

VIRTUAL REALTY BETWEEN CORPOREITY AND CONTEXT SCHOOL

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Abstract: The current historical, educational and social context is characterized by the constant presence of the digital world, both before the advent of the COVID-19 pandemic, and even more so later (Molina, Michilli, Gaudiello, 2021). The world of education has undergone, and will still have to face major changes to adapt to the continuous development of digital practices and contexts (Fabiano, 2020). Nevertheless, there is always one constant: the physical presence of the students and the body, which represent a fixed and irreplaceable point in the educational processes (Küçük, 2023). Virtual world and corporeal reality, as antithetical as they may seem, are both involved in the teaching-learning process (Agbo, Oyelere, Suhonen, Laine, 2021). This work aims to highlight how in reality the body and digitization should not be put in opposition, but rather work in harmony, in a perspective in which the virtual world is seen as a fundamental dimension of corporeality. In this sense, the educational experience that the student lives in the virtual world must be considered as something that involves the body and therefore belongs to the real world (Gadille, Impedovo, 2020). Body and virtual reality are, therefore, two closely interdependent and multidimensional realities. In this regard, the world of schools must not think and act according to a perspective of disembodied digitization and a devirtualized corporeality, but according to the criterion of a body that becomes a virtual body, therefore capable of exploring and inhabiting spaces in different and unprecedented ways, and of giving value to the plurality of embodied experience (Rinn, Khosrawi-Rad, Grogorick, Robra-Bissantz, Markgraf, 2023)..

Keywords: Virtual body; Virtual Environment; Physical education; School.



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1. Introduction

The importance and value of the body, from an educational-training point of view, has changed over the years (Di Maglie, 2020). The idea of a body separated from a mind has been abandoned in favour of the concept of corporeality and embodied cognition capable of giving due importance to the body.

The term embodied cognition is intended to define a theory of human intelligence and behaviour that states that the way of thinking, understanding and inter-

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acting with the world is closely linked to bodily experience (Cerulo, 2019). In this sense, the brain does not operate in isolation, but is closely connected with the body and the external environment, therefore, bodily experience becomes an integral part of the cognitive, emotional and social process.

In the school environment, embodied cognition helps to create an engaging and effective learning environment, fosters a deeper and more concrete understanding of concepts and helps students develop practical and social skills necessary for future life (Macedonia, 2019).

With the spread of the Covid-19 pandemic, the question of the body and its presence in the world of education has become urgent and necessary. This event generated two significant problems:

1. the lack of physical interaction in both recreational and pedagogical educational spaces;
2. the need to use digital systems necessary to create forms of relationships and bonds different from the classic ones.

Therefore, the post-pandemic in the world of education has stood out for the presence of the digital world, no longer understood as an exception but as the necessary rule to be able to offer an educational proposal appropriate to the peculiarities of learners (Sousa, Duarte, Campos, Matos, 2021). It has decisively accelerated the digitization processes already present and partly activated by educational institutions, managing to improve the use and understanding of the digital world understood as a form of educational expression of the school world (Rapanta, Botturi, Goodyear, Guàrdia, Koole, 2021).

Initially, the relationship between the virtual world and the body turns out to be something still primordial and little used in educational proposals, so much so that, in some cases, the idea of a conflictual relationship between body and digital is still alive. This work aims to highlight the relationship between virtuality and corporeality, not understood as a conflict, but as a bond capable of generating a virtual bodily experience (Gamelli, Ferri, Corbella, 2020).

2. The digital world in school

Technology and the digital world have been present in education since their inception (Rivoltella, 2020). This need arises from the need that education has to update itself in order to be able to propose educational processes capable of responding to the needs of students (Carstens, Mallon, Bataineh, Al-Bataineh, 2021).

The pupil, whether it is primary, secondary or university, unconditionally uses technologies in multiple ways and contexts, therefore, digital seems to represent a solution to be able to adapt, and not make obsolete, educational proposals to a reality and a school audience that is certainly heterogeneous and changing over time (Kuru Gönen, 2019). It is for this reason that it is possible to say that the pandemic generated by Covid-19 has done nothing but accelerate a process already underway. In addition, with it it was possible to understand how important it is for the teacher to be in possession of digital skills and to be able to use any technological tool (Aeni, Hanifah, Sunaengsih, 2019).

The term digital native, an appellation associated with the student, seems to indicate that the main difference between the student and the teacher is the date of birth, as it is this that determines technological ability (Dalle Luche, 2023). In reality, this is not necessarily true, since using a mobile phone or surfing the Internet does not imply that you know how to use digital tools correctly, nor that you know their full potential. With this in mind, teachers have the opportunity to guide students in their first digital steps in order to develop their critical skills and in general teach how to make good use of technology (Hakaj, 2022).

However, the use of digital technology must not detract from the importance of the relationship between learning and everyday life. In this regard, when we talk about learning in schools, we think of a specific form of learning that also generates implications in the experiences of everyday life, therefore also from a social, relational and emotional point of view, therefore not only cultural (Andresen, Boud, Cohen, 2020).

Using the digital world means being able to understand not only the positive sides but also being aware of the negative ones, such as the distance between school and everyday life, in some cases generated by an excessive presence of digital experiences no longer with a specific purpose, as in the case of the school institution, but as an excessive and disproportionate use in any formal context, informal and non-formal (Merico, Scardigno, 2023).

The use of new technologies punctuates the life of the School Institution as, as is evident, technological solutions help to improve daily life in schools in various ways. It certainly helps in the teaching process, understood as an innovative form of communication with which it is likely to multiply the possibilities of dissemination and access to educational content (Del Zozzo, Santi, 2020). In addition, technology facilitates communication for the entire school community involved in education: starting with pupils, followed by ATA staff, staff, families or the student body itself. Through digital tools, any volume of information can be processed and transmitted immediately, efficiently and easily.

The use of the virtual world allows the creation of educational communities through which it is possible to share experiences and good practices that improve students' progress (Díaz, Saldaña, Avila, 2020). By carefully observing teaching materials and digital tools, there is a strong propensity to make the teaching-learning process more motivating and to improve the classroom climate, beyond the irreplaceable importance of physical presence.

Technology represents a facilitator for learning for the student, even more so when it is characterized by virtual environments and therefore by the educational flexibility necessary for each student to use digital content at will, adapting it to their way of learning (Chaichumpa, Wicha, Temdee, 2021). By doing so, it is possible to create educational experiences that can be defined as unique and personalized, as the student can acquire new knowledge according to their own learning rhythms. Obviously, the role of the teacher must be a guide to the learning process characterized by the relationship with digital tools, only in this way will it be possible to generate a teaching proposal that is motivating and meaningful, therefore able to increase interest and participation in learning (Corrias, 2021).

3. The physical and virtual body

The body should not be understood as a physical reference point those functions within an objective space and therefore on certain emotional-relational distances, but it must be thought of as a means of establishing emotional-social relationships and bonds in reference to specific situations (Città et al., 2021). In this regard, learning experiences are characterized by the presence of the body, therefore they must be co-constructed with and through the body. Being aware of having a body is equivalent to being aware of the fact that it is located in a certain space and time and in relation to other bodies (Maggi, 2020).

Being aware of one's body is equivalent to being able to live experiences through that body, which will be characterized by originality and relationships of perspective, movement and affections (Fontana, Mignosi, 2023).

Usually, the idea that it is of one's own body is of an object of which one is in possession, without its own identity, therefore we speak of an exclusively physical body. On the other hand, it is necessary to have the idea of a living body characterized by experience and the relationship that is created with the surrounding environment. From this point of view, the body can be understood as a centre of action, i.e. capable of perceiving external stimuli and acting accordingly towards the surrounding world (Cecoro, 2021). The ability to perceive is a fundamental aspect to make us reflect on the fact that when we talk about the body and the relationship with the environment, we must not only dwell on the movements and relationships of the real world but also on the idea of a body present in everything that happens in the virtual environment. In this sense, any virtual stimulus that is applied to the body generates a virtual reaction and not a real one, but still capable of creating an experience that could be defined as inter-sensory (Buccini, 2023).

Obviously, any virtual movement is not visible in the real world, even if it is able to generate a learning experience, since it is lived and described in the first person. Therefore, the body can be present both physically and virtually, and in the latter case, it becomes a tool capable of promoting orientation, not only from a physical point of view but also from an emotional, social and relational point of view, without there being an initial motor exploration in space (Pastel et al., 2021).

When we talk about the physical body and the virtual body, it is necessary to make a distinction because in the first case it is a body that is a means of relating to the physical outside, while in the second case it is a body capable of reorganizing all space-time relationships to use them in the digital world (Neyret, Bellido Rivas, Navarro, Slater, 2020).

Obviously, if there is this distinction between the physical body and the digital body, there is no difference in everything that the virtual or real experience generates from a social, emotional, communicative and cognitive point of view. Therefore, there are differences from the point of view of time and space, but there is no difference from the point of view of experience and the effects that the latter generates. For this reason, it is possible to say that the virtual body is, in some respects, real, in the sense that it is perceived and experienced as a generative projection of concrete and constructive experiences and actions (Çakıroğlu, et al., 2021).

The link between technology and the body exists, and in a certain sense, the former could be considered as an extension of the latter, as it is capable of creating new relationships or new balances between the body and the environment within a dynamic and changing cognitive-relational process (Checa, Bustillo, 2023).

A further aspect of the potential of the virtual body that should not be underestimated is the fact that it never works alone but relates to human and non-human bodies, and, virtual and non-virtual. Thanks to the inseparable link between the physical and virtual bodies, a representation of the former in the latter is continuously generated, creating a hybrid state, i.e. a projection of the body not as a simple bodily presence from a physical point of view but as the thought image of oneself (Yian-noutsou, Johnson, Price, 2021).

4. Experimental protocol: the virtual body in education

The body and the digital world are closely related, so much so that it can be said that the virtual environment can be a fundamental dimension of corporeality (Selchenok, Berest, 2019).

Technological innovation represents a means to ensure that the pupil, if we analyse the school context, lives an experience that is at the same time social, emotional, relational and cognitive (Shuhratovich, 2020). With this perspective, the virtual body does not want to completely eliminate its physical presence but simply to discover and enhance bodily experiences in the virtual world.

The digital world therefore becomes a moment of active and meaningful construction for the pupil as the learning experience he or she lives, even if deriving from a virtual environment, generates an acquisition of knowledge not only from a cognitive point of view but also from a social and emotional point of view (Hamidovna, 2020). It is for this reason that it is necessary to review educational and training processes, so as to be able to offer learners pedagogical proposals that are original and innovative.

The main difference between the virtual body and the physical body lies above all in space and time, in the sense that the physical body can only be in a certain point and at a specific time, while the virtual body could easily be in several points at the same time, which is why it is possible to speak of simultaneity.

In the school environment, analysing the differences between the traditional classroom and the virtual classroom, it is possible to observe that in both cases the body is the one that allows attention and motivation to be constant over time during the learning experience, but the body, as such, is able to create moments of orientation, guided and not, with or without the motor aspect, while the virtual body allows you to explore and inhabit any space in different and innovative ways (Aboobaker, KA, 2020).

Therefore, from a pedagogical point of view, the virtual body offers the possibility of having intersensory, personal or social experiences that take place at the same time, precisely because it is able to fully exploit the potential of the body itself (Di Tore, et al., 2022).

The aim of this work is to investigate whether virtual reality in association with physical education can be used as a learning tool to improve pupils' knowledge, attention and motivation. This study was carried out in the 2002/2023 school year in a lower secondary school in the province of Bari.

Two first classes, two second classes and two third classes were randomly selected. Subsequently, a control group and an experimental group were created for each class. The substantial difference between the control group of the experimental group is that the former carries out conventional teaching activities while the experimental group calibrates the teaching proposals on the combination of physical

education and artificial intelligence with the addition of the other disciplines, so that this intervention is characterized by interdisciplinarity and transversality.

Table 1. Differences between Experimental Group and Control Group.

Lower Secondary School					
<i>Experimental Group</i>			<i>Control Group</i>		
Number of students	Class	Age	Number of students	Class	Age
23	1°	10 - 11	20	1°	10 - 11
27	2°	11 - 12	25	2°	11 - 12
19	3°	12 - 13	24	3°	12 - 13
TOT. = 69	-	-	TOT. = 69	-	-

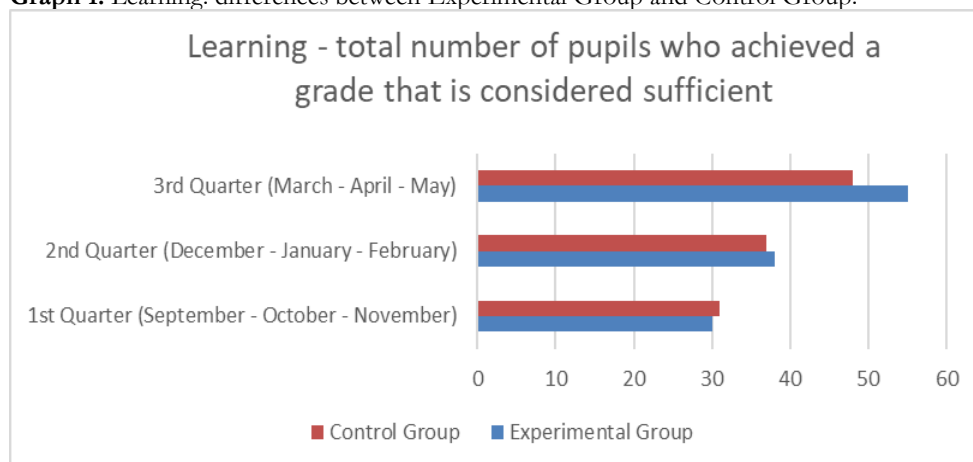
The activities to which the experimental groups are subjected are contemplated with the association of the use of virtual reality and body movements, so the subject that will be most interested is physical education.

The intervention lasted one year and each group had a similar number of pupils, in order to avoid an over-representation of a specific class and consequently disorders from the point of view of the results of the study. The data collection took place on a quarterly basis (1st Quarter = September - October - November / 2nd Quarter = December - January - February / 3rd Quarter = March - April - May) and was carried out by two researchers, in collaboration with the teachers, responsible for assessing the attentional, motivational and cognitive axis. It took place through direct observation as regards attention and motivation, while through questionnaires, proposed and evaluated by the teachers, as regards the cognitive aspect.

It should be noted that both the control groups and the experimental groups benefited from didactic proposals generated by the same teachers and with identical learning contents. The difference between the two groups lies in the modality, means and tools used during the didactic proposal.

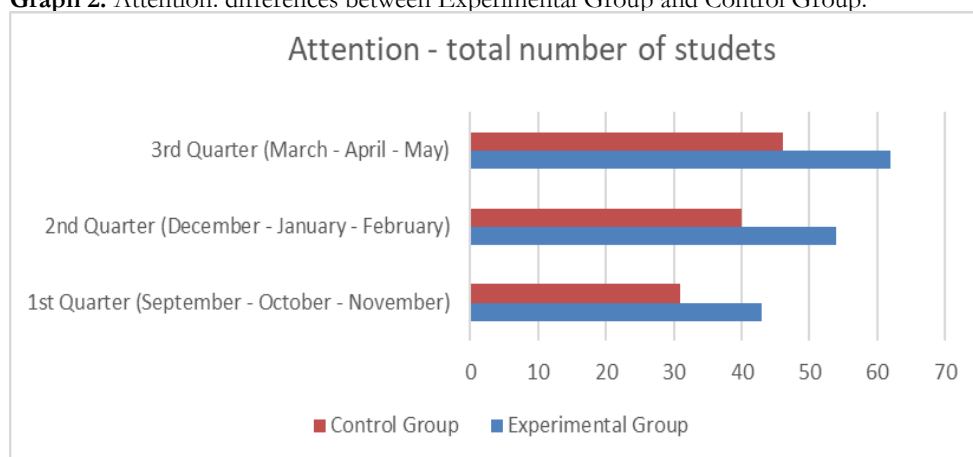
For each group, descriptive and summary statistics were formed in order to analyse the differences between the various groups before and after the intervention and at the beginning and end of each trimester.

Graph 1. Learning: differences between Experimental Group and Control Group.



The results from each trimester show that, from the point of view of learning, there is substantial parity in the first (30 out of 69 pupils in the experimental groups and 31 out of 69 in the control groups achieved at least a satisfactory grade) and in the second trimester (38 out of 69 pupils in the experimental groups and 37 out of 69 in the control groups achieved at least a satisfactory grade), while in the third trimester it is observed that the combination of physical education and the virtual world begins to show its potential, since 55 out of 69 pupils in the experimental groups and 48 out of 69 in the control groups have achieved at least a sufficient evaluation. This growing gap in the data obtained between the control and experimental groups began in the second trimester and increases in the third trimester, suggesting that pupils need time to understand how to use these teaching proposals for learning purposes, and, unfortunately, not everyone has the necessary knowledge to use virtual reality. As far as the attentional and motivational axis is concerned, unlike learning, there is a substantial difference in the three trimesters between the experimental and control groups.

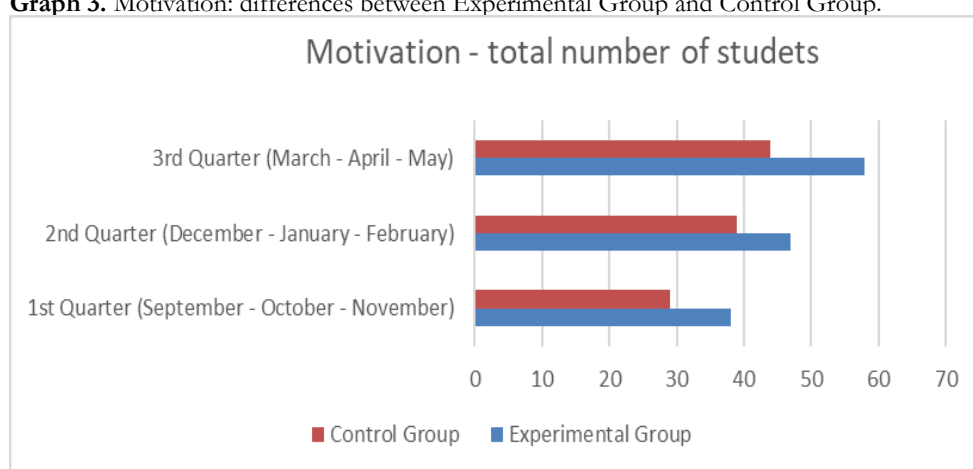
Graph 2. Attention: differences between Experimental Group and Control Group.



In particular, as far as attention is concerned, in the first trimester it was observed that 43 out of 69 pupils in the experimental group showed greater interest in the

teaching proposals, managing to maintain a constant level of attention over time, while in the control group only 31 out of 69 pupils had at least sufficient attention to the teaching proposal. In the second trimester the difference between the experimental group and the control group increases (Pupil Difference First Trimester = 12 / Pupil Difference Second Trimester = 14) as in the experimental group 54 out of 69 pupils maintained at least a sufficient level of attention, while in the control group 54 pupils out of 69 showed interest. In the third trimester the gap increases (Pupil Difference First Trimester = 12 / Pupil Difference Second Trimester = 14 / Pupil Difference Third Trimester = 16) since in the experimental group 62 out of 69 pupils showed constant interest during the teaching proposal, while in the control group only 46 pupils out of 69.

Graph 3. Motivation: differences between Experimental Group and Control Group.



As far as motivation is concerned, as in the case of attention, there is a substantial difference in the data obtained in the various quarters of the experimental groups and the control groups. Specifically, in the first trimester it was recorded that 38 out of 69 pupils in the experimental group were found to be motivated in carrying out the tasks assigned by the teachers during the teaching proposals, while in the control groups only 29 out of 69 pupils were found to be motivated. In the second trimester the difference between the experimental and control groups did not increase, but there was an improvement in each group compared to the first trimester, as 47 out of 69 pupils in the experimental group showed motivation, interest and participation during the teaching proposals, while the control group showed only 39 out of 69 pupils. Finally, in the third trimester, 58 out of 69 pupils in the experimental group and 44 out of 69 pupils in the control group showed motivation during the teaching proposals. Therefore, although with a slight decrease in the second trimester, the difference from the first to the third trimester between the experimental and control groups increased (Pupil Difference First Trimester = 9 / Pupil Difference Second Trimester = 8 / Pupil Difference Third Trimester = 14).

These data highlight how the combination of physical education and the virtual world motivates and increases students' attention, making them the main actors in the teaching-learning process during the lesson.

5. Conclusions

This work aims to highlight the importance of the relationship between the body and the virtual world in the school environment, analysing what can be the link between the use of technologies (virtual world) and physical education (body), and the influence that this combination can generate in the learning of learners, on their motivation and interest in school and educational proposals. Specifically, it was observed that as far as motivation and attention are concerned, the experimental groups that benefited from the combination of physical education and virtual world, and showed a greater propensity towards didactic proposals than the control group. As far as learning is concerned, a smaller difference was observed between the control group and the experimental group, although there was a gradual improvement, in the various quarters, in favour of the combination of physical education and virtual world.

These results show how the emerging relationship between virtual reality and physical education in schools can contribute to creating positive effects on learning, but also reducing distractions and therefore potentially lowering pupils' perceptual abilities.

In the field of education, it is possible to say that virtual reality in association with the body generates an effective form of learning deriving from simulations of experiences that also stimulate and involve the emotional, social and relational axis (Ledger, Fischetti, 2020). This new modality therefore makes it possible to eliminate a traditional form of teaching characterized by the frontal lesson in which the student is a simple spectator and the body is not considered except in the hours of physical education, in favour of an innovative teaching in which the learner is at the centre of the teaching-learning process (Zou et al., 2021).

References

- Aboobaker, N., & KA, Z. (2020). *Influence of digital learning orientation and readiness for change on innovative work behaviour: reflections from the higher education sector*. Development and Learning in Organizations: An International Journal, 34(2), 25-28.
- Aeni, A. N., Hanifah, N., & Sunaengsih, C. (2019). The impact of the internet technology on teacher competence and student morality. In *Journal of Physics: Conference Series* (Vol. 1318, No. 1, p. 012046). IOP Publishing.
- Agbo, F. J., Oyelere, S. S., Suhonen, J., & Laine, T. H. (2021). Co-design of mini games for learning computational thinking in an online environment. *Education and information technologies*, 26(5), 5815-5849.
- Andresen, L., Boud, D., & Cohen, R. (2020). *Experience-based learning*. In *Understanding adult education and training* (pp. 225-239). Routledge.

- Buccini, F. (2023). *Learning in the metaverse: for an educational use of hybrid environments Apprendere nel metaverso: per un uso didattico degli ambienti ibridi*. Q-Times Webmagazine, (3), 121-133.
- Çakıroğlu, Ü., Aydın, M., Özkan, A., Turan, Ş., & Cihan, A. (2021). Perceived learning in virtual reality and animation-based learning environments: A case of the understanding our body topic. *Education and Information Technologies*, 26(5), 5109-5126.
- Carstens, K. J., Mallon, J. M., Bataineh, M., & Al-Bataineh, A. (2021). *Effects of Technology on Student Learning*. Turkish Online Journal of Educational Technology-TOJET, 20(1), 105-113.
- Cecoro, G. (2021). La centralità del corpo in azione nei processi comunicativi, emotivi e apprenditivi, nell'ambito della comunicazione aumentativa e alternativa (CAA) nella scuola dell'infanzia. *IUL Research*, 2(4), 23-36.
- Cerulo, K. A. (2019). Embodied Cognition. *The Oxford handbook of cognitive sociology*, 81.
- Chaichumpa, S., Wicha, S., & Temdee, P. (2021). *Personalized learning in a virtual learning environment using modification of objective distance*. Wireless Personal Communications, 118, 2055-2072.
- Checa, D., & Bustillo, A. (2023). Virtual Reality for Learning. Springer
- Città, G., Allegra, M., Arrigo, M., Chiazese, G., Chifari, A., Dal Grande, V., ... & Gentile, M. (2021). *Pensiero Computazionale ed Embodied Cognition*. Atti Convegno Nazionale, 185.
- Corrias, G. (2021). *Progettazione, realizzazione e testing di un ambiente di realtà virtuale immersiva per l'apprendimento*. Dottorato di Ricerca Filosofia, Epistemologia e Storia della Cultura Ciclo XXXIII, Università degli Studi di Cagliari.
- Dalle Luche, R. P. (2023). Concettualizzazioni cliniche e psicopatologiche degli esordi psicotici dalla seconda metà dell'800 ai nativi digitali. *Rivista sperimentale di freniatria: la rivista dei servizi di salute mentale: CXLVII*, 2, 2023, 119-139.
- Del Zozzo, A., & Santi, G. (2020). Prospettive teoriche per lo studio della contaminazione tra ambienti di insegnamento/apprendimento fisici e virtuali. *Didattica della matematica. Dalla ricerca alle pratiche d'aula*, (7), 9-35.
- Díaz, J., Saldaña, C., & Avila, C. (2020). Virtual world as a resource for hybrid education. *International Journal of Emerging Technologies in Learning (iJET)*, 15(15), 94-109.
- Di Maglie, A. (2020). *Gestione delle emozioni e benessere psicofisico: il ruolo dell'educazione motoria e della pratica dell'attività fisico-sportiva*. In Le emozioni. Atti del Workshop 2019 (pp. 11-24).

- Di Tore, S., Caldarelli, A., Todino, M. D., Campitiello, L., Beatini, V., & Capellini, S. A. (2022). *Colmare il divario tra Scuola e Storia: il Progetto Scan Italy*. Education Sciences & Society-Open Access, 13(2).
- Fabiano, A. (2020). *Didattica digitale e inclusione nella scuola dell'autonomia* (Vol. 1, pp. 1-224). Anicia Editore.
- Fontana, S., & Mignosi, E. (2023). Tra esplicito e implicito: comunicazione multimodale e relazione inter-soggettiva nei contesti di apprendimento. *Italiano LinguaDue*, 15(2), 154-164.
- Gadille, M., & Impedovo, M. A. (2020). The embodiment dimension while learning and teaching in a virtual world. *Journal of Systemics, Cybernetics and Informatics*, 18(3), 1-8.
- Gamelli, I., Ferri, N., & Corbella, L. (2020). *Corpi remoti eppure presenti. La sfida dei laboratori virtuali universitari di pedagogia del corpo*. Giornale Italiano di Educazione alla Salute, Sport e Didattica Inclusiva, 4(3), 84-92.
- Hakaj, E. (2022). *Docenti e tecnologie: l'evoluzione dell'interesse, dell'efficacia e della competenza sulle tecnologie in classe nell'interazione tra docente esperta e novizia*. Doctoral dissertation, Scuola universitaria professionale della Svizzera Italiana (SUPSI).
- Hamidovna, N. R. (2020). Preparation of children in schools by making technological techniques in pre-school education. *European Journal of Research and Reflection in Educational Sciences*, 8(2), 120-124.
- Küçük, T. (2023). The power of body language in education: A study of teachers' perceptions. *International Journal of Social Sciences & Educational Studies*, 10(3), 275-289.
- Kuru Gönen, S. İ. (2019). *A qualitative study on a situated experience of technology integration: Reflections from pre-service teachers and students*. Computer Assisted Language Learning, 32(3), 163-189.
- Ledger, S., & Fischetti, J. (2020). *Micro-teaching 2.0: Technology as the classroom*. Australasian Journal of Educational Technology, 36(1), 37-54.
- Macedonia, M. (2019). Embodied learning: Why at school the mind needs the body. *Frontiers in psychology*, 10, 2019.
- Maggi, D. (2020). *Un flusso in apprendimento: il corpo*. Mizar. Costellazione di pensieri, 2020(13), 29-39.
- Merico, M., & Scardigno, F. (2023). *Il continuum dell'educazione: Teorie, politiche e pratiche tra formale, non formale e informale*. Ledizioni.

- Molina, A., Michilli, M., & Gaudiello, I. (2021). La spinta della pandemia da Covid-19 alla scuola italiana. *Mondo digitale*, 20(1), 47-80.
- Neyret, S., Bellido Rivas, A. I., Navarro, X., & Slater, M. (2020). *Which body would you like to have? The impact of embodied perspective on body perception and body evaluation in immersive virtual reality*. *Frontiers in Robotics and AI*, 7, 31.
- Pastel, S., Chen, C. H., Bürger, D., Naujoks, M., Martin, L. F., Petri, K., & Witte, K. (2021). *Spatial orientation in virtual environment compared to real-world*. *Journal of motor behavior*, 53(6), 693-706.
- Rapanta, C., Botturi, L., Goodyear, P., Guàrdia, L., & Koole, M. (2021). Balancing technology, pedagogy and the new normal: Post-pandemic challenges for higher education. *Postdigital Science and Education*, 3(3), 715-742.
- Rinn, H., Khosrawi-Rad, B., Grogorick, L., Robra-Bissantz, S., & Markgraf, D. (2023). Virtual Worlds in Education-A systematic Literature Review.
- Rivoltella, P. C. (2020). Scuola. Tecnologia più condivisione: Così si può fare buon e-learning. *Avvenire. it*.
- Selchenok, A. K., & Berest, V. A. (2019). *Corporeality and the self: dissolving borders with technology*. Вестник Российского университета дружбы народов. Серия: Философия, 23(3), 302-311.
- Shuhratovich, I. U. (2020). Application of innovation in teaching process. *European Journal of Research and Reflection in Educational Sciences*, 8(5), 4-8.
- Sousa L., Duarte, Campos P., & Matos S. (2021, July). The use of interactive technologies for education in pandemic and post-pandemic contexts: Design implications. In *CHIItaly 2021: 14th Biannual Conference of the Italian SIGCHI Chapter* (pp. 1-7).
- Yiannoutsou, N., Johnson, R., & Price, S. (2021). *Non visual virtual reality*. *Educational Technology & Society*, 24(2), 151-163.
- Zou, W., Ding, W., Shan, X., & Wu, X. (2021). *Innovation of college physical education teaching mode in the era of big data*. In *The Sixth International Conference on Information Management and Technology* (pp. 1-5).