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Influence of the Neuro-Educational Environment on One's Socialization under Total Digitalization

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Abstract: *The institute of education is an instrument of advanced development, a means of forming a new shaping socio-cultural pattern, with its specific means of significant socialization potential in the conditions of rapid development of society's digitalization. Only education, in its present dimension - neuropedagogy, is able to conduct successful socialization of an individual by teaching her from the position of the laws of brain functioning; to intensify this process in the conditions of total digitalization in accordance with the laws of brain functioning. Intensive use of formal and informal education in the daily life of today's society and socialization of the population in the digital environment because of its activities in the virtual sphere create a wide space for the realization of opportunities. They are conditioned by the rapid dynamics of information flow as a global factor of modernity, generating both advantages and problems in the educational process, cognitive development, social adaptation of personality; formation of traditional ways of relations; changes in the neural architecture of the human brain in the long term; emergence of risks beyond the limits of the digital space. It was established how representatives of different generations, grouped into appropriate age focus groups and in the process of receiving formal and informal education, are socialized in the digital space. The paper reveals how the cognitive domain of personality changes under the influence of digitalization in the context of the respondents' stay in the educational environment. The specifics of socialization in the digital environment and the reasons for the preference of virtual form of communication were determined. The types of digital danger in the virtual environment were revealed.*

Keywords: *Cognitive processes, educational space, digital environment, socialization, formal education, non-formal education, digital danger.*

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Introduction

Large-scale digitalization as the technical basis of today's global society permeates all spheres of life and irrevocably affects the ways and forms of existence of every individual. The extensive integration of technological advancements into everyday life, coupled with the development of virtual communication, provide a wide platform for expediting the socialization of individuals and the achievement of their potential. In contrast, it frequently induces their social detachment, perceived as a deterioration and destruction of conventional social associations of people, the seclusion of personality, when somebody partitions life into two parts: genuine life in the cyber world and pretend life in the true world, whereby it becomes a wraith (Subrahmanyam & Greenfield, 2008, p. 146).

The specifics of personality formation in the context of global configurations is the formation of new value and meaning orientations. This is associated with the expansion of personal space through the active use of innovative technologies and advanced means of communication. As a consequence, new forms of interpersonal relations emerge, thanks to which the connection between countries, peoples and specific people becomes more intense and intense. That is, the development of new digital technologies that expand the boundaries of an individual's external freedom. As a result, there were changes in people's perception of life, there was a significant enrichment of their potential, the expansion of socio-cultural perceptions. Individuals in countries of various levels of development can formulate their plans and aspirations, not only looking at the norms, values and lifestyles of their own environment, but also those that they may be attracted to even though they are unattainable (Maltseva, 2019, p. 27). Simultaneously, the prime concentration of the information sphere is the personality with its varying needs, chiefly the need for socialization, which is to be fulfilled by the successful digitalization of society, the impact of which is significantly amplified by the one’s stay in an educational environment (Kovalenko, 2020, p. 12).

Despite the extensive research conducted on the impact of information and communication technologies, digitalization, the Internet and social networks on one’s socialization in today’s society, along with the significant expertise of educators in the field of neuropedagogy, there remains a lack of comprehensive understanding regarding the cerebral mechanisms at play during the educational process and the socialization of multiple generations within the digital realm. This gap includes the need to uncover key behavioural patterns exhibited by individuals in virtual

spaces, explore how the educational environment affects the level of socialization in the digital world and categorize various types of digital risks (Grundmann, 2011, p. 64).

Digital technologies, as the most important means of activity, have a direct impact both on the person as a whole, and on the structure of cognitive processes, in particular. In the modern world a significant part of scientific works is devoted to the study of cognitive mechanisms in childhood and adolescence, but in the process of socialization and formation of the cognitive sphere of the older population remains little studied and debated, which determines the relevance of this study.

The purpose of the study

The purpose of the study is to determine the consequences of the impact of digitalization on the main spheres of society in the coordinates of cognitive processes, to establish empirical features of digital socialization of 4 generations and the main patterns of behavior of Internet users, to find out the specifics of socialization of different ages in the digital space, to determine the impact of staying in educational space on the degree of socialization and establish types of digital danger in a virtual environment.

The objectives of the empirical study are:

- to establish the success of socialization in the digital space of representatives of different generations, grouped into appropriate age focus groups, and being in the process of formal or informal education;
- determine the impact of being in educational space on the degree of socialization of the control focus group of respondents who are not in educational space;
- to establish the types of digital threats in the virtual environment;
- diagnose and summarize the results of studies of cognitive processes in different age groups under the influence of the digital environment, carried out by representatives of various scientific schools associated with cognitive psychology and neuropedagogy.

Materials and methods

During the study, the authors used the method of analytical review of scientists' opinions on the problems of changes in the cognitive development of society in different age groups, the processes of their thinking, memory and attention in the context of the impact of socialization mechanisms, digitalization and educational space on the human psyche. In the study of possible transformations of the innate qualities of personality occurring under the influence of digital space on

the processes of socialization, we used the results of scientific psychological and pedagogical studies of domestic and foreign scientists in the field of social interaction in the information space in the conditions of formal or informal education.

To collect empirical information, a qualitative approach was chosen with a combination of four methods: interviews and questionnaires - to collect statistical information; analytical and graphical - for its processing and analysis. Qualitative methodology was chosen because the authors were interested in in-depth coverage of the topic under study.

In the empirical research 100 people at the age of 14 to 61 years old and over, studying, working or retired and living in different regions of Ukraine were interviewed. Four focus groups of 20 people each were selected: 14-24 years old, 25-40 years old, 41-60 years old.

All interviewers of these focus groups are in the process of active learning in formal or non-formal education environment.

To strengthen the understanding of the degree of socialization in the digital environment in the context of lifelong learning of the four selected focus groups, as well as to investigate age-related changes in cognitive function and memory, a fifth, control focus group of 20 people and age category 61+, whose representatives are not in the educational process, was introduced into the study.

Results

Strauss & Howe (1991) were the ones who presented the idea of generations (p. 11). According to it, people of the same age group are united by common features dictated by social conditions of the territory where they were brought up. As a result, the researchers came up with 6 generations in the 20th and 21st centuries, 4 of which today are socialized in the digital space and whose cognitive system is going through epochal (Strauss & Howe, 1991, pp. 45□ 48). Moreover, it should be noted that this transformations
socialization takes place in the context of the globally recognized concept of lifelong learning in formal and non-formal educational settings.

We will define the features of digital socialization of different generations and the main patterns of behavior of Internet users; neuropsychological problems associated with virtual communication and their causes; we will establish the threat of the individual in the virtual environment with the help of such methods of empirical research as:

I. Interview "Time spent on the Internet and the devices used to do so".

II. Questionnaire "Real and virtual communication: identifying reasons".

I. Interview "Time spent on the Internet and the devices used for this purpose". To determine why respondents prefer virtual reality communication and how much time they spend on the Internet, an interview consisting of 7 questions was developed:

1. Is communication important to you?
2. For what purpose do you use the Internet?
3. What device do you use to communicate on the Internet?
4. What kind of interaction do you prefer: real or virtual?
5. What is the average amount of hours you spend online?
6. What is the average amount of hours you communicate in the real world?
7. What types of digital threats have you encountered in the virtual environment?

The above focus group interviews provided the following information:

1. Is communication important to you?

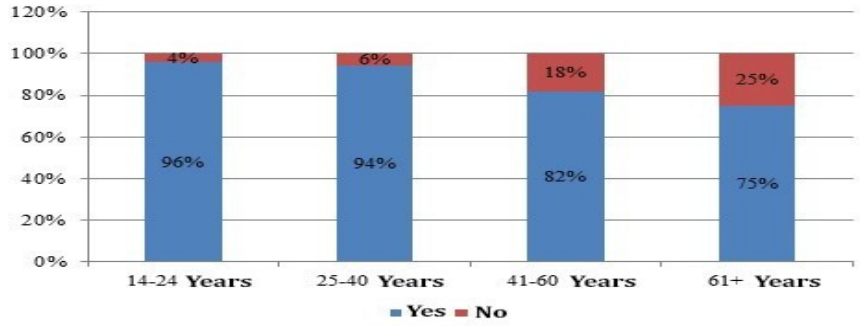

Figure 1: *The degree of importance of communication for the respondents*
Source: author's elaboration

Communication turned out to be most important for the interviewees of ages that belong to the so-called "first half of life. On average, for these two focus groups, the affirmative response was 95%, and the negative response was 7.5%. For the other two focus groups, those belonging to the "second half of life," there was a decrease in the need to communicate. The average for these two focus groups was 78.5% affirmative and 21.5% negative. The lowest need for communication is observed in the control group, where 62% of respondents recognized it as important for themselves. We believe that a significant impact on the level of socialization through communication in all four focus groups is through

the presence of respondents in the educational process, because its very mechanism encourages to be in constant dialogue, if not with all participants, then at least with the teachers. This was confirmed by the results of the survey in the control group.

2. For what purpose do you use the Internet?

Table 1. Assigning Information to the Digital Search Environment of the Focus Groups Examined, %

Content	14-24	25-40	41-60	61+	61+ (Control group)
Gaining knowledge of the news	39.0	91.2	84.3	72.8	64.5
Broadening one's horizons by gathering knowledge	67.2	89.4	76.1	46.3	21.8
Incorporating educational information	90.6	61.2	33.5	19.7	3.1
Communicating virtually through messaging and social networking	91.0	94.3	89.0	77.3	27.4
Gaming	78.3	67.1	48.4	37.7	0.9
Purchasing goods and services	37.3	72.5	69.1	21.5	5.1
Accessing state services	24.0	78.4	75.7	34.8	2.7
Handling a bank account	61.9	96.3	89.1	51.4	18.3
Settling utility accounts	51.4	92.4	67.9	36.5	4.4

Source: the authors' own conception

An analysis was conducted to examine the various purposes for which the surveyed digital environment was used, based on the focus group affiliation. Interviewees aged 14-24 gravitate to content related to virtual communication (91.0%), educational content (90.6%) and entertainment content (78.3%). Quite a high proportion of cognitive content is associated with the constant stay of the lion's share of the representatives of this focus group in the educational environment. Also for this reason, the content related to the provision of their own life activities in the "adult world" is used at an average level of 43.7%.

The two focus groups with age frames of 25-40 years and 41-60 years are the most demanding users of the digital environment with maximum use of its features and functionality. Here we observe the highest level of efficiency in the use of all the types of information environment proposed in the interview, both cognitive and entertaining, and content related to the provision of personal life activity.

The oldest of the age focus groups studied is characterized by a high level of use of content related to virtual communication (77.3%), news

(72.8%) and cognitive (46.3%) content, as well as the use of online banking (51.4%).

The results of the study of the control group showed that the respondents use the digital environment mainly to get news, as do their peers in the fourth focus group, all of whose participants are involved in non-formal education. But in the control group the number of those using educational content is 6,4 times less than the respondents of focus group 61+; the number of those who expand their worldview with the help of Internet is 2 times less; the number of those who are in virtual contact via messengers and social networks is 2,8 times less. This means that the preparation for classes and tasks by participants in the educational process, even in non-formal education, encourages respondents in the focus group 61+ not only to communicate more, but also to use the digital environment to find the necessary information in a different way than respondents in the control group.

3. What device is used to connect to the Internet?

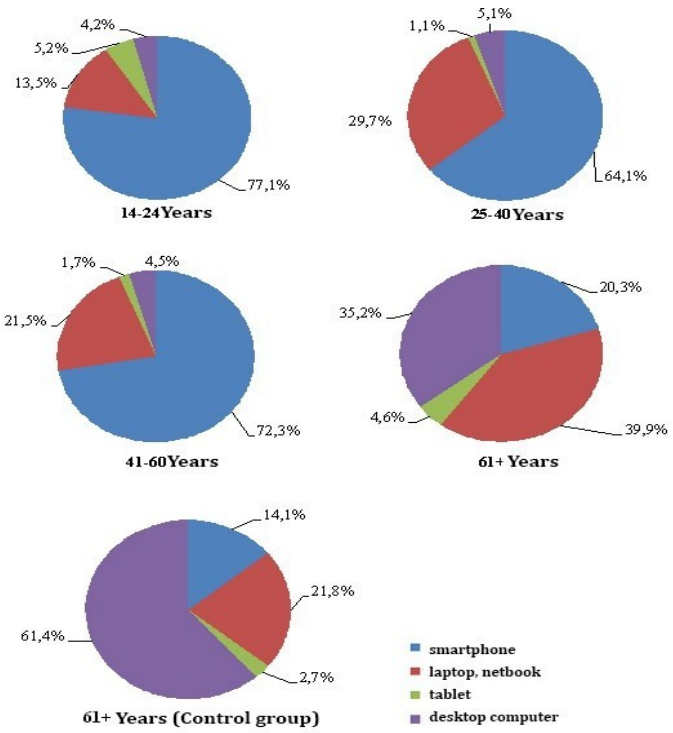

Figure 2: *Extent to which gadgets are used to connect to the Internet*
Source: author's elaboration

4. What kind of interaction do you prefer: real or virtual??

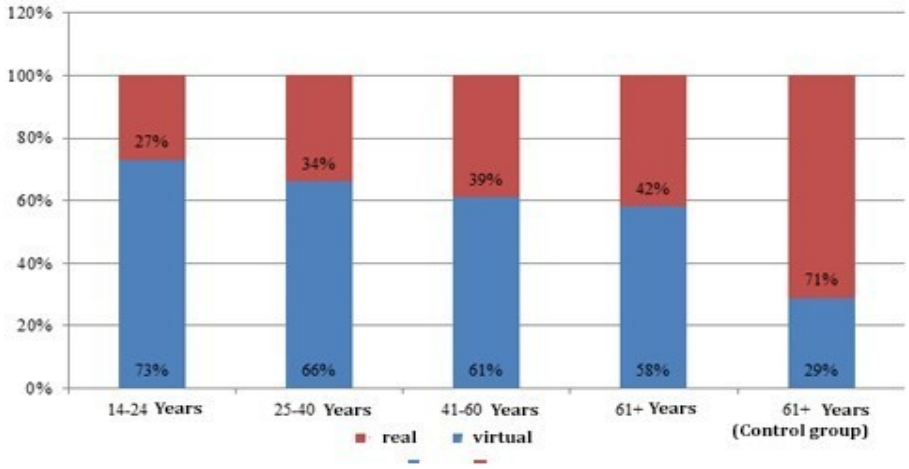

Figure 3: *Choice of communication format preference: real or virtual*
Source: author's elaboration

The analysis of Figure 3 suggests that the vast majority of respondents in all four groups prefer virtual communication, especially young people aged 14-24 (73% of respondents). Representatives of focus groups 3 and 4, with the age range from 41 to 61+, where this figure was 39% and 42%, respectively, are most attracted to real communication. The results of the survey in the control group yielded diametrically opposite results: 71% of respondents insist on real communication, which is one of the consequences of the lack of access to quality Internet, the limited circle of communication and the incentive to expand it, for example in the form of mastering new educational tools.

5. How many hours on average do you spend on the Internet?

From questionnaire results (see Fig. 4), it was revealed that the typical time respondents stay connected online each day is 5 hours and 43 minutes, equating to 34% of their waking hours. Representatives of the two focus groups in the age category from 25 to 60 years old can stay in the digital environment the longest. Restrictions on staying online for respondents aged 14-24 are caused by parental control, as well as attendance at formal and informal education. At the same time, restrictions for the fourth focus group, representing the 61+ age group, are mainly caused by age changes and health conditions.

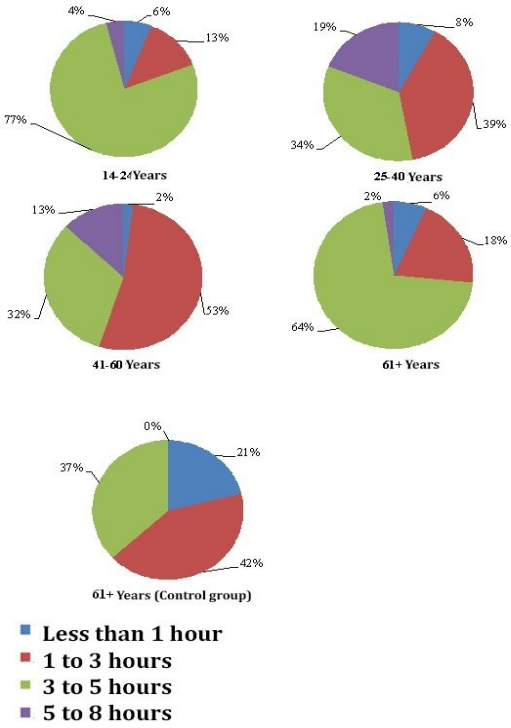

Figure 4: *Amount of time spent on the Internet*
Source: author's elaboration

The interviews revealed that the average time respondents spend on the Internet is 5 hours and 43 minutes per day, which is approximately 34% of their waking time. Representatives of two focus groups in the age category from 25 to 60 years old can stay in the digital environment the longest. Restrictions on staying online for respondents aged 14-24 are caused by parental control, as well as attendance at formal and informal education. At the same time, restrictions for the fourth focus group, representing the 61+ age group, are mainly caused by age changes and health conditions.

The vast majority of respondents, due to the absence of one of such powerful stimuli as learning, are most often in the digital environment for 1- 3 hours. This is due to the fact that they do not spend time, neither on staying at lectures or practical classes, nor on communicating with teachers or fellow students, nor on completing tasks.

6. How many hours on average do you communicate in the real world?

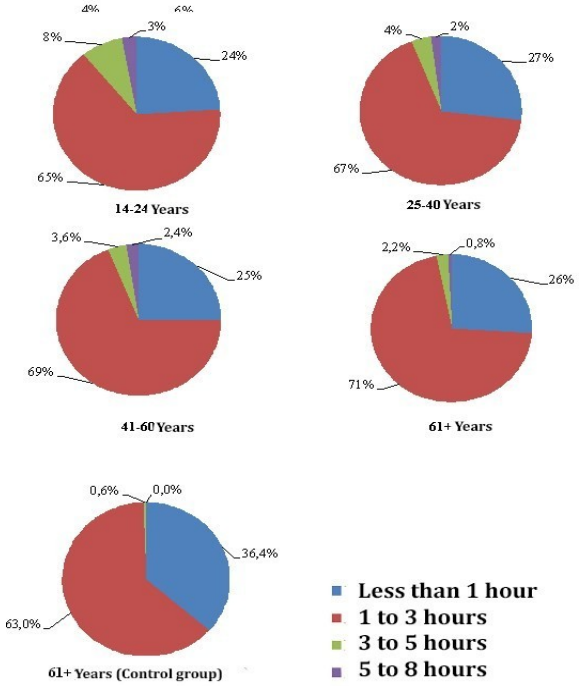

Figure 5. *Amount of time devoted to real communication*
Source: author's elaboration

The interview data on the amount of hours dedicated to "live" communication reveal that the majority of respondents devote between 1 and 3 hours a day to communication. This figure, on average, for the four focus groups was 68%. It should be noted that as the age category of respondents increases, the time devoted to communication gradually increases as well. Also at approximately the same level (24-27%) is the indicator of communication, holding less than 1 hour. The largest gap among the 4 studied focus groups was observed in the answers regarding the duration of communication from 3 to 5 hours: for the respondents aged 14- 24 it was 8%, and for the respondents aged 61+ it was 2.2%.

As for respondents in the control group, the situation was similar to the previous question: their overwhelming majority (63%) also devotes between 1 and 3 hours a day to communication.

7. What types of digital threats have you encountered in the virtual environment?

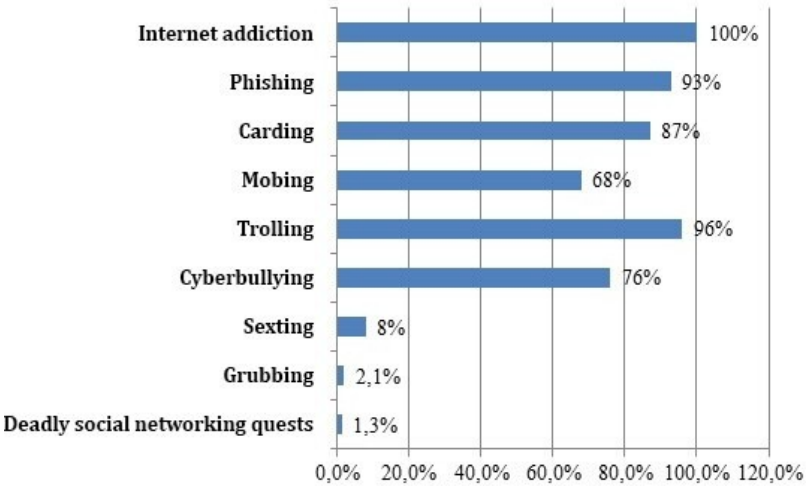

Figure 6. *Types of digital threats to Internet users*
Source: author's elaboration

The development of the current global Internet has stimulated the emergence and rapid increase in various types of addiction and cybercrime, ranging from fraud to criminal acts. The survey showed that respondents in all focus groups have Internet addiction to varying degrees (100%). Mocking, rudeness, humiliation and insulting online was encountered by 96% of respondents in all focus groups. The extortion of personal data from online users was encountered by 93% of respondents between the ages of 24 and 61. But if such types of risks as phishing, carding, mobbing are typical mainly for age categories from 25 to 61+, then cyberbullying (76%), sexting (8%), grooming (2.1%) and deadly quests in social networks (1.3%) threaten the first focus group in the 14-24 age group**.**

The interview revealed that absolutely all the respondents at least once in their life have encountered risks related either to personal stay in the virtual environment or to attempts of malicious actions to use personal data of the respondents.

Therefore, users of the digital environment should not forget about safety measures in communication, because it is very often with strangers who cannot be seen. It should also be noted that virtual crooks are psychologists, who most often establish contact with teenagers in chat rooms or on forums.

II. Questionnaire "Real and virtual communication: identification of reasons". Respondents were asked to answer the questions and choose the answer options: virtual or real communication

Table 3: Respondents aged 14-61+ identified reasons for preferring virtual communication over real one

Question to	Real communication, %	Virtual communication, %
Where do you perceive information better?	28	72
Where do you find it easier to find adequate information about events	17	83
Where do you find it easier to formulate opinions?	28	72
Where is it easier for you to articulate your thoughts?	25	75
Where there is more responsibility?	78	22
Where do you find it easier to get to know another person?	6	94
Where can you make friends more easily?	5	95
Where do you find the most appealing way to communicate?	10	90
Where are you more psychologically comfortable?	37	63
Where can you be the person you want to be?	15	85
Where is it easier to break up with a person, to break off a relationship?	0	100
Where is it easier for you to tell the truth?	42	58
Where do you find it easier to confess your feelings?	35	65
What do you prefer: the anonymity of virtual communication or the publicity of real communication?	11	89
Where do you find it easier to end an unpleasant conversation?	5	95
Where are you more open?	33	67
Where do you find it easier to point out human flaws?	16	84
Where do you find it easier to show your emotions?	40	60

Source: author's elaboration using the idea of, Marchenoka (2016)

Our survey revealed that respondents of different ages prefer virtual communication. This is explained by the following:

1. Receiving information, its analysis for truthfulness, as well as the degree of perception and adequacy of response is better carried out in virtual space. We attribute this to a much lower level of emotional coloring, which carries virtual information compared to real communication and the presence of time interval for its reflection.

2. Due to a greater degree of psychological comfort in the virtual environment, which was indicated by 63% of respondents, they more easily formulate and express their thoughts (respectively, 72% and 75% of respondents).

3. Respondents indicated that in the virtual environment they feel a much lower level of responsibility for their actions and to their communication partners only 22%. In turn this fact in turn determines: a greater emotional freedom in communication, which was pointed out by 60% of respondents; greater ease in getting acquainted with other people (94%) and in finding friends (95%). The lower level of responsibility in the virtual environment was also the reason for the absolute unanimity of respondents of all ages in the question of which environment it is easier to break off relations with a partner, who indicated in the survey exclusively in virtual space (100%).

4. Anonymous virtual socialization also allows the vast majority of respondents of all ages (85%) to imagine themselves in the digital environment as someone they want to be.

Discussion

Theoretically applied analysis of research works of representatives of various scientific schools connected with cognitive psychology, neuropedagogy and neuroimaging has allowed us to make generalizations and conclusions supplementing our own research. These generalizations emphasize that global digitalization has a significant impact on the formation of mental abilities of individuals, and the cognitive processes of Internet users are accompanied by neuroplastic restructuring of the brain. A special condition that maximally activates these processes is an individual's stay in an educational environment. The learning process is enabled by the synaptic level, which is activated by electrical signals and neurotransmitters (Stordeur, 2014, p. 120). That is, there is a creation of synaptic connections between unremarkable neural networks, their densification and intensification.

Research shows that neurocognitive responses to socialization through learning in the digital environment are similar to those in real life. For instance, when faced with a negative assessment of their knowledge and abilities during virtual education or a refusal in online conversations, both children and older adults show increased activity in the areas of the brain associated with social cognition and avoidance of the physical world (medial prefrontal cortex) (Achterberg et al., 2017, p. 107; Grossmann, 2013, p. 1). A substantial amount of data is emerging that excessive trust in online reviews adversely impacts the self-esteem of youth,

particularly those with inadequate social-emotional health, due to the prevalence of cyberbullying, augmented nervousness, sadness and detachment. (Lin et al., 2016, p. 323; Vannucci et al., 2017, p. 163).

Identifying a causal relationship between extensive social media use and poor mental health is still a challenge, as there is a complex symbiosis between multiple influencing factors, including restricted time for sleep and face-to-face social interaction, plus augmented time spent on the web (Twenge et al., 2017, p. 4). Given the high popularity of social media use among young people, future research should carefully examine the potentially harmful effects on the health and well-being of the 14- to 24- year-old population.

Members of different age groups with mental disorders are the most vulnerable to the negative influence of social media. At the same time, however, these media can provide a new platform for improving their mental health if the potential of the digital environment is properly harnessed. Hence, social media may be implemented to foster social ties, build social backing and foster self-efficacy in education, which could result in long-term, functional progress in serious mental health disorders (Gleeson et al., 2013, p. 438).

Digital socialization and non-formal education have a particular impact on people in the 61+ age group. This is due to the fact that searching for information online engages more neural circuits than reading text pages in older adults who are not in the learning process. Moreover, experiments have demonstrated that online and smartphone-based educational computer games can be used to reduce the cognitive deterioration caused by aging (Small et al., 2009, p. 120). Thus, the digital environment and informal education are becoming a new and accessible platform for adults to maintain cognitive function in old age. On this basis, it should be noted that successful cognitive aging depends on learning and applying cognitive strategies that can compensate for the aging-related decline in "raw" memory. Formerly, this was known as enhancing inner cognitive processes (e.g., through memorization techniques) or employing cognitive unloading in conventional formats (e.g., list formation, recollection) (Kühn et al., 2014, p. 265).

Taking the above into consideration, it is noteworthy that while young and middle-aged individuals are particularly susceptible to rejection, peer pressure and unfavorable assessments while socializing in the digital sphere, elder people use social media to combat isolation, obtain informal education and thus benefit from the physical, mental and neurocognitive advantages associated with making digital social connections (Anguera et al., 2013, p. 100).

Conclusion

Digitalization has created new neuropsychological and sociocultural conditions in which the process of personality formation, processes of thinking, memory and attention develops. The digital environment functions as:

a) the social arena in which one identifies and finds themselves;

b) an outcome of human mental and creative energy, a medium facilitating communication and action, the acquisition of which contributes to the intellectual and personal growth of people (Bocheliuk, 2020, p. 90);

c) a hub of interactive education for formal and informal instruction.

The conducted interviews showed that communication is necessary and important for the majority of respondents in all focus groups, at the same time its value for the respondents decreases with age from 96% at the age of 14-24 years old, to 75% at the age of 61+. Its level is also low among respondents in the control group, who, in addition, are not in the process of actively receiving formal or informal education.

The analysis of the content of interest of respondents in the digital environment differed depending on the affiliation of the focus group. Respondents aged 14-24 years gravitated towards content related to virtual communication (91.0%) and entertainment content (78.3%), were less interested in content related to the provision of life needs of the citizen. Respondents of focus groups with age limits of 25-40 years and 41-60 years turned out to be the most demanding users of the digital environment with maximum use of its features and functionality. Here we observe the highest level of efficiency in using all the types of information environment offered in the interview, both cognitive and entertaining, and content related to the provision of personal life activity. The results of the study of the responses of the control group showed that its respondents use the digital environment mainly for news.

To access the Internet, the vast majority of the representatives of 3 focus groups, the age range of which is from 14 to 60 years, use smartphones (the average figure is 71.2%). For representatives of the oldest focus group, the most common device for staying in the digital environment are laptops and desktop computers (75.1%), and for respondents from the control focus group this indicator was 83.2%.

The vast majority of respondents in all four groups prefer virtual communication, especially young people aged 14-24 (73% of respondents). More than others are drawn to real communication by representatives of focus groups 3 and 4, with an age range of 41 to 61+,

where this index was 39% and 42%, respectively. This does not apply to respondents in the control focus group, where 71% of respondents insist on real communication.

The interviews revealed that the average time spent by the respondents on the Internet is 5 hours and 43 minutes per day, i.e. approximately 34% of their waking time. The respondents of 14-24 years old (77%) spend the longest time online, spending 3-5 hours a day in virtual communication and devoting only 1-3 hours a day (65%) to real contact with parents, friends, classmates. Worryingly, on average 25.5% of respondents in all focus groups spend less than 1 hour a day in real communication. The control focus group was least likely to be online.

On the whole, the interview allows comparing the cognitive processes occurring in different age focus groups, including the control group, under the conditions of their stay in the digital environment in the context of being tied to the educational environment. The main conclusion is that learning activities associated with receiving both formal and informal education have a positive effect on the cognitive ability of an individual, contributing to their social integration and slowing down the decline of cognitive and mental activity in old age.

A study of the risks encountered in the virtual environment made it possible to establish that Internet addiction affected 100% of respondents to some degree, and trolling affected 96% of respondents in all focus groups. As for other types of danger, there is a clear distinction according to age category. Respondents aged 24 to 61+ encountered phishing (93%), carding (87%), and mobbing (68%). Respondents in the 14-24 age category, encountered cyberbullying (76%), sexting (8%), grooming (2.1%), and life- threatening social media quests (1.3%) in their daily lives.

The results of the questionnaire showed that the respondents of all focus groups are keen on communication in virtual reality. This is due to the fact that the digital environment attracts freedom of action, when the person, using digital tools, can form an idea of himself in the interlocutor (85%), which cannot be done in real communication. An analysis of answers made it possible to conclude that such freedom of action and a low (22%) level of responsibility in comparison with the real world make it easier to find a friend (95%) or a beloved person (94%), easier to point out his/her shortcomings (84%), easier to part with a person (100%). Virtual space gives more opportunities for unemotional analysis of information and decision- making (72%), to show your emotions (60%).

The virtual world offers a particular capacity and situation for social interaction which, when combined with learning, can bring about different intellectual attributes of brain structures and processes compared

to the real world. (Gómez, 2020, p. 223). Notwithstanding these minor variations, the human brain processes signals from concrete and virtual social surroundings in a similar way, as evidenced by the collective cognitive abilities which eventually determine their underlying framework (Firth et al., 2019, p. 121).

Since the digital transformation of society with the massive introduction of the Internet is less than 30 years old, the long-term effects on socialization in society as a whole have not yet been established. In view of this, it seems particularly important that future research determines the effects of digitalization on the individual during different age periods of his or her life. Extensive research on this topic has shown that the harmful effects of digital multitasking on attention are especially severe in early adolescence, surpassing even the impacts observed in older adolescents. Additionally, it has been observed that intensive Internet usage over three years is connected to a decline in verbal intelligence, as well as a delay in the development of gray and white matter regions (Baumgartner et al., 2017, pp. 3–8). On the other hand, the opposite, positive effect of the impact of digital multitasking is observed among the elderly, whose cognitive responses are undergoing a gradual decline, and for whom learning in an active digital environment can become a new source of positive cognitive stimulation.

The neuropedagogical approach to education has advantages over other learning mechanisms, as it encourages teachers to adapt educational methods not to the level of the applicant's mental abilities, but to their intellectual capabilities. This allows education applicants to fully use all the available potential for self-development, removes artificial barriers to their socialization in the digital environment.

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