Comprehensive evaluation of the use of advanced technologies in education

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Abstract: *Adopting a new solution based on advanced technologies in an educational system brings both benefits and disadvantages. The negative effects, if not properly managed and according to solid ethical principles, over time, may escalate significantly and generate resistance to change and progress. In our work, through a comprehensive evaluation of the Advantages vs. Disadvantages of the use in education of advances technologies we aim to identify those strategic benchmarks for the informed use of this technology as supporting tools of the educational process.*

Keywords: Advanced Technology, SWOT Analysis, Digital Educational strategy, educational trends.

1. Introduction

The implementation of advanced technologies in education is a highly debated topic, with numerous arguments determined by the multitude of benefits that are estimated to bring them in order to increase the quality of the educational act and the efficiency of educational processes. By personalizing the learning experience, compared to the determining disadvantages (for example: the impossibility of establishing the truth of the content developed by artificial intelligence in open-source platforms), the level to which advanced technologies can be used effectively can be fair and ethical determined. As a rule, the highlighted limits relate to data protection and to ensuring the fairness of information access. But it misses the reality that they are addictive and do not support the development of critical thinking, especially for young ages education.

2. The limits of the use of advanced technologies in education

Digital education is not limited to internet connectivity, but also to a series of resources for some educational units, the possibilities of supporting children's families for participating in online lessons, the quality of training of the teaching staff regarding the necessary digital skills, the homogeneity of educational programs that determines the same set of skills, etc. All this produces gaps and situations that lead to a lack of predictability, in the medium and long term.

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We believe that the topic of our paper cannot stimulate interest in advanced technologies in an educational unit that has a poorly equipped computer laboratory, such as Preda Buzescu Secondary School, in Vlădaia, Mehedinți county (Hartaedu, 2024). And such examples are numerous in Romania, even if, at the country level, it is estimated that 87% of citizens use the Internet or services offered through the Internet (MMT, 2023).

However, those who have adapted, even partially, to a digital education must understand the limits of exploiting advanced technologies in education and adopt a correct strategy, in an ethical and safe manner, to achieve a flexible, adapted and of quality, able to respond to current challenges, to generate vision change and well-integrated citizens in the labor market, which, in the end, will ensure sustainable economic growth, resilience and functional predictability of all elements of the national digital ecosystem.

Through the action-reaction relationship, "digital transformation in education is driven by advances in connectivity, widespread use of devices, the need for individual flexibility and the acute demand for digital skills" (SMART-Edu, 2021).

2.1 The implementing advanced technologies advantages

In Romania, the digitization of public entities in education is planned through the National Strategy on the Digital Agenda for Romania 2020. Thus, a flexible, digitized, adaptable, quality education system will be created, capable of responding to challenges and generating a change in everyone's behavior citizens. From the perspective of using advanced technologies, the labor market is changing. New trades are formed and developed that require new educational and training programs for a digital society and a green economy.

The main advantages and opportunities of using advanced technologies in education are:

1. *Providing personalized learning:* AI algorithms can analyze each student's performance and learning style, with the analysis product forming the basis of personalized study programs to individual student requirements;
2. *Educational support based on virtual tutors:* AI applications can provide real-time support and educational content. They can answer questions, explain concepts, generate examples and provide quick feedback, similar to consulting a human tutor.
3. *Automated evaluation:* AI applications built for assessment of practical work and exams reduce teachers' time and can provide objective assessments to understand student performance and behavior.
4. *Crafting immersive content, easier and more efficient:* advanced technologies can help generate educational content (presentations, exercises, lesson plans etc.) based on curriculum standards and student needs, provide essential

support for students with disabilities by helping them actively participate in lessons.

5. *Immersive experiences:* XR technologies (AR, VR and MR) can create interactive learning experiences that stimulate students' emotions making the learning process much more engaging and effective.
6. *The educational environment management:* technologies that help to effectively manage the class of students (attendance monitoring, tracking student progress, integrating parents in activities related to class management etc.).

2.2 Disadvantages of excessive use of digital technologies

One of the biggest risks of the massive use of advanced technologies is promoting dependency on them. Thus, a person no longer feels the need to critically analyze the information found, is no longer obliged to perform mental calculations and no longer uses his memory. Replacing the quality of the human mind leads to redundancy and worklessness. That is why laws are required to increase the safety of social health (Radio Romania Actualității, 2024). Of course, technology only causes harm to the extent that we let it do so.

We appreciate that the main disadvantages regarding the use of advanced technologies in education are:

1. *Stimulating dependence on technology:* Students, without the help of electronic devices are not able to solve problems mentally.
2. *Depersonalization of education*: The excessive standardization of education based on AI solutions uniformize educational programs, generated through quantitative analyzes of performance rates and not based on the educational experience or particular skills of each student.
3. *Ethics and privacy issues, cyber risks*: Large volume of data about students and teachers is attractive for cyber-attacks. They can affect cyber identity security, student privacy and security, compromise information through deep-fake techniques etc.
4. *Unequal access to technology and additional costs*: For disadvantaged areas, the implementation and maintenance of these technologies can result in additional costs that turn into a substantial effort on local and family budgets.
5. *Health problems:* Extensive digital devices utilization can affect health by causing concentration problems, burnout, headaches and back pain, sleep problems, stress etc. On a social level, technology addiction causes a reduction in social interaction which, over time, can cause antisocial and emotional behavior problems.

3. SOWT analysis for the use of advanced technologies in education

In order to improve the quality of learning, training and professional performance, based on the specialized literature, we carried out an analysis establishing the specific elements of the SWOT matrix (Strengths, Weakness, Opportunities, Threats) specific to the educational ecosystem.

SWOT Analysis - Strengths

S1 – the upward trend in technological innovations revolutionizes pedagogic methodologies, reduces the dependence on the individual capacities of teachers, facilitates the sharing of knowledge, creates new ecosystems of collaborative and interconnected learning.

S2 – develops personalized learning according to learning, understanding and retention styles, is a support for students with visual, auditory or kinesthetic problems.

S3 – supports the development of educational products, produces new performance standards, eliminates educational divisions and redundant disciplines, establishes new dimensions of academic competence.

S4 – stimulates the involvement of local communities in the administration of educational units and the educational process.

S5 – shapes the involvement of the beneficiaries (HR entities, economic and industrial entities, services, etc.) for the proactive support of education and the creation of new jobs and specialties.

SWOT Analysis - Weaknesses:

W1 – the lack of appropriate legislation and norms does not ensure the personnel protection and the consumer in establishing legal liability, in other aspects related to ethics and morality, generating negative perceptions in the effort to education and workforce reconfigure.

W2 – the insufficiency of teaching staff or the lack of performance indicators based on quality criteria facilitates the maintenance of teaching staff without digital skills, which, also as a temporary solution, causes negative reactions to the implementation of advanced technologies in education.

W3 – weakens interpersonal interaction (teacher-student), develops dependence on technology and produces deficiencies in social skills among students.

W4 – quality compromising and turning the educational institution into a profit-driven business of senior teachers.

W5 - the lack of an adequate legislative framework to stimulate financing and investment, public-private partnerships, as well as other community contributions.

SWOT Analysis - Opportunities:

O1 – the existence and increase of calls for projects from European/national funds, awarding of prizes to stimulate student success and academic excellence.

O2 - extracurricular activities for academic and institutional development, stimulating participation in symposia, training courses, supporting educational and scientific publications, developing professional culture and other elements specific to local culture.

O3 – new "plug and play" approaches, systematic CAT4 (Cognitive Abilities Test) evaluations, individualized development plans etc., streamline the operations of all educational processes.

O4 – development opportunities that, together with improved student results, translate into increased income.

O5 – unlocking the educational potential in poles of excellence. The attraction of exploration through advanced technologies will captivate parents and students, providing the opportunity for increased education and the formation of an institutional image of continuous improvement of educational potential.

SWOT Analysis - Threats:

T1- lack of staff and digital technologies as a result of not knowing how to attract resources, disinterest in continuous professional training etc.

T2 – poor institutional communication, the erosion of respect for the teaching staff performing in the development of digital skills, against the background of the lack of communication between the school and the students' families.

T3 – legislative and curricular instability in the education system, high mobility of teaching staff in the fundamental disciplines.

T4 – the decrease of interest in the critical deepening of educational content through free access to summaries created by AI, the lack of solutions to identify students who cheat in national evaluations (Youngs, 2024).

T5 – ineffective support of families with a precarious material situation, providing help with old digital technologies, incompatible with current software and hardware requirements.

4. Discussions

Note that the Strengths and Opportunities points offset the Weaknesses points. Capitalizing on opportunities can eliminate risks and create advantages for personal development, for career and professional reconversion, for developing initiatives and innovations in education, entrepreneurship and business, as well as for identifying strategies and practices for accumulating practical experiences to

improve education. Based on the strengths, plans can be developed to exploit the opportunities in education, allowing to maximize the stability and effective development of educational programs.

For this, mentalities must be changed. Prioritizing actions and initiatives based on impact and resources will attract new funds and quality human and material resources, which will stimulate communication and interest in the educational product offered to the market.

Today's students are highly intelligent and it is the school's job to help them develop. Education based on advanced technologies can be turned into a spectacle, with students and teachers feeling supported by the school.

The school must be supported professionally by stakeholders in the creation of educational policies, but also by the whole society to ensure educational comfort in a digital environment. A responsible involvement of all decision-makers is required because the resulting product will influence the standard of living and well-being, both locally, regionally and nationally. In this sense, educational units could be more concerned with harmonizing education with other local entities in order to develop the local or regional economy for regional production units (Badawi & Ciupercă, 2023), developing practical activities in public-private partnerships.

All students have their concerns and fears. Communication and learning methods must be expanded into multidisciplinary approaches to determine understanding and educational progress. Let's imagine a discipline project based on digital twin technology. How spectacular would be a geography lesson where, in addition to studying the relief, specific historical events, cultural patterns, fauna and flora etc. will be understood.

Undoubtedly, all this involves funds and resources. Educational programs can benefit from all of this by combining funding sources and by developing effective strategies for attracting funds, such as: grants and direct subsidies for educational institutions, stimulating participation in project competitions on European and International Funds, allocation of funds from local and regional budgets, collaboration with private companies and other community participation in supporting educational programs, but also issuing bonds based on school success, using crowdfunding platforms for fundraising, donations and sponsorships etc.

5. Conclusions

There are many ideas, but someone has to implement them. In our analysis, we have addressed the multi-criteria factors that influence the implementation of the national digital education strategy at the level of educational institutions. We specified that the factors identified in the SWOT analysis are not as important for educational units that, at present, are unable to possess such technologies. For

these, their support must be increased in order to be able, in the future, to adequately respond to the challenges of the educational environment, through objective and honest approaches in the evaluation of the entire national education system.

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