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Media Technology and Educational Innovation

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In a highly digitized society, digital technologies are frequently discussed as the main catalyst for educational change (Sancho, 2010). If this premise is not new, it gained increasing relevance during the pandemic context. Here, institutions were drastically confronted with the existence of several different ways to access knowledge, that triggered the reflection about pedagogical innovation, towards a student-centered, global, purpose-oriented learning process (Zhao, 2020).

The present work aims to explore how digital media and technology can foster the change of educational practices. Therefore, it will explore the current trends and paths in the field of digital training and digital media-based learning. It will also briefly approach attitudes and beliefs that can act as drivers and barriers to such change, providing an evidence-based discussion on the affordances and constraints of 21st-century pedagogical approaches.

Current Trends and Paths in Digital Training and Learning

Digital training and learning strategies are now seen as feasible alternatives, either by fully supporting educational approaches or by complementing traditional methods. These alternatives are considered as tending to have lower costs for students, decreasing the time to complete courses and programs, through flexibility and ubiquitous access, including mobile devices, fostering engagement, and effectiveness (Joosten, Lee-McCarthy, Harness, & Paulus, 2020).

Adaptive Learning. As above-mentioned, modern education capitalizes on digital technologies to build student-centered learning solutions, that support personalized trajectories in the educational process. Here, adaptive learning emerges as a pillar, based on the systematic assessment of the achieved learning outcomes in relation to complex

machine learning systems, and including as much as possible students' specificities, and their socioemotional profile (Xie, Chu, Hwang, & Wang, 2019).

Open Educational Resources. Open Educational Resources (OER) are not pedagogical approaches *per se*, but rather a premise adopted in the dissemination of educational materials, enhanced by the potentialities of digital technologies. These approaches consist of "teaching, learning, and research materials in any medium, digital or otherwise, that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no, or limited restrictions" (UNESCO, 2012). OER policies are nowadays highly linked to Creative Commons licenses (Imberman & Fiddler, 2019), and to the current priorities in citizen science, highly supported by the United Nation's 2030 Sustainable Development Agenda (Fritz et al., 2019).

Gamification and Game-based Learning. A game is "a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome" (Salen & Zimmerman, 2003, p. 96). In the field of educational change, games have been operationalized through two main possible paths: gamification or the use of game design elements in non-gaming contexts (Deterding, Khaled, Nacke, Dixon, 2011); and game-based learning, which implies the usage of games as actual learning environments (Plass, Homer, & Kinzer, 2016). As a pedagogical strategy, both approaches capitalize on the value of play, which allows humans to easily generate a repertoire of innovative behaviors, increasing exploration and cooperation (Pellegrini, Dupuis, & Smith, 2007). As learning environments, games are motivation inductors, through their ability to provide immediate and concrete feedback of performance, balance optimal levels of challenge and frustration, and use failure as a motivational tool for large-scale success (Granic, Lobel, & Engels, 2014).

Massive Open Online Courses. Massive open online courses (MOOCs) are one of the most relevant trends in education in recent years. They can be defined as open access, global, video-based instructional content, problem sets, and forums released through an online platform, as a course for participants to enroll on (Baturay, 2015). Nowadays, MOOCs are a very widespread resource, explored as facilitators for foundational changes in the educational sector (Langen & van den Bosch, 2014), towards the democratization of

knowledge, if the required digital access conditions are of course met (Moura, Souza, Neto, & Viana, 2017).

Transmedia Strategies. Transmedia storytelling is a multimodal approach to present multimedia narrative content, with nonlinear, participatory elements. This might include printed materials, documents, apps, social media activities, games, audio, video, and/or animated resources (Lamb, 2011). In education, transmedia is seen as particularly relevant to foster students' engagement, supporting an educational approach that matches their daily life in a complex media world, through a narrative that is multifaceted and interactive. Therefore, transmedia pedagogical content can frame "scale modes of social interaction where the physical and virtual worlds interact" (Pence, 2011).

Blended Learning. The inclusion of digital technology-based tools into academic courses introduces a new way to approach instructional goals, frequently called Blended Learning (Delialioğlu & Yildirim, 2007). In the field of Blended Learning, in recent years, three main pedagogical paths have been explored: station rotation, where students rotate between different learning methods, both online and face-to-face; flex model, with students moving on their own among the delivery modalities; self-blended model, that is meant to assist face-to-face teaching, with students learning one or more subjects online, with and online teacher; and enriched virtual model, with students taking "traditional" offline classes, learning the content and instructions by themselves, using online learning (Ayob, Halim, Zulkifli, Zaid, & Mokhtar, 2020).

Virtual Reality. Virtual Reality (VR) environments consist of several computer-based applications that support immersive, highly visual, 3D features, allowing the learner to look about and navigate within a seemingly real world (Lioce et al., 2020). In the field of education, VR's conceptual approach consists of the support of learning processes by framing concrete representations of abstract concepts in almost tangible ways (Winn, 1993). More recent empirical research has also supported the potential of VR environments in the promotion of collaborative problem-solving and higher-order thinking, through more engaging activities for learners (Pellas, Kazanidis, Konstantinou, & Georgiou, 2017).

Artificial Intelligence. Artificial Intelligence (AI) is often presented as part of other educational strategies, as VR, adaptive learning, game-based learning, among others. According to Chen, Chen, & Lin (2020), its applications in educational contexts can include: assessment of students and schools (adaptive learning and personalized learning approaches); grading and evaluation (image recognition, computer vision, prediction systems); personalized intelligent teaching (data mining and learning analytics); smart school (face recognition, speech recognition, virtual labs, hearing and sensing technologies); or online/mobile remote education (edge computing, virtual personalized assistants, and real-time analysis). Nevertheless, to actually support a sustainable and inclusive educational change, AI has to be more than an engineering product, but instead a human-centered, socially contextualized solution, co-created by different stakeholders (Porayska-Pomsta & Rajendran, 2019).

Drivers and Barriers to Educational Change

Depending on the specific strategies one wants to adopt as drivers of educational change, different promoting and risk factors can emerge. Therefore, planning one or several simultaneous types of approach necessarily implies exploring its enhancing factors and possible threats to its success. Moreover, educational systems are very complex, challenging, and difficult to model, hindering the potential support to practitioners and policymakers in the planning of evidence-based change-driven strategies (Lemke & Sabelli, 2008).

A potential path to foster sustainable educational change is to develop evidence-based or, as often called, second-order educational change, while following specifically structured frameworks to support the process, that includes a matching between the characteristics of the measures to be implemented and according to methodological considerations. According to the framework developed by Hubers (2020), In the case of media technology-based educational change and if we consider, for example, the implementation of VR game-based resources to enhance students' performance, it would require:

- The definition of the constructs to be measured, operationalizing educator's involvement in the implementation of such resources;
- The definition of specific assessment methods and tools, with a specific emphasis on multi-methods approaches;

- The approaching of the causality chain between the adopted resources and the obtained outcomes;
- The exploration of the changing process, specifically the conditions under which it occurred.

Regarding barriers, one of the most common mistakes when analyzing media technology-driven change is the premise that society's digitalization is homogenous. This is misleading if we consider that, during the COVID-19 pandemic, two in every three children and young people aged 25 years or less do not have internet access at home. Even if these numbers may not apply to Europe in general, they are still marked in Eastern Europe and Central Asia, where the internet access rate is 59% for people aged between zero and 25 years old, with the remaining 41% without access in their homes (United Nations Children's Fund and International Telecommunication Union, 2020). If access is a necessary precursor to participation in media, as well as in democratic civic structures (Carpentier, 2011), fostering sustainable educational change in this field implies also access improvement and democratization. Besides internet access, also media production resources are critical issues for schools, particularly teaching personnel. The scarce existence of video cameras, voice recorders, smartphones, and other media production tools not always supports the creation of media content with pedagogical purposes and its use in the classroom (Hobbs & Tuzel, 2015). This would be a pillar to support the production and use of media and information, one of the key areas in UNESCO's Media and Information Literacy Curriculum for Teachers (Wilson, Grizzle, Tuazon, Akyempong, & Cheung, 2011).

Skills Development and Educational Change

Education targeted at the development of 21st Century Skills intends to promote skills like critical thinking, non-routine problem solving, teamwork, and information fluency (Ananiadou & Claro, 2009). Current conceptual models for 21st Century Skills are complex, including a set of different, yet integrated dimensions. The so-called 3R's - reading, writing, and arithmetic, and other 21st century interdisciplinary themes, appear in the base of a set of skills, that also include: life and career skills; learning and innovation skills - critical thinking, communication, collaboration, creativity; information, media, and technology skills. Transversely, the model is operationalized by different support systems: standards and assessments; curriculum and instruction; professional development; and learning environments (Partnership for 21st Century Learning, 2019).

If 21st Century Skills include different information, media, and technology skills, the role of media technology in educational change becomes even more clear. The effective citizens of the future, whose personal development is based on the current educational system, must be able to exhibit information literacy, media literacy, and Information, Communications, and Technology (ICT) literacy skills, in a functional and critical manner (Partnership for 21st Century Learning, 2019). Training such citizens implies, not only an educational system that is directed to technology, but also driven through technology, emphasizing the role of media usage, but also media creation training in it (Costa, Tyner, Henriques, & Sousa, 2018). This premise is aligned with the notion that the future of media literacy needs to include the promotion of action in addition to interpretation, as a way to answer the increasing role of audience-generated content and the need for citizens' active participation (Bulger & Davison, 2018).

Summary

The current societal context exhibits a very high media complexity. The personal and professional development of efficient citizens must therefore take place in an educational system with and for media technology. Recently, the COVID-19 pandemic highlighted the possibilities offered by media technology to foster profound educational changes, supported by different strategies, that can be implemented alone or in combination with each other. This includes adaptive learning; OER; gamification and game-based learning; MOOCs; transmedia strategies; blended learning; VR; and AI.

The implementation of such strategies implies the reflection on a set of barriers and hindrances, emerging both from society-related contextual factors and the particular aspects of each technology. Implementing media technology-driven educational strategies that effectively support change must be carefully planned, through comprehensive frameworks that map the needs of the different stakeholders, in a co-designed and person-centered manner. It also requires a mindset that is as unbiased as possible, avoiding preconceived ideas about media and technology access or related literacy skills. Also, these skills must be addressed through media-based learning strategies themselves, that are driven both to digital media usage and creation, as central to the personal and professional development of effective citizens in a highly mediated society, where audience-generated, participatory approaches are a pillar.

References

- Ananiadou, K. & Claro, M. (2009). *21st Century Skills and Competences for New Millennium Learners in OECD Countries*. Organization for Economic Cooperation and Development (OECD).
- Ayob, N., Halim, N., Zulkifli, N., Zaid, N., & Mokhtar, M. (2020). Overview of Blended Learning: the Effect of Station Rotation Model on Students' Achievement. *Journal of Critical Reviews*, 7(6), 320-326.
- Baturay, M. H. (2015). An Overview of the World of MOOCs. *Procedia - Social and Behavioral Sciences*, 174, 427-433. <https://doi.org/10.1016/j.sbspro.2015.01.685>
- Bulger, M. & Davison, P. (2018). The Promises, Challenges and Futures of Media Literacy. *Journal of Media Literacy Education*, 10(1), 1-21.
- Carpentier, N. (2011). *Media and Participation*. Intellect Ltd
- Costa, C., Tyner, K., Henriques, S., & Sousa, C. (2018). Game Creation in Youth Media and Information Literacy Education. *International Journal of Game-Based Learning*, 8(2), 1-13. <https://doi.org/10.4018/IJGBL.2018040101>
- Delialioglu, O. & Yildirim, Z. (2007). Students' Perceptions on Effective Dimensions of Interactive Learning in a Blended Learning Environment. *Educational Technology & Society*, 10(2), 133-146. <https://dx.doi.org/10.3389%2Ffpsyg.2021.696845>
- Deterding, S., Khaled, R., Nacke, L. E., Dixon, D. (2011). Gamification: Toward a Definition. *CHI 2011 Gamification Workshop Proceedings*, 12-15.
- Fritz, S., See, L., Carlson, T. et al. Citizen science and the United Nations Sustainable Development Goals. *Nature Sustainability*, 2, 922-930. <https://doi.org/10.1038/s41893-019-0390-3>
- Granic, I., Lobel, A., & Engels, R. (2014). The benefits of playing videogames. *American Psychologist*, 69(1), 66-78. <http://dx.doi.org/10.1037/a0034857>
- Imberman, S. & Fiddler, A. (2019). Share and share alike: using Creative Commons licenses to create OER. *ACM Inroads*, 10(2), 16-21. <http://dx.doi.org/10.1145/3324887>
- Hobbs, R. & Tuzel, S. (2015). Teacher motivations for digital and media literacy: An examination of Turkish educators. *British Journal of Educational Technology*, 48(1), 7-22. <https://doi.org/10.1111/bjet.12326>
- Hubers, M. D. (2020). Paving the way for sustainable educational change: Reconceptualizing what it means to make educational changes that last. *Teaching and Teacher Education*, 93. <https://doi.org/10.1016/j.tate.2020.103083>
- Joosten, T., Lee-McCarthy, K., Harness, L., & Paulus, R. (2020). *Digital Learning Innovation Trends*. WICHE Cooperative for Educational Technologies.
- Lamb, A. (2011). *Reading redefined for a Transmedia Universe*. International Society for Technology in Education.

- Langen & van den Bosch (2014). Massive Open Online Courses: disruptive innovations or disturbing inventions? *Open Learning: The Journal of Open, Distance and e-Learning*, 28(3), 216-226. <https://doi.org/10.1080/02680513.2013.870882>
- Lemke, J. L. & Sabelli, N. H. (2008). Complex Systems and Educational Change: Towards a new research agenda. *Educational Philosophy and Theory*, 40(1), 118-129. <https://doi.org/10.1111/j.1469-5812.2007.00401.x>
- Lioce L. (Ed.), Lopreiato J. (Founding Ed.), Downing D., Chang T. P., Robertson J. M., Anderson M., Diaz D. A., Spain A. E. (Assoc. Eds.) & the Terminology and Concepts Working Group (2020). *Healthcare Simulation Dictionary* (2nd Ed.). Agency for Healthcare Research and Quality. <https://doi.org/10.23970/simulationv2>
- Moura, V. F., Souza, C., Neto, J. D. & Viana, A. B. (2017). MOOCS' Potential for Democratizing Education: An Analysis from the Perspective of Access to Technology. *EMCIS 2017: Information Systems*, 139-153. http://dx.doi.org/10.1007/978-3-319-65930-5_12
- Partnership for 21st Century Learning (2019). *Framework for 21st Century Learning. Battelle for Kids*. Retrieved from http://static.battelleforkids.org/documents/p21/P21_Framework_Brief.pdf
- Pellas, N., Kazanidis, I., Konstantinou, N., & Georgiou, G. (2017). Exploring the educational potential of three-dimensional multi-user virtual worlds for STEM education: A mixed-method systematic literature review. *Education and Information Technologies*, 22, 2235–2279. <https://doi.org/10.1007/s10639-016-9537-2>
- Pellegrini, A., Dupuis, D., & Smith, P. (2007). Play in evolution and development. *Developmental Review*, 27(2), 261-276. <http://dx.doi.org/10.1016/j.dr.2006.09.001>
- Pence, H. E. (2011). Teaching with Transmedia. *Journal of Educational Technology Systems*, 40(2), 131-140. Plass, J. L., Homer, B. D., & Kinzer, C. K. (2016). Foundations of Game-Based Learning. *Educational Psychologist*, 50(4), 258-283. <https://doi.org/10.1080/00461520.2015.1122533>
- Porayska-Pomsta, K. & Rajendran, G. (2019). Accountability in Human and Artificial Intelligence Decision-Making as the Basis for Diversity and Educational Inclusion. In J. Knox, Y. Wang, & M. Gallagher, *Artificial Intelligence and Inclusive Education Speculative Futures and Emerging Practices* (pp. 39-59). Springer.
- Salen, K. & Zimmerman, E. (2003). *Rules of Play: Game Design Fundamentals*. MIT Press.
- Sancho, J. M. (2010). Digital Technologies and Educational Change. In A. Hargreaves, A. Lieberman, M. Fullan, & D. Hopkins, *Second International Handbook of Educational Change* (pp. 433-444). Springer. https://doi.org/10.1007/978-90-481-2660-6_26
- UNESCO (2012). *What is the Paris OER Declaration?* Retrieved from <https://en.unesco.org/themes/building-knowledge-societies/oer>
- United Nations Children's Fund and International Telecommunication Union (2020). *How many children and young people have internet access at home? Estimating digital connectivity during the COVID-19 pandemic*. UNICEF.



- Wilson, C., Grizzle, A., Tuazon, R., Akyempong, K., & Cheung, C. (2011). *Media and Information Literacy Curriculum for Teachers*. United Nations Educational, Scientific and Cultural Organization (UNESCO).
- Winn, W. (1993). *A conceptual basis for educational applications of virtual reality*. Human Interface Technology Laboratory of the Washington Technology Center - University of Washington.
- Xie, H., Chu, H., Hwang, G., & Wang, C. (2019). Trends and development in technology-enhanced adaptive/personalized learning: A systematic review of journal publications from 2007 to 2017. *Computers & Education*, 140. <https://doi.org/10.1016/j.compedu.2019.103599>
- Zhao, Y. (2020). COVID-19 as a catalyst for educational change. *Prospects*, 49, 29-33. <https://doi.org/10.1007/s11125-020-09477-y>