted: Maj 25 2023
Article Published: Jul 5 2023

The Impact of Interactive Digital Technology Exposure on Generation Z Students Learning Performance in Computer Graphics and Simulations: A Comparative Study of Greece and Serbia

Extended summary

As the functionality of modern digital societies is primarily based on interactive digital technology, educational technology has inevitably gone through a process of digitalization. Studying information technology, computer science, or computer engineering in the post-digital era makes it very hard for students to disjoin personal technology needs, learning necessities, and future career demands, putting them at great risk for developing psychological disorders. The focus of our research was on the population of older adolescents and young adults in their early 20s, often named Generation Z, as they grew surrounded by portable digital devices, common Internet access, and a variety of online services that are mostly in use today.

The aim of the research was to examine the effects of the interactive digital technology exposure on learning performance in computer graphics and simulations. We explored the relations between the ways that students use digital devices and technologies, learning performance, and ultimately, their academic success. As digital competencies presume the adequate use of technology, we argue that students often overestimate their self-perceptive levels, thus they can easily fall into the negative spiral of behavioral and personality disorders.

The research was conducted between October 2021 and May 2022 at the School of Informatics, Aristotle University of Thessaloniki (Greece), and at the Faculty of Technical Sciences in Čačak, University of Kragujevac (Serbia). The research sample is intentional – a total of 397 students from Greece and Serbia, evenly representing various geographical, economic, and so-

¹ veljko.aleksic@ftn.kg.ac.rs

Copyright © 2023 by the authors, licensee Teacher Education Faculty University of Belgrade, SERBIA.

This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0) (<https://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original paper is accurately cited.

cio-cultural environments. The students first completed the self-report questionnaire and then performed a specific set of practical activities in accordance with their group affiliation which was scored. Following the theoretical-empirical nature of the research, the participants were examined by the descriptive-analytical non-experimental method using surveys and quantitative observation, based on which the distribution of properties was established and the relationships among variables were analyzed.

The students from Greece spent significantly more time using online services or playing digital games, on average. The type of the preferred devices the students used to go online and the weekly average hours spent gaming had the greatest effect on developing the Internet gaming disorder. The students from Serbia achieved better results than the students from Greece in all practical activities except the Test of focus, precision, and persistence while doing repetitive tasks on a computer. An increase in time spent online correlated with a decrease in the levels of technical literacy skills, 2D computer drawing skills, and teamwork/communication competence. This negative relationship was interpreted as the consequence of the cognitive and/or emotional technological preoccupation, as a regular craving for interaction with digital devices surely could lead to developing an obsession, social overload, and exhaustion, ultimately causing a downward spiral of academic success. The type of the preferred gaming device was the most important digital technology exposure predictor of the learning performance factors gain both in Greece and Serbia. Unexpectedly, digital gaming exposure and Internet gaming disorder were not significant predictors of academic success.

The research results contribute to a deeper understanding of the extremely complex relationships between the digital social environment, students' digital preferences and habits, and learning performance factors that are specific to the field of computer graphics and simulations, thus the resulting model dually provides teachers with the opportunity to adapt their activities more efficiently and students with a self-diagnostic tool helping them to improve learning performance more effectively.

Keywords: educational technology, computer graphics, computer simulations, learning

References

- Aaron, L. S. and Lipton, T. (2017). Digital Distraction: Shedding Light on the 21st-Century College Classroom. *Journal of Educational Technology Systems*. 46 (3), 363–378. <https://doi.org/10.1177/0047239517736876>
- Adžić, S., Al-Mansour, J., Naqvi, H. and Stambolić, S. (2021). The impact of video games on Students' educational outcomes. *Entertainment Computing*. 38, 100412. <https://doi.org/10.1016/j.entcom.2021.100412>
- Aleksić, V., and Ivanović, M. (2017). Early Adolescent Gender and Multiple Intelligences Profiles as Predictors of Digital Gameplay Preferences. *Croatian Journal of Education*. 19 (3), 697–727. <https://doi.org/10.15516/cje.v19i3.2262>

-
- Anthonysamy, L. and Singh, P. (2023). The impact of satisfaction, and autonomous learning strategies use on scholastic achievement during Covid-19 confinement in Malaysia. *Heliyon*. 9 (2), e12198. <https://doi.org/10.1016/j.heliyon.2022.e12198>
 - Bassiouni, D. H. and Hackley, C. (2014). 'Generation Z' children's adaptation to digital consumer culture: A critical literature review. *Journal of Customer Behavior*. 13 (2), 113–133. <https://doi.org/10.1362/147539214x14024779483591>
 - Bereczki, E. O. and Kárpáti, A. (2021). Technology-enhanced creativity: A multiple case study of digital technology-integration expert teachers' beliefs and practices. *Thinking Skills and Creativity*. 39, 100791. <https://doi.org/10.1016/j.tsc.2021.100791>
 - Blanco-Herrera, J. A., Gentile, D. A. and Rökkum, J. N. (2019). Video Games can Increase Creativity, but with Caveats. *Creativity Research Journal*. 31 (2), 119–131. <https://doi.org/10.1080/10400419.2019.1594524>
 - Buiza-Aguado, C., Alonso-Canovas, A., Conde-Mateos, C., Buiza-Navarrete, J. J. and Gentile, D. (2018). Problematic Video Gaming in a Young Spanish Population: Association with Psychosocial Health. *Cyberpsychology, Behavior, and Social Networking*. 21 (6), 388–394. <https://doi.org/10.1089/cyber.2017.0599>
 - Cao, X., Masood, A., Luqman, A. and Ali, A. (2018). Excessive use of mobile social networking sites and poor academic performance: Antecedents and consequences from stressor-strain-outcome perspective. *Computers in Human Behavior*. 85, 163–174. <https://doi.org/10.1016/j.chb.2018.03.023>
 - Chowdhury, N. F. H., Debnath, P. and Bhowmik, D. (2020). How Does Internet Usage Influence the Academic Performance of University Students? A Case of MBSTU. *IOSR Journal of Research & Method in Education (IOSR-JRME)*. 10 (3), 15–24. ISSN: 2320–7388 <https://doi.org/10.9790/7388-1003021524>
 - Collisson, B., Eck, B. E. and Harig, T. (2021). Introducing Gen Z psychology majors: Why they choose to major in psychology (and what they expect to learn). *Scholarship of Teaching and Learning in Psychology*. <https://doi.org/10.1037/stl0000249>
 - Çebi, A., BahçekapılıÖzdemir, T., Reisoğlu, İ. and Çolak, C. (2022). From digital competencies to technology integration: Re-formation of pre-service teachers' knowledge and understanding. *International Journal of Educational Research*. 113, 101965. <https://doi.org/10.1016/j.ijer.2022.101965>
 - Dindar, M. (2018). An empirical study on gender, video game play, academic success and complex problem solving skills. *Computers & Education*. 125, 39–52. <https://doi.org/10.1016/j.compedu.2018.05.018>
 - Ding, D., Guan, C. and Yu, Y. (2017). Game-Based Learning in Tertiary Education: A New Learning Experience for the Generation Z. *International Journal of Information and Education Technology*. 7 (2), 148–152. <https://doi.org/10.18178/ijiet.2017.7.2.857>
 - Feng, S., Wong, Y. K., Wong, L. Y. and Hossain, L. (2019). The Internet and Facebook Usage on Academic Distraction of College Students. *Computers & Education*. 134, 41–49. <https://doi.org/10.1016/j.compedu.2019.02.005>
-

-
- Flanigan, A. E. and Babchuk, W. A. (2022). Digital distraction in the classroom: exploring instructor perceptions and reactions. *Teaching in Higher Education*. 27 (3), 352–370. <https://doi.org/10.1080/13562517.2020.1724937>
 - Gentile, D. A., Bailey, K., Bavelier, D., Brockmyer, J. F., Cash, H., Coyne, S. M. ... and Young, K. (2017). Internet gaming disorder in children and adolescents. *Pediatrics*. 140 (Supplement_2), S81–S85. <https://doi.org/10.1542/peds.2016-1758h>
 - Hawi, N. S., Samaha, M. and Griffiths, M. D. (2018). Internet gaming disorder in Lebanon: Relationships with age, sleep habits, and academic achievement. *Journal of Behavioral Addictions*. 7 (1), 70–78. <https://doi.org/10.1556/2006.7.2018.16>
 - Hernández-Lara, A. B., Serradell-López, E. and Fitó-Bertran, À. (2019). Students' perception of the impact of competences on learning: An analysis with business simulations. *Computers in Human Behavior*, 101, 311–319. <https://doi.org/10.1016/j.chb.2019.07.023>
 - Hippler, H. J., Schwarz, N. and Sudman, S. (Eds.). (1987). *Social information processing and survey methodology*. New York: Springer Verlag.
 - Hu, X., Gong, Y., Lai, C. and Leung, F. K. S. (2018). The relationship between ICT and student literacy in mathematics, reading, and science across 44 countries: A multilevel analysis. *Computers & Education*. 125, 1–13. <https://doi.org/10.1016/j.compedu.2018.05.021>
 - Isaacs, A. N., Scott, S. A. and Nisly, S. A. (2020). Move out of Z way Millennials. *Currents in Pharmacy Teaching and Learning*. 12 (12), 1387–1389. <https://doi.org/10.1016/j.cptl.2020.07.002>
 - Javaeed, A., Jeelani, R., Gulab, S. and Ghauri, S. K. (2019). Relationship between internet addiction and academic performance of undergraduate medical students of Azad Kashmir. *Pakistan Journal of Medical Sciences*. 36 (2). <https://doi.org/10.12669/pjms.36.2.1061>
 - Knowles, M. S., Holton III, E. F. and Swanson, R. A., (2014). *The adult learner: The definitive classic in adult education and human resource development (8th edition)*. London: Routledge.
 - Liu, C. and Chen, J. (2019). Consuming takeaway food: Convenience, waste and Chinese young people's urban lifestyle. *Journal of Consumer Culture*. 21 (4), 848–866. <https://doi.org/10.1177/1469540519882487>
 - Livingstone, S. (2017). iGen: why today's super-connected kids are growing up less rebellious, more tolerant, less happy – and completely unprepared for adulthood. *Journal of Children and Media*. 12 (1), 118–123. <https://doi.org/10.1080/17482798.2017.1417091>
 - Maulina, H., Abdurrahman, A., Sukamto, I., Kartika, N. and Nurulsari, N. (2020). Z-generation learner characteristic and expectation in the RI 4.0 era: a preliminary research in physics teacher college in Lampung. *Journal of Physics: Conference Series*. 1572 (1), 012091. <https://doi.org/10.1088/1742-6596/1572/1/012091>
 - Mestre-Bach, G., Fernandez-Aranda, F. and Jiménez-Murcia, S. (2022). Exploring Internet gaming disorder: an updated perspective of empirical evidence (from 2016 to 2021). *Comprehensive Psychiatry*. 116, 152319. <https://doi.org/10.1016/j.comppsy.2022.152319>
 - Oates, S. (2019). The Importance of Autonomous, Self-Regulated Learning in Primary Initial Teacher Training. *Frontiers in Education*. 4, 102. <https://doi.org/10.3389/feduc.2019.00102>
-

-
- Pontes, H. M. and Griffiths, M. D. (2017). The development and psychometric evaluation of the Internet Disorder Scale (IDS-15). *Addictive Behaviors*. 64, 261–268. <https://doi.org/10.1016/j.addbeh.2015.09.003>
 - Pontes, H. M., Király, O., Demetrovics, Z. and Griffiths, M. D. (2014). The Conceptualisation and Measurement of DSM-5 Internet Gaming Disorder: The Development of the IGD-20 Test. *PLOS ONE*. 9 (10), e110137. <https://doi.org/10.1371/journal.pone.0110137>
 - Putwain, D., Sander, P. and Larkin, D. (2012). Academic self-efficacy in study-related skills and behaviours: Relations with learning-related emotions and academic success. *British Journal of Educational Psychology*. 83 (4), 633–650. <https://doi.org/10.1111/j.2044-8279.2012.02084.x>
 - Rehbein, F., Staudt, A., Hanslmaier, M. and Kliem, S. (2016). Video game playing in the general adult population of Germany: Can higher gaming time of males be explained by gender specific genre preferences? *Computers in Human Behavior*. 55, 729–735. <https://doi.org/10.1016/j.chb.2015.10.016>
 - Rubach, C. and Lazarides, R. (2021). Addressing 21st-century digital skills in schools—Development and validation of an instrument to measure teachers’ basic ICT competence beliefs. *Computers in Human Behavior*. 118, 106636. <https://doi.org/10.1016/j.chb.2020.106636>
 - Rubinstein, J. S., Meyer, D. E. and Evans, J. E. (2001). Executive control of cognitive processes in task switching. *Journal of Experimental Psychology: Human Perception and Performance*. 27 (4), 763–797. <https://doi.org/10.1037/0096-1523.27.4.763>
 - Sahithi, A. (2020). Use of Social Media and its Effects in School Going Adolescents. *Indian Journal of Youth & Adolescent Health*. 6 (2), 20–25. <https://doi.org/10.24321/2349.2880.201910>
 - Seemiller, C. and Grace, M. (2017). Generation Z: Educating and Engaging the Next Generation of Students. *About Campus: Enriching the Student Learning Experience*. 22 (3), 21–26. <https://doi.org/10.1002/abc.21293>
 - Sengupta, A., Broyles, I., Brako, L. and Raskin, G. (2017). Internet Addiction: Impact on Academic Performance of Premedical Post-Baccalaureate Students. *Medical Science Educator*. 28 (1), 23–26. <https://doi.org/10.1007/s40670-017-0510-5>
 - Smith, T. and Cawthon, T. W. (2017). Generation Z Goes to College. *College Student Affairs Journal*. 35 (1), 101–102. <https://doi.org/10.1353/csaj.2017.0008>
 - Starkey, L. (2019). A review of research exploring teacher preparation for the digital age. *Cambridge Journal of Education*. 50 (1), 37–56. <https://doi.org/10.1080/0305764x.2019.1625867>
 - Will, P., Bischof, W. F. and Kingstone, A. (2020). The impact of classroom seating location and computer use on student academic performance. *PLOS ONE*. 15 (8), e0236131. <https://doi.org/10.1371/journal.pone.0236131>
 - York, T. T., Gibson, C. and Rankin, S. (2015). Defining and measuring academic success. *Practical assessment, research, and evaluation*. 20 (1), 5. <https://doi.org/10.7275/hz5x-tx03>
 - Zhang, W. (2015). Learning variables, in-class laptop multitasking and academic performance: A path analysis. *Computers & Education*. 81, 82–88. <https://doi.org/10.1016/j.compedu.2014.09.012>
-

-
- Zhang, A. and Aasheim, C. (2011). Academic success factors: An IT student perspective. *Journal of Information Technology Education: Research*. 10 (1), 309–331. <https://doi.org/10.28945/1518>
 - Zhu, S., Xu, Z., Dong, Y., Xiong, N. and Wang, Y. (2022). What will the future kitchen look like? An exploratory laboratory study of the future expectations of Chinese Generation Z. *International Journal of Industrial Ergonomics*. 87, 103259. <https://doi.org/10.1016/j.ergon.2021.103259>