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Invited Speakers

Shaun Gallagher

Department of Philosophy, The University of Memphis (USA)

Magdalena Kersting

Department of Science Education, University of Copenhagen (Denmark)

Sebastian Ruit

Institut für Bewegungswissenschaften, Sport und Gesundheit, Universität Graz (Austria)

Jordan Zlatev

Division for Cognitive Semiotics, Lund University (Sweden)

The Fifth E: 4E cognition and education

Shaun Gallagher
Lillian and Morrie Moss Chair of Excellence in Philosophy
University of Memphis

I'll highlight the various 4E contributions to educational theory and practice, addressing questions about the role of brain science and developmental psychology, embodied processes, social cognition, natural pedagogy, enactive metaphor, and socially extended cognitive institutions. I'll also suggest how embodied and extended approaches to cognition can offer a critical perspective on issues pertaining to gender and race.

Metaphors in Motion: Navigating the Embodied Landscape of Science Education in the Age of Artificial Intelligence

Magdalena Kersting
University of Copenhagen

This talk explores the dynamic intersection of traditional embodied communication strategies and the transformative impact of generative artificial intelligence (GenAI) on science education. Drawing from empirical research, I will first examine how science teachers use metaphors as embodied tools to effectively convey complex scientific concepts, rooted in physical experiences that enhance conceptual understanding and student engagement.

Building on this foundation, I will then investigate the rapid advancements in GenAI and their implications for education. Human learning and meaning-making are inherently tied to our physical and sensory experiences, contrasting with GenAI's advanced capabilities that lack the intrinsic embodiment of human cognition. This contrast raises significant questions about maintaining the embodied nature of educational experiences.

Through a scoping literature review and theoretical insights, I will propose strategies for integrating AI technologies while preserving and enhancing embodied teaching practices. By fostering dialogue between established methodologies and emerging technologies, this talk aims to inspire educators and researchers to embrace new technologies with a deep appreciation for the embodied nature of human learning.

Physical Education as Embodied Experience? Approaches to and Perspectives for Embodiment in Sports Pedagogy

Sebastian Ruin
University of Graz

In sports pedagogical discussions there is undoubtedly a dualistic tradition which views the body as an object to be dominated or controlled by the mind. At the same time, however, efforts have also been made for centuries to overcome such dualistic ideas and to assume a unity of body and mind in sports pedagogical approaches. These go back not least to Rousseau's idea of a natural education and range from progressive education and movement pedagogical approaches to more recent concepts of aesthetic education in movement and sport or experience-oriented physical education.

In this lecture, these considerations, which from today's perspective would in my opinion be close to embodied education, will first be presented. Based on this, the concept of embodied experience in particular will be brought into focus as a central educationally relevant moment in order to consider current problems in sports pedagogy in this light. With a view to my main areas of work, I will then focus on two topics in particular. On the one hand, the question of how learners (in educational settings characterized by diversity) encounter power and hierarchy as embodied experience is explored. This also raises the question of whether and, if so, how the incorporation of a democratic habitus can be initiated in physical education. On the other hand, increasingly digitalized living environments come along with a change in (body-related) experiential spaces. Accordingly, the question of how embodied experience can be understood in digitalized contexts and what significance this could have for physical education will be explored.

Intertwining the body and signification in phenomenology and cognitive semiotics

Jordan Zlatev
Division for Cognitive Semiotics
Lund University

While certain current theories from cognitive linguistics like Conceptual Metaphor Theory commonly pay lip service to the crucial role of human “embodiment”, the depth of their understanding of the body rarely go beyond reductionist conceptions such as “the cognitive unconscious” or “the sensorimotor centers of the brain”. As phenomenology, and in particular the work of Merleau-Ponty has shown, the constitutive role of the lived (human) body for meaning making and thinking runs much deeper than this. In the fundamentally creative, and incapable of formalization act of *expression*: “knowledge and communication sublimate rather than suppress our incarnation, and the characteristic operation of the mind is in the movement by which we recapture our corporeal existence and use it to symbolize instead of merely to co-exist.” (Merleau-Ponty 1964, p. 7)

In my presentation, I explicate some aspects of this phenomenology of perception and expression with the help of a model that derives from cognitive semiotics, the Motivation & Sedimentation Model (e.g., Zlatev 2023; Zlatev & Moskaluk 2022). MSM schematically distinguishes between three levels of meaning-making: Embodied, Sedimented and Situated, intertwined with relations of motivation on the one hand, and individual and social sedimentation, on the other. On this basis, I propose in my presentation first a theoretical and then an empirical analysis with potential implications for the field of embodied education.

Theoretically, I show that the MSM-based analysis of meaning makings shows why currently popular Large Language Models (LLMs) and their corresponding “AI chatbots” are necessarily deprived of meaning. In short, they operate only on sedimentation links between statistically defined language patterns, and corresponding sub-expressive formulations. Any “meaning” and “creativity” is projected onto them by people, since (a) there is no bodily experience to motivate such structures in the first place, and (b) no creative situated sign use from which these structures can sediment from. Empirically, I show how MSM can be used to operationalize metaphors with different degree of creativity, in language as well as other semiotic systems like depiction, based on the degree to which they are motivated by the Embodied level of meaning making.

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Working group topic

(1) Conceptual blending

Through the development of the theory of conceptual blending, Fauconnier and Turner argue that “all our learning and thinking consists of blends of metaphors based on simple bodily experiences”. By drawing from and integrating structures from different conceptual spaces, we form novel features that did not exist in the original spaces.

Modeling: Phenomenological Approach and Embodiment

Giancarlo Artiano¹, Emilio Balzano²

¹ *Dipartimento di Matematica e Fisica, Università degli Studi della Campania Luigi Vanvitelli,*

² *Dipartimento di Fisica Ettore Pancini, Università degli Studi di Napoli Federico II*

Keywords

Modeling; Phenomenological Approach; Sensorimotor Systems; Physics Education; Embodied.

Embodied cognition focuses on how personal bodily experiences help to structure cognition and language (Nathan, 2021). This implies that cognition, such as recalling memories, reasoning, and inferences, involves engaging sensory and motor systems to gather pertinent information (Barsalou et al., 2003; Chakravorty and Gupta, 2018). In physics education, the interest in embodied learning likely arises because many physics concepts revolve around the actions and interactions of objects at the human body's scale (Euler et al., 2019; Kontra et al., 2015). Physics concepts are a natural candidate for studying embodied learning because physical interactions are integral to our experiences from the beginning of our interaction with the world. (Johnson-Glenberg et al., 2016). According to our conceptual framework (Guidoni et al., 2005), the phenomenological approach to modeling scientific phenomena is in accordance with embodied practice. The body is a significant resonance mediator in exploring, for example, the phenomenology of force and equilibrium. It serves as an interface structure that connects a human being's internal states with the external stresses of reality (Arcà & Guidoni, 1987).

The present work assumes that the first interface between people and reality is the sensorimotor system, which is sensitive to exchange signals with the surrounding environment (Balzano et al., 2005). Acting a force through the body can help students feel how they are exerting a force, engaging in a specific motor pattern, and being more aware of controlling their body. Motor patterns may differ when we pull, push, or rotate an object. Assuming a motor pattern model consistent with phenomenology is a clue to how students model learning processes about phenomenology. Accurate observation of body movement combined with complex experimental activities designed on physics content makes understanding the student's learning dimension possible. It helps them in the modeling and formalisation processes regardless of their school level, whether they are kindergarten or university students. We involve teachers in sharing the need to understand how children communicate the meaning of mathematical and physics concepts with their bodies and *how action shapes thought* (Tversky, 2019). We will discuss examples of how, from our experience, it is clear that even with secondary school students and university teaching, the body's involvement helps understand models and theories.

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Bio

Giancarlo Artiano has a PhD in physics education. He is a science and mathematics lower secondary school teacher and member of the Laboratorio per l' Educazione alla Scienza community of practice, which currently has around 600 people, including school teachers, researchers, and educators who share and reflect on a way not traditional way of teaching physics. Research activities on the learning and teaching of physics in formal and informal contexts, the development of study material with the help of new technologies and strategies for teaching modern physics at school are combined with social activism on issues relating to education broadly.

Emilio Balzano is an associate professor of physics education at the University of Naples Federico II. The research activities are finalised to improve science learning and teaching through permanent training. From a Vygotskian socio-cultural framework, his research interests focus on questions raised in the field of experimental and theoretical research about: -cognitive models; -the design of school activities; -the structure of the science curricula; -the relationship between science-mathematics-technology, the relationship between formal and informal contexts; -the models of teachers preparation. The research has been developed in the framework of national and international science education and communication projects.

Entanglement between Yoneda-lemma and conceptual blending

Miglena Asenova
Free University of Bozen-Bolzano

Keywords

Conceptual blending; Mathematics education; physics education; category theory; Yoneda lemma; embodiment.

In Asenova (2021/2024) the metaphorical use of a few very basic category theoretical tools (category, functor, representable functor, natural transformation, Yoneda lemma) in the context of research in mathematics education is investigated and modeled. More specifically, the focus of the above-mentioned research is on the use of the Yoneda-lemma as a metaphor for definition of a mathematical object in mathematics education. The Yoneda-lemma is one of the most important and groundbreaking results in category theory. Speaking down to earth, the metaphorical sense of this theorem is that an object can be perfectly known by coming to know which are its counter-images that are “sent back” by the other objects that interact with it. Developing further the metaphor, one can think of the Yoneda-lemma as the mathematical counterpart of the proverb “tell me who you’re with and I’ll tell you who you are.”

Starting from this basic idea, the proposal in this outline consists of considering this approach in a wider sense, where the object that we want to know could be a mathematical or a physical one, and where conceptual blending provides the cognitive foundation for grasping analogies in knowing objects in those contexts. In this sense, the basic concepts of category theory listed above act as technical tools useful to entangle the way we know the objects in mathematics or in physics by conceptual blending (see Figure 1).

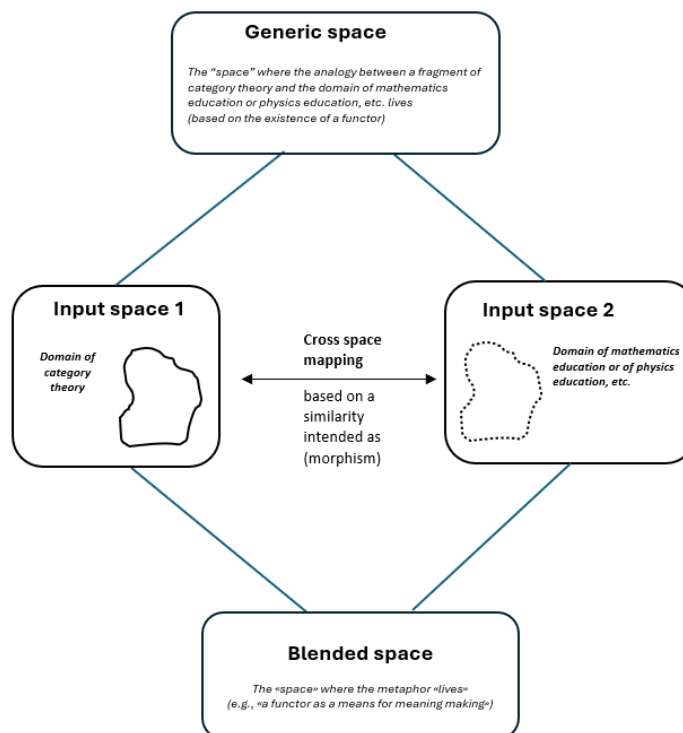


Figure 1. Representation of a conceptual blend between category theory and mathematics or physics education

An interesting point to be investigated is how the metaphorical sense of the Yoneda-lemma could be unfolded by conceptual blending and how the result could be applied to the knowledge of some specific mathematical (e.g., “function”, “proportionality”, etc.) or physical (e.g., “energy”, “force”, “equilibrium”, etc.) objects.

This would require singling out other objects that represent the context that frames the one we want to know, to clarify how this object “looks like” from the viewpoints of that context-objects, and to connect that viewpoints to a conceptual web that characterizes the object we want to know.

This last conceptual web would be the blended space that characterizes the object we want to know, and it would be based on the structural analogies that give rise to the generic space conceived as a functor between the basic category-theoretical tools (Input space 1) and the context the object is embedded in mathematics education or in physics education (Input space 2). Analogies between knowing of mathematical objects in mathematics and physical objects in physics could be the result of a farther step of abstraction on conceptual blending.

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Bio

Miglina Asenova is researcher in mathematics education at the Free University of Bozen-Bolzano. She has a master’s degree in mathematics from the University of Modena and Reggio Emilia (Italy) and a PhD in Mathematics Education from the University of Catania(Italy). Her research interests are related to the use of category theory and logic for modeling in mathematics education, as well as to the role of semiotic interpretative knowledge and feedback in teachers’ training.

Embodied foundations of projective geometry in historical textbooks: a case study

Agnese Del Zozzo
University of Trento

Keywords

Projective geometry; Textbooks; Metaphors; Conceptual blending.

Robert (1998) suggests that abstract mathematical concepts are grounded in experiential image schemas, and that reasoning is guided by schema-property correspondences. I would like to propose a similar analysis but in the context of the foundations of projective geometry (improper elements together with operations of projection and section) as they are introduced in a historical textbook: *Lezioni di geometria analitica e proiettiva*, written by Guido Castelnuovo in 1904. Robert begins his paper by recalling Lakatoff's distinction between *formal mathematics* - the program fully developed by David Hilbert - and the *informal mathematics* that preceded it. In this sense, textbooks like that of Castelnuovo, who was a contemporary of Hilbert, play a special role: they present a kind of informal way of presenting mathematics in the process of being formalized. Indeed, between the second half of 1800 and the first half of 1900, geometry, in particular analytic geometry and what later became algebraic geometry, was characterized by a marked change of perspective, which began with the introduction of linear algebra techniques with the work of Sylvester, Cayley and Grassmann around 1850 and then continued with the advent of commutative algebra techniques, in a crescendo of innovations that eventually led to schema theory and finally to an approach framed in terms of category theory. As a mirror of its time, from a linguistic point of view, Castelnuovo (1904) is a book characterized by an important presence of natural language used to describe visual and dynamic geometric objects and processes. Castelnuovo's textbook contains metaphorical expressions related to its content and historical context, using language that refers to sensorimotor experience and spatial perception. Starting from a focus on the foundations of projective geometry, we can identify many linguistic expressions that invoke metaphors that project from the realm of sensorimotor experience to that of geometry. Against this background, an analysis of some metaphors will be proposed in the light of conceptual blending (Fauconnier & Turner, 2003).

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Bio

Agnese Del Zozzo is a Research Fellow at the Dep. of Information Engineering and Computer Science of the University of Trento and holds a Ph.D. in Mathematics Education from the Dep. of Mathematics of the same university. She holds a bachelor's and master's degree in mathematics from the University of Bologna, a level II master's degree in "Expert in Learning Disorders and School Difficulties" from the University of Pavia, and a postgraduate degree in "Technologies for Teaching: Devices and Diversity" from the University of Trento. She is a member of the Nucleo di ricerca in Didattica della matematica (NRD) of the University of Bologna and she is author of several articles and books on research and popularization in mathematics and mathematics education. She also holds training courses for teachers at all school levels.

Blending the Artificial Intelligence and the Robotic body in Education

Rosa Gallelli¹, Angela Balzotti², Pasquale Renna³
University of Bari

Keywords

Embodied Learning; Social Robot; Posthuman; School; Education.

In our pedagogical and didactical reflection, we argue the hypothesis that the processes of subjectivation are marked by an irreducible tension towards a "posthuman becoming" (Braidotti, 2014): a process of openness and hybridization of the subject towards the otherness of nonhuman, organic and machinic entities to which the subject incessantly connects. (Maturana & Varela, 1992; Marchesini, 2002, 2009, 2014; Pinto Minerva&Gallelli, 2004). Social robots represent one of the most advanced frontiers of the hybridization processes just described. In fact, research in this field is focused on the possibility of equipping such anthropomorphic robots with the ability to acquire knowledge and informations from the environment, to connect constructively previous knowledge and acquired knowledge, and to activate relationships with humans and other robots. By the way, proposing a research in the Primary School, we argue the significance of child-social robot collaboration in educational contexts, emphasizing the integration of large language models (LLMs) such as ChatGPT into social robots, in order to enhance children's trust and interaction. Rooted in a tradition of research inspired by Jean Piaget and Turkle's studies on children's interactions with social media, the investigation aims to understand children's perceptions of AI, emotions, and trust. We propose an experiment which involved children aged eight to nine interacting with ChatGPT to promote reasoning about AI.

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Bio

Rosa Gallelli is Associate Professor of Didactics and Special Pedagogy in Dept of Education Sciences, Psychology, Communication Sciences at University of Bari Aldo Moro. For years he has been dealing with hybridizations of human-machine identity. rosa.gallelli@uniba.it

Angela Balzotti is ph.d. in Environment, Medicine and Health in Dept of Education Sciences, Psychology, Communication Sciences at University of Bari Aldo Moro. She studies the psychological implications of the relationship between human intelligence and artificial intelligence. angela.balzotti@tiscali.it

Pasquale Renna is Associate Professor of Pedagogy in Dept of Psychology at University eCampus. He studies intercultural pedagogy and the intersections between human and environment. pasquale.renna@unicampus.it

Embodied Engineering Education: Ideas on Conceptual Blending for Learning and Assessment

Matthew M. Grondin^{1,2}, Michael I. Swart¹, and Mitchell J. Nathan¹
Department of Educational Psychology-Learning Sciences¹
Department of Mechanical Engineering²
University of Wisconsin-Madison

Keywords

Conceptual Blending; Engineering Education; Embodied Education; Multimodal Communication.

In engineering education, my work examines the multimodal communication patterns between engineering students collaboratively constructing knowledge. Reasoning about concepts in engineering not only requires students' proficiencies in mathematics and physics, but ultimately requires communicating in the language of the engineering practice and culture.

Preliminarily, we have documented that embodied learning, evidenced by students' speech and gesture, stems from knowledge and experiences both in formal learning contexts (i.e., course-specific content) and outside of formal learning contexts (i.e., non-course-specific content). In terms of speech, *course-specific* and *non-course-specific* language is used to describe *structure* (i.e., static features) and *function* (i.e., dynamic behavior) (Grondin et al., 2023, Grondin et al., 2024). As for gesture, *static depictive* gestures (i.e., static features) and *dynamic depictive* gestures (i.e., operant behavior) can be either *conceptually concordant* (i.e., movement that aligns with discussed concepts) or *conceptually discordant* (Breckinridge Church & Goldin-Meadow, 1986; Walkington et al., 2014; Grondin et al., 2022; Grondin et al., under review). We have documented that *course-specific* and *non-course-specific* language that is correlated with *discordant gesture* production declines after argumentation and negotiation in group settings (Grondin et al., 2024). Furthermore, we have also found shifts in reasoning from superficial understandings using structural speech and static depictive gestures to deeper-level scientific reasoning with stronger correlations using functional speech and dynamic depictive gestures. These modes of communication ground learners' understandings of complex concepts (Barsalou, 2008; Nathan, 2022; Grondin et al., 2023), and are reflected in speech and gestures that depict both the structure and function of engineering objects.

We contend that cognitive mechanisms employed in student reasoning are *blends* of embodied experiences developed within and outside the classroom, and through body-based, analogical and metaphorical representations that *simulate* their current understandings of complex phenomena (Hostetter & Alibali, 2008). Using the notion of *conceptual blending*, Fauconnier and Turner (2002) argue that during thinking and learning past bodily experiences can give rise to new hybrid metaphors that blend properties of the prior experiences. For example, *vectors* are a conceptual blend of natural numbers with radial direction. New understandings of this sort can emerge as novel representations of scientific ideas that did not exist in the original spaces. As researchers we ask, can we identify characteristics of these emergent representations? As educators we ask, how can we foster formation of these new representations? And how can these representations reveal understandings?

During lessons, we see evidence that students co-construct novel conceptual blends and experience shifts in their conceptual blends (Nathan, 2022). For example, prior to lab experience and in collaborate discourse students may structurally describe the geometry of sample under a torsion load and statically depict this geometry using a circular gesture. After the lab experience, they may functionally describe how the exterior of the sample changes using a twisting-of-a-towel analogy while dynamically depicting how torsion creates these new surface features. To this, it is imperative

that we better understand how these blends emerge and how to create learning opportunities that foster students' conceptual development. For example, in cases when students exhibit conceptual discordancy, educators can assist students in deducing the logic chain that produces their global insights. Engineering educators can scaffold students to map their emerging knowledge using metaphors or analogies. We can develop pedagogical tools to purposely guide generation of mappings that are more indicative of scientifically valid forms of reasoning.

The mathematical formalisms often used in many engineering educational experiences can interfere with instruction intended to foster novices' emerging understandings in their transitions towards expertise (Nathan, 2012). In contemporary education, we can craft curricular activities that capture learners' attentions and capitalize on predilections for conceptual blending. Ultimately, it is crucial that educators meet the needs of students by providing rich experiences that allow students to ground foundational concepts to familiar embodied experiences and metaphors that can ultimately empower their exploration for knowledge in meaningful ways (Nathan, 2022).

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Bio

Matthew Grondin, M.S. BME, M.S. Ed.Psych. A joint-degree PhD student modelling the multimodal communication patterns of engineering students undergoing embodied learning interventions.

Michael Swart, PhD. An artist in the science of perception using design research to craft curricular activities that empower students to embody their conceptual understandings.

Mitchell J. Nathan, Ph.D., BSEE. is the Vilas Distinguished Achievement Professor of Learning Sciences in the Department in the School of Education at the University of Wisconsin-Madison. Dr. Nathan investigates the nature of thinking, learning, and teaching in K-16 mathematics and engineering, with an emphasis on embodied cognition and social nature of knowing and instruction, such as the role of gestures and the design of embodied and immersive learning technologies.

Selective triggering of Image Schemas using the example of understanding plant nutrition

Jorge Groß, Malte Michelsen
 Institute of Science Education, Leibniz University Hannover

Keywords

Image schemas; cognition linguistics; plant nutrition; change in concepts and notions.

Within the last 30 years, there has been a lot of research done that aims to identify students' conceptions in a diverse range of biological topics. Plant nutrition and photosynthesis is one of the most difficult issues teachers are confronted with in science classes. This can be due to everyday and embodied conceptions students' hold, which are often profoundly contrary to their scientific counterparts. But why is it so difficult to understand plant nutrition and photosynthesis? Driver (1989) and other colleagues argue that students construe abstract phenomena like plant nutrition on the basis of everyday experiences. Conceptions on the topic of Plant nutrition are one of the most thoroughly researched subjects using cognitive linguistics (e.g. Messig & Groß, 2018; Michelsen et al., 2022). The following "pathways of understanding" provides an overview on commonly used notions and concepts.

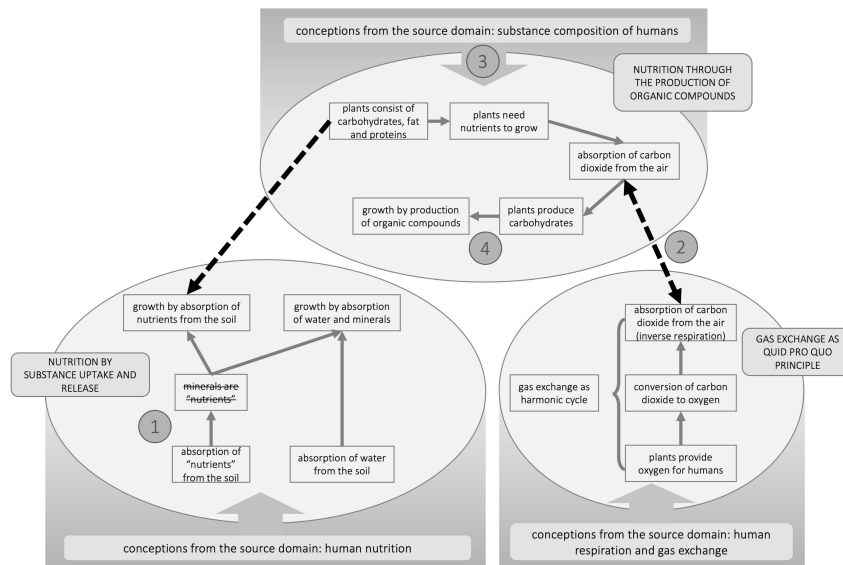


Figure 1: Learning pathways on the topic of plant nutrition (Messig, 2020)

For the development of such learning progressions, we use a differentiated classification of conceptions, which is based on a hierarchical structure:

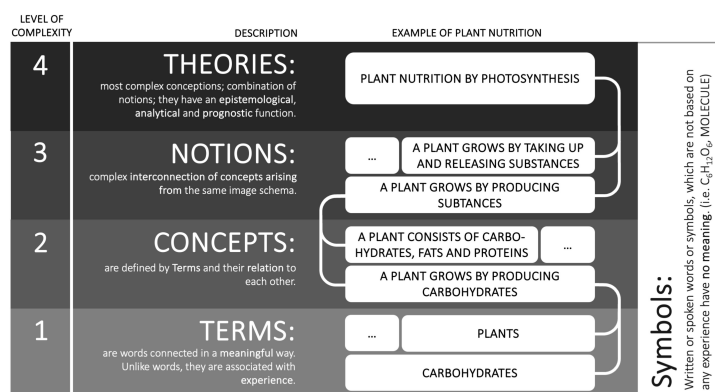


Figure 2: Internal structure of conceptions (Michelsen et al., 2022)

While previous attempts in triggering conceptual change relied heavily on logical reasoning, we want to try a different approach:

1. We seek conceptual change on the level of notions, which directly correspond to underlying Image Schemas.
2. We propose that a combination of experience (sensory input) and the use of cognitive linguistically designed language and imagery may trigger an Image Schema currently not used by a learner.
3. To enable the learner to consciously switch between the major notions of plant nutrition and the underlying Image Schemas for explaining a phenomenon, we propose discussing the implications of alternative Notions on problem solving tasks.

Since we already know about the notions on plant nutrition, we now need the best ideas for designing fruitful learning environments. In particular, we would like the workshop participants to develop together with us...

- ... occasions for sensory-motor-experience related to the phenomenon of plant nutrition.
- ... cognition-linguistically designed illustrations whose visual language corresponds to a notion on the subject of plant nutrition.
- ... cognition-linguistically designed text which contains metaphors and analogies corresponding to a notion on the subject of plant nutrition.

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Bio

Jorge Groß is a German biology teacher. The focus of his research is on science teaching and learning and the use of cognitive linguistic in teaching processes. His commitment is particularly focused on linking the various phases of teacher training and on advising school and non-school institutions.

Malte Michelsen, Biology/Chemistry teacher and researcher with experience in designing formal and informal learning environments according to cognition linguistics.

Embodied narrative for physics teaching

Luisa Lovisetti¹ and Marco Giliberti¹

¹Physics Department “Aldo Pontremoli” University of Milan

Keywords

Theatre; Mechanics; Body activities.

Physics is often taught as a purely “intellectual” subject, which, despite presenting itself as an important tool for interpreting the world, is strangely completely disconnected from the use of the body and the observation of the aspects of physics that involve it [Giliberti, 2023]. This separation of rational from corporeal aspects of physics teaching is even more pronounced in undergraduates STEM physics courses.

Contrary to usual practice, in the Preparation of Didactical Experiences course for master’s degree students in Mathematics or Physics, we insert approximately 20 hours of embodied activities within an inquiry learning process with some aspects of scientific theatre work (see the website “Lo spettacolo della fisica” available at <http://spettacolo.fisica.unimi.it>.) and the use of music [Carpinetti, 2016]. In fact, according to our experience, it is important to broaden the usual notion of inquiry activities – *i.e.*, the 5E inquiry cycle or ISLE activities – to insert them into an active learning process with embodied and creative activities of personal and social, as well as disciplinary, significance; in fact, it is the personal attribution of meaning the mostly makes disciplinary aspects truly cultural [Fazio, 2021].

In teaching, one cannot address only the mind, it is the whole person that must be involved: memories, emotions, rationality, hopes, predictions, fears, successes are all things that come both, through the mind and the body [Carpinetti, 2011]. Furthermore, the narrative aspects, even those connected to the body, are fundamental for understanding.

The activities we propose are almost completely concentrated on disciplinary aspects (mechanics with particular attention to the physics of oscillations) in a broad context in which emotions play an important role. But the aspects of disciplinary understanding, attribution of meaning, and emotional aspects are experienced together in a series of (mostly) self-chosen activities of various kinds, among which embodied ones are very important [Ødegaard, 2003].

As one student said in a metacognitive discussion following our activities, “Collective movements to simulate the molecules of a gas in various situations help to identify each of us with a reference system internal to the gas” .“Interaction with others is useful because you find yourself inside a concrete example of a complex interesting system” observes another student. Exercises in interaction with three students at a time, based on mutual trust, are considered by the students to be “useful because they create a bond of physical trust and help to open up and overcome shyness”. “Experiencing the oscillations with the body allows us to much more deeply fix the things discussed. Physically working with a long spring to create a small scene embodies and deepens with the body the notion of normal ways of oscillation: the spring becomes, in fact, a physical guide for body’s movements. Trying to move with constant acceleration is a unique experience to distinguish with the body the two notions of acceleration and speed.

Physical imitation exercises of the teacher’s movements help to create a learning community in which the teacher is a promoter and facilitator, not a lecturer. Furthermore, actions to expand emotional aspects help to connect disciplinary aspects with personal meanings.

In this seminar, we are interested in presenting, as examples, some of the simplest activities among those we use during the Preparation of Educational Experiences course – which do not require any prior specific physics preparation – and discuss their effectiveness with other participants.

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Bio

Luisa Lovisetti holds two master's degrees, one in Mathematics and another in Physics, both with theses focusing on historical issues. During her Ph.D. in Physics at the University of Milan, her research centred on quantum physics education, with a specific emphasis on historical and cultural aspects. She is co-author with Marco Giliberti of the book "Old Quantum Theory and Early Quantum Mechanics – A Historical Perspective Commented for the Inquiring Reader" (Springer, 2024).

Marco Giliberti is Associate Professor in History of Physics and Physics Education at the University of Milan where he teaches Relativity and Didactics of Physics through the laboratory. He conducts research in Quantum Physics and Quantum Field Theory Education, the teaching of Electromagnetism, and Physics Education through Science-Theatre. He is also involved in teacher training. He is the author of more than 80 publications in national and international journals; he is co-founder of the group "The Physics Show", is co-author and actor of eight scientific shows, and a lesson-show about Quantum Physics, which, overall, have had more than 400 replicas in Italy and Europe. He is author of two books: "Physics at theatre" (Aracne, 2014) and "Higgs and the physics of elementary particles" (RCS Mediagroup, 2016) and co-author with Luisa Lovisetti of the book "Old Quantum Theory and Early Quantum Mechanics – A Historical Perspective Commented for the Inquiring Reader" (Springer, 2024).

The arrow from the eye, visual rays and the living body

Agne Paulsson
Kritianstad University Sweden

Keywords

Misconceptions; Seeing.

Hwang & Roth (2011) mean that bodily experience “has not received much attention, if any, in science and mathematics education” (p 165). Fuchs (2013) has pointed out that what has been called misconception in the science education literature “actually turn out to be valid embodied conceptualizations”.

One such misconception is considered to be that children (and adults!) think we see by visual rays coming out from the eyes (Fetherstonhaugh & Treagust, 1992; Winer et al 2002).

When we learn about light, we have to perceive ourselves as passive lightreceptors not an active subject. This doesn't match with our lived experience and Selley (1996) have pointed it can lead students into rote learning of something that feels intuitively incorrect. This, in turn, can lead to undermine students' own confidence in understanding science. Even Erwin Schrödinger (2012) admits that seeing ourselves as passive lightreceptors is “A strange reality! Something seems to be missing in it. “(p 123).

I would say that what is missing is our bodily experience of looking out in the world. We direct our gaze at objects. We are also gaze-followers, we follow the gaze from other individuals to know their intentions. That is central in human interaction.

From an enactive perspective seeing, like all perception, is an active process (Noë 2004). Similar thoughts has been said by Gibson (1979) and Dewey (1896). That is reflected in our language. When we say “She looked at the tree and saw it was a maple” then “look” is a manner verb that specify the activity of the subject, and “saw” is the result verb (Gärdenfors, 2022).

I have gone through the “misconception – litterature” about seeing and light and found that most of them regard gaze, directed outward, and/or active seeing as a misconception. For example Fetherstonhaugh & Treagust (1992) found that 75% of students have “ the visual ray idea”. What the students actually said was “ We see by looking”, they were not talking about visual rays. When Winer et al (2002) examine which direction students prefer when they have to describe how we see, they come to the conclusion that 60% of adults' belief in visual emissions.

I think it is misleading to claim that students belief in visual rays or emissions, when they just express their bodily experiences of seeing out in the world. I think the embodied concept that seeing is an active outwarded process is correct. That is something teachers have to make explicit when we learn about light. Because then we have to imagine ourselves as passive light-receptors (wich we from some perspective are).

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Bio

Agne Paulsson. Since 26 years a lecturer in biology at Kristianstad University..Before that I teached science at upper secondary school. I see embodied cognition, enactivism as a better theoretical alternative than approaches that conceive the rational mind as the only source of sense. I regard thinking, meaning-making and understanding as deeply rooted in our bodily experiences. I also have a You-Tube Channel where I explain human physiology (in swedish).

Conceptual Blending in Measuring the Speed of Sound: how enactment can strengthen the understanding of an experimental measurement setup

Francesca Telesio¹, Marzia Garzetti²

¹Department of Physics, University of Genoa; ²Department of Mathematics, University of Genoa

Keywords

Speed of Sound; Phyphox; Enactment; Conceptual Blending; Educational Design.

In an educational activity conducted with two eighth-grade classes, students explored the concept of measuring the speed of sound using a blend of miming and digital tools (acoustic stopwatch). This approach aligns with the conference theme of Conceptual Blending (Fauconnier and Turner, 2002), demonstrating how embodied experiences and digital tools can be integrated to enhance scientific understanding.

The chosen experiment is the measurement of the speed of sound, based on the time difference between two acoustic stopwatches placed at a fixed distance s . The acoustic stopwatch is a timer which starts when it receives a sound above a certain threshold, and it stops with a second sound above the same threshold.

A first sound impulse (hand clap) is generated close to the first stopwatch (Timer 1). After an arbitrary lapse of time, a second sound impulse is generated close to the second device (Timer 2). The time difference recorded is equal to twice the distance divided by the speed of sound ($\Delta t = \frac{2s}{v_{\text{sound}}}$).

Initially, the students engaged in a miming exercise to conceptualize the experimental setup. Two students enacted the two impulse peaks propagations, moving between two acoustic stopwatches impersonated by two other students. This physical enactment was crucial for understanding the experiment's functioning and the relationship between the different reference frames of the two timers. By physically embodying the roles, students could intuitively grasp the propagation of sound waves and the timing mechanism.

Following this miming phase, the students conducted the actual experiment using the Phyphox app, which provided accurate acoustic stopwatches (Staacks et al., 2018). The enactment phase allowed the students to internalize physical concepts related to sound propagation, making the transition to the practical application more seamless and effective. The miming allowed the students to have a perception of the sound motion, which is fast and invisible. Following the enactivist approach (Abrahamson et al, 2021), we exploited the help of physical movement and sensory perception in conceptual development. This hands-on experience reinforced their understanding of the physics principles and the interplay between the two reference frames of the timers, which are crucial for calculating the speed of sound.

During the conference, we will discuss the role of the educational choices made, particularly the selection of elements involved in the miming to represent the physical concepts. For instance, the choice to represent the wavefront instead of the sound itself reflects the need to avoid conveying the idea of a sound wave as related to a net displacement of molecules. Additionally, representing two distinct wavefronts, one originating from the first source, close to Timer 1 and the other from the second source, close to Timer 2, maintains the rigor that the two sound waves are different and are generated from different sources. However, since the speed of sound is constant, the time needed to go from one point to the other or vice-versa is the same. These educational choices underpin the structuring of enactment experiences and the conceptual blending between the enactment and the actual experiment. The aim is to reflect on these choices to move towards a more conscious definition of criteria that make the use of enactment activities meaningful for scientific concepts.

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Bio

Francesca Telesio is a laboratory technician at the Physics Department of University of Genoa. She graduated and got her PhD in physics at the University of Genoa and worked at the Nanoscience institute of CNR (CNR-NANO) at NEST in Pisa. Passioned both of experimental aspects of condensed matter physics and of teaching education, after the post-doc she taught mathematics and science at the Italian junior high school ("scuola secondaria di primo grado"). She is a tenured teacher for mathematics and science in junior high school and she has teaching qualification for physics in high school. In her spare time, she engages in storytelling and role playing games.

Marzia Garzetti is a research fellow at the Mathematics Department of the University of Genoa. She earned her PhD in Mathematics Education from the Free University of Bozen, focusing on designing inclusive mathematical activities for junior high school students. She has experience teaching mathematics and science at the Italian junior high school level and mathematics at the high school level.

Currently, she is engaged in research on curriculum development and curricular resources, working within a research community that includes junior high school teachers and university researchers at the University of Genoa.

Conceptual metaphors to train primary school teachers in contemporary high energy physics

Matteo Tuveri^{1,2}

¹*Physics Department, University of Cagliari, Cittadella Universitaria, 09042 Monsserato, Italy*

²*INFN Sezione di Cagliari, Cittadella Universitaria, 09042 Monsserato, Italy*

Keywords

Conceptual metaphor; storytelling; contemporary high energy physics; primary school teachers.

Training primary school teachers in contemporary physics challenges researchers in physics education. Indeed, these topics are outside of standard scholar programs, and teachers studied them during their careers as students. Nevertheless, regardless of their age, pupils come into physics watching TV shows or social media, which engage the public with the mysteries of the cosmos at all scales, from the quantum to the cosmological ones (Tuveri et al., 2024). One way to introduce teachers to these topics is through storytelling and metaphors.

Stories engage and motivate people, fostering their curiosity about physics and scientific imagination (Simon, 2000). Indeed, when opportunely contextualized, metaphors are valuable tools to foster pupils' visual thinking skills, leading them to imagine the invisible world described by contemporary physics (Millar et al., 1998; Corni et al., 2022). Moreover, building stories on metaphors can help teachers foster pupils' critical thinking and problem-solving skills (Rowcliffe, 2004; English, 1998). By integrating structures from different conceptual spaces, from our everyday life experience (the metaphor source) to something unknown and paradoxical (the metaphor target, i.e., a contemporary physics topic), we shape knowledge with new features that did not exist in the original spaces. This process is structural in physics when new knowledge is built from previous using an analogical and metaphorical conceptual understanding of phenomena (Fuchs, 2012b). We can consider quantum mechanics, which results from implementing the acoustic wave-like physics analogy to describe atoms' phenomenology. It happens similarly in gravitational physics with the metaphor of "listening to the invisible" due to gravitational waves. Other examples are the "Big Bang" (explosion – the birth of the universe) and "black holes" (deep and dark holes – a spacetime region where gravity is so strong that even light cannot escape from there) metaphors, respectively. In the case of classical mechanics, the ideas of heat, electricity, and magnetism arise from an analogy with fluid mechanics, and the language of physics still resents these first attempts (e.g., "the heat flows from a hot body to a cold one").

Creating a metaphorical understanding of physics phenomena is very similar to problem-solving. While solving problems, experts and novices start from a given problematic situation and must find a procedure to resolve an initial state, arriving at a new, unknown final state (Corni, 2023; Dieks, 2021; Stahl, 1987). Studying the efficacy of such metaphorical learning of phenomena around us and preventing misconceptions and wrong understanding is a crucial point of research in physics education (Kokkotas, 1997; Kramar, 2021; Tuveri et al., 2024).

Our research focuses on the following research questions: How can primary school teachers be trained on contemporary physics topics? How do we measure their level of learning of such topics considering the informal nature of such activity? Our methodology introduces teachers to contemporary physics topics, employing storytelling and scientific metaphorical nursery rhymes to stimulate and engage them. These tools act as a stimulus for the process of inquiry to start. The latter considers building or using some exhibits to play with the metaphors we are dealing with in hands-on activities. A debate phase within the training activity stimulates their critical thinking, discussing analogies and differences between the natural physical phenomenon and what they played with the exhibit. The design of the training activity is that of teaching experiments, where most of the attention is on semiotics. Qualitative and formative evaluations are carried out during the final part of their

training. It is addressed to debate, representing an ongoing evaluation phase. During this part, teachers start reasoning about metaphors, analogies, and limits of describing phenomena. The training ends with a recap where teachers choose the words that, according to them, resume and represent the content of the activity. Understanding why they choose a specific word fosters their ability to use the natural language to discuss physics [6]. During the workshop, we will show our methodology, making a specific example of particle physics and the atomic structure of matter. We will discuss the structure of the experiments, starting from the metaphors and the stories we used. We will show the exhibit used to introduce teachers to this topic and the tools implemented to carry the debate phase. The final “words of the day” activity will be discussed. We suggest that starting from primary schools, these interdisciplinary approaches mixing STEM with Arts can be helpful to bolster the diffusion of a “culture-scientific-STEAM” vision in society.

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Bio

Matteo Tuveri is a researcher at the University of Cagliari and the Cagliari Division of INFN in Physics Education Research and History of Contemporary Physics. He has a background in gravitational theoretical physics and science communication. In his research, he develops communication and teaching methodologies between art, technology, history, philosophy, and science to foster physics learning and train teachers of all grades. His research also focuses on studying the cognitive mechanisms of learning, linking natural and mathematical languages to promote the conceptual understanding of physics. Musician and writer, he studies the role of storytelling and conceptual metaphors in learning physics and as a tool to communicate physics. He is a member of the Einstein Telescope collaboration and collaborates with schools and institutions in regional and national contexts.

Look up! Opening the Gaze. Embodiment beyond boundaries in an ecological dimension through the arts and theatre.

Nazario Zambaldi
PEA Pedagogy Ecology and the Arts conference

Keywords

Gaze; Phenomenology; Arts; Theatre; Biopolitics.

This proposal is based on the doctoral thesis at the Free University of Bozen/Bolzano “Embodied Education through arts and theatre”, continuing many years of research in theatre and the arts, both in teaching in schools and in artistic and theatrical production. During my PhD as a visiting researcher at Humboldt University, I participated in the “Lived body – Corporeality – Embodiment Pedagogical Perspectives of a Phenomenology of the Lived body” (Husserl, 1952; Merleau-Ponty, 1945) symposium and later in “Emotion – Feeling – Mood: Phenomenological and Pedagogical Perspectives” with the contribution “E-motion: an Imaginative Variation” (Zambaldi, 2021).

In the workshop recently proposed in Copenhagen at the *First International Conference on Embodied Education* “Genesis of the Gaze” opening the gaze is at the centre of an awareness of the presence in which physical vision can sometimes be an obstacle. The reductionism, from which Embodied Education studies have tried to distance themselves from the beginning, risks resurfacing by reducing the necessary changes in learning environments (made increasingly urgent by digitalization) to mere physicality, understood as material corporeality and thus instrumental. This approach is insufficient. The arts, particularly theatre, if understood as practices of ‘working on oneself’ can help open up possibilities for authentic ‘augmented reality’ rather than reducing the channels of experience (of reality).

This is possible by integrating the progressive impoverishment of ‘grasping the world’ and thus of life resulting from contemporary ‘dematerialisation’, preparing an authentic paradigm shift of which Embodied Education can point a way. The arts and the theatre can offer a necessary support, i.e. tools that make a conscious presence possible in an intra- and inter-subjective, i.e. political dimension. In this sense, arts-based research can offer a biopolitical (Foucault, 1978) vision in which the boundaries between subject and world – and between subjects and worlds – are taken as opportunities for dialogue and for stratification and enrichment in the co-construction of the “real” on an ecological level (Bateson, 1977) in the most recent line of research summarised in the speech “Polis: arts-based research in education” <https://end-educationconference.org/2021/special-talk/>

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Bio

Nazario Zambaldi, visual artist graduated at the Academy of Fine Arts in Bologna, theatre director and curator of festivals and exhibitions, teacher in philosophy and humanities graduated at the University of Trento, PhD in pedagogy at the Free University of Bolzano.

Working group topic

(2) Emotion and the body

Emotions find expression in the body, moving the body. Certain emotional situations influence the tense state of the body and the quality of its movement, breathing and thinking. So, body awareness is an irreplaceable resource for sensing (discerning, feeling) the emotional process as a flow of energy and information and can be a resource to consciously regulate and guide them. This means that the body has a mind, and the mind has a heart: all these dimensions find their healthiest condition in integration.

The role of body experience and empathy in second language acquisition of preschoolers with migration background

Kirsten H. Beier-Marchesi
Free University of Bolzano

Keywords

Language acquisition; Holistic learning; Kinaesthetic techniques; Empathy; Laban Movement analysis.

In the study of language acquisition, holistic methods attempt to integrate cognitive, communicative-interactive, affective and psychomotor aspects of learning (Abendroth-Timmer/Gerlach 2021). These approaches are based on concepts from humanistic education that view the person as an autonomous social, emotional and intellectual being (Aden/Eschenauer 2020). This view is supported by more recent research in the cognitive sciences and linguistic embodiment theories (Lakoff/Johnson 1999) assuming the existence of a dialectic unity of cognition and emotion. Learning processes are holistic, as language is embodied and cognitively structured. In learning a second language, emotional attitudes combined with kinaesthetic techniques can work together to create intrinsic motivation and empathy for language and other cultures. An individual's ability to learn a second language can be stimulated by applying integrated movement and creative techniques based on Laban Movement Analysis (Kestenbergh-Amighi et al. 1999). Delegates will get a short overview on an innovative body-oriented approach to second language teaching discussing the importance of emotional and physical mediation to emergent language learning processes.

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Bio

Kirsten H. Beier-Marchesi studied modern languages, education and sports science, specializing in Laban's principles of movement. She teaches the integration of movement and dance to interdisciplinary education, especially in second language learning. Beier-Marchesi is currently working on her PhD at the University Vechta (Germany) focusing on second language acquisition through creative movement in pre-school education and the use of The Kestenbergh Movement Profile (KMP) (movement pattern observation and interpretation) as evaluation instrument in holistic learning processes. Beier-Marchesi is currently teaching pedagogy and didactics of movement education at the Faculty of Education of the Free University of Bolzano.

Movement based-Performing Arts and Bodily Imagination in Teaching and Learning

Nicoletta Cappello
University of Catania, University of Girona

Keywords

Embodied Education; Bodily imagination; Kinesthetic memory; Kinesthetic empathy; Movement-based Performing Arts.

My ongoing research is concerned with conceptualization of imagination as a bodily process -in relationship to emotion, movement and energy, and as embodied learning and teaching strategy in education. Through my doctoral research, I am currently working on the following questions: What kind of learning experiences would enhance a movement-based performing arts lessons that focus on bodily imagination in the context of teacher training? What kind of educational strategies would favor a movement-based performing arts lessons that focus on bodily imagination in the context of teacher training, beyond learning art? How can we draw on the Movement-based Performing Arts in order to develop a pedagogical theory and practice of bodily imagination for General Education?

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Bio

Nicoletta Cappello is an Acting in Physical Theatre Teacher at the Royal School of Dramatic Arts (RESAD) in Madrid and a Doctoral Researcher in Education and Arts in cotutelle between University of Catania (UniCT) and University of Girona (UdG). Her research is concerned with exploring the potential of Participatory Movement-based Performing Arts as an approach to Embodied Education in the context of Teacher Training, with a special focus in the role of bodily imagination in the pedagogical relationship. She was a visiting Doctoral Researcher in the Artistic Doctorate in Performing Arts (Department of Dance and Dance Education) at the University of the Arts Helsinki and she permanently collaborates with the Chair of Movement and Languages of UdG. She worked as a board Lecturer at the ECC- European Cultural Center for Performance Art, and as a Teaching Artist in PLANEA, Art and School Network. She has authored various award-winning performance pieces in which the audience is the main performer. She is the founder and artistic director of “El Público: Performance + Participation”, a creation, educational and research project facilitating performing arts-based learning and training processes that center the body in General Education and other cultural institutions. El Público produces movement-based art and education in the format of interactive educational plays, expanded performances and artistic instructional resources, and collaborative devising processes of community-based performances.

«More than meets the eye»¹

Carla Cardinaletti
Free University of Bolzano

Keyword

Perception; Self; Embodiment; Mirror; Visual art.

«The reflected image is the border between reality and a dream world or apparition; it has no substance and is the instant which follows the changes in reality» (Penone, in Lancioni, 2018)

According to Dewey's statement «art as experience²» (1980) this proposal investigates, through visual art, the role of the mirror in the tension between the self and its image. The self is here understood according to Gallagher's *pattern theory of self* (2013): «it contends that the self is a dynamic gestalt made up of different aspects that are interrelated in a non-linear equilibrium» (Sanchez, 2019, p. 13). The aim of this contribution is to explore if and how self-perception has changed, and is changing with the advent of new technologies, and how they affect to identity.

Since antiquity, the Western culture has favored the distal senses, and between hearing and sight, it is the latter that has had primacy (Bruzzone, 2016). In the same way, the human desire of mirroring has its origins in myths, such as that of Narcissus who, by reflecting himself in a pond, falls in love with himself until he is consumed in front of the source (Tani, Rima, & Agamennoni, 2018).

First mirroring himself through Nature, the human being then invented the mirror, whose origin can be traced back to ancient civilizations (Melchior-Bonnet, 2002). Originally a magical object³ (Brusatin, 1995) - Apuleio was accused of magic because he owned a mirror (Perutelli, Paduano, & Rossi, 2010) -, then a luxury item (Melchior-Bonnet, 2002), today it is part of our everyday life, so much so that we have it at our fingertips, thanks to the screen of our smartphone (Tani, Rima, & Agamennoni, 2018). Since the Renaissance, the mirror has fascinated artists, who have included it not only in their paintings⁴, but also in installations and performances⁵. According to Gallagher's aesthetics thinking *art* is able «to suspend our habits of thought» (Sanchez, 2019, p. 19); therefore, relying to artists' vision might be a way to address the nowadays complex and pivotal issue of self-reflection. Stanghellini (2020) states that in the age of selfie «the self *only* takes shape through the gaze of the other» (p. 16, translation by the author) and that we are witnessing one of the most worrying anthropological mutations of the present time: «The fading of the flesh» (p. 49, translation by the author).

If human being «looks with the head and eyes» (Gibson, 2014/1979, p. 193, translation by the author) and perception is a psychosomatic act: «Not of the mind or of the body but of a living observer» (ivi,

¹ Title suggested by Nannucci's artwork (2000).

² Dewey's book title.

³ «Fine, but even if I were to admit to looking at myself, what great fault is it to know one's own image, and not set it aside in the same place, but to carry it everywhere, at our disposal, in a small mirror?» (Apuleio, in Brusatin, 1995, p. 39; translation by the author).

⁴ E. g.: van Eyck, 1434; Memling, 1482; Bellini, 1515; Parmigianino, 1527; Caravaggio, 1546; Tintoretto, 1557; de la Tour, 1638; Velasquez, 1644; Vermeer, 1657; Kersting, 1827; Manet, 1876; Signorini, 1898; Magritte, 1937; Bacon, 1971, etc.

⁵ E. g.: Pistoletto, 1961-62; Penone, 1970; Acconci, 1973; *Gehry, 1991-97; Kapoor, 2006; Martinelli, 2011-2022; ArgentoVivo, 2019; Cardinaletti, 2021-24; Jonas, 2024/1960-70*, etc.

p. 345, translation by the author), what does it happen to our relationship with our image if we use a reflecting device able to share our *self/-ie* in real time? Is the observer still *living* in his/her reflected shared image⁶?

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Bio

Carla Cardinaletti, PhD in Education, is research assistant at the Free University of Bolzano/Bozen in Brixen/Bressanone where she coordinates the MultiLab Eduspace. Her research interests include general pedagogy, creative studies, and visual studies. She is professional public visual artist, and has exhibited both in Italy and in Europe, winning international contests and residencies and has been exhibit curator of the 00A Center for Contemporary Photography (Merano | Trento) since 2023.

⁶ It is worthy to consider that in Italian there is no strict distinction between *image* and *picture*.

Embodying Education: Embodied Presence and Emotional Awareness in Teacher Training

Nadia Carlomagno¹, Arianna Ricciardi², Valentina Discepolo³
^{1,2,3} University Suor Orsola Benincasa of Naples, Italy

Keywords

Embodied Cognition; Embodied Presence; Body Awareness; Educational Theater; Teacher Training; Theatrical practices.

In every educational context, presence is crucial for effectively communicating concepts and engaging participants [1]. It can be conceived as the educator's ability to actively occupy space and communicate in a way that makes the others emotionally involved [2]. Embodied presence invites questions of authenticity, perception, interaction, and cognition [3]. The research's objective is to investigate how presence influences the effectiveness of educational communication and student engagement. From this perspective, an interdisciplinary analysis integrating neuroscience [4], pedagogy [5], and theater [6] becomes necessary to reflect on how emotions are expressed in the body and how specific emotional states influence bodily tension, movement, breathing, and cognitive processes. Through Art-Based Research (ABR) [7], articulated in the CReAP+T approach: "Corporeity, Creativity, Relationship, Emotion, Action, Performativity+Technology/Training" [8], it has been explored how presence is perceived by students. In particular, the pilot research was conducted with 60 third-year students from the Bachelor's degree in Education Sciences, in the workshop "Giocando s'impara: tecniche per l'animazione e la comunicazione teatrale," at the *University Suor Orsola Benincasa*. The course was characterized by experiential lessons in training, simulation, play, and creativity, which outline theatrical practices with the goal of developing pedagogical skills through the use of theater and creative play. The course structure was designed to integrate theory and practice, with a particular emphasis on embodied presence and bodily awareness [9]. To understand how theatrical practice can influence the presence and the perception of itself, various research tools were used: 1. Pre- and post-course questionnaires: at the beginning and at the end of the workshop, a questionnaire has been proposed to evaluate and observe any changes in their perceptions. 2. Individual assignments: during the course, various individual tasks were proposed to stimulate and gather information on the student's perception of the topic of interest. In conclusion, the research results indicate that theatrical practices have proven to be a powerful tool for self-reflection and professional development for students [10]. In particular, the data collected from the questionnaires highlighted a greater perception of presence as an integrated state involving mind, body, and emotions. Theatrical practice has proven particularly effective in facilitating the understanding of emotions through movement and scenic action. The ABR + CReAP+T approach facilitated the exploration and expression of emotions, enhancing their ability to interact and engage with others. This research represents a first step toward understanding the importance of embodied presence in education and highlighting how theatrical practices can increase awareness of it.

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Bio

Nadia Carlomagno is a tenured full professor of Experimental Pedagogy at the Università degli Studi Suor Orsola Benincasa in Naples. She serves as the scientific coordinator for the International Research Group Education: "BioEducational Embodied Research on Performing Activities On Theatre, Pedagogy and Didactics" (BERPA TDP), which focuses on the transdisciplinary investigation of performing activities. At the same university, she conceived and directs the First Level Master's program in "Theatre, Pedagogy, and Didactics: Methods, Techniques, and Practices of Performing Arts" and the Second Level Master's program in "Performing Arts: Theatre, Pedagogy, and Didactics: Methods, Techniques, and Practices of Performing Arts." She is a member of the scientific societies SIREM, SIRD, and SIPED. She is also part of the research group affiliated with the Italian Society of Pedagogy (SIPED) on "Research and Transformative Learning." Prof. Carlomagno has authored over 140 publications and has received several awards and participated in numerous national and international conferences. She is a Visiting Professor on topics related to Experimental Pedagogy at Democritus University of Thrace, Komotini, Greece. Additionally, she is a member of the Scientific Research Committee at the Centre CIT (Centre for Theatre Culture and Initiative) "Mario Apollonio" at the Università Cattolica del Sacro Cuore in Milan. She also curates the "Theatre, Pedagogy, and Didactics" section of the Orso Blu editorial series for the Scholè-Morcelliana publishing house, along with Prof. Pier Cesare Rivoltella.

Arianna Ricciardi - University Lecturer. Suor Orsola Benincasa University of Naples. Teaching assignment for the workshop "Giocando s'impara – techniques for animation and theatrical communication" in the degree course in Scienze dell'Educazione. – Collaborator for the course "Research Methodology in Pedagogy" of Professor Nadia Carlomagno, Suor Orsola Benincasa University of Naples. – Collaborator of the International Research Group BERPA TDP "BioEducational Embodied Research on Performing Activities On Theatre, Pedagogy and Didactics" under the scientific direction of Prof. Nadia Carlomagno, Suor Orsola Benincasa University of Naples.

Valentina Discepolo – Collaborator with an assignment in the workshop "Giocando s'impara – techniques for animation and theatrical communication" in the degree course in Scienze dell'Educazione at Suor Orsola Benincasa University of Naples. Graduated in Performing Arts and Multimedia Production at Suor Orsola Benincasa University of Naples. Specialized as a support teacher for secondary school. Certified yoga teacher for adults and children.

The Body as Epistemological Terrain for Health Cultivation

Danielle Denichaud
Ontario Institute for Studies in Education
Toronto Metropolitan University

Keywords

Wellness; health education; health promotion; classroom culture; teaching strategies.

Through the intimate landscape of the body, we bear the imprint of generational nutritional consumption (Price, 2009), and are woven with the energetic patterns of relationships experienced in-utero, throughout the lifespan and inherited through ancestral lines (Hübl, 2020; Menakem, 2017). Our political, economic, social, cultural and environmental realities inhabit the unique fleshy and energetic mind-body-heart-spirit complexes of self, and therefore *embodiment* is the epistemological site for understanding the root cause and solution to existing holistic disease expression. Centring the body as epistemological and emancipatory terrain can be found in educational research towards decolonization (Cook, 2008; Shiva, 1992), social justice (Johnson, 2018; Syedullah & Leiner, 2021), environmental ethics (Hawkins, 2007; Macy & Brown, 2014) and holistic wellness (Marti & Sala, 2006; Myss, 1996); *embodiment* is named as one of “five gateways for holistic educators to explore and develop...with the power to bridge the divides we have created in our world” (Crowell, 2019, p. 297). My research joins this community and pursues the seeming paradox of developing a consilient language of holistic health education to foster meaningful praxis for the unique bodies of teachers and their students.

In trauma-honouring dialogue processes, the body-heart-mind connection is paramount for integrating painful and blocked emotions which, when left untended are causally related with disease processes for individuals, including now common conditions of anxiety, depression and hyperactivity in youth and adults (Maté, 2000; Maté & Maté, 2022). However, in Canada, many educators have expressed discomfort engaging in authentic emotional work with students, due to high rates of *compassion fatigue* (Koenig et al., 2018) along with difficulty maintaining base level self-care in hydration, nutrition, sleep and physical activity (Canadian Teachers’ Federation, 2020). Furthermore, motivation to prioritize classroom wellness practices alongside academic activities in consistent and meaningful ways is alarmingly scant (Allison et. al, 2018; Bedard et. al, 2019). As a holistic health practitioner, health educator and advocate for compassionate learning pathways, I am interested in creating adaptable inquiry frameworks and accessible practices for teachers to enter into authentic and emotionally safe reflexivity through health cultivating praxis; in support of creating regenerative classroom cultures rooted in and inspired towards self-other relational care and holistic wellness.

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Bio

Danielle Denichaud is the first of her family to be born on Turtle Island, with ancestry tracing back to South Africa, France and Italy. Her professional roots are grounded in contemporary dance, holistic health consultation, compassionate chronic disease recovery and movement education. Her experiences in movement as expression, movement as therapy and movement as learning led her to pursue undergraduate studies in child education and graduate studies in social justice education, curriculum studies, teacher education and policy development. Danielle works as a knowledge mobilizer for Dreamwalker Dance Company and is a contract lecturer at Toronto Metropolitan University and the Ontario Institute for Studies in Education. Through inter-arts curation, academic publications, international speaking and ongoing research, she explores if/how embodied pedagogies and methodologies represent fecund pathways for engagement across the domains of social justice, ecological stewardship, holistic wellbeing, art-making and community building.

Children' perception towards alpine rivers and their related natural risks

Mita Drius¹, Florian Schwabel², Anna Scaini³, Elena Zwirner⁴, Wolfgang Wanek²

¹Facoltà di Scienze della Formazione - Fakultät für Bildungswissenschaften

Libera Università di Bolzano - Freie Universität Bozen

Viale Ratisbona 16 - Regensburger Allee 16

I-39042 Bressanone – Brixen

²Division of Terrestrial Ecosystem Research

Center of Microbiology and Environmental Systems Science

University of Vienna

A-1030 Vienna, Djerassiplatz 1

³Affiliation 1: Department of Physical Geography, Stockholm University, Sweden

Affiliation 2: Bolin Centre for Climate Research, Stockholm, Sweden

⁴Laboratoire de Psychologie Sociale et Cognitive

Université Clermont Auvergne

63 037 Clermont-Ferrand, France

Keywords

Cultural ecosystem services; sense of identity; river ecosystems; children' perception.

Theoretical background

Riverine ecosystems provide fundamental ecosystem services such as drinking water, nutrient filtration and local climate regulation, but also Cultural Ecosystem Services (CES) such as spiritual and religious values, educational values and sense of identity (Thiele et al., 2020). CES are intangible benefits that human beings receive from natural and seminatural ecosystems (Fish et al., 2016). In comparison with other ecosystem services, CES have been under-researched partly due to the challenges in measuring intangible values (Fish et al., 2016; Scaini et al., 2021).

Sense of identity can be defined as peoples' emotional and spiritual bonds to places, in this case to "their" river (Verbrugge et al, 2019). Sense of identity and sense of place can offer a way to study the cultural values people receive from ecosystems (Stedman 2016). Among such values, the awareness about the natural risks linked to a river and the ability to coexist with them could be supported by a high science literacy level. Moreover, time spent in close contact with nature could allow direct experience with the peculiarities of one's own territory and equally nurture a positive attitude towards the river (Zelenski et al. 2015).

Key objectives

This study explores i.) the attitude of children towards riverine ecosystems (perception, P) and their awareness of natural risks related to rivers; ii) whether natural science literacy (SL) and frequent contact with nature (CN) have an influence on P, and iii) if these factors are coupled with a strong sense of identity (SI).

Research design and methodology

The study area was set in South Tyrol (IT) and it foresaw the participation of German-speaking middle school pupils whose schools were located in the proximity of two rivers, Talfer and Adige. A short questionnaire composed of 17 questions was administered to 311 pupils of the first and second grades of 7 middle schools. Among the 17 questions, two tested knowledge on general natural processes (q.12-q.13), one on evolution (q.14), and two on food web and biodiversity (q.15-q.17). Three questions tested knowledge about natural risks (q.6, q.7, q.9), and two questions asked about preferences surrounding the place they live in (q. 11 and q.3); one was about their SI in the territory

(q. 10); one asked about social learning (q.8); and the remaining four questions were about the perception connected to the river and the surrounding territory, and their contact with nature (q.1, q.2, q. 4, and q.5).

Findings

Results showed that half of the pupils spend time in nature at least once a week, have a positive attitude towards the rivers (curiosity, joy), are aware of what a natural risk is and know how to behave in case of a flood. However, half of them cannot identify the strongest natural risk in their territory. 41% of the pupils declare to have a strong relationship (SI) with their territory, and 30% enjoy the natural elements part of it. Regarding science literacy, the vast majority of children were unable to complete the tasks on biodiversity (93%) and food web (88%) correctly. Although there was no correspondence between SI and P, SI was positively correlated with CN.

Conclusions

These results show that pupils tend to develop a sense of identity for their territory and they tend to have positive feelings towards their river. It also shows that pupils tend to be aware of the related natural risks and how to behave properly. A better planning of the tasks used to represent science literacy could bring to different outcomes, reason why there is a need to carefully evaluate the type and difficulty level of the tasks selected.

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Bio

Mita Drius is ecologist with a research background in the topics ecosystem services, green infrastructure, and ecology education. She works as researcher at the Faculty of Education, Free University of Bolzano-Bozen, where she teaches Biology Education. In the last ten years she has been working in several renown international research institutes, such as the International Union for Nature Conservation (IUCN) in Cambridge (UK), the Centre for Ecology and Hydrology (CEH) in Bangor (UK), the University of Vienna (A), and the National Research Council-Institute of Marine Sciences (CNR-ISMAR) in Venice (I).

Searching *on* and *through* the body

Nicoletta Ferri

Department of Human Sciences for Education, University of Milano-Bicocca

Keywords

Embodied Research; Embodiment; Embodied Pedagogy; Experiential Anatomy; Performative Inquiry.

During the doctoral dissertation, I explored through qualitative and performative methods the *embodied teaching* (Bresler, 2012) by conducting a cooperative and narrative oriented research at a Primary School in Milan, working with teachers using Experiential Anatomy. During the research process, I used some performative skills (I am trained in Contemporary dance, Dance-movement-therapy and Educational and Community dance), to analyze performatively the data and give feedbacks to participants through a video-performance. The research is described in the text: *Ferri, N. (2022). Embodied Research. Ricercare con il corpo e sul corpo in educazione, Armando Editore, Roma* (Siped Award 2022).

In recent years, I have been more explicitly interested on the relationship between the choreographic language and research in school contexts, being involved in a research group of my Department within the Erasmus+ project "Media Dance Plus". We analyzed the potential of choreographic-based artistic residencies in two Secondary Schools (in Italy and France). The project was coordinated by Fondazione Piemonte dal Vivo and had as partners the University of Milano-Bicocca, the Liceo Classico "Alfieri" in Turin, Lycée International (Saint-Germain-en-Laye, France), La Briqueterie Centre de Development Choreographique (France), and the "Lavanderia a Vapore" Dance Residency Center, Collegno (To). The project and the research process are described in the text: *Ferri, N., Schiavone, G. (2022), Dance and School Innovation. Media Dance Plus a European research project, Franco Angeli, Milan* (open access).

This research from 2022 to the present, in collaboration with Fondazione Piemonte dal Vivo and Hangar - Piedmont Region's agency for cultural transformation – has converged in a new study named *Educare alla Bellezza*. I'm part of the scientific head team of a research community composed of artists belonging to Children Theater Companies of the Piedmonts Circuit, teachers and Primary School directors of the Piedmont territory, in collaboration with AslTo3 and Turin Territorial School Office. The community investigates the role and value of the performative dimension in school contexts from a multidisciplinary perspective.

I would like to explore with the colleagues the role of the body and the performative languages in education and in learning and teaching processes.

I am also interested in sharing embodied practices to investigate the chosen themes.

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Bio

Nicoletta Ferri, PhD in Education, is a researcher in General and Social Pedagogy at the Department of Human Sciences for Education 'Riccardo Massa' of the University of Milano-Bicocca, where she teaches Embodied Pedagogy. She works on embodied education and performative languages in training contexts.

Embodied Music Pedagogy for Inclusion: A Research Project on Teacher Training Between Italy and Europe

Ester Giamberini
Florence University

Keywords

School Inclusion; Embodied Music Pedagogy; Well-being; European Projects; Inclusive Teaching Skills.

The *artistic experience* (and the musical experience in particular) represents a unique formative experience: through it unwinds, in fact, both a hermeneutic-reflexive process of the Self, reaching to touch the most intimate notes of the person and thus his or her emotional processes, and perceptive paths that give voice to multiple forms of communication, playing a central role in the development of the person, of identity and of the capacity to enter into relationship with the Other.

Jacques Dalcroze had already intuited and theorized with the *eurythmy model* how the body is central to the musical experience, the place-laboratory where music takes shape and meaning through movement, favouring the construction of an important inclusive setting in which to enhance the specificities and potentialities of each person, developing self-awareness and a profound capacity to listen. During the 20th century, other educational theories and models have associated the characteristics of music education with an *embodied approach*, culminating in the *Embodied Music Education model*.

The valorization through art of corporeity as a learning environment and encounter of each one's diversity is therefore evident and central to developing an inclusive approach that revolves around the principle of *inclusion in action*: the artistic gesture as a privileged tool in the creation of a relationship of care for oneself and others. By exploiting the immersive potential of music and the arts according to an embodied approach in educational paths, and thus also in school paths, the classroom context is transformed into a sensory-enveloping and engaging environment in which the participation of each learner is placed at the center. The need to offer educational opportunities that respect everyone's capacity to learn and foster the development of each pupil's rich expressive potential, invites us to formulate innovative pedagogical approaches and to configure appropriate, quality pathways aimed at concretizing and structuring an *embodied arts education*, starting with teacher training pathways, to develop that inclusive posture that is a cornerstone for an inclusive school.

A new research project focusing on this intersecting theme in the European educational context aims to explore this field of research with a broad and innovative perspective, through an acute and questioning gaze, respectful of who and what it encounters. The study will utilize a systematic review methodology, including an analysis of the European *ALIISA Project* based on a cumulative review of the existing literature on the subject, and a comparative study of inclusion policies and teacher training across Europe. By identifying and documenting best practices and mapping relevant European projects, the research seeks to implement the European network for inclusive artistic education by adding Italy's innovative and pioneering voice on this issue.

This phase aims to identify available resources and gaps that need to be filled in order to improve teacher training in this area.

An important component will be field research, which will include interviews with key players in the *ALIISA Project*. These interviews will be used to investigate the use of embodied approaches in teaching and to collect empirical data on the effectiveness of these methods. The results of this investigation will be used to design a specific educational intervention, which will be implemented and monitored in the second phase of the project. This intervention will involve the teachers of the

Istituto Comprensivo ‘Le Cure’ in Florence, with the aim of testing and evaluating the effectiveness of an educational approach based on embodied artistic pedagogy. Teachers will be trained and supported in the adoption of these practices, and the intervention will be closely monitored to assess its impact on the well-being and inclusion of students and teachers. Expected outcomes include the dissemination of best practices, development of new educational models, and enhancement of well-being for students and teachers through inclusive arts education.

In today's complex society full of educational challenges, every researcher is called upon to take a step for change, to trigger the search for answers to questions that have perhaps already been said and discussed but which today demand a new answer in the dynamic evolution of the society in which we are immersed. A different perspective that can give that *La* to the orchestra of knowledge, that benchmark with which to tune in again to start playing another music.

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Bio

Ester Giamberini is a doctoral candidate in Educational Sciences and Psychology at the University of Florence, with a rich academic background in music education, musicology, and music therapy. She actively participates in academic conferences and workshops, both in Italy and internationally, where she presents her research on topics such as immersive music labs in school design and the use of digital tools in early childhood education.

She has published international articles including works on the interdisciplinary artistic approach and the innovative use of technology in music educational settings. She is also involved in several educational initiatives, including seminars and webinars on topics ranging from music therapy to digital literacy in schools. Her commitment to the field is further demonstrated by her contributions to various academic publications and her active role in scholarly communities.

Embodied Narrative Epistemologies for Teacher Education: Developing energy and presence through multimodal interactive oral storytelling

Valentina Gobbett Bamber

Free University of Bozen-Bolzano, Italy ⁽¹⁾

Prospect Courses – Middlesmoor English & Teacher Development Courses ⁽²⁾

Keywords

Embodied narrative epistemologies; energy; presence.

The proposed working group activity foregrounds embodied narrative epistemologies as hospitable ecologies for emotional awareness and regulation as well as for teacher education and (English) language teacher education, because of their educationally optimal integration of affective and embodied elements (Damasio, 2018). Additionally, the proposed activities entail an ethically-based willingness to develop, and thus an ability to deploy and communicate, *energy*, with energy in its turn enabling related enactments of *presence* as an educational imperative (Rodgers & Raider-Roth, 2006). The proposed activity is thus congruent with the Emotion, motivation and the body strand of the 1st Specialist Seminar, and additionally with The body and energy strand. The approach underpinning the Working Group activity is *multimodal interactive oral storytelling*, (MIOS – Gobbett Bamber, 2022; forthcoming), long enacted by the presenter in English language teacher education and language teaching work, and informed by unibz students' feedback as regards teacher educator *presence*.

Themes for the proposed Working Group activities centre around the embodied epistemologies arising from active engagement with world stories, with such stories selected on the basis of their universal resonance and affinity with contemporary concerns. Participants will be invited to select from world stories from different cultural traditions. The proposed stories touch on inter-related themes, such as life stages in human development, resilience, nature, humanity's belonging to and relationship with the natural world, sustainability, and interculturality/global citizenship education. Most of the proposed world stories were adopted, with student adaptations for specific young language learners, in unibz Faculty of Education English teacher education laboratories from 2005-2024, and in English language teaching in the UK.

The Working Group activity aims and modalities entail collaborative embodied retellings of world stories selected by participants, with subsequent group reflections. One (or more if appropriate) chosen stories are to be interactively led by the speaker. Subsequently they will be collaboratively re-enacted by all participants, with embodied, holistic and *presence* elements wholly experienced through engaging in the embodied, affective-relational nature of teacher educator-student teacher encounters. The proposed Working Group activity thus aims to foster firstly the participants' ability to embody and communicate *energy*, as revealing our underlying values and commitment to student teachers' development in light of their future/ongoing societal roles and responsibilities; and, secondly, the participants' *presence* as enabling element in attending to student teachers' and young learners' evolving needs in the here-and-now.

The Working Group activity will subsequently be illuminated by group reflection and discussion phases, with group reflections-on-action stemming from elements of interest to participants. Examples of such reflections may include: the affordances provided by narrative epistemologies in relation to embodied synergies in education; storied emotions as emergent through movement and voice; mobilising energy as communicating commitment and personal as well as professional values; relationally enabling future teachers to be emotionally and bodily as well as cognitively *present* in

the classroom, in light of the relational-motivational-developmental affordances for learners that such presence entails.

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Bio

Valentina Gobbett Bamber (Doctorate in Education (University of Reading, UK), MA in TEYL (University of York, UK) is an Anglo-Italian researcher, lecturer, teacher trainer, singer, and UK English language school director, teacher and teacher educator. Since 2005 she has worked as adjunct professor at the Free University of Bozen/Bolzano with responsibility for a high number of Master in Primary Education English language teacher training laboratories, as well as other courses such as English for academic purposes. At the FUB and in the UK she implements an embodied, holistic and sustainable approach to language development and teacher education (multimodal interactive oral storytelling). In May 2024 she was invited to hold a teacher training course on global citizenship education through children's literature as part of the Diversity in Action-EU project at the unibz Faculty of Education. Her research interests include pre-/in-service teacher education approaches which posit the educationally-crucial embodied relational competences and presence of teachers as fostered by the corresponding relational expertise of teacher educators/trainers in hospitable teacher education ecologies.

“Game changers”. Educating pre-service teachers towards social-emotional skills

Giovanna Malusà, Maria Elena Picone
Free University of Bozen, Italy

Keywords

Initial teacher education; Social-emotional skills; Cooperative games; Embodied education.

The UNESCO (2024) approach to transformative education considers cognitive, socio-emotional, and behavioral dimensions of learning to cultivate transformative engagement by learners.

Recent studies (Agostini & Francesconi, 2020) suggest fostering educational experiences that increase individuals’ awareness of their lived experiences and emphasize the value of “embodied educational practice” (Francesconi & Tarozzi, 2012; 2019). In particular, *Findhorn’ cooperative games* (Platts, 1996) integrate bodily, relational, metacognitive, and metaphorical dimensions (Gallagher & Lindgren, 2015). Cooperative games allow the reprocessing of playful and embodied experiences in relation to oneself and others. This engagement with increasingly deeper inner levels is crucial for personal development (Malusà, 2020).

However, what kind of awareness and social-emotional skills do student-teachers acquire through participating in one or more sessions of cooperative games that involve the body as well as non-verbal communication?

Assuming the Experiential Learning Model and the holistic approach of the Findhorn Foundation (Platts, 1996; Malusà, 2023a), this workshop is scaffolded as follows:

- First, the outcomes of a case study (Malusà, 2023b) will be presented. The sample includes 157 second-year students from the Primary Education Master's program at the Free University of Bozen. They engaged in a workshop on cooperative games during their indirect internship.
- Second, participants will have the opportunity to directly experience some cooperative games (ice-breaking, exploration, and trust-building activities).
- Finally, there will be time to discuss and reflect on the experience and on the educational relevance of cooperative games within a holistic approach to enhance socio-emotional skills in initial teacher education.

Participants are requested to wear comfortable clothing and to be ready to engage actively in the games.

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Bio

Giovanna Malusà, PhD in Psychology and Education and a school psychologist, worked as a primary school teacher for 35 years. Currently, she is an internship coordinator tutor at the Free University of Bozen and an adjunct professor at the universities of Trento, Bozen and Verona. Her fields of interest include Social Justice education, Intercultural education, Teacher education, Embodied Education, SEL and active teaching methods, for which she conducts training courses to teachers. She is a member of advisory board of “Encyclopaideia, journal of phenomenology and education”; and she is a certified facilitator in Findhorn games.

Maria Elena Picone, Bachelor in Languages and Literatures and Primary Education, has been teaching English and in English at primary and secondary level for over 30 years. Currently she is an internship coordinator tutor at the Free University of Bozen, Erasmus and eTwinning school ambassador and primary school teacher at the Manzoni Primary School in Bozen. Her interests include initial teacher education, Clil, international dimension, plurilingualism, inclusion, soft skills, technology.

Children's literature and Embodied Education. Focus LIBRO-GIOCO

Giulia Mirandola
Free University of Bozen-Bolzano

Keywords:

Children's Book; Libro-gioco; Space; Movement; Body Awareness.

The Libro-gioco is not a book for playful entertainment, nor is it an activity book (Mirandola, 2022). Books in current use in children's reading practices are examined here to recognise some of the constituent principles of the LIBRO-GIOCO, particularly: the physical and emotional relationship with the book object; the manipulation and fine study of the materials, techniques and mechanics of which the book is composed; the use of the body and multisensory perceptions to activate motivation to play and the pleasure of reading; the exploration of the physical world and language through this type of object and narration from the first year of life.

The first examples we can refer to are the experiments Bruno Munari conducted from the late 1940s onwards with the *Libri illeggibili* (Maffei, 2002), and later with the *I prelibri* (Munari, 1980), which he considered to be made for multisensory communication. In 1977, the publishing house La Coccinella debuted with the series "I libri coi Buchi" (books with holes) (Farina, 2011). The holes in the books inaugurated a new concept of designing books for children, but also of reading them (Mirandola, 2022). Special attention deserves the architect and artist Fanny Millard, founder of Extra Éditeur d'Espaces. Millard, in addition to designing for all senses, seems committed to designing for all bodies (Millard, 2017).

Finow-Grundschule Staatliche Europa-Schule Berlin (SESB) Primary school was the place to approach research about libro-gioco in an empirical way. I will treat as a case study the Chamäleon Buchclub workshop, a bilingual reading group consisting of boys and girls from classes III and IV, which I conducted during the school years 2021-2022 and 2022-2023.

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Bio

Giulia Mirandola è assistente di ricerca presso unibz (Facoltà di Scienze della Formazione, campus Bressanone) nell'ambito del programma di ricerca "IMAGO - Libri illustrati – multilingue, in rima e senza parole – nelle scuole materne ed elementari dell'Alto Adige" diretto dalla Prof. Dr. Jeanette Hoffmann. Insegna Letteratura per l'infanzia all'Accademia di Belle Arti di Verona. Collabora con l'Università di Padova, presso il Dipartimento di Scienze storiche, geografiche e dell'antichità e il Museo di Geografia. Scrive per le riviste *Quarantotto*, *Hamelin*, *Liber*. È inoltre autrice dei libri illustrati *En plein air*. All'aria aperta per osservare, conoscere e disegnare i giardini storici del Trentino e gli spazi verdi vicino a casa tua (*Topipittori*, 2017), *Libere e sovrane*. Le donne che hanno fatto la Costituzione (*Settenove*, 2020) e *Pioniere*. Le donne che hanno fatto l'Europa (*Settenove*, 2022). Collabora con CCI-Centro per la Cooperazione Internazionale di Trento al progetto di educazione alla cittadinanza globale "Pioniere".

Emotions moving to the encounter of body-mind and I-You, through Aikido

Roberto Travaglini

Dipartimento di Studi Umanistici (DISTUM) dell'Università degli Studi di Urbino Carlo Bo.

Keywords

Emotions; motivations; mind-body; research-action; psychophysical exercises.

The teaching-learning process that places the learning subject at the centre cannot neglect the unfolding of an in-depth and complex reflection that unravels around quite a few questions on motivation and its implicit formative, self-formative and expressive process. The motivations that induce subjects of all ages in life to engage in a learning process, and thus to confront possible difficulties and limitations, mostly derive from an almost inevitable plurality of external conditioning, such as rewards and punishments, or, in the more strictly scholastic sphere, from the intentional use of these evaluative instruments by the teacher.

It would be desirable, on the contrary, for the will to learn to be intrinsic (self-motivation) rather than extrinsic (hetero-motivation) and for what comes from the external environment to be placed in the foreground, dropping into the background - but not annulling - what comes from the external environment in a typically programmatic and predeterminative manner. Education would therefore have the task of avoiding any action inhibiting the biological need to learn starting from the present experience, nurturing the innate emotional-cognitive and bodily-kinesthetic capacities of the learning subject to the best of its ability with the construction of an educational environment that favours their most direct and immediate expression.

It is pedagogically permissible to believe that in learning experiences it is necessary to create an educational environment capable of evoking a reactive correctness of the entire biopsychological structure, a sort of innate wisdom capable of regulating the organism in its mind-body wholeness (which is very reminiscent of Piagetian self-regulation): it is a matter of forces/energies that intervene from within, making 'right', 'correct', 'regular', 'adapted' (hence functional) - one might even say homeostatic - the individual's global reaction to his or her needs and ordinary behaviour (which are realised thanks to the activation of interests and their consequent direct relationship with the gratifying object). The individual needs no other support than environmental comfort, if anything, to the natural (physiological) activation of his intrinsic needs.

The educational culture underlying aikidō, if practised in out-of-school contexts or, even better, if integrated with certain pedagogical paradigms, can be transformed into an extremely interesting cognitive and didactic horizon to 'open the minds' (Gardner) and make the bodies of many Western students supple, by now unaccustomed to learning through bodily experience and non-verbal communication, and often not very sensitive to a natural discipline whose value aspects undoubtedly compensate for the excesses and imbalances of a broader social malaise.

An effective and immediate encounter between formalised pedagogical thought and the constructs of aikidō is certainly not easily achievable, especially since a theoretical-practical interaction between these disciplines has never previously been approached with the appropriate scientific spirit, as it is a possible interdisciplinary field that is as yet unexplored and very fluid. This encounter can be seen as a field of research with considerable potential, aimed at enriching both disciplines.

Pedagogy could draw considerable research cues from the guidelines of aikidō and, in general, from the study of traditional budō, bending the axis of its interests towards values concerning ethics, the socio-relational aspects of teaching, mind-body integrity, interpersonal relations, confrontation and cognitive and emotional overcoming of conflicts, the synergy between theory and practice, aesthetic research, and intercultural integration.

In short, the project could concern a careful hybridisation between the concepts of intrinsic motivation, individual and collective emotional expressions and the practical philosophy inherent in

the teachings of aikidō: the workshop could feed on certain practical appreciations typical of this far-eastern resource (of Japanese origin) together with the most attentive looks of contemporary pedagogy at active learning according to the keys promoted by John Dewey and related European activism.

Workshop:

kokyu (breathing) exercises - aikitaiso (aikidō gymnastics) - ashisabaki and taisabaki (movements in body space: movements of legs, trunk and arms in coordination with each other) - ukemi (gentle falls) - waza (structured movements in pairs); kinonagare (flow of vital energy, inwardly and in the encounter with the other).

The practice parts will be supplemented by theoretical-pedagogical insights. The didactic support of some collaborators is not excluded.

Themes and research questions

The main themes of this workshop concern the motivations and emotions involved in the theoretical-practical experience of aikidō, an art whose philosophical and practical principles can potentially be applied and used in the educational-formal sphere, particularly in socially and territorially extended contexts such as schools, from pre-school to secondary school.

The question arises as to whether such an educational proposal is capable of enhancing the cognitive-emotional processes underlying the students' learning experience in order to lead them to a more satisfactory process of understanding (mental openness) and a general existential state of greater psychophysical well-being.

1. Paradigmatic frameworks

Theoretical frame of reference, the result of a possible hybridisation of some authoritative paradigmatic viewpoints:

- a. Deweyan pragmatism/activism (active schooling, especially European) = self-motivation in learning; biological processes underlying the construction and co-construction of knowledge;
- b. theory of multiple intelligences (H. Gardner's neo-progressivism): in particular, bodily-kinesthetic intelligence and, of the 'five keys of the mind', emotional intelligence;
- c. practical aikidō philosophy: teachings and exercises proposed by its founder, Morihei Ueshiba, and by his greatest pupils (in particular Master Hiroshi Tada).

2. Research design and methodology

Observation of a group of children and adolescents (but also adults, who could be teachers), before, during and after the proposition of some well-designed practical exercises and letting them try them out through the action-research method.

The workshop can be an exploratory field to observe the effects of such a theoretical-practical method.

3. Expected results and potential impact of the work in terms of spin-offs in educational contexts and practices

The achievement of emotional-cognitive, existential and socio-relational benefits on the part of students and teachers is expected, resulting in a change in the general educational climate.

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Bio

Roberto Travaglini, professore associato di Pedagogia generale e sociale; docente di Metodologia della ricerca pedagogica e di Pedagogia del gioco presso il Dipartimento di Studi Umanistici (DISTUM) dell'Università degli Studi di Urbino Carlo Bo, dove dirige il master di primo livello in Pedagogia e educazione del gesto grafico.

Praticante e insegnante di aikidō; 7° dan dell'Aikikai d'Italia e dell'Aikikai Honbu Dojo di Tokyo; shihan (dal 2018) e membro della Direzione Didattica dell'Aikikai d'Italia (dal 2019); responsabile del dōjō Fujinami di Bologna.

Ha scritto e curato diversi saggi pedagogici, tra cui i volumi Educare con l'aikidō, Erickson, Gardolo (TN) 2009; I processi formativi dell'aikido, ETS, Pisa 2011; R. Travaglini, Per una pedagogia dell'aikidō, Aracne, Roma 2018; R. Travaglini, L'arte dell'aikidō. L'educazione etica ed estetica del Maestro Yōji Fujimoto, Luni, Milano 2019. Co-dirige Graphos, rivista internazionale di Pedagogia e didattica della scrittura (graphos.info). Dirige alcune collane editoriali.

Ha organizzato e/o partecipato in veste di relatore a molti convegni nazionali e internazionali, il cui argomento specifico, in taluni casi, è stato l'aikidō.

Embodied Theories of Cognition and the Affect of Mathematical Problem Solving

Stephanie Varga
University of Alberta, Faculty of Education

Keywords

Affect; posing|solving; problem posing; problem solving; mathematics education.

The role of affect in mathematical problem-solving has inspired this proposal for the 1st Specialist Seminar on Embodied Education. According to the enactive theory of cognition, cognition is embodied. Embodiment enables partnership between mathematical problem-solving and *mathematical problem-posing*, the study of how interesting mathematical problems are formulated (Cai et al., 2015). According to enactivism, the cognitive acts of posing and solving are inseparable (Banting & Simmt, 2017). The inseparable acts are referred to by enactivist scholars as a unified process that they call *posing|solving* (Banting & Simmt, 2017; Proulx & Maheux, 2017). Exploration of affect in the context of posing|solving is a contemporary field of study—it holds potential to answer the call for an affective heuristic for problem solving (Goldin, 2010). This seminar topic responds to this call by clarifying what would be the requirements for an embodied, affective, heuristic for problem solving.

In keeping with the outline for a research forum forwarded by Proulx, Simmt, and Towers (2009), the following features will guide the arisings from this seminar discussion:

...studies...done on [embodied cognition] in mathematics education will be shared; contributors will focus on insightful features that [embodied cognition] offers us; particularities of [embodied cognition theory] will permeate all discussion and presentations; and finally, but not least, interactions and discussions will take place about the ideas put forward. (p.1-249)

An embodied, affective, view of problematizing and coping will frame the discussions. This research-oriented topic extends the work of scholars at the University of Alberta who have worked for decades to bring enactivist theory to mathematics education (Proulx, Simmt, & Towers, 2009).

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Bio

Stephanie Varga

I am a fourth-year doctoral student at the University of Alberta, Faculty of Education. I specialize in secondary mathematics education and I consider how bodily processes and lived experience contribute to knowledge spaces that learners create. I work under the supervision of Dr. Florence Glanfield who specializes in both enactivism and Indigenous ways of knowing. My overarching topic of research is computerized formative assessment, that is, assessment that occurs throughout the learning process to benefit both learning and teaching. My candidacy work focuses on Problem Posing Pedagogy, an implementation of mathematical problem posing in the classroom. I currently use Problem Posing Pedagogy in the classroom as a junior/senior high school mathematics teacher.

The role of emotions in science teaching, mediated through narrative and metaphor

Jörg Zabel

Leipzig University, Institute for Biology, Workgroup Biology Education. Leipzig, Germany.

Keywords

Narrative; metaphor; conceptual change; experientialism.

My expertise today is predominantly in the field of narrative in science education, student conceptions and conceptual change (e.g. Zabel, 2009; Zabel & Gropengießer, 2011; Zabel & Gropengießer, 2015). I had been acquainted with embodiment and Conceptual Metaphor Theory during my time as a PhD student in Hannover, when my supervisor was Harald Gropengießer. Harald is passionate with the works of Lakoff & Johnson (1989) and has contributed significantly to introduce CMT into Biology education research as *Experientialism*. I see a lot of parallels between metaphor and narrative when it comes to a constructivist perspective on science teaching. They can both be considered as tools of understanding that are closely linked to everyday experience. Therefore, I have been a founding member of the *Center for Metaphor and Narrative in Science* inaugurated in 2016, hosted by the Department of Education and Humanities of Unimore. It was conceived and founded by Annamaria Contini and Federico Corni. Its mission is to explore metaphor and storytelling as fundamental devices of imaginative rationality, especially as they are used in science education.

The idea of using narrative in science learning has already been discussed for many decades in science education research (Avraamidou & Osborne, 2009; Soares et al., 2023). The positive vision that narrative methods can improve the understanding and memorization of science content has been labelled the *narrative effect* (Norris et al., 2005). There are theoretical foundations for this assumption, e.g., the constructivist approach to narrative by Jerome Bruner (1986, 1996). Consequently, the ‘power of story’ has become interesting for science teaching. However, it appears that the assumption of a narrative effect, as tempting as it may be, cannot adequately characterize the potential and the causal mechanisms related to the different forms of using narrative in learning science. Particularly, the great majority of existing studies have focused on interventions centred around the consumption of narrative material by the students, e.g., reading explanatory stories or listening to historical science stories. There is far less empirical evidence when it comes to the production of narratives by the students themselves. Therefore, in a recent study (Zabel & Averdunk, 2024), my colleague Cornelia Averdunk and I investigated what contribution a student-centred narrative intervention can make to the conceptual understanding of protein biosynthesis in the context of viral infections and virus replication. The sample group encompassed 68 secondary school students ($M = 15.7$ years, $SD = 0.57$ years) who explained virus replication in a written text, either narrative or expository (non-fictional). Our data analysis encompassed an analysis of the structural narrativity in the student texts, as well as a concept-related rating of the level of scientific correctness in three categories.

Furthermore, in the framework of the Erasmus+ project ECOSCOMICS, for cooperative partnerships in school education led by *Stimuli* association (Paris), I am currently involved in the development of a series of science webcomics *Supertroupers* together with a team of artists and science educators (n°2021-1-FR01-KA220-SCH-000030110), see also Maron, Bordenave & Govin (2019).

My objective for this specialist seminar is to learn more about the role of emotions in science teaching, and how they can be introduced and mediated through narrative and metaphor. While narrative deals with human experience and emotions inherently, e.g. the work of Alessandra Landini and other examples suggests that there are also more direct and embodied ways of integrating emotion into

science teaching. I would like to explore this pathway together with the experts in our seminar. That is why I chose strand (2) “Emotion and the body”.

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Bio

Jörg Zabel is a professor in Biology Education at Leipzig University (UL). After working as a grammar school teacher (2000-2003), he investigated the role of narrative for understanding evolution in his PhD thesis at Leibniz University Hannover. In 2011, he became a full professor at UL Life Science Faculty and has been leading the Biology Education workgroup since then. His research interests are teaching and learning evolution theory, biodiversity and bioethics, conceptual metaphor and narrative in science teaching.

Working group topic

(3) Motivation and the body

The word “Motivation” derives from the Latin verb “Movĕo, es, movi, motum, ěre”: movement, push, direction of a subject toward an object. Currently, the concept of motivation has a twofold use: a) when we wonder what causes, controls and guides a behavior of an individual, b) when we push people to do something they are not able (or not willing) to do on their own. In both cases, the several motivational systems exert their effects through a series of actions aimed at accomplishing biosocial targets.

When everything is embodied: a science experience with 2-year-old children

José Cantó¹, M. Lluïsa Ortiz², Almudena Marín³, Sandra P. Tierno⁴

¹Science Education Department, University of Valencia (Spain), jose.canto@uv.es

²El Castell Kintergarten, La Pobla Llarga (Spain), 46037339@edu.gva.es

*³Doctoral school of the University of Valencia and Educational Inspection (Spain),
marin_almpor@gva.es*

⁴Science Education Department, University of Valencia (Spain), sandra.tierno@uv.es

Keywords

Early Childhood Education; 0-3 years old; science teaching; embodied experience.

Some studies highlight the importance of offering educational environments, contexts and experiences that stimulate the potential of children from birth, so that they can develop different scientific skills while respecting the different maturation rates they present (Johnston and Nahmad-Williams, 2009; Allen and Kambouri-Danos, 2017).

Marotz and Allen (2013) indicate that, during the first year of life, it is necessary to carry out activities that stimulate the use of the primary senses. Thus, contact with different types of materials, textures, flavors, luminosities are recommended... always from a point of view of enjoyment and safety, adapting to your needs. But the first instrument with which children obtain information about the world is their own body. Therefore, it is important to design experiences that take the body into account as an active element that facilitates all learning. For this reason, embodiment practices are important for self-growth, learning, and awareness.

According to Governini and Arcodiacono (2021) children in kindergarten are constantly engaged in embodied activities that require the manipulation of objects, such as building blocks, wood, fabrics, toys... But these objects are "external" since it is the adult who offers them when planning the educational space with which the children have contact. Our proposal is to use an object that, although external, is embodied since it is part (literally) of their entire life: the diaper. It can be very useful not only as an object with certain characteristics and properties (absorption, composition...), but also as a platform to work on scientific concepts such as weight or nutrition.

In that way, a group made up of education professionals at different educational levels (university, kindergarten, inspection) have designed, within the framework of initial teacher training, a series of activities in which the body is used to work on skills, specific scientific fields, contemplated in Spanish legislation for children in the early childhood education stage (0-6 years). Through a significant element for children (the diaper), some sessions for a 2-year-old classroom have been carried out within the framework of embodiment (Cantó et al, 2023). We describe three of them:

- One of the programmed proposals was to carry out a session in which the children had to fill the diapers with water dyed with different colorants. By using syringes of different sizes, pipettes... and diapers they could experiment and make transfers with the water and, at the same time, the diaper served as a material substrate to experience its absorption capacity. They were also able to see how the water changed color when the colorant was added, which was surprising for most. Throughout the activity they asked many questions, made their predictions and even appeared their own and guided challenges to achieve a certain color.
- Another of the proposals consisted of using these same diapers to carry out one of the most important scientific practices: measuring as a concept of comparison. Thus, the children had to weigh the diapers they had filled in the previous proposal and compare them with new ones. First, they experienced it with their own bodies and then they did it using a specially constructed scale, in which the accuracy of the measurement was not the priority, but rather they could appreciate in a very visual way the difference in weight between the two types of

diapers. This led to conversation, debate and questioning of certain situations between them and with the teacher.

- Finally, and taking advantage of the hot days, a proposal was planned in which they could experience the weight of the diapers on their own bodies. For this reason, we invited some boys and girls to put on traditional plastic diapers and, for others, we put disposable waterproof diapers. In this way, it was possible to see how the first ones absorbed a lot of water, swelled and weighed and the others did not. Later, when they removed the diapers, they observed them and weighed them in their hands and with the scale. This was the trigger to think about why there was a difference in behavior and whether it was related to their internal composition. In this way, the children were able to plan small actions to find out and also relate it to the session in which the diapers were weighed.

Our intention in this communication has been to explain the potential that embodiment has in working with young children to introduce science work. It is a perspective that has the advantage of being an innate part of the children's world, but which we adults have abandoned.

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Bio

José Cantó is a full professor at the University of Valencia specializing in scientific education in the early stages (0-6 years).

M. Lluïsa Ortiz is a teacher of Early Childhood Education and head of a school for 0-3 years.

Almudena Marín is a teacher of Early Childhood Education and Education Inspector.

Sandra P. Tierno is a contracted professor at the University of Valencia specializing in scientific education in the early stages (0-6 years)

Enhancing Health and Education Through Physical Movement: Experience from the Sports Pedagogy Team at Free University of Bozen- Bolzano

*Attilio Carraro, Camilla Costagliola, Marta Duina, Antonino Mulè, Roberto Roklicer, Giampaolo Santi
Faculty of Education, Free University of Bozen-Bolzano, Brixen-Bressanone, Italy*

Keywords

Embodied Learning; Motor Skills; Physical Activity Promotion; Physical Education; Sports Pedagogy.

The Sport Pedagogy Research Unit at the Faculty of Education of the Free University of Bozen-Bolzano is at the forefront of research in health and well-being promotion through physical activity. The Unit has led numerous studies at international, national and regional level. Our main research topics focus on promoting healthy lifestyles and reducing the risk of developing diseases through physical activity promotion, sports practice, and the enhancement of physical literacy in people of different ages (from children to adults). Additionally, we explore promoting active lifestyles among underrepresented groups, such as individuals with mental health problems. Projects also emphasize physical education and teachers' education, focusing on assessing and enhancing physical fitness and motor skills. Research includes psychological aspects linked to the dual careers of student-athletes and strategies to decrease sedentary behaviours among students and university staff, such as incorporating active breaks. The great part of these research activities embraces the concept of embodied education, through the integration of physical movement and skills into the learning process to enhance cognitive and emotional development. This approach emphasizes the interrelation of body and mind, encouraging active participation and experiential learning in educational settings.

Mapping Learners' Embodied Emotions: A Multi-Method Exploration Immersed in Realistic Professional Scenarios

Rita Cosoli^{1,2}

¹Swiss Federal University for Vocational Education and Training (SFUVET)

²University of Geneva (UNIGE)

Keywords

Embodied Emotions; Mirror Neuron System; Physiological Response; Real-Time Monitoring; Virtual Reality.

Ideas and research questions related to the concept “*Emotion, motivation, and the body*”:

- Can **high-emotional professional scenarios** enhance embodied learning and motivation?
- How can a **real-time adaptive virtual system** (e.g., Virtual Reality), based on emotional and behavioral data, be used to enhance learning, motivation, and positive emotions?
- How can the potential of **action-observation treatment**, based on the mirror neuron system, be effectively transferred from clinical to educational contexts?
- How can **prior observation** of a professional scenario (e.g., videos or Virtual Reality) enhance subsequent performance by activating the same sensory-motor areas in learners?
- How do the **emotions displayed** by teachers influence learners' emotional and psychophysiological responses, and how do these emotions affect learning and motivation?
- Can a real-time emotion monitoring system (e.g., using physiological measures or AI-based algorithms) enhance **self-awareness** and **coping strategies** during the learning and execution of professional tasks?
- How can **multisensory stimulation** (e.g., olfactory and haptic feedback) in virtual environments enrich the learning experience and influence emotion, motivation, and learning outcomes?

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Bio

Rita Cosoli: Fascinated by neuroscientific research, I completed my master's studies in Psychobiology and Cognitive Neuroscience at the University of Parma, where I had the privilege of delving deeply into pioneering research on mirror neurons and their translational applications in several contexts. Currently, as a PhD candidate in neuroscience at the University of Geneva, I am focusing on emotional processes within educational contexts, investigating them through a multidisciplinary and multi-method approach.

I also hold the position of Junior Researcher at SFUVET, based in Lugano, in a lab specializing in immersive technologies for enhancing vocational education. Merging neuroscience, education, and innovative technologies, my research focuses on learners' emotional and stress responses during immersive educational simulations. I employ non-invasive physiological measurements, such as salivary cortisol, alongside self-reported measures in classroom environments, field simulations, and laboratory settings. In a recent project with paramedic trainees, I investigated stress-related responses in immersive 360° hypervideo of an emergency scenario. This study aimed to highlight the emotions experienced both during a real-world simulation and while observing the same scenario through a head-mounted display, exploring the potential of immersive technologies to prepare students for emotional management in their future professional practice (Cosoli et al., under review).

Enhancing Kinesthetic Learning and Physical Literacy through AI: Exploring the Role of Intelligent Wearables, VR, and AR in Physical Education

Camilla Costagliola¹

¹Faculty of Education, Free University of Bozen/Bolzano

Keywords

AI in Physical Education; Kinesthetic Learning; Virtual Reality (VR); Intelligent Wearables; Physical Literacy.

During my sports science career, I have researched gait and the efficiency of human locomotion using 3D motion analysis. I have also explored the benefits of physical activity (PA) and the use of remote sensors for monitoring health and movement.

Currently, I am in the initial stages of conducting a comprehensive review of artificial intelligence (AI) applications in physical education (PE) and the promotion of PA. AI-powered tools, such as motion-capture systems and intelligent wearables, can be implemented in PE to provide real-time analysis and feedback on students' movements. This allows for personalized instruction tailored to individual needs, helping students improve their skills and physical performance. Virtual reality (VR) and augmented reality (AR) platforms, driven by AI, create immersive environments where students can practice and refine their motor skills in simulated settings that mimic real-world scenarios. These technologies encourage active participation and deeper kinesthetic learning, fostering a sense of embodiment as students interact with digital environments through physical actions. By integrating AI into PE, educators can create a more dynamic, interactive, and effective learning experience that emphasizes the importance of physical activity and embodiment. At the seminar, it could be interesting to reflect on what ways AI technologies that promote embodiment, such as VR and AR, enhance kinesthetic learning and physical literacy in students and on how students perceive their embodiment and physical presence in virtual environments created by AI.

Bio

Camilla Costagliola

M.Sc. Human Movement Sciences,

Research Assistant at Free University of Bozen/Bolzano

Touch and contact: sensory experiences as a perspective for change

Federica Felici

Associazione Italiana Jaques-Dalcroze

Keywords

Experience; Use of the self; Wonder; Awareness; Habits.

“You can’t do something you don’t know if you keep doing what you know”.

This aphorism by the Australian actor of the last century F.M. Alexander, creator of the discipline of psychophysical re-education that has his name, introduces us to one of the main aspects of Pedagogy: change occurs through new experiences.

What induces us to change perspective, to question our certainties, to modify our habits? Change - and even before that the motivation to undertake different paths from the usual ones - occurs by virtue of a particular moment of *amazing*. Amazing produced by an unprecedented experience, never before experienced, most often lived through the senses.

In the traditional educational relationship, based on words and transmissive learning, there is neither space nor time, nor interest, for this type of approach, but when this relationship is based on physical contact... everything changes!

In the Alexander Technique, the touch of the teacher’s hands encourages the student to observe incorrect postural habits and release unnecessary unwanted tension; this process leads to a natural alignment and awareness of a more coordinated and connected use of the Self. In Dalcroze Eurhythmics, sound and music are the privileged means that allow us to perceive, internalize and translate the response to sound stimuli through the body and movement.

Both Methods lead to a more attentive listening to oneself, to greater freedom and fluidity of movement and breathing, to a better organization and awareness of one’s being.

The main objective – the focus – is to enter into a relationship with the other through a resonance, in pure harmony.

This type of approach requires openness and willingness to imagine and experiment with a different path than the usual one: why not?

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Bio

Federica Felici has a diploma in cello and Alexander Technique, a discipline that she has taught for years in various Conservatories of Music, Choirs, Associations and at the Accademia del Maggio Musicale Fiorentino. Expert in music and movement and certified in Dalcroze Rhythmics, she is involved as a trainer in the dissemination of this method. She has a degree as a Learning Tutor. She is a special needs teacher and Referrer for inclusion at "Le Cure" Institute in Florence with which she won and created an Erasmus+ Project dedicated to Inclusive Pedagogy through the Arts. Federica likes to teach and transmit her knowledge in the warmth of the relationship.

Short outline of my expertise

Federica Ferrari
University of Bologna

Keywords

Metaphor; Sustainable Persuasion; Transformative Metaphor; Integration; Healing.

I am Associate Professor at the University of Bologna, Department of Modern Languages, Literatures and cultures. I received a PhD in “Language and Culture Sciences” (2006) and a Master in Counselling (2009). My research predominantly focuses on persuasive phenomena within strategic communication. My recent interests explore conceptual metaphor as a text analysis cercamethod, a persuasive tool in political discourse and a transformative device in counselling and psychotherapy. In 2018 I published the research monograph *Metaphor and Persuasion in Strategic Communication: Sustainable Perspectives* (Routledge). Of particular interest with respect to the theme of this seminar are some of my recent chapters and research articles: “[The ‘Transformative’ Power of Metaphor: Assessing its Unexplored Potential at the Crossroads between Static and Dynamic Instances](#)”, appeared in: *The Language of Crisis – How Metaphor, Metonymy and Frames Construct Crisis Discourse*, Amsterdam, John Benjamins, 2020, and “The ‘transformative’ power of ‘integrated metaphor’ in counselling: applying and measuring its implemented potential”, appeared in *Metaphor and the Social World* in 2020; the chapters “[Metaphor and Persuasion at work with Emotions and Identity in Interaction](#)”, in: *Quaderni del CIRM*, 2021, “[Dalla paura al desiderio: strategie persuasive e creative di senso](#)”, in *Complessità pandemica*, La Vela, 2023, and finally my recent research article “Can metaphors heal (for real)?” appeared in *Quaderni di Semantica* in 2023.

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Bio

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Through the Glass Training with Performing Arts: bodies that think, experience emotions and transform behaviours

Irene Gianceselli, Andrea Bosco, Luigi Pastore
University of Bari “Aldo Moro”

Keywords

Through the Glass Training; Performing Arts Education; Enactivism; Pier Paolo Pasolini; Repeated Measures Anova.

We propose a method, inspired by the *Manifesto for a new theatre* by Pier Paolo Pasolini (1968), for the social being education through performing arts (Gianceselli 2024). We identified the metacognitive training *Through the Glass* (Gianceselli, Bosco 2024; Gianceselli, Bosco & Pastore 2024) based on an enactive approach. Our experience is from an empirical result: 237 students were divided into three randomized groups, two experimental and one control group. In the groups undergoing the treatment, the management of the workspace has been modified to offer a democratic and active participation during the workshop (Lewin, Lippitt, & White 1939). The experimental groups, thanks to the metacognitive training, rethink the relationship between body and emotions. According to the data collected with questionnaires (Bosco 2023; 2024) and analyzed with a Repeated Measures ANOVA, all training participants experienced significant increases in *self-efficacy* in post-intervention compared to the control group. In particular, the experimental groups register after the training an increase in *motivation* to study compared to the control group. It is also interesting to assess that the control group has recorded, in the absence of treatment, a worsening *discomfort* related to the use of technologically mediated products compared to the experimental groups: exposure to black and white films involves negative emotions in those who do not undergo metacognitive training and therefore do not have the opportunity to reflect on the relationship between mind, body and emotions. During the workshops dedicated to cinematographic and theatrical language, indeed, it is possible to stimulate the participants to recognize how the learning and emotions elicited by cultural discourses change in relation to posture (Briñol & Petty 2003) and in relation to the possibility of sharing and debating ideas in a democratic and collaborative context. The goal of our research has always been to share our training with future teachers and educators in a Lifelong Learning perspective. We therefore wonder how our enactive approach can be strengthened.

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Bio

Irene Gianceselli, after the master’s degree in Sciences of Performing Arts And Audiovisual Production (LM-65, UniBA) she is PhD Candidate of Doctoral Programme (Science of Human Relations) at the Department of Education, Psychology, Communication Sciences (Curriculum Cognitive, Emotional, and Communicative Psychology Processes). Since 2023 she is a member of ESREA - Transformative and Emancipatory Adult Education Network.

Andrea Bosco, psychologist, is Full Professor of Psychometrics at the University of Bari Aldo Moro. Since 2013 he has been co-founder of Doctoral Programme in Science of Human Relations, and from 2018 he is the Coordinator. He carried out his research work at the Department of Education, Psychology, Communication Sciences (University of Bari) and had got several international scientific collaborations on spatial mental representations, on behavioural intervention for topographical disorientation in Dementia, on visuo-spatial memory and verbal overshadowing, on behavioural intervention strategies for persons with deep disorders of consciousness, and on aging.

Luigi Pastore is Associate Professor of Theoretical Philosophy at the University of Bari Aldo Moro (Department of Education, Psychology, Communication Sciences), his interests include Epistemology, Philosophy of Mind, Philosophy of Cognitive Science, Continental Philosophy, European Philosophy.

Nadia Pelageina
University of Köln

Keywords

Second language phonology acquisition; phonological training; teaching and motivation; second language phonology - talent and attitude;

My educational background includes a Bachelor's degree in Linguistics and Theatre Studies from the University of Essex and the University of Malta. Currently, I am pursuing a Master's degree in Phonetics at the University of Cologne. Additionally, I am employed as a student assistant for Professor Martine Grice and I also teach English to 5th-7th grades in Cologne.

My primary research interests are in phonetics and phonology, with a particular focus on second language (L2) phonology acquisition and pedagogy. This includes exploring second language training methods and the use of gestures. I conducted a pilot study with Professor Florence Bails on the use of gestures in acquiring the distinction between long (fleece) and short (kit) vowels in English. I am very interested in how various types of phonological training and the development of phonological awareness in a classroom setting impact learner motivation and confidence.

As an English teacher, I am particularly interested in exploring how embodiment can enhance teaching methods and impact memory, motivation, and concentration. I believe that understanding and integrating multimodality and embodiment is crucial not only in phonetics and phonology but also in language teaching. Therefore, I am eager to continue exploring this area.

My BA dissertation focused on the acquisition of English short and long vowels by second language learners. Since then, I have participated in several studies as a student assistant, including research on hand gestures in the intonation of Maltese English and a current study on autism and intonation.

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Bio

<https://ifl.phil-fak.uni-koeln.de/phonetik/institut/personen/nadia-pelageina>

Bachelor of Arts (Honours) in Linguistics with Theatre Studies, University of Malta & University of Essex, England.

MA Linguistics, Phonetics, University of Cologne.

Student assistant, University of Cologne, Faculty of Phonetics.

Response- able care practices for taking care of the world

Charlotte Sermeus
University of KULeuven, Belgium

Keywords

Response-able; feminist new materialism; embodied education; responsibility; care politics.

My research is part of a larger project called Towards an Education of the Senses (EoS): An alternative pragmatic view on STEAM. This research explores the STEAM initiative as a possible pedagogical response to the social and ecological issues that are becoming increasingly pressing in society. Although education, and art education in special, does tend to be harnessed for this purpose, it is hindered from doing so by its distinctly instrumental nature (e.g. in function of the demands of the labour market). As an alternative, this research aims to move beyond these trends, which are also strongly embedded in the current STEAM movement, by conceptualising with STEAM a new fundamental framework based on insights from prominent thinkers such as William James, Isabelle Stengers, Donna Haraway and Bruno Latour. In integrating the arts with STEM fields, we want to develop a design for an 'education of the senses' (EoS), where immediate learning outcomes and competition give way to an intergenerational caring for the world we share. A world that sorely needs this care today.

In my research, I focus on the element of care and question how we can take care of the world. For this, I lean on feminist posthuman/new materialism and care ethics perspectives. Posthuman here is understood as that which is beyond human exceptionalism. It strives to include non-humans such as animals, plants, rocks,... and especially the way in which these constantly act on and with each other (so also human beings). The political ethics of care, as it is called by numerous authors like Tronto, Puig de la Bellacasa and Bozalek & Zembylas, is an “approach to personal, social, moral and political life that starts from the reality that all human beings need and receive care and give care to others” (Bozalek & Zembylas, 2023, p5). In their book, Bozalek and Zembylas strive for an ethics of care that goes beyond humanism and in order to do so, provide us with an alternative framework for looking at care. For this, they build on the work of Karen Barad, Donna Haraway, Joan Tronto, Maria Puig de la Bellacasa and many more. The two most important concepts and frameworks they introduce is that of responsibility and response-ability. Responsibility is equated with accountability for marks on bodies (Bozalek & Zembylas, 2023). According to Haraway, responsibility is a relationship crafted in intra-action through which entities, subjects and objects come into being (Haraway, 2008, p7). Ethics then, is an acknowledgement of our complicity in the entanglements we are a part of. Acting ethically and responsibly is thus being aware of our entanglements and taking care of it (Bozalek & Zembylas, 2023; Haraway, 2008; Barad, 2007).

In order to do so, we have to be(come) response-able. Response-ability refers to the capacity to respond. Response-ability is being potentiated by practices such as attentiveness, politeness and curiosity, rendering each other capable, openness to encounter, and iteration or ongoingness (Bozalek & Zembylas, 2023, p63). In this part of my research, I focus on the practice of attentiveness. Attentiveness means noticing, that is, paying attention to details. Attentiveness involves the cultivation of all types of noticing (visual, auditory, smell, touch), activating the “sensibility of all our embodied faculties” which leads to some form of response (Lenz Taguchi, 2012, p. 272). Here, embodied practices and protocols will come into play. By creating certain protocols, I hope to cultivate attentiveness in order to be (more) response-able. Body-oriented/embodied protocols/exercises can work two-fold: 1) care for the self helps with taking care of the world (because how can we take care of the world if we can't take care of our own system), and 2) becoming sensitive and attentive to entanglements and small details helps us in becoming attentive to and responsible for

the world. My hypothesis thus is that by seeing “entanglements” in/around our body (for example: i relax my feet automatically when I relax my shoulders, stress gives me digestive issues,...) that we will become more sensitive to the entanglements outside or around our bodies/systems. For example, in the exercise ‘Listening to silence’, we became sensitive to the fact that silence (something inside our heads and also around us) is constituted by materials/materiality. These exercises and protocols will then lay the groundwork for developing response-able practices with students.

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Bio

Charlotte Sermeus (She/her) is a PhD- researcher and pedagogue at the University of KULeuven, Belgium. During her master, she focused in her thesis on socio-materialism in technology. This made her develop a passion for new materialism and finding new ways of doing research through the post-humanistic lens. During the beginning of her PhD, became interested in the idea of care, taking care of the world and the role of the body in it. The work she is doing now, is fueled by a passion of taking care of the world and her experience in body-oriented practices.

Plants as determinant bodies to qualify learning spaces

Beate Weyland

Free University of Bolzano, Faculty of Education

Keywords

Learning environments; plants; body of nature; senses; space.

Founded in 2022, the Edenlab laboratory - an acronym for Educational Environments with Nature - has set itself the goal of contributing to a new perspective on inhabiting and planning learning spaces through the presence of plants.

The question is whether plants can be understood as 'determining bodies': not only present, irreplaceable, necessary, that 'dominate every terrestrial environment and make up 99 per cent of the biomass on Earth', as Michael Pollan (2014, p. 5), among others, reminds us, but also allies to appropriate and improve the educational space, which usually suffers in terms of beauty, order and harmony.

The proposal to introduce plants into educational environments is intended to lead to a reappropriation of the body, precisely where it has been neglected for too long: the human body in education, the body of educational spaces, the body of nature (to which humans also belong).

In the various general didactics workshops offered at the EDENLAB laboratory of the Free University of Bozen-Bolzano, students not only experience the presence of plants in a learning context, but also have the opportunity to develop activities and materials for a playful and sensory approach to plants. The aim of the activities is, on the one hand, to appropriate and qualify learning spaces with natural and living solutions and, on the other hand, to create didactic artefacts in which the plant element is part of the material created and to develop ways of activating the senses in the didactic process. In this way, we will contribute to a new connection with plants and nature by bearing witness to the phenomena of plant blindness (Jose et. Al 2019) and working concretely on the theme of sustainability by endeavouring to see the world as a whole made up of human and non-human beings.

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Bio

Beate Weyland is Associate Professor of Education at the Faculty of Education of the Free University of Bozen-Bolzano. In her research, she investigates the relationship between pedagogy, architecture

and design in the reorganisation and development of kindergartens, schools and educational institutions, with a particular focus on their spaces. She founded and directs the research laboratory EDEN Educational Environments with Nature, which focuses on the study of ecological and sustainable solutions for the development of educational spaces with an interdisciplinary approach in which plants are extraordinary mediators.

<https://edenlab.unibz.it/>

Working group topic

(4) The body and energy

Energy, or, more colloquially, force or power, is a broad concept that arises from embodied experiences of (causative or “forceful”) encounters we have with nature, with other people in social situations, and with our personal emotions and feelings. It makes its way into academic fields such as physics, biology, ecology, economy, geopolitics, and policy, where its meaning is formalized, restricted, and therefore changed, at least to some degree. However, in all these fields, it pays off to rediscover the embodied meaning of the concept.

Real-time Multimodal Embodiment Experiences

Giancarlo Artiano¹, Emilio Balzano²

¹ *Dipartimento di Matematica e Fisica, Università degli Studi della Campania Luigi Vanvitelli,*

² *Dipartimento di Fisica Ettore Pancini, Università degli Studi di Napoli Federico II*

Keywords

Multimodality; Social Semiotics; Real-Time Sensors; Physics Education; Embodied.

The present submission introduces a novel approach that bridges bodily perception and motor experience with physics and mathematical modeling, leveraging real-time data acquisition sensors. The innovative aspect of this work lies in the hypothesis that a multimodal and social semiotic approach to embodied learning (Airey and Linder, 2017; Kress et al., 2001; Weliveriya et al., 2019), in conjunction with the judicious use of technologies, can significantly enhance the understanding of physics models and mathematical formalisation.

Online sensors and human interface devices play a pivotal role in this approach, enabling learners to receive real-time feedback, such as their movements. This feedback, in turn, aids in adjusting their actions (multimodal aspect) during a specific movement. Moreover, the involvement of other individuals in the same activity provides additional feedback, fostering an essential interpersonal and relational aspect (social semiotic aspect). Coordinating the self and coordinating with others are most often investigated separately. In effect, motor coordination has long been studied in the sole context of individual actions, while a growing number of studies have recently focused on coordination at the interpersonal level (Sebanz et al., 2006; Schmidt and Richardson, 2008; Laroche et al., 2014; Cornejo et al., 2017; Wiltshire et al., 2020; Desnoyers-Stewart et al., 2024). This perspective is not explored mainly in physics and mathematics education research.

Over the years, our research group has developed several activities involving students' bodily and interpersonal aspects using real-time sensors. Online sensors can contribute to acquiring extensive scientific competencies in physical and mathematical sciences. The possibility of accurately representing and interpreting complex phenomena and concepts represents a resource in this sense. Presenting multiple graphs of the same motion, such as those detailing position, velocity, acceleration, and phase space, allows for their practical interpretation together. In light of this, the graphical representation and multi-representation of such phenomena and concepts with these tools is fundamental for students seeking a deeper understanding of phenomenology by going beyond the oversimplifications too often presented by textbooks. An exciting activity for children and adults is to draw a space-time graph with their body, walking back and forth toward the Motion Detector (MD). Real-time graphs of moving objects and bodies in front of the MD can be analysed to highlight correspondences between natural movement and its graphical representations.

In this sense, using a low-cost and scalable technology, we design the multimodal system to support active and participatory experiences for infants, adolescents, and adults. We will present examples where we showcase activities that utilise a variety of sensors to facilitate coordinated learning among students. These activities are designed to harness the support of both the teacher, interfaces, and group dynamics in the teaching process.

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Bio

Giancarlo Artiano is a PhD in physics education, science and mathematics lower secondary school teacher and member of the Laboratorio per l'Educazione alla Scienza community of practice, which currently has around 600 people, including school teachers, researchers, and educators who share and reflect on a way not traditional way of teaching physics. Research activities on the learning and teaching of physics in formal and informal contexts, the development of study material with the help of new technologies and strategies for teaching modern physics at school are combined with social activism on issues relating to education broadly.

Emilio Balzano is Associate Professor at the University of Naples Federico II for the academic discipline Physics Education. The research activities are finalised to improve science learning and teaching through permanent training. From a Vygotskian socio-cultural framework, his research interests focus on questions raised in the field of experimental and theoretical research about: - cognitive models; -the design of school activities; -the structure of the science curricula; -the relationship between science-mathematics-technology, the relationship between formal and informal contexts; -the models of teachers preparation. The research has been developed in the framework of national and international projects in science education and communication.

Weighing words: Revisiting collective narratives about Eating Disorders through creative body movement

Antonella Cuppari; Silvia Luraschi
University of Milano-Bicocca

Keywords

Eating Disorders; performative research; embodied narratives; ecosystemic epistemology.

1. The weight of words and diagnosis in the experience of people with Eating Disorders

Words carry weight and create texts and contexts of meaning that determine how people describe themselves and the world. In the experience of those who have lived with an Eating Disorder, some words weigh so heavily that they inscribe themselves on the body and modify the image that the individual has of themselves, creating real *traumas of naming* (Ghenò, 2021). The diagnosis “is not an innocent project” (Urbistondo Cano & Simon, 2022, p. 136): language is indeed a powerful epistemic tool. When a person becomes the “object” of a diagnosis, they are “taken into care” by services and become a “patient,” the recipient of actions and discourses that delimit the lexicon that shapes and gives meaning to their experience. Rachel Aviv is an American writer and journalist with a story of anorexia experienced in childhood. In recounting her early hospitalization experience (Aviv, 2022), she emphasizes how the label of the diagnosis shaped her identity and a therapeutic language through which she learned to understand herself. If diagnosis is an effort aimed at describing the origin of the illness to locate and objectify its cause (Good, 1999), it is equally true that illness “does not occur *only* in the body, but in life” (ibid., p. 204). The diagnosis thus delivers an image around which a narrative takes shape. The catalyzing *energy* of some dominant words that draw from medical and technical-specialist language deprives the *body* of the possibility of telling its own story in its own words.

2. A performative research: from individual stories to the political voice of bodies

The performative research - the subject of this contribution - drew from the anorexia stories of the two authors to generate a process of bringing these stories into motion. In the first phase, the research utilized the autoethnographic method to explore the level of the individual stories (Cuppari & Luraschi, 2023a). In a subsequent phase, the stories entered into a dialogical relationship through duoethnographic writing (Cuppari & Luraschi, 2023b), while the third phase, currently underway, has opened the two stories to those of other people who have personally or closely encountered an Eating Disorder, through narrative workshops that have led to the creation of a collective video performance. The process of the emergence of individual stories allowed the words contained in them to leave the intrasubjective and private dimension to inhabit the relational and intersubjective space. This transition, nourished by the practice of duoethnographic writing, has become a theater in which to *learn to unlearn* (Bateson, 1972) habitual narrative modes and to seek unprecedented connections capable of generating transformations within stories. The emergence of discourses on the *body* has generated an energy eager to actively engage bodies in relation, recognizing the peculiarity of their political voice. The publication of the first articles on the research has catalyzed the interest of other people with an experience of Eating Disorders. This interest has initiated the third phase of the research, aimed at opening individual stories to a collective dimension. In this phase, narrative material has been collected from books (biographies written by people with a history of Eating Disorders, novels, poems, ...), podcasts, newspaper articles, and collective events held between

February and June 2024 with people interested in the topic. The collection of narrative material was aimed at creating a collective video performance that could bring different perspectives on Eating Disorders. For the creation of the video performance, a mixed working group was formed that brought together the academic world with the artistic professions and social work.

3. The political energy in the narration of bodies

The research has represented a challenge that primarily involved the researchers themselves, who were, at the same time, participants and performers in the research. It has allowed for the exploration of the possibility of collectively rethinking Eating Disorders through performative activities in public spaces, capable of breaking isolation and giving political voice to the “disorders.” The collective *energy* activated by the performative action in public space has thus positioned itself as a generative and creative matrix of alternative ways of narrating the experience of those who have lived with an Eating Disorder through their bodies.

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Bio

Antonella Cuppari, PhD, tutor and expert in Family Counseling (Master's Degree in Pedagogical Sciences), collaborates with the Department of Human Sciences for Education R. Massa, University of Milano-Bicocca. She is responsible for the Social Area of the social cooperative La Vecchia Quercia in Calolziocorte (LC, Lombardy) and the Research and Innovation Area of the Social Enterprise Girasole in Lecco (LC, Lombardy). She is a dancer in the Osteoporosis Dance Theatre collective (Piero Bellotto) and a poet. She published with Dialoghi Edizioni the poetry collection “Che fine fanno i corpi” (What Happens to Bodies), which received an honorable mention at the VIII International Literature Prize “Per troppa vita che ho nel sangue”.

Silvia Luraschi, PhD, is a pedagogist, counselor, and teacher of the Feldenkrais Method. She is an adjunct professor in Pedagogical Counseling at the University of Bergamo. She collaborates with the Department of Human Sciences for Education R. Massa, University of Milano-Bicocca. She is the author of the book “Le vie della riflessività: per una pedagogia del corpomente” (The Paths of Reflexivity: For a Pedagogy of the Body-Mind) (Armando Edizioni, 2021). She coordinates educational projects at the social cooperative Comunità Progetto in Milan (MI, Lombardy) and is a member of Philo - School of Philosophical Practices in Milan.

“Feeling” mathematicians

Understanding the commutative property of multiplication through body percussion at Primary School

Eliana Danzi

PhD student of the Palermo University

Keywords

Embodied education; inclusive laboratory; integrated skills; music and mathematics; teacher training.

Learning from experience means relating what you "know" with what you "know how to do", using all perceptual channels: semantic, tactile, visual, kinesthetic, auditory. In this study, which is the result of an experiment with children in a second/third-grade primary school class, we show how body percussion, by anchoring learning in an embodied exploration of personal, relational and physical space, also guarantees “naturalness” in the acquisition of abstract components. Understanding the concept of quantity means representing numbers, recognizing the ordinal relationship between different numbers and being able to perform operations with them. My presentation concerns a unit of work on the commutative property of multiplication, starting from the numbers displayed on the body and transforming mathematical materials into motor patterns. Experienced through movement, relationships and multiplied in rhythmic ensemble performance, these activities not only support boys and girls cognitive growth, nurturing their motivation - and ability - to work with the language of numbers and sounds, but also lay the foundations for self-awareness and openness to others. The pedagogical intervention can thus welcome each participant in a space of sharing and communication. This configures the place as a learning environment in which to implement paths aimed at co-constructing meaningful experiences and defining a training profile characterised by authenticity. The performances take shape as solutions to problems (the materials themselves) to be questioned. They are the result of metacognitive-cooperative work. The class group is defined as a research community. It suggests how an exploratory and creative approach could become a transdisciplinary framework that guarantees unified and integrated pathways. It is clear how participation in this seminar will be characterised by a multisensory experience, i.e. by the active and embodied participation of all participants, in a theoretical framework in which learning means interacting with the physical and social environment with the whole brain-body-mind system.

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Bio

Eliana Danzi is a PhD student in Technologies and Methods for University Education (XXXIX cycle) with a research project on methodological innovation that fits into the theoretical framework of embodied theories. She graduated in violin and viola and in ensemble music at the Accademia Nazionale di Santa Cecilia in Rome. She is a certified expert in the Orff-Schulwerk Methodology at SPM Donna Olimpia in Rome. She is a trainer in the field of pedagogy and music teaching, and conducts body music and body percussion workshops for the most important Italian training institutions. Since 1997 she is a teacher in public school and she collaborates as a researcher with INDIRE.

Embodied Narratives in Science Education: Role Play as a Tool for Understanding Natural Forces

Elisabeth Dumont
ZHAW School of Engineering

Keywords

Narratives in Science Teaching; Embodied Learning; Role Play in Science Education.

Humans naturally think in stories. They use these stories to understand their environment, natural processes, and experiences. Scientific ideas often come in the form of (mathematical) models. These models explain how different parts work together in a system. However, explaining how these parts work together isn't the same as telling a story. To make a scientific model, you also need other elements, like electricity, light, momentum, heat. Stories in science involve agents and events caused by these agents. People sense natural forces like wind and rain through their bodily interaction with the environment. These forces act as characters in the scientific narratives. Stories also link people emotionally to science. Nature becomes relatable, filled with characters that interact and communicate. In short: stories transform abstract scientific concepts into relatable, understandable experiences, highlighting the active elements in nature.

The stories can be embodied via role play. We have performed role plays involving forces of nature with students of different age groups. The students embody the forces of nature. By acting out these roles, they physically experience what these forces of nature might "experience" if they were able to do so. In other words, in our imagination, we can put ourselves "in these agents' shoes". The logic inherent in physical interactions with our bodies will tell us much about how forces of nature act, what they can and cannot do. In this role play the students can experience visually and physically the interactions and energy transfers within the system. Actors and props are used to embody sunlight, electricity, heat, and light, and also the energy flow. This dramatization helps convey the dynamic of natural and technical processes, making them more tangible and understandable.

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Primary Physical Science Education: An Imaginative Approach to Encounters with Nature, Hans Ulrich Fuchs and Federico Corni, Springer, 2023
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Bio

Elisabeth Dumont is a physicist and mathematics educator with a strong commitment to innovative teaching methods and interdisciplinary approaches. With a solid background in science and a keen interest in the intersection of natural sciences and humanistic disciplines, she focuses on enhancing scientific understanding through creative and interactive educational practices.

Since 2010, she has been a physics teacher at the Zurich University of Applied Sciences (ZHAW). She has collaborated with Hans Fuchs and Federico Corni for over ten years. In her role, she teaches physics and system dynamics to engineering students, applying her research insights directly to her teaching. Her research interests center on embodied education, particularly the use of narratives and role play in science teaching. She investigates how humans perceive and understand nature through storytelling, aiming to make abstract scientific concepts accessible and comprehensible for learners.

Energy in the body and in nature: educational use of sensations and emotions in Learning stories to better understand a multifaceted and complex concept

Alessandra Landini

Comprehensive Schools "A. Manzoni", Reggio Emilia; University of Modena and Reggio Emilia

Keywords

Energy; Body; Emotions; Sensorimotor system; Learning stories.

Human understanding, as Mark Johnson has well explained, has its roots in physical structures, such as balance, force and container. These structures originating from the sensory-motor system and our interaction with the world are schematized in our conceptual system as image schemas and mental representations that operate in producing meanings and enrich our ability to interpret reality, both in the physical and non-physical, immaterial world. Metaphorical expressions are part of this embodied characteristic of our mind and represent part of that embodied understanding that allows us to investigate aspects related not only to human understanding, but also to investigate the logic and semantics of language, cognitive development in people, human activities and feelings, even in the cultural, pedagogical and anthropological dimensions underlying them.

In the course of my research studies on science education, specifically about the teaching of physics and biology, as well as in general didactic, I have particularly explored the concept of energy, exploring its multi-metaphorical character, and an idea of energy that offers conceptual continuity in physics, biology and chemistry. The research results, have therefore sought to contribute to the reflection on the unifying character of the complex concept of energy. Moreover, they aim to glimpse its peculiarities, not only for a holistic vision of the sciences in early education, but also in the attempt to give voice to paths that led to the definition of vertical curricula in education and the identification of the core concepts on which to base them.

To foster the embodied character of human understanding, among the most representative and experimented methodologies, the Role Play, the "Playing of Energy", Viola Spolin's "physicalization" and the "Theater of the Forces of Nature" emerge as forms of emotional and physical experience that can facilitate the deep understanding of the concept of energy and the interaction between the forces of nature. In this regard, it would be interesting to explore the variety of simulative architectures that can facilitate the approach to this unifying concept of energy.

Understanding a phenomenon, or the interpretative simulation of an object and its components, requires a focus that fosters a deeper interpersonal and intrapersonal comprehension. In fact, a teacher should be aware of the impact of stories and "learning stories", based on the body and on both physical and mental sensitivity. The functionality of these playful, simulative tools that start from structured narratives, seems to us confirmed by studies on imagination and the role of the sensory-motor system in conceptual development. Not only does cognitive linguistics confirm the use of the figurative aspects of language and narratives as powerful cognitive tools, but neuroscience also confirms with its contribution some assumptions about Embodied Cognition and metaphorical language.

Consequently, from this research work, which later led to the study of vertical conceptual curricula, I have deepened the analysis of conceptual organizers that guide the path of teachers in the K-13 grade levels with continuity and gradual complexity. My attention has focused, among others, on the concept of "limit and boundary" and on that of "balance". The latter seems characterized by an interesting multi-metaphorical character, as well as energy, offering rich possibilities for action to educators.

Barsalou (2010) describes a series of tasks that the human conceptual system must be able to perform. These include providing a complete mental representation of an immediately accessible experience, allowing the representation of a non-immediate experience, an experience that must be accessible to a large number of people, making sense of the world, allowing inferences to be drawn from the

representations used, and at the same time allowing productivity and creativity. In what way can human conceptual systems perform these tasks and what kind of human conceptual system is able to perform these functions? What can an in-depth and embodied work on the core concept of "Balance" or "Energy" offer in terms of metaphorical and interpretative possibilities? The analysis of "image schemas, domains, frames, mental spaces" used by all speakers, together with simulative and playful architectures, supported by "Learning stories", can serve the purpose of organizing and giving coherence to the learning experience.

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Bio

Alessandra Landini, School Principal of "IC Manzoni" in Reggio Emilia, PhD in Didactic of Physics, Lecturer of General Didactic at University of Modena and Reggio Emilia.

Interoceptive Wisdom Training for Teachers

Martina Maddaluno
University of Trento

Keywords

Emotional Intelligence; Energy Body; Interoception; Yogic Theory of the Mind-Body Continuum. 4E Cognition.

In a dynamic and rapidly evolving world, teachers are being challenged to not only impart academic knowledge but also to address the holistic well-being of their students. Suffice it to think that it is becoming more and more common for teachers to refer students to psychologists (Sohn 2024). This, however, is only a palliative for numbers tell us that they are not dealing with a few ‘problematic students’, but with the genuine discomfort of an entire generation and with their subconscious need to know the self in all its facets head-on (Abrams 2022). Education is thus being challenged to radically rethink itself and, I believe, to do so it is essential to make interoceptive wisdom a core component of teacher training and, eventually, the pillar of an educational paradigm grounded in the “lived [dimension of] experience” (Petitmengin 2021).

With the term ‘interoceptive wisdom (IW)’ I am referring to the ability to be aware of and attuned to one’s internal bodily signals, to self-regulate one’s emotions, and to consciously channel one’s energy. Indeed, IW training aims at equipping teachers with the skills to develop and enhance interoceptive sensitivity, interoceptive accuracy, interoceptive awareness, interoceptive insightfulness and interoceptive responsivity; hence to provide them with the tools to pass this knowledge on to students.

The hypothetical training could comprise of a theoretical part, an experiential part and an inquisitive part. The theoretical element might consist of an introduction to the 4E approach to cognition and an in-depth multi-disciplinary analysis of the energy body and embodied consciousness drawing from Ayurveda and the Tantric-Yogic lore. Even though such traditions can be difficult to grasp for the Western mind, at least at first, it is becoming clear, especially to scientists, that they provide a valuable, coherent and pragmatic theory of the mind body-continuum (Venkatram et al. 2019). The experiential part, that also aims at clarifying eventual doubts, could consist of breathing exercises (pranayama), bioenergetic exercises, mindfulness, body-scan meditation, ayurvedic self-massage, Awareness Through Movement (ATM) exercises and reflective journaling. Finally, the inquisitive component of the training will challenge teachers to critically think and rethink the education system and the didactic curriculum. On which assumptions about the individual is it constructed? How can the curriculum be more reflective of the corporeality of the human experience and do justice to it eventually favoring integration instead of perpetuating fragmentation? How can an interoception-informed education help students draw insightful links between disciplines presented as unrelated? Think of the commonsense divide between science and humanities. How can a better understanding of one’s own energy body and inner dynamics foster a deeper understanding of the world and otherness at large?

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Bio

Martina Maddaluno is a scholar working at the intersection between philosophy, cognitive science and bodywork. She obtained a Bachelor's degree in Philosophy from 'La Sapienza' University of Rome,, a Research Master's degree in Media, Art, and Performance Studies from Utrecht University and, as of September, she will start studying Cognitive Science (MSc) at the University of Trento. Her main interest lays in the relationship between mind, body, and society, explored from a variety of angles.

In her bachelor's thesis, she studied technogenesis and the changes in self-perception experienced by individuals wearing brain-machine interfaces using the '4E' approach to cognition. Her master's thesis, on the other hand, explored the nexus between embodiment and revolution in Ernest Becker, Karl Marx, and the Tantric lore from a neuroscientific perspective. She investigated the psychological basis of dualistic thinking and proposed that tantric technology and subtle body anatomy could provide the West with a scientifically sound method to ground consciousness, potentially serving as a catalyst for societal change.

Throughout the past year, Martina participated in Berkeley's reading group "Embodied Underground," followed an online series on polyvagal theory and the workings of the autonomic nervous system and its regulation through Feldenkrais and bio-feedback devices, and studied fascia release therapy, anatomy trains theory, and bioenergetics as an autodidact. She also completed a level I Ayurvedic practitioner course, deepening her understanding of the yogic theory of mind, consciousness, and energy-body anatomy. Additionally, she occasionally gives mindful movement and dance improvisation workshops herself. She engages in these diverse activities to explore cognition and consciousness—which she understands as embodied, embedded, extended, and enactive phenomena—from a standpoint that tries to both integrate and transcend science, somanautics, and philosophy

Education is a theme that occupies Martina's thoughts frequently. She believes school is the place where estrangement from the "felt dimension of experience" (Petitmengin 2021) could be either mended or exacerbated. Corporeality, understood as the dynamic matrix of passions and needs grounding the human animal in the world, is often disregarded in many public schools. When addressed, it is usually from a reductionist perspective that breaks it down into individual components—e.g., physical education, sexual education—presented as unrelated, thereby foreclosing the possibility of a deep understanding of the world, its dynamics, and one's very self. In the context of this seminar, I would like to join the group focussing on 'the body and energy' and/or 'emotions, motivation, and the body' and reflect on the possibility to incorporate interoceptive wisdom in teacher training programs.

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Elements of nature, sound and movement

Annamaria Minafra
Conservatorio "G. Puccini" - La Spezia (IT)

Keywords

Natural elements; Embodied intersubjective experience; Sound and movement; Social educational contexts.

This proposal aims to explore the embodied experience of the energy of natural elements (Air, Water, Fire, and Earth) combined with sound in social situations like educational contexts. As a music teacher, my interest in this topic starts from observing young children's behaviour when asked to represent or explain one of these elements. Children usually express these elements through an embodied experience combining movement with sound and appear unable to separate these two components. For example, to represent wind, children show its intensity through movement accompanied by a corresponding intensity of sound. To express light wind, they move their bodies slightly and voice soft sounds. Children manifest similar behaviour when representing water and so on. Their behaviour reveals that children ground their knowledge in movement (Sheets-Johnstone, 2011; 2013) combined with sound patterns (Findlay, 1971). Even we adults perceive such phenomena as movement always accompanied by sound. For example, we see the rain falling and listen to its sound. Only by listening to sound can we understand the intensity of the rain. Similarly, this occurs with wind or fire. According to Gallese and Morelli (2024), movement—and its intensity or energy through which it is manifested—assists us in making sense of our experience and appears fundamental for our cognitive processes. This kind of experience could be adopted in the learning process through an active approach of 'learning by doing' (Dewey, 2001, p. 192) in social educational contexts. From the embodied cognition perspective, knowledge is based on an intersubjective process as individuals interact with and learn from each other through movement and try to make sense of it (Gallese and Morelli, 2024). Considering these ideas, this proposal aims to explore a possible way to learn how to identify and separate the physical characteristics that regulate each element of nature and sound through an embodied experience. For example, a free dramatization of the wind could be realized in a group. First, the dramatization could be accompanied by a vocal improvisation that reflects the intensity of the wind movement. Then, to perceive each characteristic of the wind and sound and become aware of it, the wind could be dramatized with no sound, followed by a rendition that only utilizes the voice. The same procedure could be applied to each element of nature, first one by one, then combined.

This procedure could make the learning process enjoyable while developing curiosity and creative skills. Group members would also learn to observe and listen to each other. Moreover, if they are guided to reflect on their embodied experience (Gallese and Morelli, 2024) by the teacher, they will discover the physical laws of each element of nature.

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Bio

Annamaria Minafra, graduated both in viola and Philosophy of Education, received her PhD in Philosophy of Music Education in the 2019 at UCL-Institute of Education in London (UK). From an empirical phenomenological approach, her research interest focuses on the body-mind relationship both in professional musicians and beginner violin-group players.

She was President of the Doron Association in Florence-Italy for ten years, developing teaching experience, collaborating with local institutions such as state schools and Florence municipality. She collaborated with other Italian Associations, organizing some orchestra workshops for children and teachers, and was member of the Pedagogic Committee of Italian Association of Music School (AIdSM).

She presented selected findings from her research at national and international conferences and published part of her research in English and Italian. She currently teaches for a music teacher training program at Conservatory of music “G. Puccini” – La Spezia (IT).

Domain-Inherent Metaphors in STEM: The Example Energy and Force

*Charlotte H. Müller
ETH Zurich, Switzerland*

Keywords

Chemistry; Conceptual Metaphor; Embodied Cognition; Scientific Discourse.

Many concepts in chemistry are not perceptible in any way. Therefore, proponents of conceptual metaphor theory have argued that these concepts must be understood by means of metaphorical mappings from an experiential domain to the chemical target concept (Lakoff & Núñez, 2000; Niebert & Gropengiesser, 2015). The difficulty lies in what aspects of the source domain should be mapped to the target domain and which ones should not. Niebert and Gropengiesser (2015) argued that metaphorical mismappings, that is mappings during which either too many or the wrong attributes are mapped from the source to the target domain, are the source of many misconceptions in science. It is therefore of great interest to understand what metaphorical mappings are present in educational contexts employed both by experts (teachers) and novices (students) either intentionally or unintentionally.

Chemistry education research has focused on instructional analogies, i.e. analogies that were designed specifically to facilitate the learning process with the target audience in mind (Müller & Rau, in preparation). Here, I want to argue that next to these instructional analogies, the metaphorical mappings inherent to chemical terminology and visualizations are equally as important. I will illustrate this argument with the example of the force (in a quantum chemistry) concept.

In a recent study, we aimed to teach the quantum chemical notion of force, i.e. force acting on an atom in motion is equal to the change in potential energy opposite to the direction of motion, by allowing the students to feel this force while observing the energy change. By introducing this macroscopic fore, we introduced an instructional analogy between the bodily experience of pushing and being pulled and the quantum chemical notion of force as the change in energy. On a more fundamental level, we employed the verticality image schema in that the energy was conceptualized as a hill where more energy corresponded to the level of elevation. In addition, the students brought previously established metaphors from everyday life to the experience. The way they communicated during problem-solving (and therefore during chemical discourse) was inherently metaphorical. Here, energy was often conceptualized using the force image schema. These two image schemas stood in conflict with one another. The students' colloquial understanding of force as equal to energy was more robust than the intended instructional analogy. Sometimes, the embodied experience even supported this unintended understanding, since it is not trivial to distinguish between the value and the slope of the energy graph, i.e. if there is a force present because the energy value is higher or because the energy slope is steeper (Müller et al., 2024). We know that experts often use multiple conceptual metaphors throughout the problem-solving process to reason about different aspects of the problem (Jeppsson et al., 2013). However, in this specific case, the students did not understand the metaphorical nature of these two ways of looking at energy and thought that they contradict each other. Finally, throughout the intervention, metaphorical terminology was used. For example, with the activation barrier, chemists mean the increase and decrease in energy throughout a chemical reaction. Similarly, chemists talk about the leaving group, the breaking of a bond, or the nucleophilic attacker. It is not clear to me, how these domain-inherent metaphors affect the integration of the instructional analogy such as the one described in here.

At the seminar, I would love to discuss more how we can consider and even make use of the rich embodied understanding of energy (or force) that students bring to the classroom when introducing them to scientific knowledge generally understood to be “disembodied”. Furthermore, I wonder in

what ways we can reconceptualize scientific knowledge as embodied knowledge, or in other words, whether we should consider all knowledge as embodied since all knowledge was constructed at some point by a human (with a body) and what this would mean for teaching.

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Bio

Charlotte H. Müller is a theoretical chemist by training and moved to the learning sciences during her doctoral project. Under the supervision of Prof. Manu Kapur and Prof. Markus Reiher, she gained experience with interactive simulations as facilitators for learning quantum chemical concepts, force specifically. The simulation allowed the students to feel the force that would act on a specific atom as they were pulling it over a computer screen, thereby offering an embodied experience.

At the time of the seminar, she is an early-career fellow at the Collegium Helveticum and a postdoctoral researcher in the learning and instruction group lead by Prof. Martina Rau at ETH Zurich. She investigates metaphors present in chemical education. Specifically, she is interested in domain-inherent metaphors, that is metaphors that are part of chemical terminology or visualizations. Her current focus is therefore on chemistry classroom discourse.

The concept of energy as the ascent from the abstract to the concrete

George Santi
University of Pavia

Feynman (1977) defines energy as a certain quantity that does not change in the manifold changes that characterize natural phenomena. It is one of the most abstract ideas since it expresses a mathematical principle, that is, there is a numerical quantity which does not change in physical phenomena. Energy cannot be traced back to a specific mechanism nor to something concrete:

Something like the bishop on a red square, and after a number of moves – details unknown – it is still on the same square. It is a law of this nature. (Feynman, 1977, p. 4-1)

In teaching-learning processes, in order to grasp the concept of energy it is necessary to trigger what activity theory calls the ascent from the abstract to the concrete (Davydov, 1990). This notion expresses the dialectics between abstract and concrete, general and particular, and sensuous and conceptual. Concept formation begins from the sensually experienced concrete, understood not as isolated things but as the complex relations in which the subject is acting, as “a definite system of interacting phenomena, (...) a system forming a certain coherent whole” (Ilyenkov, 1982, p. 96).

The research problem is to single out this system of actions that allows students to sensuously encounter the generality and abstractness of the concept of energy. In our pursuit to ascend from the abstract to the concrete, we can turn to several theoretical tools, such as image schemas and metaphors, reflexive activity mediated by cultural-historical artefacts, including mathematical semiotic systems that express energy conservation principles at different levels of generality.

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Feeling the Impulse: Bodily, Metacognitive, and Emotional Experiences in Addressing Misconceptions about Momentum

Fan Wang, Julia Chatain, Manu Kapur
ETH Zurich, Switzerland

Keywords

Physics Education; Misconceptions; Embodied Learning; Sensory Perception; Emotions.

Teaching and learning the concept of momentum has been notoriously challenging. Students frequently hold persistent misconceptions about momentum even after formal instruction (Lawson & McDermott, 1987). Traditional math-heavy pedagogy and everyday language that conflate force, energy, and related terms further complicate students' understanding (Bryce & MacMillan, 2009). As a result, students often lack the motivation to address these misconceptions due to being unaware of them, or struggle to learn due to the high barrier of conceptual change (Smith III et al., 1994).

One way to optimize this learning process is to make it more embodied. Explicitly experiencing the concept-related phenomenon, combined with proper instruction, might help build more accurate mental representations and provide grounding opportunities for long-term memory (Nathan, 2021; Wilson, 2002). Drawing on this theoretical hypothesis, we are designing a learning process where students observe the phenomenon of falling objects and are asked to catch them. The feeling of the impulse on their hand will be interpreted and instructed, according to the impulse-momentum theorem, as the “change of momentum of the object”, which is commonly and anecdotally referred to by students as “force possessed by the object” (Hestenes et al., 1992).

In this seminar, I would like to focus on two topics stemming from this embodied design.

First, I would like to discuss how to appropriately map physics concepts onto students' bodily experiences. There has been debate on whether the sensation in the hand in this context represents momentum, force, energy, or power (Fuchs, 1987). These are distinct physics concepts, but individuals may attribute them to the same feeling. Is it possible to reach a consensus when describing bodily experiences in scientific terms? If yes, how can we use agreed-upon matches between bodily experiences and scientific terms to design meaningful learning activities? Would this address or reinforce misconceptions? If not, what challenges does this pose for embodied education?

Second, I am particularly interested in the metacognitive and emotional experiences elicited and regulated due to bodily movement in learning. Embodied learning involving bodily movement is considered promising for increasing students' motivation and enjoyment as an affective outcome (Ale et al., 2022). However, deep and effective conceptual learning often requires students to undergo “productive struggles” (Kapur, 2014; Warshauer, 2015). Given the difficulty of understanding momentum, it is expected that students will experience unpleasant emotions during the learning process. Are these negative emotions inherent to the concept itself, suggesting that students must emotionally struggle to learn, or can alternative pedagogical designs, such as embodied approaches, mitigate this struggle? Does embodied education have the potential to ensure better cognitive learning gains while, at the same time, eliciting differently perceived emotions or promoting more effective emotional regulation strategies as a catalyst for learning?

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Bio

Fan Wang is a doctoral student in the ETH Zurich – EPFL Joint Doctoral Program in the Learning Sciences, focusing on designing embodied learning processes for physics education. Before her doctoral study, she obtained bachelor’s and master’s degrees in physics, with a special interest in quantum optics and measurement. Besides studying and working, she also had over 2 years of secondary school math and physics teaching experience as a volunteer working in NGOs that help less-advantaged children in China.

Dr. Julia Chatain is a Senior Scientist at the Singapore-ETH Centre, responsible for the Future Embodied Learning Technologies (FELT) project. She collaborates with the Professorship for Learning Sciences and Higher Education (LSE) on several projects about embodied learning and math education. She supervises the "Achieving Adaptive Mathematics Knowledge through Embodied Causal Learning" project, funded by the Jacobs Foundation Young Scholar grant. Moreover, she co-leads the development of a mobile math learning app. Julia completed her doctorate on how embodied interaction in Virtual Reality can be designed to support learning and grounding of abstract concepts of mathematics and received the "Outstanding Dissertation" ETH medal for this work.

Prof. Dr. Manu Kapur is currently the Director of the Singapore-ETH Center, and Professor for Learning Sciences and Higher Education at ETH Zurich, Switzerland, where he also directs The Future Learning Initiative (FLI). Manu is also the Founding Chair of the ETH Zurich – EPFL Joint Doctoral Program in the Learning Sciences. He conceptualized and developed the theory of Productive Failure to design for and bootstrap failure for learning mathematics better. He has done extensive work in real-field ecologies of STEM classrooms to transform teaching and learning using his theory of productive failure across a range of schools and universities around the world.



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