EDUCATION AND NEW DEVELOPMENTS

2024
Volume 2

Edited by
Mafalda Carmo

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Education and New Developments 2024

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Mafalda Carmo

Edited by Mafalda Carmo, World Institute for Advanced Research and Science (WIARS), Portugal

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FOREWORD

This book contains the full text of papers and posters presented at the International Conference on Education and New Developments (END 2024), organized by the World Institute for Advanced Research and Science (WIARS).

Education is a fundamental right that accompanies us from the very beginning of our lives. It encompasses every experience we encounter, influencing and shaping our thoughts, emotions, and actions. Whether we engage in formal education within classrooms or learn from the world around us, the process of acquiring knowledge plays a vital role in our personal growth and development. It equips us with the tools to navigate the complexities of life, broadens our perspectives, and empowers us to make informed decisions. This International Conference seeks to provide some answers and explore the processes, actions, challenges and outcomes of learning, teaching and human development. Our goal is to offer a worldwide connection between teachers, students, researchers and lecturers, from a wide range of academic fields, interested in exploring and giving their contribution in educational issues.

We have brought together a diverse group of individuals with various backgrounds to contribute their unique perspectives and knowledge on Education. By including people from different nationalities and cultures, we aim to create a rich plethora of experiences that can broaden our understanding of human nature and behavior. The exchange of ideas and experiences among our participants helps to cultivate personal and academic development, providing a platform for the exploration of new insights and discoveries.

END 2024 received 729 submissions, from more than 50 different countries, reviewed by a double-blind process. Submissions were prepared to take form of Oral Presentations, Posters, Virtual Presentations and Workshops. The conference accepted for presentation 284 submissions (39% acceptance rate).

The conference also includes one Keynote presentation by Dr. Ipek Kocoglu, Kean University, USA. We would like to express our gratitude to our invitee.

This conference addressed different categories inside the Education area and papers are expected to fit broadly into one of the named themes and sub-themes. To develop the conference program, we have chosen four main broad-ranging categories, which also covers different interest areas:

• In **TEACHERS AND STUDENTS**: Teachers and Staff training and education; Educational quality and standards; *Curriculum* and Pedagogy; Vocational education and Counselling; Ubiquitous and lifelong learning; Training programs and professional guidance; Teaching and learning relationship; Student affairs (learning, experiences and diversity; Extra-curricular activities; Assessment and measurements in Education.

• In **PROJECTS AND TRENDS**: Pedagogic innovations; Challenges and transformations in Education; Technology in teaching and learning; Distance Education and eLearning; Global and sustainable developments for Education; New learning and teaching models; Multicultural and (inter)cultural communications; Inclusive and Special Education; Rural and indigenous Education; Educational projects.

• In **TEACHING AND LEARNING**: Critical, Thinking; Educational foundations; Research and development methodologies; Early childhood and Primary Education; Secondary Education; Higher Education; Science and technology Education; Literacy, languages and Linguistics (TESL/TEFL); Health Education; Religious Education; Sports Education.

• In **ORGANIZATIONAL ISSUES**: Educational policy and leadership; Human Resources development; Educational environment; Business, Administration, and Management in Education; Economics in Education; Institutional accreditations and rankings; International Education and Exchange programs; Equity, social justice and social change; Ethics and values; Organizational learning and change, Corporate Education.

The contributions were published across two volumes, and this is the Volume 2 of the book titled Education and New Developments 2024, that showcases the outcomes of dedicated research and developments undertaken by authors who are driven by their passion to enhance research methods that directly relate to teaching, learning, and the practical applications of education in the present day. Within its pages, you will find a diverse array of contributors and presenters who expand our perspectives by delving into various educational matters.

This second volume focuses on the main areas of PROJECTS AND TRENDS and ORGANIZATIONAL ISSUES, being the contributions of the other two areas published in Volume 1.

We would like to express thanks to all the authors and participants, the members of the academic scientific committee, and of course, to our organizing and administration team for making and putting this conference together.

Hoping to continue the collaboration in the future.

Respectfully,

Mafalda Carmo
World Institute for Advanced Research and Science (WIARS), Portugal
Conference and Program Chair

Porto, Portugal, 15 - 17 June, 2024

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KEYNOTE LECTURE

"REVOLUTIONIZING LEARNING: THE IMPACT OF ARTIFICIAL INTELLIGENCE ON EDUCATIONAL PARADIGMS"

Dr. Ipek Kocoglu
Kean University, USA

Abstract

The integration of Artificial Intelligence (AI) in education is revolutionizing traditional teaching methods and curriculum development by facilitating personalized and adaptive learning experiences. This research paper explores the transformative role of AI in enhancing educational paradigms by optimizing learning outcomes tailored to individual needs. Drawing from a range of studies, the paper examines the effectiveness and challenges of AI applications within various educational settings. Our findings indicate that AI significantly boosts educational performance by adapting content delivery to match individual learning styles and needs, thus reshaping educational strategies and personalizing the learning experience. Furthermore, AI-driven adaptive learning systems not only customize educational content but also streamline administrative tasks for educators, enhancing overall efficiency. However, this technological advancement also introduces challenges, including ethical concerns and privacy issues that necessitate thorough scrutiny and careful implementation. The paper emphasizes the importance of comprehensive teacher training and ongoing ethical evaluation to ensure responsible use of AI in education. Through a nuanced understanding of AI's potential and limitations, this study provides actionable insights for educators and policymakers aiming to harness AI technologies to foster more dynamic and responsive educational environments.

Keywords: *Artificial intelligence, adaptive learning, educational technology, curriculum development.*

Biography

Dr. Ipek Kocoglu is an assistant professor of Strategy and Organization Theory in the Department of Management at Kean University. Following her doctoral studies in Management and Organization Theory, Dr. Kocoglu completed her post-doctoral research at Stevens Institute of Technology through a prestigious fellowship. She combined her background in industrial engineering and technology and innovation management to advance a framework that uses abductive research for new idea generation. Dr. Kocoglu's research focuses on gender diversity and sustainability. She has published in top-tier journals listed in the Financial Times 50 including the Academy of Management Review, The Leadership Quarterly, Management Decision, International Journal of Production Research, and Engineering Management Journal. Her research addresses critical issues like the effect of social context on women leaders' perceived competence, and the impact of extreme threats on organizational risk-taking. In her recent project Dr. Kocoglu develops a framework for digital sustainability solutions by leveraging Information Systems to mitigate the effects of climate change. Her contributions to academia have earned her numerous accolades, including the Excellence in Scholarship Award from Kean University and the Eschenbach Award for Best Paper from the American Society of Engineering Management. A recognized leader in open education, Dr. Kocoglu has been instrumental in pioneering the Open Education Resources (OER) conference at Kean University. She passionately advocates for using OER to close the educational equity gap for minorities and first-generation students. Dr. Kocoglu continues to inspire students in courses on entrepreneurship, organizational behavior, and strategic management. She is the author of a textbook on Organizational Theory and several influential book chapters on digital business models and strategies for developing digital government platforms. Beyond her academic achievements, Dr. Kocoglu serves as the Global Ambassador for inclusive research at the Diversity, Equity, and Inclusion Division of the Strategic Management Society. She is an active reviewer for esteemed journals, including Academy of Management Discoveries and Management Decision. Dr. Kocoglu's research has garnered over a thousand citations and has been featured in popular media such as Psychology Today, underscoring their impact on both academic and public spheres.

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MEDIA AND AUDIO-VISUAL TECHNOLOGIES FOR TEACHING ARTISTIC CREATIVITY: A COURSE FOR PRESCHOOL AND PRIMARY SCHOOL TEACHERS

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Abstract

The contribution presents a media-archaeological methodological approach to the device of the narrative and audio-vision for teaching the fundamentals of audio-visual culture. The activity involves the creation of short animated cartoons with sound, based on musical subjects. The originality of this approach consists in not relying on automatic technologies for the realization of the product, endowed with producer-programmed intelligence and its inscribed knowledge, but being based on the deconstruction and reworking of traditional techniques to solicit a conscious, non-immersive approach to the construction of visual and sound, and their mediation technology. The course is based on a modular type of methodology: it involves work divided into a series of successive steps, each of which can be modulated by the teacher: the complexity of the tasks will be managed by the teacher, taking into account the specific age (for example, in the experiences (for example, in our experiences with the last preschool classes, we have replaced writing with voice recording). The educational path we outline here can be successfully applied to classes between the last year of kindergarten and the entire primary school. The activity involves group work; from 2015 onwards, it was developed in teaching laboratories of the Primary Education Science degree course at the University of Turin and partly tested in various schools in the territory, teaching courses of between 40 and 50 hours each. This year, we have notably deepened the media-archaeological approach and addressed the dimension of sound.

Keywords: *Audio-visual media, media archeology, teaching, animation, sound.*

1. Conceptual framework

Digital technologies in recent years have undertaken a predominant role in creative processes related to sound and image. Tools for creating sound and multimedia have slowly incorporated a certain amount of implicit knowledge and have developed the ability to replace part of the human creative process; these mechanisms often act in a manner hidden from the users/authors, who are not always aware of the underlying processes. Digital technologies thus change the relationship humans have with the creation of sound and image.

The development of digital technologies designed for the teaching of musical and audiovisual creativity has accompanied this process, even in the primary school. Suffice it to mention important teaching platforms such as MIROR (Addessi, 2020; 2022), or projects such as OPEN SoundS (Canazza et al., 2012): for the music field alone, the taxonomy developed by the LIM (Music Informatics Laboratory of Milan University) counts 65 digital applications dedicated to the primary school (Mandanici et al., 2023). And equally we see the development of teaching multiple strategies dedicated to teaching music and audiovisual through technologies, see e.g., Waldron, Horsey, & Veblen (2020) and William & Webster (2022).

The implementation of educational technologies is usually designed to trigger formative processes by simplifying complex operations through processes that hide some of the complexity by having a certain amount of intelligence inscribed within them. It thus operates within the framework of what we might call the logic of immersion (Grau, 2002). This is a logic that aims to hide the signs of technological mediation, targeting the use of the state-of-the-art technologies. The goal of using technology in these courses is to amaze the users and convey content by simplifying cognitive processes. This process is based on media transparency (Bolter & Grusin, 1999).

In this paper we intend to follow an opposite path: we want to employ obsolete technologies and alienate them, without hiding the signs of technological mediation, starting from a medium-archaeological

perspective. Indeed, studies on media archaeologies (Huhtamo & Parikka, 2011) have unveiled different approaches, parallel and hidden histories, and nonlinear processes in technological evolution, providing a completer and more complex picture of the interaction between technological devices, humans, and social forms. Applying a mediarcheological gaze also implies dwelling on the failures, observing the technological setbacks, analyzing technologies while avoiding to interpret them within the horizon of linear historical progress; deconstructing them, and with them deconstructing the common evolutionist narrative. Our idea is not to employ state-of-the-art media and technologies, but to deconstruct them, exploring obsolete technological processes-with their potentials and limitations-with the aim of highlighting the implicit processes hidden in the current application of technologies and media in pedagogy. The idea is to employ obsolete technologies to avoid concealing the processes usually hidden from the awareness of the author/user. To interpret the technological lag and limitations of technologies in their specific expressive and creative potential and not as limits to creativity. Aim for the development of creative processes that do not follow what is programmed by a developer, but arise from the deconstruction of technologies, media, and media processes.

The didactic experience we are proposing here is based on the re-enactment of obsolete artistic practices realized through digital media. We propose to reproduce creative processes typical of the analog world in the digital universe, exploring the *phygital* realm (see Reilly & Dawson, 2021). In this way, we deconstruct the digital and unleash the educational and creative potential of practices conceived within a different media universe. The distinction between the digital and analog universes has been theorized within the framework of cybernetic theory (Schröter, Ernst & Warnke, 2022); we want to deconstruct this transition and use de-algorithmized procedures, thus analog processes, through the deconstruction of merely digital technologies. We implement obsolete models and processes through digital media, avoiding the exploitation to the state-of-the-art potentialities of new technologies.

We aim at exploring and recontextualizing two now-dated artistic practices and technologies with a didactic purpose: the stop motion technique, from the nineteenth-century tradition, and Foley sound, from the thirties. Through them we want students to discover sound and image – both in their material dimension and in their technological mediation – and to explore these in a different way than they usually do.

2. Method

The methodological line with which we have set up the archaeological media education work revolves around a procedure that has been devised and tested since 2014 in about 50 schools in the area, working mainly with two age groups of students: those 3-6 and those 6-11 (predominantly with primary school students and, secondarily, with kindergarten students) (Denicolai & Parola, 2017). The procedure was designed on the assumption that the concept of 'computational thinking' (Wing, 2006; 2008) can also be applied to the activity of building audiovisual products (Denicolai, 2021). In practice, the ultimate aim of the entire process has always been to help the younger generation approach the media, and film and audiovisual language in particular, through two fundamental steps. Firstly, the procedure theoretically draws on traditional pedagogical theories relating to learning by doing derived from Dewey and Constructivism, later taken up by Seymour Papert's Constructivism. Secondly, and in view of the reference to Papert, we thought of extrapolating the concept of computational thought, algorithm and the idea of the 'reconstruction' of an experience – as well as a thought and knowledge. In this sense, the medioarchaeological deconstruction we mentioned above corresponds in media theory to this aspect. Reconstructing knowledge means, in our case, dealing with a subject matter by exploiting the expressive codes of sound and visuals, thus producing audio-visual products – usually short stop-motion animated films – enabling students to dwell on the value of the individual passage and its weight in the overall economy of the media object then obtained. Similarly, the constructionist approach also makes it possible to identify units of meaning – i.e. individual parts of narrative and then of video – which are thus better understood by students, before being assembled into an object and thus having an overall view of it. In the purely cinematic sphere, Ejzenstejn's (1985/2012) idea of a shot composed of several parts and thus composite seems to adhere to such a conception. It is then up to the brain to put the pieces together, i.e. to provide the observer with an overall view. In this sense, working on smaller parts of an educational content and its audiovisual rendering means applying an algorithmic process of breaking down a complex object (both theoretical and abstract, as well as practical and concrete) into many smaller, simpler parts, so that the process of understanding each of these is easier, before having an overall view again. Ultimately, we think that even the production of an audiovisual object can be used by students – appropriately guided by the teaching staff – to reason on at least three levels. Firstly, on the chosen theme to be represented, thus on a typically narrative and content aspect; secondly, on the discursive logic underlying the production of the object itself: thus, on the necessary steps, including technical ones, to produce an animation video using the stop-motion technique; thirdly, but not lastly, on the fundamental logical and causal relationship

underlying all our actions and activities in the construction of experience. In this sense, the reference to computational thinking and coding as a way of 'educating' the machine, i.e. of imparting commands that always have a causal relationship between them, is also perfectly applicable to the production of the visual object. In synthesis, the procedure is organised as follows:

1) creation of the story (based on a 'musical subject') by the group writing of the story (for children not writing, but narration and voice recording);
2) creation of the story (based on a 'musical subject') by the group writing of the story (for children not writing, but narration and voice recording);
3) re-writing in the form of scenes, both from the point of view of the action, the visual dimension and the sound dimension;
4) creation of the storyboard, understood as the process of synthesising the scenes (also includes the design of the soundscape, which is then to be realised);
5) construction of sets and props (from a sound point of view, choice and experimentation of materials with which to produce the sounds);
6) filming using the stop-motion technique;
7) planning and writing of the sound, starting from the sound analysis of the storyboard, and definition of its temporal structure, also in relation to the unfolding of the image;
8) recording of the soundtrack by means of foley techniques and live performance;
9) editing by means of physical devices of sound textures through real-time performance act;
10) audiovisual editing of scenes;
11) restitution in the classroom of the work done and the product realised.

Each step listed here is linked to the next and previous ones by the causal relationship. In practice, the participants – i.e., pre-school and primary school students – learn how to make short animation videos using the stop-motion technique based on an actual procedure, which is similar in its logic to that of programming a machine. In this way, we try to stimulate both a critical approach to the specific activity and a greater awareness of the processes that are inherent in the use of technology. Clearly, each step then has internal relationships, again governed by the causal relationship. In this way, we tend to multiply and multi-level a single reasoning approach, the one based on evidence and its consequences. Each step has purely didactic objectives that relate both to the specific topic that is dealt with by means of audio-visual narration and to the transversal skills and soft-skills that participants can develop and apply in carrying out these steps. Furthermore, each step provides for ways of verifying the result obtained: these ways, as a rule, follow the Italian National Indications of the school curriculum and are based on an assessment by objectives achieved.

From the audio perspective, our approach addresses four educational issues. The first is children's discovery of the acoustic dimension of the landscape. We aim to increase awareness of the acoustic ecosystem, the importance of which has been emphasized by soundscape studies introduced since the 1970s (Schafer, 1977). Sound planning involves reasoning about the soundscape and its nature: how to acoustically depict a landscape, which sounds it contains, which represent it, and which distort it. The second issue that the proposed experience is meant to highlight is to make children aware of the artificiality of the sound dimension in audiovisual productions. Being born in an environment constellated with sound reproduction devices, one perceives the acoustic dimension of audiovisual products immediately, transparent, as if they were part of nature, lacking the electronic mediation (Spaziante, 2009). The acoustic dimension surrounds the child, who draws information from it without being aware of the source from which it comes, hardly noticing it (Dyson, 2009). Working on recording by trying to imitate sounds and their effect by different means involves becoming aware of the artificiality of reproduced sound and its potential to convey content. The third point that our experience wants to raise from the educational point of view is to make people understand the relevance of the sound dimension in the construction of meaning. Indeed, sound conveys meanings, which can be artificially constructed and which we perceive as immediate. Working on sound makes one aware of its relevance in emotional communication, in giving nuance and color to otherwise inanimate objects. Finally, the creation of the sound involves the performative practice, which forces the students to think about how to realize the sounds and organize them over time. It forces them, since they cannot realize everything they would like in real time, to choose what is relevant to the action and what to leave out, and to organize the sound tools, i.e. the physical materials in such a way that they are manageable in a live performance.

3. Discussion

The question of the assessment of the goals achieved is considered starting from the skills assessment forms in use in the Italian first-cycle school (Castoldi, 2016), because we considered it appropriate to allow the teachers involved – also those who intend to use the method autonomously,

i.e., without taking part in research projects – to apply the normal docimological methods also to the audiovisual experience construction procedure. In this way, each teacher has the opportunity to choose which specific goals to achieve, while also offering an overview of the effectiveness of the method indicated. The experimentation of the method concerned in particular the action with the audiovisual language (stop-motion animation) on which we have already tested some evaluation lines relating to the transversal competences and soft-skills of the European Union. In this sense, out of the total number of classes involved, we noticed a general acquisition of skills related to teamwork and the ability to collaborate, as well as a gradual increase in interest in the specific topics covered by each product. For the sound and music part, we intend to proceed by enriching the evaluation scheme with specially identified items, so as to better highlight the possible advantage of using this method also for understanding the dynamics of the soundscape and soundscape and its use in meaning-making processes.

We believe that it is important to emphasise that the construction of the stop-motion animation products is designed according to procedural logic – typical of coding education – with the aim of helping students 'make and behave like machines', in order to understand the logic that governs their operation. The 'doing the machines' is thus not an imitation of technology, but is 'taking it apart'; each class normally uses smartphones or tablets to shoot video, exploiting apps such as iMotion (for Apple iOS) or Stop Motion Studio (for Android): but the students are invited to use the technologies without automatic settings – which allows the device to shoot the frame sequences autonomously – but using them in manual mode. In this way, the students take the individual photographs and subsequently edit the material with editing software (again, not exploiting the potential of artificial intelligence). The procedure, therefore, stimulates the students to reason by cause-and-effect relationships even in the realisation of passages where technology could take the place of humans. Likewise, we think it is useful to work in the same way on the soundscape, relying on live recordings and then editing with the previously made video track. In this way, procedurally becomes on two levels: the video is the basis on which the students can imagine a soundscape that is not only a commentary on the image but can in effect dialogue with what is seen. As with video editing, sound editing, using manually managed software, eliminates all machine intervention in favour of a greater awareness of the creative value of the whole process.

4. Conclusions

In this article we have tried to introduce a working methodology based on the use of audio-visual language, asking students in first-cycle schools (3 to 6 years old and 6 to 11 years old) to build animation products using the stop-motion technique, following a procedural logic that is typically used in coding education today. To this activity we are adding a special focus on the sound and musical level, because we intend to formalise the methodology also as a tool to have a greater awareness of how creativity can exploit the syncretic language of the audio-visual. All experimentation and research start from a theoretical basis that refers to media studies and musicology, with a focus on how these theories can also have an important impact on the training of future teachers in the first cycle (kindergarten and Primary School) of the Italian school system.

References

Addessi A.R., (2020) A device for children's instrumental creativity and learning: an overview of the MIROR platform. *Frontiers in Psychology*, *11*, 1–21.

Addessi, A. R. (Ed.). (2022). *A criativitadade musical e motora das criancas com a plataforma MIROR: Referencial teorico, experimentos e caminhos educacionais*. Curitiba: Appris.

Bolter, J. D., & Grusin, R. (1999). *Remediation: Understanding new media*. Cambridge: MIT Press.

Canazza, S. & Eldridge, S., Fiocchetta, G., Himonides, E., Nicollet, Q., & Rodà, A. (2012). *OPENSounds. Rapporto di Ricerca sulla presenza di ambienti di apprendimento per la produzione musicale remota con particolare riferimento a quelli indirizzati al sistema educativo e formativo dei paesi partner*. Retrieved from https://www.opensounds.eu/sites/default/files/Open%20Sounds%20WP2_Rapporto%20di%20Ricerca%20Finale%20sugli%20%20ambienti%20di%20apprendimento%20virtuali%20per%20fare%20musica_DEF%20ita.d.pdf

Castoldi, M. (2016). *Valutare e certificare competenze*. Roma: Carocci.

Denicolai, L. & Parola, A. (2017). *Scritture mediali. Riflessioni, rappresentazioni ed esperienze mediaeducative*. Milano: Mimesis.

Denicolai, L. (2021). Parlare e scrivere cinematograficamente per pensare tecnologicamente: un modello di esperienza visuale. *Sociologia Della Comunicazione, 62*, 121-138. https://doi.org/10.3280/sc2021-062008

Dyson, F. (2009). *Sounding New Media: Immersion and Embodiment in the Arts and Culture*. Berkeley: University of California Press.

Grau, O. (2002). *Virtual Art: from Illusion to Immersion*. Cambridge: MIT Press.

Huhtamo, E. & Parikka, J. (2011). *Media Archeology*. Berkeley: University of California Press.

Wing, J. (2006). Computational thinking. *Communication of the ACM, 49*(3), 33-35.

Wing, J. (2008). Computational thinking and thinking about computing. *Philosophical Transactions of the Royal Society A, 366*(1881), 3717-3725.

Ejzenstejn, S. M. (1985/2012). *Teoria generale del montaggio*, Venezia: Marsilio.

Mandanici, M., Spagnol, S., Avanzini, F., Baratè, A., & Ludovico, L. A. (2023). Una tassonomia multidimensionale delle applicazioni per l'educazione musicale. In L. Gabrielli (Ed.), *Corpi fisici. XXIII Colloquio di Informatica Musicale* (pp. 132-139). Venezia: IUAV.

Reilly, P., & Dawson, I. (2021). Track and trace, and other collaborative art/archaeology bubbles in the phygital pandemic. *Open Archaeology, 7*(1), 291-313.

Schafer, R. M. (1977). *The Tuning of the World*. Philadelphia: University of Pennsylvania Press.

Schröter, J. & Ernst, C. & Warnke M. (2022). Quantum Computing and the Analog/Digital Distinction. *Grey Room, 86*, 28-49.

Spaziante, L. (2009). Come dire cose senza parole: figuratività sonora e sound design, tra musica e cinema. In M. P. Pozzato, & L. Spaziante (Eds.), *Parole nell'aria. Sincretismi fra musica e altri linguaggi* (pp. 281-291). Pisa: ETS.

Waldron, J., Horsley, S., & Veblen, K. (Eds.). (2020). *The Oxford Handbook of SocialMedia and Music Learning*. Oxford: OUP.

William, D. B., & Webster, P. R. (2022). *Experiencing Music Technology* (4th Ed.). Oxford: OUP.