



ISSN Print: 2394-7500  
ISSN Online: 2394-5869  
Impact Factor: 8.4  
IJAR 2022; 8(2): 380-384  
[www.allresearchjournal.com](http://www.allresearchjournal.com)  
Received: 02-12-2021  
Accepted: 05-01-2022

**Puja Singh**  
Nowgong College  
(Autonomous), Nagaon,  
Assam, India

**Dr. Jyotismita Das**  
Department of Zoology,  
Nowgong College  
(Autonomous), Nagaon,  
Assam, India

**Zuganta Jyoti Das**  
Assam University, Silchar,  
Assam, India

**Corresponding Author:**  
**Dr. Jyotismita Das**  
Department of Zoology,  
Nowgong College  
(Autonomous), Nagaon,  
Assam, India

## Effect of digital technology on our brain health

**Puja Singh, Dr. Jyotismita Das and Zuganta Jyoti Das**

DOI: <https://doi.org/10.22271/allresearch.2022.v8.i2e.9472>

### Abstract

**Background:** Digital technology is a source of information, source of entertainment and a platform for social interaction and making new friends. Besides, researchers found from their research that it cause a bad effect on our health, especially on our brain health due to excessive use of digital gadgets.

**Aim:** Effect of digital technology on our brain health.

**Materials and Methods:** The data is collected from pub med/Medline, Google scholar.

**Result:** After reviewing many research papers, we can say that digital technology has both its own pros and cons; we have to use digital technology a controlled way to reduce its harmful effect on the brain health.

**Conclusion:** We discussed both good and bad effects of digital technology on our brain health but we have to study this topic on the basis of other aspect also like its effect after COVID-19 pandemic, effect on GenZ generation etc. to come up with clearer result, than what we have now.

**Keywords:** Digital technology, internet, brain health, social media

### Introduction

According to World Health Organisation, a good brain health is a state in which every individual can realise their own abilities and optimize their cognitive, emotional, psychological and behavioural functioning to cope with life situations. Brain health conditions emerge throughout the life course and are characterised by disruption in normal brain and functioning<sup>[1]</sup>. The human brain craves for information, and there was a revolution that began around 1980 called digital revolution, which is now become a large store house of unlimited information and this revolution become solution for that craving of human brain. In the last 3-4 decades digital technology has emerged rapidly day by day and with it the human brain also tries to adapt itself with every new experience with it. Though at first we thought digital technology was a helpful tool in our daily lives but with the passage of time the neurologist come to know that it has also a harmful effect on brain health. Because of being surrounded by all kinds of technologies, we suffer from heightened attention deficit symptoms, impaired emotional and social isolation, unpaired brain development, disrupted sleep etc.<sup>[3]</sup> According to a Global Overview report 2021, from 7.83 billion total population 4.66 billion people have access to internet and this number increasing rapidly every day<sup>[2]</sup>. In this review report, we try to abridge all good and bad effects of digital technology on our brain health.

### Materials and Methods

The related data on effect of digital technology on our brain health were recouping from the digital data bases like Google scholar, pub med/Medline, and Google search engine.

### Results and Discussion

In the course of adaptation with the new digital technologies we forget that for proper functioning of our brain it needs proper rest, sleep and full concentration and time to analyse new information. As there is an increased in the time we spend on technology and digital screens, its effects on our brain health increases day by day<sup>[3]</sup>. According to 2021 screen time statics report, most people on average, spend 3 hours and 15 minutes on phones<sup>[4]</sup>. In Table.1 we mention all the possible harmful effect of digital technology on human brain health which is found from reviewing different research papers.

In spite of bad effects of digital technology, the new studies show that it has several benefits on brain health. The Table.2. Shows the benefits on brain health. Besides, on the given Table.2. There are also some other positive effects of digital technology on our mental health, like improving depression, stress release, anxiety control etc. These are

found through different studies but it needs elaborate research for authentication [56, 57, 58, 59, 60]. We review some research papers related to the effect of digital technology on our brain health. The outcomes of the research papers are given below in Table.3.

**Table 1:** The Name of Harmful Effect of Digital Technology on Our Brain Health

Serial No.	Name of Harmful Effect on Our Brain	Findings
1	Reduced Attention	A 2014 meta-analysis indicates a correlation between media, technology use and attention problems. There is a link between extensive screen time and symptoms of attention deficient hyperactivity disorder (ADHD) [5, 6, 7, 8, 9].
2	Impaired Intelligence	Different studies shows that spending extensive period of time with digital media translate to spending less in time communicating face to face which impaired intelligence [10, 11, 12, 13].
3	Technology Addiction	Study shows that students with internet addiction are likely to suffer from ADHD symptoms than from other psychiatric disorder. But between ADHD symptoms and internet addiction link is not confirmed yet [14, 15, 6, 17, 18, 19].
4	Social Isolation	Ninety percent of young adults in the U.S use social media and they visit the platform daily. Paradoxically, social media use is linked with social isolation which cause poor health outcomes and increase mortality [20, 21, 22].
5	Impact on Cognitive Development	Studies shows that children with daily basis of screen time has been associate with poorer language development executive functioning [23, 24, 25, 26, 27, 28].
6	Effect on Sleep	Recent studies indicates that screen exposure disrupts sleep, which can have negative effect on cognition and behaviour of the individual [29, 30, 31, 32, 33, 34].
7	Grey Matter Atrophy	Multiple studies have shown atrophy (loss of tissue volume) in grey matter areas in internet/gaming addiction [35].

**Table 2:** The Name of the Beneficial Effect of Digital Technology on Our Brain Health

Serial No.	Name of Beneficial Effect on Our Brain	Findings
1	Neural Exercise	The finding suggest that searching online may be form of brain neural exercise and also suggest that searching may remain novel and mentally stimulating process then after continued practice [36, 37, 38, 39].
2	Internet Training and Brain Functioning	Many study suggest that short term internet search training may increase white matter integrity in the right superior longitudinal fasciculus which could result from increased myelination [40, 41, 42, 43].
3	Cognitive Training	In a meta-analysis of computerized cognitive training investigation found an overall moderate effect on cognition in mild cognitive impairment across 17 trials small to moderate effect were reported for global cognition attention working memory and learning abilities [44, 45, 46, 47].
4	Multitasking Skills	Studies shows that the multitasking training improve other skills, including working memory and divided and sustained attention [48, 49, 50, 51].
5	Working Memory and Fluid Intelligence	The study results indicates that successful transfer of improved working memory to improved fluid intelligence measures with a dose-dependent training effect [52, 53].
6	Visual Attention Reaction Time	Different finding suggest that playing action video games can improve cognitive and motor skills that improve surgical skills and lower error roles in the operating room [54, 55].

**Table 3:** Findings of different research papers on the effect of digital technology on our brain health.

Serial No.	Author	Study Aim	Findings
1	Choudhury and Mcknny, 2013	Digital media, the developing brain and the interpretive plasticity, neuroplasticity.	By analysing the neurological adolescent in the digital age as a society extended mind. Firstly, in the sense that adolescent cognition is distributed across brain, body and digital media tools and secondly by viewing adolescent cognition as enabled and transformed b the institution of neuroscience [61].
2	David A, Ziegler I, Mishra Jyoti And Adam Gazzley Z, 2015	The acute and chronic impact of technology on our brain.	A cursory view of the literatine seems to media multitasking and early life exposure in a negative light, a more nuanced exploration shows some profoundly promise aspect of hoe new technology might be harassed to enhance cognition in at risk population, leading to better lives [62].
3	Reid Chassiakos Y, Redecky J, Christakis D, Moreno M and Cross C, 2016	Children and Adolescents and digital media.	The effect of media use on children and adolescent is minimize by parent by understanding their own roles in modelling appropriate media use and balance between media time another activities [63].
4	Ra.C.Cho J, Stone M, De La Carda J, Golden son N and Moroney E, et al, 2018	Association of digital medial use with subsequent symptoms of attention deficit/ hyperactivity disorder among adolescent.	Among adolescent followed up over 2 years there was statically significant but modest association between higher frequency of digital use and subsequent symptoms of ADHD. Further research need to determined whether this association is casual [64].
5	Firth J, Torous J, Stubbs B, Firth J, Steiner G and	The online brain: how the internet may be changing our	The internet can produce both acute and sustained alternation in each of these areas of cognition, which may be reflected in changes in the brain.

	Smith L, <i>et al</i> , 2019	cognition.	And for further research how the outcome of brain cognition and brain impact on ages of internet youth different from elderly <sup>[65]</sup> .
6	Ketlewell J, Das Nair R, and Radford K, 2019	A systematic review of personal smart technologies used to improve outcomes in adults either acquired brain injuries.	At present there is insufficient evidence to support the clinical benefit of personal smart technology to improve outcomes in acquired brain injury, researchers need to study to measure the potential harmful effect <sup>[66]</sup> .
7	Hutton J., Dudley J, Horowitz, Krus J, Dewitt J and Hooland S, 2019	Association between screens based media use and brain white matter integrity in preschool aged children.	This study found in association between increased screen based media and use, compared with the AAP guidelines and lower micro structural integrity of brain white matter traits supporting language and emergent literacy skills in prekindergarten children <sup>[67]</sup> .
8	Abdelrahman N R, Polventro M, Wending A, Goetz C and Arnez B, 2020	Brain health: Attitudes towards technology adoption in older adults.	This study suggest that in order to promote the use of technology in older adults, one need to consider wider contextualises, not only design peruses but older adults rational for using technology and their socio- ecological context <sup>[68]</sup> .
9	Korte Martin, 2020	The impact of the digital revolution on human brain and behaviour: where do we stand?	Digital media do have an impact on human psychological well being and cognitive performance and this depends on total screen time and what people actually doing in the digital environment <sup>[69]</sup> .
10	Small W, Lee J and Bookheimer S, 2020	Brain health consequence of digital technology use.	Researchers elucidate both help and harm of brain by digital technology but through specific program, videogame etc. We can improve the harmful effect of it and for further research needs to elucidate mechanism and casual relation between technology use and brain health <sup>[3]</sup> .

### Conclusions

The effect of digital technology on our brain health has both good and bad sides, but anything of too much is harmful. So, if we over use these technologies, it will have a harmful effect on our brain health. From the above discussion, we come to know that digital technology has its own pros and cons. Our engagement with technology is increasing swiftly and due to COVID-19 pandemic, a large population of the world turns its work place and study institution to on line platforms. For last two years, due to COVID-19, people have to spend more time online than usual. And it creates a new evolution in the field of digital technology. Researchers have a great opportunity to study deeply about the effect of digital technology on our brain health after the COVID-19 pandemic. Because of increased online involvement, it may give different results or new information about this topic. Beside this for future research, researchers can also study the brain health and its development in GenZ generation because this generation is the first to be born into a time when this digital technology existed. GenZ are the first digital native among all other past generations because they were born between 1997 and 2012. Because of their exposure with digital technology just after the birth, researchers can get clearer results of their study on this type of topic in case of GenZ generation than millennial and GenX generation.

### References

1. Brain Health. 2021. Retrieved 24 July 2021, from <https://www.who.int/health-topics/brain-health#tab=tab-1>
2. Digital. Global overview report, 2021. Retrieved. [cdn.ampproject.org/v/s/data-report.com/reports/digital-2021-global-overview-report?amp\\_js\\_v=a6&andamp\\_gs=1&format=amp&usqp=mq331AQKKAFFQArAB||ACA%3D%3D#aoh](https://cdn.ampproject.org/v/s/data-report.com/reports/digital-2021-global-overview-report?amp_js_v=a6&andamp_gs=1&format=amp&usqp=mq331AQKKAFFQArAB||ACA%3D%3D#aoh) 2021-global-overview.report
3. Small G, Lee J, Bookheimer S. Brain health consequences of digital technology use. *Dialogues in clinical Neuroscience*. 2020;22(2):179-187. Doi-10.31887/dcn.2020.22.2/gsmall
4. Screen Times and Technology Use across America! Simple testing. 2021. Retrieved 24 July 2021, from <https://simpletesting.com/scren-time-survey/>
5. Anderson M, Jiong Teens J. social media and technology, pew research. Center. 2018. <https://www.pewinternet.org/2018/05/31/teens-social-media-technology-2018/>. Posted May 31, 2018. accessed June, 2018
6. Ra CK, Cho J, Stone MD, *et al*. Association of digital media use with subsequent symptoms of attention-deficit/hyperactivity disorder among adolescents. *JAMA*. 2018; 320(3):255-263.
7. Schou Andreassen C, Griffiths MD, Kuss DJ, *et al*. The relationship between addictive use of social media and video games and symptoms of psychiatric disorders: a large-scale cross-sectional study. *Psychol Addict Behav*. 2016;30(2):252-262.
8. Nikkelen SW, Valkenburg PM, Huizinga M, Bushman BJ. Media use and ADHD-related behaviors in children and adolescents: a meta-analysis. *Dev Psychol*. 2014;50(9):2228-2241.
9. Greicius MD, Krasnow B, Reiss AL, Menon V. Functional connectivity in the resting brain: a network analysis of the default mode hypothesis. *Proc Natl Acad Sci USA*. 2003; 100(1):253-258.
10. American Academy of Paediatrics, Committee on Public Education. American Academy of Paediatrics: children, adolescents, and television. *Paediatrics*. 2001;107(2):423-426.
11. Giedd JN. The digital revolution and adolescent brain evolution. *J Adolescent Health*. 2012;51(2):101-105.
12. Kirsh SJ, Mounts JWR. Violent video game play impacts facial emotion recognition. *Aggress Behav*. 2007;33(4):353-358.
13. Uhls YT, Michikyan M, Morris J, *et al*. Five days at outdoor education camp without screens improves preteen skills with nonverbal emotion cues. *Comput Hum Behav*. 2014;39:387-392.
14. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 5th ed. Arlington, VA: American Psychiatric Association, 2013.

15. Young KS. Psychology of computer use: XL. Addictive use of the Internet: a case that breaks the stereotype. *Psychol Rep.* 1996;79(3, pt 1):899-902.
16. You JH, Cho SC, Ha J, *et al.* Attention deficit hyperactivity symptoms and Internet addiction. *Psychiatry Clin Neurosci.* 2004;58(5):487-494.
17. Cheng C, Li AY. Internet addiction prevalence and quality of (real) life: a meta-analysis of 31 nations across seven world regions. *Cyberpsychol Behav Soc Netw.* 2014;17(12):755-760.
18. Ko CH, Yen JY, Yen CF, *et al.* The association between internet addiction and psychiatric disorder: a review of the literature. *Eur Psychiatry.* 2012;27(1):1-8.
19. Panagiotidi M, Overton P. The relationship between internet addiction, attention deficit hyperactivity symptoms and online activities in adult. *Compr Psychiatry.* 2018;87:7-11.
20. Primack BA, Shensa A, Sidani JE, *et al.* Social media use and perceived social isolation among young adults in the U.S. *Am J Prev Med.* 2017;53(1):1-8.
21. Nicholson NR. A review of social isolation: an important but under assessed condition in older adults. *J Prim Prev.* 2012;33(2-3):137-152.
22. Meshi D, Cotton SR, Bender AR. Problematic social media use and perceived social isolation in older adults: a cross-sectional study. *Gerontology.* 2020;66(2):160-168. doi:10.1159/000502577.
23. Radesky JS, Christakis DA. Increased screen time: implications for early childhood development and behavior. *Pediatr Clin North Am.* 2016;63(5):827-839.
24. Horowitz-Kraus T, Hutton JS. Brain connectivity in children is increased by the time they spend reading books and decreased by the length of exposure to screen-based media. *Acta Paediatr.* 2018;107(4):68-693.
25. Duch H, Fisher EM, Ensari I, *et al.* Association of screen time use and language development in Hispanic toddlers: a cross-sectional and longitudinal study. *Clin Pediatr (Phila).* 2013;52(9):857-865.
26. McDonald SW, Kehler HL, Tough SC. Risk factors for delayed social-emotional development and behavior problems at age two: results from the All Our Babies/Families (AOB/F) cohort. *Health Sci Rep.* 2018;1(10):e82. doi:10.1002/hsr.2.82.
27. Tomopoulos S, Dreyer BP, Berkule S, Fierman AH, Brockmeyer C, Mendelsohn AL. Infant media exposure and toddler development. *Arch Pediatr Adolesc Med.* 2010;164(12):1105-1111.
28. Hutton JS, Dudley J, Horowitz-Kraus T, DeWitt T, Holland SK. Associations between screen-based media use and brain white matter integrity in preschool-aged children. *JAMA Pediatr.* 2019 Nov;4:e193869. doi:10.1001/jamapediatrics.2019.3869
29. Cheung CH, Bedford R, Saez De Urabain IR, Karmiloff-Smith A, Smith TJ. Daily touchscreen use in infants and toddlers is associated with reduced sleep and delayed sleep onset. *Sci Rep.* 2017;7:46104. doi:10.1038/srep46104.
30. Cabré-Riera A, Torrent M, Donaire-Gonzalez D, Vrijheid M, Cardis E, Guxens M. Telecommunication devices use, screen time and sleep in adolescents. *Environ Res.* 2019;171:341-347.
31. Christensen MA, Bettencourt L, Kaye L, *et al.* Direct measurements of smartphone screen-time: relationships with demographics and sleep. *PLoS One.* 2016;11(11):e0165331. doi:10.1371/journal.pone.0165331. eCollection 2016.
32. Amorim L, Magalhães R, Coelho A, *et al.* Poor sleep quality associates with decreased functional and structural brain connectivity in normative aging: a MRI multimodal approach. *Front Aging Neurosci.* 2018;10:375. doi:10.3389/fnagi.2018.00375. eCollection 2018.
33. Branger P, Arenaza-Urquijo EM, Tomadesso C, *et al.* Relationships between sleep quality and brain volume, metabolism, and amyloid deposition in late adulthood. *Neurobiol Aging.* 2016;41:107-114.
34. Cajochen C1, Frey S, Anders D, *et al.* Evening exposure to a light-emitting diodes (LED)-backlit computer screen affects circadian physiology and cognitive performance. *J Appl Physiol (1985).* 2011;110(5):1432-1438.
35. Retrieved 24 July, 2021. from <https://Spartanyaath.mcv.edu/precollege/documents/Thisisyourbrainonlineforprecollegefacultyandstaffmarch2015.pdf>
36. Verghese J, Lipton RB, Katz MJ, *et al.* Leisure activities and the risk of dementia in the elderly. *N Engl J Med.* 2003;348(25):2508-2516.
37. Small GW, Silverman DHS, Siddarth P, *et al.* Effect of a 14- day healthy longevity lifestyle program on cognition and brain function. *Am J Geriatr Psychiatry.* 2006;14(6):538-545.
38. Madden M. Internet penetration and impact. Pew Internet & American Life Project. Available at: [http://www.pewinternet.org/pdfs/PIP\\_Internet\\_Impact.pdf](http://www.pewinternet.org/pdfs/PIP_Internet_Impact.pdf). Published April 2006. Accessed March 2020.
39. Haier RJ, Siegel BV Jr, MacLachlan A, *et al.* Regional glucose metabolic changes after learning a complex visuospatial/motor task: a positron emission tomographic study. *Brain Res.* 1992;570(1-2):134-143.
40. Gaddipati H, Moody TD, Shirinyan D, Small GW, Bookheimer SY. Internet training alters working memory neural circuitry in older adults. Poster presented at the Annual Meeting of the Society for Neuroscience, San Diego, California, 2010.
41. Dong G, Hui L, Potenza MN. Short-term Internet-search training is associated with increased fractional anisotropy in the superior longitudinal fasciculus in the parietal lobe. *Front Neurosci.* 2017;11:372. doi:10.3389/fnins.2017.00372.
42. Shapira N, Barak A, Gal I. Promoting older adults' well-being through Internet training and use. *Aging Ment Health.* 2007;11(5):477-484.
43. White H, McConnell E, Clipp E, *et al.* A randomized controlled trial of the psychosocial impact of providing internet training and access to older adults. *Aging Ment Health.* 2002;6(3):213-221.
44. Ball K, Berch DB, Helmers KF, *et al.* Effects of cognitive training interventions with older adults: a randomized controlled trial. *JAMA.* 2002;288(18):2271-2281.
45. Rebok GW, Ball K, Guey LT, *et al.* Ten-year effects of the advanced cognitive training for independent and vital elderly cognitive training trial on cognition and everyday functioning in older adults. *J Am Geriatr Soc.* 2014;62(1):16-24.



46. Miller KJ, Dye RV, Kim J, *et al.* Effect of a computerized brain exercise program on cognitive performance in older adults. *Am J Geriatr Psychiatry.* 2013;21(7):655-663.
47. Hill NT, Mowszowski L, Naismith SL, Chadwick VL, Valenzuela M, Lampit A. Computerized cognitive training in older adults with mild cognitive impairment or dementia: a systematic review and meta-analysis. *Am J Psychiatry.* 2017;174(4):329-340.
48. Skaugset LM, Farrell S, Carney M, *et al.* Can you multitask? Evidence and limitations of task switching and multitasking in emergency medicine. *Ann Emerg Med.* 2016;68(2):189-195.
49. Van der Schuur WA, Baumgartner SE, Sumter SR, Valkenburg PM. The consequences of media multitasking for youth: a review. *Comput Hum Behav.* 2015;53:204-215.
50. Anguera JA, Boccanfuso J, Rintoul JL, *et al.* Video game training enhances cognitive control in older adults. *Nature.* 2013;501(7465):91-101.
51. Halford GS, Cowan N, Andrews G. Separating cognitive capacity from knowledge: a new hypothesis. *Trends Cogn Sci.* 2007;11(6):236-242.
52. Gray JR, Chabris CF, Braver TS. Neural mechanisms of general fluid intelligence. *Nat Neurosci.* 2003;6(3):316-322.
53. Jaeggi SM, Buschkuhl M, Jonides J, *et al.* Improving fluid intelligence with training on working memory. *Proc Natl Acad Sci U S A.* 2008;105(19):6829-6833.
54. Green CS, Bavelier D. Action video game modifies visual selective attention. *Nature.* 2003;423(6939):534-537.
55. Rosser JC, Lynch PJ, Cuddihy L, *et al.* The impact of video games on training surgeons in the 21st century. *Arch Surg.* 2007;142(2):181-186.
56. U.S. Department of Health and Human Services, National Institutes of Health, National Institute of Mental Health. Technology and the future of mental health treatment. Available at: <https://www.nimh.nih.gov/health/topics/technology-and-the-future-of-mental-health-treatment/index.shtml>. Last revised September 2019. Accessed February 2, 2020.
57. Peter L, Reindl R, Zauter S, *et al.* Effectiveness of an online CBT-I intervention and a face-to-face treatment for shift work sleep disorder: a comparison of sleep diary data. *Int J Environ Res Public Health.* 2019;16(17):pii:E3081. doi:10.3390/ijerph16173081.
58. Segal ZV, Dimidjian S, Beck A, *et al.* Outcomes of online mindfulness-based cognitive therapy for patients with residual depressive symptoms: a randomized clinical trial. *JAMA Psychiatry.* 2020, 29. Epub ahead of print. doi:10.1001/jamapsychiatry.2019.4693.
59. Marshall JM, Dunstan DA, Bartik W. The digital psychiatrist: in search of evidence-based apps for anxiety and depression. *Front Psychiatry.* 2019;10:831. doi:10.3389/fpsy.2019.0083.
60. Stawarz K, Preist C, Coyle D. Use of smart phone apps, social media, and Web-based resources to support mental health and well-being: online survey. *JMIR Ment Health.* 2019;6(7):e12546. doi:10.2196/12546
61. Choudhury S, McKenny. Digital media, the developing brain and interpretive Plascity of Neuroplascity. *Transcultural psychology.* 2013;50(2):192-21s. doi-10.1177/13634641512474623
62. Ebook. Retrived from <http://The acute and chronic, impact of technology on our brain> David A, Ziegler I, Mishra Jyoti and Adam Gazzley Z, University of California, San Fransico 2 Mount Sinai School of medicine, 2021.
63. Reid Chassiakos Y Redecky J, Christakis D, Moreno M, Cross C. Children and Adolescent and Digital media. *Pediatrics.* 2016;138(5):e20162593. Doi:10.1177/0269215519865774.
64. Ra Cho CJ, Stone M, De La Carda J, Golden Son N, Moroney E. *et al.* Association of disital media use with subsequent symptoms of attention deficit/ hyperactivity disorder among adolescent. *JAMA* 2018;320(3):255. doi:10.1001/JAMA.2018.8931
65. Firth J, Torous J, Stubbs B, Firth J, Steiner G, Smith L, *et al.* The “online brain: how the internet may be changing our cognition. *World Psychiatry.* 2019;18(2):119-129. Doi:10.1002/wps-20617.
66. Ketlewell J, das Nair R, Radford K. A systematic review of personal smart technologies used to improve outcomes in adults with acquired brain injuries. *Clinical rehabilitation.* 2019;33(11):17051712. Doi:10.1177/0269,155|9865774
67. Hutton J, Dudley J, Horowitz Krus J, dewitt J, Hooland S. Association between screen-based media use and brain white matter integrity in preschool aged children. *JAMA paediatrics.* 2020;174(1):e193869. Doi: 10.1001/Jamappediatrics.2019.3869.
68. Abdelrahman N, Polventro RM, Wending A, Goetz C, Arnez B. Brain health attitudes towards technology adoption in older adults, *Healthcare.* 9(1):23. Doi:10.3390/healthcare9010023
69. The impact of the digital revolution on human brain and behaviour where do we stand? *Dialogues in clinical neuroscience.* 2020;22(2):101-111; doi:10.31887/dcons.2020.22.2/mKorte.