Research on the harmful impact of digital technology on effective learning in adults

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Abstract: *The advanced digital technologies use in the adult education system represents a real advantage through the facilities offered for the educational process, for the production and development of knowledge. These are also accompanied by a series of risks regarding the quality of content and correct learning. In our paper, we present the comprehensive results of our research and propose a strategy and a platform for educational support of human resources institution, against the background of the development of analytical skills and critical thinking.*

Keywords: Learning styles, Digital Technologies, Digital Educational strategy, Online educational platform.

1. Introduction

In the digital age, technology has revolutionized the way for learn, interact and access information. The Internet, disruptive educational technologies (AI/ML), mobile electronic devices (phones, tablets, laptops etc.), online platforms etc., have revolutionized the content and the methods of learning, and making the entire educational process much more fluid and volatile.

Both teachers, instructors and educational tutors, as well as learners, have been faced with new types of challenges for learning correctly, in an ethical and accessible way. In this paper, we will refer to the negative effects of the excessive use of digital technologies on correct learning, at the adult level.

2. Features of adult cognitive development

Digital technologies provide essential support to adults for the production, transfer and consumption of information in order to develop knowledge and understand everyday situations. The purpose of this chapter is to briefly present our results on the development of learning skills with the support of digital technology. For this, we consulted and analyzed over 150 papers, articles and scientific communications, books and opinions expressed in interviews and conferences.

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Analyzing the dominant trends, we establish that adult learning styles are: (Amponsah, 2020)

Convergent or pragmatist style – practical learning is preferred over theoretical learning. Learners prefer to reject information that does not have an obvious application, learning being achieved through autonomous and responsible thinking;

Divergent style or reflective observation – is the style characteristic of adults who have the ability to deepen into problems, ensuring sufficient time for investigations. For them, learning is understood as a process of using previous knowledge (own and identified in various sources) to give meaning to the acquired experience, correct cognitive processes and improve future actions. Cautious resolution of new situations, with the risk of forming wrong perceptions to third parties regarding their slow thinking or the existence of weaknesses in the cognitive process, is the basic dominant.

Theoretical style – is specific to those who approach situations in a logical, step-by-step, vertical manner, with the aim of assimilating disparate events into coherent theories. They synthesize information through systematic and analytical approaches through complex algorithms, having a low tolerance for uncertainty, disorder and ambiguity.

Other studies classify learning styles differently, depending on the criteria chosen. Given this diversity, we believe that the effort to create a unique educational product or program is unreliable and expensive. An educational product that is useful to most may distract others.

Based on contemporary digital technologies, which offer a wide range of educational platforms, adults can choose a method according to their learning style. In this context, divergent trajectories and diversity could negatively affect the learning of senior adults, who either do not have technology skills or are stimulated by methods determined by their profession or hobby (Neagu & all, 2024). Recent studies have demonstrated that the potential for improving learning and developing intelligence through cognitive training, mainly through gamification, improves academic performance or learning in the workplace (Badawi & Ciupercă, 2023).

Particularly at this historical stage, the rapid implementation of digital technologies can be approached as an element of novelty in work, as an opportunity to learn new things and be exposed to new information, as a routinization reduction etc., all of these elements supporting intellectual growth (Staudinger et all., 2020).

The main advantages are:

Accessibility to expanded educational resources – online educational materials can be accessed from any location, 24/7, allowing adults to learn at their own rate and in accordance with professional and personal schedule availability opportunities, without the need to take a formal course;

Personalized learning – technology can be adapted to the needs and motivational requirements of the learner, with online platforms providing real-time feedback, progress testing, recommendations for additional study materials and additional training sessions;

Improving collaboration and interaction – digital educational technologies create opportunities for learning and exchanging ideas with virtual colleagues;

Stimulating motivation through gamification – in the learning process, gamification can stimulate motivation by integrating certain rewards, rankings, competitions etc., into the game. In addition, some adults can train and develop their digital skills, an essential condition for the professions of the future.

3. Disadvantages of excessive use of digital technologies in adult learning

The lack of basic digital skills, in addition to limiting access to knowledge, can undermine the motivation to learn and preserve self-satisfaction. This disadvantage will lead to isolation, similar to replacing direct human interaction with a pseudo-online life through the excessive use of digital technologies.

Other disadvantages are related to the superficiality of information in the online environment, the distraction of attention in its proximity, the development of cognitive errors and the loss of critical thinking skills.

3.1 Unlimited access to information and the risks of superficiality

Easy access to enormous amounts of information can have negative effects on the learning process of adults by quickly obtaining answers to questions based on scientifically uncertified content. Adults who rely on online search engines to obtain information may only learn basic concepts and may be “fooled” by a multitude of controlled or fragmentarily documented information (for example, false information generated by AI technology, through deep-fake techniques and other methods of social engineering etc.).

In addition, unlimited access to information can lead to a lack of discernment in selecting answers from relevant sources. It is known that many online sources are not verified for accuracy, the main criterion for selecting information being only the large number of followers. Thus, the content disseminated on social media platforms can contribute to the formation of misconceptions or incomplete concepts, generating various conspiracy theories, without a scientific basis but easy to understand. Let's give the example of the “Flat Earth Theory” (Baugh, 2024).

3.2 Distraction and the impact on concentration during learning

Frequent of digital technologies use, especially mobile ones, can contribute to loss of concentration and distraction. Online notifications, information routines

on social networks, digital messages via email or social media platforms etc., can significantly contribute to distraction and fragmentation of attention during the learning process, resulting in loss of concentration and increasing the time allocated to this process.

In addition, excessive use of the internet and digital technologies can cause procrastination, unnecessary waste of time, neglect of activities and other aspects related to professional or social duties. Studies show that multitasking or attempting to carry out several activities simultaneously, especially in the online environment (for example, reading an article while responding to WhatsApp messages), can negatively affect the understanding and retention of information, which leads to superficial learning.

3.3 Cognitive errors and lack of critical reflection

Exploiting online content without an appropriate educational method can produce cognitive errors. For example, adults who overuse information produced by AI/ML chatbots may end up accepting the information automatically, without passing it through specific filters for critical analysis (Stănescu, 202).

Besides, algorithms that analyze and provide information based on past behavior can create "information bubbles" in which adults are exposed to only certain types of content. This limits the diversity of information sources and the perspectives of critical analysis, creating a narrowing of the information front between milestones that allows the perpetuation of misconceptions or incomplete learning. And dependence on online information resources can stimulate or redirect user behavior.

3.4 Eroding adult autonomous and critical learning skills

As digital technologies are increasingly implemented in everyday life, there is a risk that more and more adults will become dependent on digital platforms and services. This increases the risk of reducing autonomous learning from books, other bibliographic sources, direct interpersonal interaction, etc. Technology, by its nature, can replace these traditional forms of learning, but it can also hinder the process of developing critical thinking skills and in-depth analysis of a subject. Excessive exposure of adults to an online learning system will lead them to consume information without fitting it into a coherent conventional framework, with application in everyday life, to stimulating mechanical learning or fragmentation of ways to solve a situation.

3.5 Negative effects on mental and physical health

Over time, excessive use of digital technologies can have negative effects on students' mental and physical health. There are medical studies that show that prolonged exposure to screens can cause eye strain, insomnia and stress, which in turn can affect the ability to concentrate and retain information. (Devi &Singh, 2023).

Also, excessive use of digital technologies can lead to a decrease in direct human interaction and social isolation (Grey & all, 2024). Adults who spend a long time in front of a screen may, over time, lose the ability to communicate directly with peers and instructors, eroding the possibility of learning or exchanging ideas in collaborative groups or teams.

4. Discussions and observations

An educational ecosystem, based on digital technologies, for adult learning is the only solution to transform existing theories and scientific research results into elements for improving social well-being and health. It will allow resources to be used harmoniously, through a sharing of strategies and action plans, in various directions whose major objective is to ensure security and personal, professional and social development.

Currently, there are institutional initiatives that have started to model the systemic relationships of education in an ecosystem, such as the STEM platform (science, technology, engineering, arts and mathematics). It approaches learning as an access point for the development of dialogue and critical thinking (European Commission, 2023), for the preparation of a quality workforce and for the literacy of citizens for a highly technology-based society. Other solutions use gamification as innovative educational tools for teaching STEM/STEAM courses such as: BBC micro: bit, VR Learn, pi-topOS, Soundtrap, Augie (developed by Pai Technology), CollabSpace etc. (EdCan, 2019).

Based on lessons learned and dialogue between experts in educational sciences, a national strategy can be established, which will establish the framework for coordinating development efforts, in the long term, regardless of the political color of the government and the functioning of institutional relations between the private sector and civil society.

Among other things, this strategy will be able to ensure:

1. Improving governance through coherent mechanisms to ensure monitoring and evaluation of education progress and adaptation of the workforce to new market requirements;

2. Strengthening national security through internal and external measures to prevent misinformation and manage crises, knowing that disinformation and misinformation represent the greatest risk estimated for 2025 (World Economic Forum, 2025);

3. Social integration and cohesion through measures to reduce inequalities, combat discrimination and integrate vulnerable groups;

4. Technological development and innovation by stimulating investments in education, to train the workforce in technological fields, in digitalization, in emerging technologies etc., which can transform the structure of the economy and the entire society.

Another aspect in which it favors the wrong education of adults concerns the dynamics of changing online sources that provide mentoring, depending on reward policies and not on the quality of information. This trend, combined with a strategy based on the "sense of belonging" of the learners, determines that the graduates' certificates represent only a recognition of the formal history of training and not an acquired skills. We believe that the policies of some institutions regarding employment practices should also emphasize online platforms for testing a candidate's practical skills. Such a solution will be a useful tool for identifying the best position and role that a candidate can hold in the organization. In addition, it can stimulate confidence in one's own capabilities, contributing essentially to the formation of a lifelong learning culture, through which citizens can remain anchored to the challenges of societal evolution.

5. Conclusions

Freedom of expression is a fundamental right essential in a democratic society. This right includes, in addition to freedom of opinion, the freedom to receive and dissemination of information. Current digital technologies are a useful tool for exercising this right, with the advantages and risks that arise from unlimited access to information.

It is essential that learning is exercised responsibly, in a framework that promotes critical thinking and deep learning. It is important to emphasize the development of autonomous learning skills and the encouragement of personal reflection in order to prevent the negative effects of the use of digital technologies, in a complex information environment, with a multitude of dangers associated with the digital world.

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REFERENCES

Amponsah, S. (2020) Exploring the dominant learning styles of adult learners in higher education. *Int. Rev. Educ.* 66, 531–550. doi:10.1007/s11159-020-09845-y.

Badawi, S. & Ciupercă, E.M. (2023) Empowering education: learning from crises to achieve resilient education in Romania. *Proceeding of the International Conference on Virtual Learning – ICVL 2023*, 18th Ed., doi:10.58503/icvl-v18y202308.

Baugh, L. Sue (2024) Flat Earth. *Britannica*, https://www.britannica.com/topic/flat-Earth [Accessed 9th January 2025].

Devi, K.A., Singh, S.K. (2023) The hazards of excessive screen time: Impacts on physical health, mental health, and overall well-being. *J. Educ. Health Promot, eCollection 2023*. doi: 10.4103/jehp.jehp_447_23.

EdCan Network (2019) *7 Innovative Educational Tools for Teaching STEM/STEAM Courses*. https://www.edcan.ca/articles/7-innovative-educational-tools-for-teaching-stem-steam-courses/ [Accessed 10th December 2024].

European Commission. (2023) *STEM Education, European School education Platform*. https://school-education.ec.europa.eu/en/learn/courses/stem-education [Accessed 10th December 2024].

Grey, E., Baber, F., Corbett, E. D., Gillison, F. & Barnett, J. (2024). The use of technology to address loneliness and social isolation among older adults: the role of social care providers. *BMC Public. Health*, 108. doi:10.1186/s12889-023-17386-w.

Neagu, G., Ciupercă, E. M., Barbu, D.C., Stanciu, A., Dinu, A. & Constantinescu, S. (2024) Open Science&Research Data Management – a contribution to online training resources for research institutions. *International Conference on Virtual Learning*. 19, pp. 133-144. doi:10.58503/icvl-v19y202411.

Stănescu, A. (2024) The impact of AI on education: Exploring the role of ChatGPT. *International Conference on Virtual Learning*. 19, 193-202. doi:10.58503/icvl-v19y202416.

World Economic Forum (2025) *The Global Risks Report 2025*. 20th Edition, Insight Report. https://www.weforum.org/publications/global-risks-report-2025/ [Accessed 16th December 2024].