



Acknowledging Montessori Education – a Research Perspective of Montessori’s Legacy for the Future Symposium Report

COMMENTARY

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ABSTRACT

On 6 May 2022, 70 years after Maria Montessori’s death, Stockholm University and the Department of Education and Didactics organized an international Montessori symposium. The idea was to present a breadth of research on Maria Montessori.

The symposium dealt with Maria Montessori in the interwar period, an analysis of the history of ideas. Another presentation suggested possible research models to study this large field. The symposium also presented interpretations of Montessori’s writings that point her out as a visionary and pioneer in education for a sustainable world. An additional research area addressed was the potential of neuroscience to examine the effects of teaching theory and learning in Montessori education. Finally, this report describes a study on whether Montessori-inspired education compared to traditional education stands up in areas of socio-economic disadvantage.

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Montessori: A public intellectual of the Inter-War Era

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My research situates the multifaceted movement surrounding Montessori, within the wider public debate context of the interwar years, with a focus on the intersections between science, politics and educational ideas (Quarfood, 2022).

As a public intellectual and movement leader, Montessori aimed at more than just a reform of teaching methods. Addressing far-reaching questions about children's place in society, her movement challenged established notions about childhood, parenting and schooling.

I will here highlight some aspects of the Montessori movement's message about the child's liberation, and how this message was received in the British and Italian cultural milieus, two countries in which the movement had a great impact. The press was helpful in establishing Montessori's image as an "educational wonder-worker". Her Casa dei bambini experiment, initiated in 1907, was presented as a unique event, a discovery of the hidden potential of preschool children. It seemed to confirm Ellen Key's vision of the 20th century as the century of the child. In the press debate it happened more than once that Montessori's educational ideas were labelled as an -ism. Articles referred to Montessorism, as one referred to feminism or Freudianism. The term Montessorism designated the wider world view, social agenda and spirit of Montessori education. Central to this world view was the idea that the child was oppressed and had to be liberated. This belief, that the liberation of the child would pave the way for a new and better world, contrasted in its suggestive ambiguity with the rigorous method offered by the movement. While there were clear instructions for the proper use of the didactic materials and the preparation of the school environment, the movement's vision of the liberated child – the very heart of the method program – was less clear. What exactly did the child have to be liberated from, and what was the ultimate purpose of this liberation?

A key concept of Montessorism was liberty, understood as biological liberty. It was a question of respecting the child's freedom to develop its psychophysical potential at its own pace, without adults interfering too much in this natural growth process. Ellen Key, like Montessori an adept of evolutionary biology of the Spencerian kind, believed that only free play could stimulate personality development at the preschool stage. Montessori dismissed this laissez faire view. Liberty and discipline were two sides of the same coin. Spiritual energies could only be liberated in a structured learning environment offering opportunities for self-development.

Thus the Montessorian concept of liberty was linked to ideas about self-discipline through auto-education.

To make the child independent was the supreme goal. To paraphrase Virginia Woolf's famous essay of 1928, the fundamental precondition of emancipation was to acquire a room of one's own. Montessori had a vision of her Casa dei bambini as a place where adult power and authority was suspended, a kind of free-zone allowing children to take command of their own learning process.

British sympathizers found it difficult to really grasp this vision. At first, they tended to interpret the Montessorian principle of liberty as corresponding to the pluralistic views of classical liberalism, where freedom of choice was central. A liberal preschool education, they believed, ought to offer a variety of stimulating educational tools, like the hors-d'oeuvres of a Swedish smorgasbord, for the children to pick and choose from. In Montessori's view, such eclecticism would lead to confusion, mental indigestion. The child's liberation could only be achieved in a life space where everything was arranged to further the development of autonomy. As Montessori claimed in a London lecture in 1921, it was necessary to create for the child "a better world than that which commonly existed around him". This captures in a nutshell Montessori's whole project: to develop real independence the child needed a room of its own. While liberals had welcomed preschools as a complement to family upbringing, and conservatives had feared that preschools would undermine parental authority, Montessori presented her preschools as a place where children could be liberated from the pressures imposed by the adult world.

In the mid-1920s Montessori radicalised her critique, denouncing "adultism" as a tyrannic ideology making everything revolve around the needs of adults, while depriving children of agency. The tensions between the generations, between adults and children, were now described as a regular war. This radical critique was inspired by the psychodynamic theories in vogue. In *Das Kind in der Familie*, 1923, Montessori developed ideas about the birth trauma and about the child's subconscious defense mechanisms, as a reaction to parental pressure. The Oedipal conflict was however absent from her description of the child's psyche. She felt free to combine Freudian ideas with theosophical notions, assuming a spiritual life force – the psychical embryo – in the depth of the child's soul. This also led to a reinterpretation of the Catholic concept of original sin. It applied to adults rather than children, Montessori claimed in the Italian journal *L'Ida Montessori*. It is the adult that must change and not the child, she declared at the 1930 International teacher training course in Rome.

It is indeed a paradox that the Montessorian critique of adultism was radicalised during the decade when her movement received support from the Mussolini regime. How was it at all possible to deliver such a sharp critique of authoritarian education in a totalitarian society, where dictatorship had been installed in 1926?

As is clear from archive material, for instance the fascist secret police files on Montessori, the fascists wanted to appropriate Montessori education for their own ends, as a means of gaining control over the new generations. A “Montessorism without Montessori” as the spy reports put it, could be a powerful disciplinary tool. Furthermore, the critique of adultism could be reframed as a dismissal of parental authority, in order to subordinate the child to totalitarian state authority.

This was of course a complete distortion of Montessori’s culture-critical message. In her denunciation of militaristic education, delivered at the disarmament conference in Geneva in 1932, Montessori claimed that the age-related power conflict was the root conflict of society, with criminality, war and oppression in its wake: “the first war among people is the war between parents and children, between teachers and pupils.” As she explained at the Montessori Congress in Rome, 1934, the child had to be liberated from too close bonds to adult authority persons. To be forced to bow to a stronger will was the “real danger”. A fascist spy described this message as “super anarchistic and in absolute contradiction to fascist objectives.”

A research methodology as an ideology – towards understanding Montessori education through empirical projects’ meta-analysis

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INTRODUCTION

A few decades ago, Jurgen Habermas (1972) described *three interests* that constitute scientific reasoning. His claim was that various forms of scientific inquiry might be based on implicit modes of thinking that he called *interests*. Another thinker, Pierre Bourdieu (1988) coined the metaphor of *domesticating the exotic* and *exoticizing the domesticated* when referring to the research activities performed by scholars who aim to describe the culture of the Other or/and especially the culture that they are part of. These two threads of thought lead to the conclusion that the way in which scientific research is done might be interesting on two levels.

The first level relates to *the results of research* as we (as a community of researchers) long to understand more, we appreciate verifying hypotheses. In this case, we first make sure that the research we are interested in meets the criteria of methodological and conceptual accuracy. Having agreed that the methodological foundations of a given project are correct, we turn our attention to the results. This level of research analysis is absolutely necessary and quite obvious, if we wish to construct knowledge, as it is always a communal effort. We are able to go forward, search deeper, analyze marginalized

issues and topics, only if we are familiar with the work of our colleagues.

There is, however, the second level of research analysis directly based on the aforementioned thinkers and their claims on scientific reasoning. For instance, by investigating the research methodologies implemented in research on Montessori education one can make an attempt to describe what interest(s) lie(s) behind the project and therefore what logic of education is “at work” there as well as – after Bourdieu – it becomes possible to check whether the scholars use the strategy of *domesticating the exotic* or *exoticizing the domestic*. This choice (regardless of whether intentional or not) may have significant social and intellectual consequences. If so, then the logic of scientific production should be investigated and the outcomes of such critical insights may bring about the insights potentially demasking presumptions of academic research reasoning.

COGNITIVE INTERESTS AND EPISTEMIC STRATEGIES

According to Jurgen Habermas scientific or academic reasoning, thought and research are based on cognitive interests. These interests can be explicit motives or/and implicit conditions in which knowledge is constructed. Furthermore, it is possible to distinguish between three different interests and hence also methodologies corresponding with them. The technical interest is analytically oriented and longs for objectivism. This form of (neo)positivist implements mainly quantitative strategies, often incorporating advanced statistical aggregations of data. Habermas reckons that the aim of this interest is verification of existing or new hypotheses and practices. This form of verification leads to the control and management of processes. For instance, we might be interested to check if the “Montessori approach works”. Positive or negative verification of such a hypothesis (of course restricted to some variables) will potentially result in sustaining or rejecting some educational practices.

The second interest that Habermas called *practical* is focused on the investigation of intersubjective and shared meanings and therefore is usually qualitative both on the level of research strategy but also on the level of the type of data gathered. The main aim in this kind of scientific reasoning relates to exploration and understanding some aspect of reality and practice. Here we can find approaches such as: (auto)ethnography, grounded theory approach or phenomenography and others. A researcher interested in Montessori education following this path could, for instance, propose a categorization of various interpretations of a given phenomenon.

The third interest is critically oriented, and Habermas calls it *emancipatory*. Here we find critical research

strategies, based on critical theories (for example – but not necessarily – Frankfurt school, feminism, Freireian inspired etc.). The main aim here is the emancipation from limits, empowerment, questioning well-established dogmas and engagement in critical insights into the cultural and social construction of human society.

In the *Homo Academicus* (1988) Bourdieu pointed out that the academic world of sociology is dominated by the epistemic strategy that he called *domesticating the exotic*. It relates to the belief that the researchers are “in possession” of adequate language, categories and tools to describe the culture of the Other. On the methodological level it may mean the attachment to surveys with close-ended questions or various tests, quasi-medical examinations and so on.

The opposite strategy is connected with the attitude and approach that Bourdieu in other works called reflective sociology. In such a strategy it is the questioning of well-established patterns of our own thought (and thus radical humbleness) that is essential. It is also necessary to negotiate the meanings with those who become the subject of our research project since their perspective is indispensable to creating any forms of research results. In other words, the researcher needs to accept the fact that they do not possess the language that can adequately describe the *other* – which of course questions the whole idea of post-enlightenment science and academic research as the most ideal language to “grasp” the complexity of our world (Diagram 2).

THE METHOD

The research questions of the analysis summarized in this text relate to cognitive interests and the two strategies outlined above. As a result, four questions were formulated, and they are as follows:

1. Which cognitive interests are present in research projects related to Montessori education?
2. Which cognitive interests (if any) are less popular or marginal?
3. Which of the two strategies are present in research projects related to Montessori education?
4. How can the results of such meta-analysis be interpreted?

The differentiating criteria taken into consideration included:

- a) research strategy – qualitative, quantitative, mixed, conceptual;
- b) data-gathering technique – surveys/polls, tests, secondary data, interviews, observations, other;
- c) research sampling scheme – randomized, intentional (non-randomised), *ad libitum*;

- d) sample population – children/students, teachers, parents, school administrators, other
- e) forms of conclusions – idiographic, nomothetic, none or no-data

The research sampling incorporated in the presented meta-analysis can be described as non-randomized, purposeful and it included 174 research reports published between 2000 – 2020 that are accessible on the Web of Science Clarivate data base and include Montessori as one of the keywords.

RESULTS

In this summary only a few results are presented due to the word count limit and they are all simple, quantitative observations. They should be treated as snapshots rather than full presentation of the research results.

First of all, there is a fairly steadily growing trend of both publications and citations of articles relating to Montessori education, in the second decade of the twenty-first century (2010 – 6 articles, 2011 – 10, 2012 – 18; 2013 – 9; 2014 – 10, 2015 – 10, 2016 – 13, 2017 – 13, 2018 – 14; 2019 – 20, 2020 – 22). This trend is even clearer when it comes to citations between 2005 and 2020. The shift in the research strategies (in five-year intervals) shows that with time the research become more diverse (see Diagram 1).

The first five years shown in the diagram (marked with the red rectangle) cannot be treated as fully justified due to the limited number of articles, but the next three other intervals show that we can talk about growing diversity in the implemented methodologies and thus cognitive interests. Nevertheless, the dominance of quantitative strategy is unquestionable.

This claim above is also clear if we take into consideration the criterion of data-gathering techniques. In all the analyzed articles surveys occur

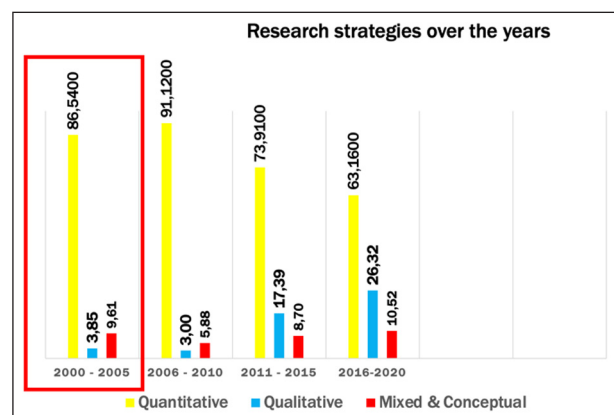


Diagram 1 Research strategies in Montessori related articles in 2000 – 2020.

Source: Own research.

most often (104 times), the tests – 16 times, secondary data – 17. Interviews (usually individual in-depth) were present 31 times, and observations – 16. The number of all identified data-gathering techniques equals 192, which means that in the case of at least 18 reports the researchers decided to use at least two techniques.

When it comes to the form of conclusions within the subgroup of research characterized by quantitative strategy, 56.8 % of them belong to idiographic reasoning with 39.5% to nomothetic (in 3.7% cases there were no conclusions to identify). Within the subgroup of qualitative research almost eighty percent of reports expressed conclusions in an idiographic manner (13.8% – nomothetic, 6.9% – no conclusions).

One of the analytical observations included combining the epistemic strategies defined by Bourdieu and the sample population.

As we can see *domesticating the exotic* is dominant regardless of the sample population, however this image becomes more diverse when the teachers and school administrators are examined. The children – although Montessori is a child-centered pedagogy (Diagram 2) – very rarely participate actively in the research processes.

There are probably a few possible interpretations. One of them might relate to highly prestigious journals' policies, possibly discouraging researchers to submit articles that are not objective, reliable (in the traditional meaning of this word) or limited to small, non-representative samples.

CLOSING REMARK

In this project I am not opting for any specific cognitive interest or epistemic strategy. In research, as in the natural world, diversity is the key word. The community of people interested scientifically in education needs various approaches, diverse languages and (auto) critical insights. Seeking for the truth (however conceived) demands asking difficult questions, even if the global tendencies are different.

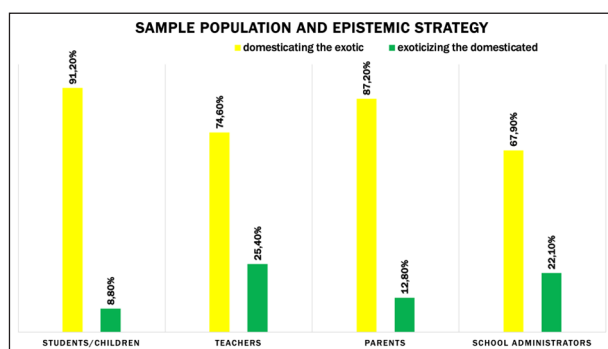


Diagram 2 Sample population and epistemic strategy.

Source: Own research.

Montessori pedagogy – Sustainability and Global citizenship

Eva-Maria Tebano Ahlquist, Ph.D. and Per Gynther, Ph.D., Stockholm University

In 2018, the OECD launched the project *Future of Education and Skills 2030* with the aim of “helping countries find answers to two far-reaching questions: what knowledge, skills, attitudes, and values will today’s learners need to thrive and shape their world, and how can education systems develop these competencies effectively?”. (OECD, 2018, p. 2). We, therefore, have examined whether Maria Montessori has formulated answers to these questions in her writings. However, the aim of the study is limited to *understanding how Montessori education, according to Maria Montessori, will enable 6–12-year olds to meet future challenges, implying to care for and contribute to the wellbeing of society and the planet as a whole*.

The study is based on qualitative content analysis, and a didactic perspective is implemented by interpreting Montessori’s descriptions and integrating the practical application described in the Montessori training courses we attended. The data interpreted consists of the three books; *To Educate the Human Potential*, *The Child, Society and the World*, and *From Childhood to Adolescence*. All three deal partly or exclusively with children in primary and middle school. In addition, two chapters from the book *What You Should Know About Your Child* have been included. Although this book deals with the preschool age, some aspects of its didactic application are also essential for later school ages.

Montessori consistently addresses education issues for sustainable development and global citizenship in these texts, often in relatively straightforward terms. Overwhelmingly, she has a theme directed toward the adult that humanity must form “a universally harmonious society” (1989a, p. 110) to meet and manage the world’s challenges. If this concept of universality is to be truly realized, it must be achieved, according to Montessori, “through a ‘direct preparation’ of the new generation, that is, through education” (1989a, p. 110). She stresses the need to cultivate a “universal consciousness”, which means a way of understanding the world with all its interrelationships, including humanity. Humans need to become aware of their part of this unity, which implies a specific responsibility. However, she claims that this understanding has not been brought to life by schools. Instead, it has “been realized more in terms of a threat of destruction” (Montessori, 1989a, p. 109). Unity implies that each individual is part of global citizenship, as we all have a relationship with the world. Therefore, teachers have a mission as agents of change as this approach and understanding are cultivated during children’s upbringing. Owing to the child’s specific developmental

characteristics and needs, Montessori argues that the age between six and twelve are susceptible to this understanding. The child has developed abstract thinking and has an imagination that enables them to travel “through time and space” (1994).

However, Montessori accentuates the importance of nourishing children’s imagination to support these characteristics. The teacher has a responsibility to acquire a deep knowledge of the subject that can go beyond the requirements of the curriculum to engage children’s imaginations. The latter is crucial for creating the conditions for emotional bonds to the content treated. Montessori (1989b) stresses that teachers must have children’s ability to imagine and visualize and therefore portrays historical events characterized as imaginative stories. She underlines that such an approach is essential for them to engage emotionally and intellectually with the content.

Moreover, Montessori’s emphasis on using children’s imaginative capacities demonstrates a desire to fully engage children in dialogues about how different ways of life are related to sustainability issues. In such dialogues, children develop an awareness of the importance of work that benefits others, and they will experience the value of the work of different actors. However, the value of different actors’ work is not always only based on factual knowledge but also on personal interests, which sometimes can conflict with each other. Montessori’s view on how teaching is supposed to be conducted will therefore create conditions for children to experience the importance of negotiating to reach solutions that can be considered reasonable and morally acceptable. Therefore, we interpret Montessori’s intention that teaching must involve activities where the teacher and the children critically examine the ideas and interests behind them, rather than promoting a specific view on such issues.

When Montessori (1989b) points out that children between the ages of 6 and 12 begin to reflect on metaphysical questions such as “What am I and what is the task of mankind?” she implies that these questions should be addressed at two levels: a human species level and an individual level. She reinforces the need for a global perspective in each individual’s lifelong search for answers to these questions. However, according to Montessori (1989b), such a search must be grounded in an awareness that the human condition results from the Earth’s 4.5 billion years of evolution. Therefore, it is not sufficient for history teaching to only study human history. The subject of history, traditionally seen as social science, thus becomes natural science as well. According to Montessori (1989b), it is necessary to understand the interrelationship between these disciplinary fields and understand that the world is not divided into subjects; instead, the intention is to get an idea of the world as a holistic whole. Therefore, the subject of history is

introduced with the creation of the universe, which must be presented in a specific way. Montessori (1989b) describes it in the following words: “To interest the children in the universe, we must not begin by giving them elementary facts about it, to make them merely understand its mechanism, but start with far loftier notions of a philosophical nature, put in an acceptable manner, suited to the child’s psychology” (p. 19). By the words “of a philosophical nature,” it is clear that it is not primarily a matter of learning facts about the universe’s history. What is crucial in this way of thinking is not to separate the history of man from the history of the universe and the Earth but rather to see them as united.

The history curriculum continues with the evolution of the Earth, followed by the study of life, including early humans to *Homo sapiens*, and the study of civilizations. This chronological example of history enables the child to orient in time and space. Children’s perspective on historical time is a critical aspect of Montessori education and at the forefront of Montessori’s didactic application (Ahlquist & Gustafsson, Gynther, 2018). In order to comprehend thousands and even millions of years, an understanding of high numbers is required. In fact, the subject of mathematics already deals with high numbers in preschool, where children can perform counting operations with thousands using concrete materials. Montessori explains, “*Perhaps the child is likely to be most impressed by size, and the tremendous extent and magnitude of life on the globe may easily be introduced, because he already has in his possession the power of numbers*” (Montessori, 1989b, p. 20). This highlights how Montessori breaks with the way the task of schooling has traditionally been treated and how subjects have traditionally been presented and illustrates Montessori’s idea of meaning-making aspects of teaching.

By placing the history of humanity in relation to the history of the universe, the creation of the Earth, and the evolution of life, Montessori goes beyond humanity’s narrow and provincial boundaries. Therefore, Montessori’s history curriculum must be seen as an expression of her desire to cultivate global citizenship. However, the content of Montessori education is not primarily about wars and rulers but about the everyday lives of people and the legacy of each civilization’s achievements. Montessori (1989b) stresses the importance of allowing children to study and visualize history in order to “help the child to realize the part that humanity has played and still has to play because such realization leads to an uplift of soul and conscience” (Montessori, 1989b, p. 55). Obviously, the aim is not primarily to have the child memorize facts about different civilizations or historical epochs. Instead, the primary purpose emerges when we consider Montessori’s quest to cultivate a universal consciousness in children: to visualize that human needs are identical, no matter where or when people have lived.

If we refer back to OECD's two far-reaching questions, Montessori highlights crucial knowledge that needs to be acquired by the child. However, this knowledge is meaningless if it cannot be used appropriately. Therefore, skills, meaning the ability to use knowledge appropriately and effectively, play a central role in Montessori's view on teaching. According to Montessori, schools must involve the whole person in learning, including a "spiritual" and philosophical dimension. If these objectives are considered, they can positively guide human behaviour. As we interpret Montessori, the goal is that education should result in values that enable people to take a stand on ethical and moral issues. Therefore, teaching must approach what Öhman describes as a pluralistic tradition characterized by "a striving to promote different perspectives, opinions and values when dealing with various issues and problems concerning the future of our world" (Öhman, 2008, p. 20). In addition, Montessori emphasizes the importance of letting children experience reality and not just read about facts. She states that "[t]here is no description, no image in any book that is capable of replacing the sight of real trees, and all the life to be found around them, in a real forest. Something emanates from those trees which speaks to the soul, something no book, no museum is capable of giving" (Montessori, 1994, p. 19). Our reading and interpretation of Montessori's writings show essential prerequisites in Montessori education to develop a sustainable society and global citizenship and encompass all subjects and activities from preschool onwards.

When helping is compromising: A perspective on learning how to learn across development

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What is the goal of every living species? To be autonomous! Autonomy is the best insurance for the durability of any living species. Thus, the genetic program encodes the information necessary to learn self-management skills across the development (Posner & Rothbart, 2007). As this program unfolds, interactions with the environment, called life experiences, are crucial and shape 'mental habits'. As adults, our reactions are mainly the results of our childhood history. It is time that new 'habits of mind' emerge, given all the challenges we face at the societal, environmental, health, and professional levels. New mindsets are crucially needed to address them.

Mindsets and habits of mind are shaped across development. As everything cannot be learned at once, biological logic allows the child to successfully develop their self-monitoring (self-management) skills thanks to gene expression. First, the child acquires skills to evolve and function in their physical environment: self-control of body and senses (i.e., sensorimotor skills) (Posner, Rothbart, Sheese, & Tang, 2007). The child confronts

limits and physical constraints and adjusts to them: hitting a wall hurts, so the child modifies their strength, speed, and movement accordingly. Children sharpen and refine their senses and lose at the same time their ability to hear all speech sounds, in favor of their mother tongue (Leroy et al., 2011; Pinel et al., 2015; Werker & Hensch, 2015). Thus, while reducing possibilities, there is a gain in efficiency of signal processing (i.e., information from the 'outside world'). This is the slow and natural selection process of specialization: the child adapts to what is needed to live. Thus we speak about the 'cognitive cascade' (Denervaud, Gentaz, Matusz, & Murray, 2020; Rose, Feldman, Jankowski, & Van Rossem, 2008). The first skills greatly influence the acquisition of the following ones. If young children do not 'calibrate' themselves correctly, they will function with an 'erroneous' or 'limited' toolbox for the rest of their learning skills. We could take the image of a box of crayons. If a young child acquires many pencils and learns to sharpen them when needed, they will be able to create a precise drawing later on. On the other hand, a child whose palette is reduced to primary colours without sharpener will have a limited vision and possibility of creation with basic tools. Without over-stimulating the young child, the first years are crucial in developing their sensory and motor toolbox.

From the age of 6, the child will progressively develop their ability to learn 'how to think': the management and control of their errors to achieve success. It is the emergence of reasoning; through errors and trials, their own and those of others. Errors are unexpected events that naturally trigger a reaction of slowing down (Danielmeier & Ullsperger, 2011; Ullsperger, Danielmeier, & Jocham, 2014; Ullsperger, Fischer, Nigbur, & Endrass, 2014). We stop to integrate information and adjust. It is even more true in elementary children, as the brain is highly plastic for that skill (Denervaud et al., preprint). Plasticity means that after any event that was not planned, the child will 'print' following feedback as means to adapt at the neural level. What the child experiences daily, such as at school, will create connections that will be reinforced during repeated experiences to finally result in what we call the automatic or spontaneous reactions of adults.

Using neuroscientific and behavioural approaches, we compared students from Montessori schools (i.e., child-centered with self-directed curricula where children are mixed with peers of different age ranges) with students from so-called traditional schools (i.e., teacher-centered with the delivery of instruction where children are regrouped with peers of a similar age range). Based on different schooling experiences, how do children shape their reactions to mistakes? How do they adjust to errors? How do they perceive their social environment? How does this influence their creative and independent thinking?

We show that Montessori students, compared to students from traditional schools, learn earlier to detect their mistakes while taking the time to self-correct. As a

result, the older they get, the less they are distressed and slowed down by getting things wrong. and self-correct spontaneously (Denervaud, Knebel, Immordino-Yang, & Hagmann, 2020). Also, after an unexpected event such as a mistake or an improbable success, our brain becomes very permeable to information to be 'learned'; it creates new connections to adapt. In this phase, the quality of the feedback is crucial. If at this time, an external value judgment or an extrinsic reward is given, the brain associates the resolution of the problem with external help. This is what I would call 'the third hand'. Indeed, let us take the example of a young child who is learning to walk. Toddlers must adjust their center of gravity together with their center of mass to achieve balance. Indeed, walking is a perpetual imbalance, we must constantly readjust balance. Children will therefore use their senses to integrate feedback from these successive imbalances and adjust their body for bearings. Falling is part of the process, and so are the first successes. In these crucial moments, if the caring adult, because of impatience or willingness to help, reaches out or holds the young child's hand when making some steps, the young child integrates this extrinsic cue as a necessity for success. The child makes biased connections: external help is needed to achieve balance! If repeated too often, this experience may limit the autonomy of movements, as their brain has integrated outside help as necessary. What to do when this 'third hand' is not there? Maybe stop, or maybe wait for other help... These may be the less adventurous or agile children later in exploring the physical world on their own. The same is true for thinking; any outside help or judgment will then be integrated as a 'pillar' necessary to succeed; the child will no longer be in their autonomy and ability to succeed but dependent on this 'third hand' (e.g., a reward, appraisal, compliment, punishment) to make most mental moves.

Congruently, we observe that for Montessori students doing wrong or right is neither 'bad' nor 'good'; there is no connotation of value (i.e., judgment) about their actions. They stick to the facts (e.g., 'it is still not correct, I need to try more'). Conversely, students in traditional schools strongly associate the action of doing right with a positive value judgment (e.g., 'it is good that I do correct') (Denervaud, Hess, Sander, & Pourtois, 2021). While we may think this is an excellent bias to have, the child will have at heart to do correct, there is a counter effect. Indeed, adults have the opposite reaction; doing wrong is experienced as something very negative (i.e., the symmetry effect) (Aarts, De Houwer, & Pourtois, 2012, 2013). Consequently, we try to avoid mistakes and aim, for the most part, at the 'correct' answers only. This behaviour prevents creative, explorative, and cooperative behaviours. Logically, we observe that where Montessori students create neural connections to solve problems, traditional school students wire their brains to memorize the correct answers (Denervaud, Fornari, et al., 2020).

In the short term, the behavioural differences may be minimal, but traditional school students may limit themselves in the long term. Indeed, aiming for the right answer is aiming for a fixed goal, not a process and the pleasure of the journey to an adjusted goal.

The social context also influences our relation to errors. As long as the context is one of collaboration and cooperation, we learn as much from our mistakes as from others. However, if the context is competitive, this learning is greatly diminished because we no longer share a common goal. Montessori students evolve in a peer-to-peer learning environment, within multi-age classrooms where social comparison is minimal and without grades (i.e., adult-based value judgments like grades, praises, or rewards), which is not the case in traditional Swiss environments. In assessing their emotional recognition skills, we observed that students in traditional schools perceived their social environment as a threat.

In conclusion, we observed that while the brain grows the faculty of learning how to learn, the children will modulate their skill according to their daily training with the errors and successes at school: the brain 'shapes' in response to experience. If it is focused on memorizing the correct answers, avoiding mistakes as much as possible, making quantitative judgments, and competing, then neural connections and behaviours will reflect that. Knowing that, as adults, we are the result of our history and, for the most part, afraid of getting it wrong and feeling threatened by others if we fail, it seems urgent to re-think elementary pedagogy. Indeed, these consequences have a broader impact on our ability to adapt. If we are afraid of making mistakes, we are afraid to think outside the box! This fear affects our flexibility and creative thinking abilities. Montessori students' creativity grows stronger as they age and will even be the key to their academic success. They will not do well in school because they perform better, but because they understand, think and adapt (Denervaud, Knebel, Hagmann, & Gentaz, 2019). It will also influence their critical thinking abilities: they are less subject to group-thinking, doing for doing's sake, or acting because the adult said so (Décaillet, Frick, Lince, Gruber, & Denervaud, submitted).

The Montessori environment allows children to embody knowledge and become masters of their thinking, to be autonomous and open to the thinking of others who are not perceived as a threat but as co-actors. In the current context and given the social problems we face, it is interesting to ask whether a fundamental root of the problem does not come from the students' school experiences. At present, social experiences are quite abnormal in that they do not reflect real life: children are isolated by age, forced to do the same, activity and given work at the same time in a restricted time window. While their brains should be dealing with diversity, we skew reality to a standardized experience. Instead of gaining

flexibility (Denervaud, Christensen, Kenett, & Beaty, 2021), the brain becomes rigid regarding unpredictable events and social experiences. Because of the significant challenges of the century, it seems urgent to consider this new knowledge to adjust educational practices so that a greater number of children develop a healthy relationship with error and with others, to let their autonomy and capacity to think and act for their future.

The impact of Montessori education on the cognitive, social and academic development of disadvantaged preschoolers

Philippine Courtier, Ph.D., Université Paris Descartes

In my lecture, I presented a pre-registered and published study (Courtier et al., 2021) in which we compared the language, math, executive, social skills and well-being of disadvantaged preschoolers. Participants were randomly assigned to either conventional or Montessori classrooms in a French public school, with the latter being adapted to French public education. To help understand how the curriculum evaluated here differed from what could be considered a high-fidelity Montessori curriculum (Lillard, 2012) we developed an openly available scale. measuring the fidelity of implementation of the Montessori curriculum in the public preschool. These adaptations included fewer materials, shorter work periods, and relatively limited Montessori teacher training.

The study consisted of two experiments, and data were collected over 4 years. In the cross-sectional experiment, we compared the effect of the curriculum on the performance of three groups of kindergarteners, i.e. the Montessori-public group, the conventional-public group and a Montessori-private group from an accredited Montessori school ($N = 176$; $M_{\text{age}} = 5-6$).¹ In the longitudinal experiment, we followed and compared the progress of the children within the public school over the three years of preschool ($N = 70$; $M_{\text{age}} = 3-6$). Both analyses showed no difference between the adapted Montessori curriculum and the conventional curriculum on math, executive functions and social skills. However, disadvantaged kindergarteners from Montessori classrooms outperformed their peers from conventional classes and had comparable performance to that of the advantaged children from the accredited Montessori preschool in reading. Also, children following the adapted Montessori curriculum were aware of their reading competence and reported feeling as competent as children from the Montessori private preschool. Thus, literacy appears to be one domain where Montessori preschool education may have the potential to reduce early socio-economic inequalities.

Because Montessori's approach to learning is quite different from conventional pedagogy, it is possible that general characteristics have made it easier for students in these classes to access reading. However, it is difficult

to explain why they would not also influence other areas of learning (e.g., mathematics learning). The advantage of the Montessori approach to reading is then most likely explained by its specific method and materials for literacy acquisition. Furthermore, the lack of difference in other learning areas indicates that this advantage does not reflect an over-investment in reading at the expense of other skills. Three hypotheses can be formulated. First, from the age of three, children systematically learn the correspondences between phonemes and graphemes (e.g., with the sandpaper letters). This method, called synthetic phonics, has been shown to be particularly effective for learning to read (Castles et al., 2018). Second, the Montessori curriculum allows children to generate words by themselves (e.g., with the movable alphabet materials), which also emphasizes learning the sounds of words and may promote their memorization (Bertsch et al., 2007). Third, the Montessori materials address learning through touch and manipulation. Combining the haptic modality with visual and auditory modalities has been shown to promote reading learning (Bara et al., 2004, 2007). Our results may thus generalize previous methodologically less rigorous studies that showed a similar early reading advantage in preschoolers from variable socio-economic backgrounds in the United States (e.g., Lillard, 2012; Lillard & Else-Quest, 2006).

NOTE

¹ N Number of participants, M age group.

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