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## **Playing in Preschool Mathematics Education during SARS-CoV-2 pandemic: a phenomenological study with Italian teachers**

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*This paper discusses the results coming from a phenomenological study implemented with a sample of 110 Italian preschool teachers about the impact of the Covid-19 on preschool education. We investigate in which way the related pandemic phenomenon changed and is still changing the preschool pedagogical/didactic scenario about Mathematics playing. Through a questionnaire we qualitatively analyze and classify teachers' argumentations highlighting their teaching approaches, their attitudes, their expectations in playing Mathematics in Preschool Education.*

*Keywords: Covid-19, phenomenological study, preschool mathematics education, math play*

### **Introduction**

The difficult times that many people around the world are living are unfortunately not new; if we study the history of societies, we can find several pandemic events such as smallpox, cholera, plague, and SARS (Yıldırım, 2021). In recent years, there have been six major epidemics, such as H5N1, H1N1, and Ebola (Gostin & Friedman, 2015). Each one of these pandemics events affected human life in many aspects from health to the economic sphere (Davies, 2013). Education is one of these aspects. The SARS-CoV-2 pandemic (Covid-19) has had a massive impact on Education: many students of different countries have been affected by school and university closures due to the Covid-19. Italy was the first Western country to suffer a coronavirus emergency. On March 4, 2020, the Italian prime minister announced an unprecedented measure in Italian history: a strict lockdown and the immediate closure of all schools and universities to contain the spread of the virus. This phenomenon then extends to other countries as well all over the world. In Italy, schools safe reopening was scheduled on 14 September 2020. In response to school closures, UNESCO recommended the use of distance learning programs and opened educational applications and platforms that schools and teachers can use to reach learners remotely and limit the disruption of Education. These proposed “solutions” had involved all levels of school, except, in many cases, PE, as underlined by several teachers and researchers in Mathematics Education (e.g. Stoiljković, 2020). Indeed, in fact, many of these educational applications and platforms were very nice and well done for primary and secondary school students (Chan et al., 2021) but not for Preschool Education (PE). PE represents the first context of public life for children. It is a space of multiple relationships, to be lived and explored, to know and share with others, in which rules and practices, different from domestic ones, are applied. A particular context in which students must learn to orient and move themselves. In this space children meet other children, sharing their experiences and giving meaning to them. PE is for little students an important experience to attend, useful to feel themselves part of a community.

## Theoretical Background

The Italian standards for the first and second cycle (grades 1 to 8, 9 to 13) of Education<sup>1</sup> discusses these aspects quoting the EU document “Proposal for a Recommendation of the European Parliament and of the Council on key competences for lifelong learning”:<sup>2</sup>

“Mathematical competence is the ability to develop and apply mathematical thinking in order to solve a range of problems in everyday situations. ... Mathematical competence involves, to different degrees, the ability and willingness to use mathematical modes of thought (logical and spatial thinking) and presentation (formulas, models, constructs, graphs, charts).” (p. 15)

To acquire skills in PE means:

“Playing, moving, manipulating, browsing, asking, learning to reflect on experience through exploration, observation and comparison of properties, quantities, characteristics, facts; it means listening to and understanding narratives and speeches, recounting and recalling actions and experiences and translating them into personal and shared traces; being able to describe, represent and imagine, "repeat", with simulations and role plays, situations and events with different languages.” (p. 21)

According to Krause et al. (2021, p. 90) the Covid-19 has shown different everyday situations and different related emerging problems; new pedagogical and didactic perspectives about competencies are needed. In all schools and particularly in PE, several children's educational paths have been abruptly interrupted, depriving children (partially or totally as happened in Italy during the first lockdown) of fundamental experiences, of relationships, of social contacts, of opportunities for learning, for playing, for growing (Chan et al., 2021). Nowadays, two years after the first evidence of the Covid-19 in Italy, researchers, experts in Education and in Mathematics Education and teachers are trying to face the challenge of re-building “new ways” of bonding, “new ways” to define relationships essential for the balanced growth of children. “New ways” of teaching/learning in PE<sup>3</sup>.

Looking at PE’s needs, they are focusing on recovering/recalling the importance of using play, favoring socialization and interactions between classmates and with teachers and promoting the development of divergent thinking, scientific thinking, essential for solving problems, including mathematical ones. Several studies tried to understand the connections between play and learning, in particular the kind of knowledge and what is produced through play in childhood cognitive growth. Play is characterized by generating a fun environment in which to learn and, to develop emotional, relational, and affective aspects that support learning (XXXX, 2018, Bobbio & Bandioli, 2019; Bruner, 1964).

According to Pramling Samuelsson & Johansson (2006) discussing the dimensions of learning in play and the play in learning is very important. Moreover Bruner (1964) argues that the play represents a good opportunity to try new behavioral combinations that could not be experimented in functional activities. When children play, they tend to “discover and abstract laws and regularities from new situations” (Bruner, 1964 p. 49). The type of thinking of which the play is an expression

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<sup>1</sup> <https://www.indire.it>

<sup>2</sup> [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0604\(01\)&rid=7](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0604(01)&rid=7)

<sup>3</sup> [https://www.miur.gov.it/documents/20182/2432359/Sistema+zero\\_sei+orientamenti+pedagogici.pdf/3b0ea542-a8bf-3965-61f0-453e85ae87d5?version=1.0&t=1589880921017](https://www.miur.gov.it/documents/20182/2432359/Sistema+zero_sei+orientamenti+pedagogici.pdf/3b0ea542-a8bf-3965-61f0-453e85ae87d5?version=1.0&t=1589880921017)

is not the convergent one aimed at solving problems that admit a single correct solution, but the divergent one that seeks alternative perspectives and possible answers (Kim & Pierce, 2013).

Play promotes and supports divergence useful for decontextualization, decentralization, verbalization, narrative integration, social behavior. Finally, the play is useful to support divergent thinking in all those non-playful, expressive, and scientific activities for the aspects relating to "making hypotheses" and "proposing and solving problems" in which divergent thinking is a crucial aspect. (Bobbio & Bondioli, 2019). As regarding mathematics education, the aspects that appear in most plays are the presence of mathematical relationships between objects of various types which translate into intuitive and highly motivated play rules and the characteristics of the systems of representation of numbers, shapes, and regularities.

In the new Covid-19 didactic scenario, playing at school is changing; play could be a bet in Education. In almost all Preschool contexts around the world it seems quite common to find didactic approaches play grounded but what happened/is happening in Covid-19 times? Something changed/is changing? In the last two years several publications tried to reply to these questions as these ones. Some researchers investigated teaching practice and their own response to the crisis (e.g., Krause et al., 2021; Maciejewski, 2021), some of them particularly referred to playing (e.g., Boland & Mortlock, 2020). Almost all of these research were related to Primary and Secondary Education, very few of them look at PE and its specification in Mathematics Education (Massachusetts Office of the Child Advocate 2020; Pramling Samuelsson et al. 2020). Hence in our opinion, it is necessary to investigate these themes related to PE.

In this research field, our main research question is, "*What do Preschool teachers think about the impact of the Covid-19 on PE?*" This study also seeks answers to three sub questions to determine the effects of the Covid-19 on PE in line with the teachers' observations. The three sub questions are as follows:

*What kind of effects do you think the Covid-19 had, and still has today, on teaching/learning Mathematics, in PE?*

*In which way (if it happened/it's happening) is the Covid-19 changing the preschool pedagogical/didactic scenario about Mathematics playing?*

*Looking at the new classroom relationship between early children and teachers, how did you define/are defining meaningful activities foregrounding play and children's perspectives?*

We think that our study is new, and we believe that it could be a possible way for further research about PE, but not only.

## **Methodology**

### **Design**

A qualitative research design was used to determine by an open-ended questionnaire the repercussions of the Covid-19 on PE. The aim of the discussed phenomenological research is to describe how preschool teachers express and make sense of their shared experiences with the complex phenomenon/scenario that they are living during Covid-19 times. In this context we

focused on teachers' feedbacks about their experiences of meaningful activities, compatible with Covid-19 restrictions, foregrounding play.

### **Participants and Questionnaire**

The research was carried out during the 2020-21 academic year, and it involved 110 voluntary Italian preschool teachers from several different school institutions in different Italian regions. The preschool teachers - mainly females (88,9%) - had 3–35 years of work experience in Mathematics at PE; almost all of them have a bachelor's degree. All participants were ensured anonymity.

The questionnaire is made up of six-items aimed to focus on the aspects that preschool teachers consider most important in describing their teaching approaches, their attitudes, their expectations in teaching Mathematics in PE during the period of Covid-19. It is a part of a more complex questionnaire, which has already been used in previous research (Yıldırım, 2021). We have chosen to analyze a questionnaire with a low number of questions, and consequently a relatively low number of answers, since we are also interested in the study of the relationship between qualitative and quantitative analysis, not discussed in this paper.

The six items are the following:

- 1. Please describe the educational context you have experienced in the last two years with your children in PE, due to Covid-19. (For example, please explain whether the children were always present; if there were moments of distant teaching; how did you manage any students' quarantines; if you worked by dividing the class into small subgroups or not, if and how you have referred to peer play ...).*
- 2. Referring, specifically, to teaching/learning Mathematics, what effects do you think Covid-19 had, and still has today, on the PE?*
- 3. Trying to make a comparison before/during the Covid-19 emergency, please indicate at least 3 keywords defining any change in your pedagogical/didactic approaches with your children in Mathematics.*
- 4. What resources, strategies, methodologies and approaches for teaching Mathematics did you use during the last two years of Covid-19, to provide sustainable PE in Covid-19 times?*
- 5. In your opinion, what kind of new paradigms will have playing in mathematical learning, during and after Covid-19 times?*
- 6. In your opinion, what are the challenges that PE had and still have to face, due to Covid-19?*

### **Results: The synoptic table on the phenomenological study with Italian teachers**

In this section, to have a clear and complete vision of the obtained results, we structured a synoptic table in which we synthesize the themes, the related argumentations (with the related occurrence) pointed out by teachers and the associated categories (positive or negative) expressed by themselves. In our opinion, this table and the related following qualitative analysis referred to some direct teachers' quotations, is useful to reply to our main research question.

In this paper we particularly refer to the data collected on the theme of playing in PE. We hope that readers could easily have a coherent view of our findings and our interpretation of these, to reply to the last two sub questions, referred to playing in PE.

The synoptic table on the phenomenological study with Italian teachers

Theme	Category	Argumentation
<b>Effects of Covid-19 on mathematics PE</b>	Negative	Teaching difficulties (n.20)
		Preschool teacher-student interaction difficulties (n.13)
		Complex emotional and social development (n.71)
		Lack in students' preparation for primary school (n.20)
		Too much responsibility to define setting, spaces, activities compatible with Covid-19 reconstruction (n. 45)
	Positive	Recovery of family ties and consequent strengthening of emotional stability for younger children (n.30)
		Development of activities with recycled materials and participation in household activities that cannot be carried out at school (n.25)
<b>Teaching experiences during Covid-19 on PE</b>	Negative	Complex and useful distance education experience (n.12)
		Difficulties to favor students' interaction (n.80)
		Complex relationship with parents (n.56)
		Difficulties to manage students' Covid-19 quarantines (n.30)
		Difficulties to manage didactic activities in small and large groups (n.40)
		Difficulties to define play activities due to Covid-19 restriction. No interaction, no safe space, no common toys ... (n.80)
	Positive	Different use of technology in distance teaching (n. 63)
		Home experiences (making cookies, tidying up the room, setting the table...) from which to recover didactic and disciplinary value (n. 45)
<b>Sustainable PE in Mathematics</b>	Negative	Difficulties to set coherent methodologies in line with Covid-19 students interaction restrictions. (n. 30)
		Difficulties to select and use technologies useful for PE students (n.25)
		Mathematics activities and plays not very well didactically organized and

		not always significant. (n.40)
		Mathematics activities not very well implemented (as in the past) due to Covid-19 reasons (n.59)
		Difficulties to favor students' interaction (n. 35)
	Positive	Use of new digital resources and methodologies. (n. 90)
		More useful parents' interaction at home (n. 75)
		More Math activities implemented by outdoor education. (n. 42)
<b>Math playing during Covid-19</b>	Negative	Difficulty to avoid contact plays and to favor students interaction in playing (n.75)
		Difficulty to remodel manipulation plays due to Covid-19 restriction (n.65)
		Consolidated plays activities not always useful in Covid-19 times (n.68)
		Playing has changed in pandemic times: players, rules, aims, is different from the past (n.78)
		Difficulties to select and use digital resources for playing in PE (n.54)
		Teachers need to rethink to playing in PE (n.62)
		Rethink to "new" meaningful play activities in Math Education (n. 50)
	Positive	Reconsider plays to be played outdoors adapting play rules (n. 70)
<b>Challenges of PE during Covid-19</b>	Positive	Activate innovative methodological approaches that are compatible with the pandemic situation in progress, without lack of learning (n. 35)
		Requalification of spaces, synergic use of different artifacts (n. 60)
		Training courses adapted to new needs (n. 77)
		Safeguarding the value of sociality and relationships (n. 80)

According to preschool teachers, the Covid-19 had different impact layers related, for example, to the teaching/learning process, emotional and cognitive development, teacher/student and student/student interaction, available resources, preparation for primary school etc. However, as they discussed in the questionnaire, Covid-19 improved some aspects such as relationship between children and parents, and consequently the emotional stability in the family context. In several cases the qualitative analysis of the argumentations produced by our teachers, evidenced a strong compromission of children's cognitive and affective developed skills during Covid-19. The

following appears examples of teachers' argumentation useful to reply to the first research sub questions:

Roberta: "Everything has been very difficult and still is".

Laura: "PE is and must remain an environment of play, of informal, free, sharing learning ... the pandemic has taken away much of this".

Anna: "I believe that in many cases it was two years of improvisation, we tried to do our best to encourage play, activities between peers both in synchrony and at a distance, without achieving the expected goals".

As regards the second and third research sub questions, related to how Covid-19 changed/ is changing preschool pedagogical/didactic scenarios about new possible Mathematics meaningful activities foregrounding play and children's perspective, we want to highlight some argumentation examples, produced in the questionnaire by preschool teachers' recommendations:

Angela: "Today, more than before, I believe that the sociability, relationship, exchange, free play, which govern all the activities of the PE, need to be better rethought in the light of the new pedagogical and didactic scenarios that Covid-19 asks us to define in the classroom."

Carlo: "The mathematical plays that we have always proposed are not replicable at this time. Those we have kept have undergone a change of rules, of interaction, of exchange between peers ... It was not easy to do all this. The playing spaces have always remained the same in many cases and this has not helped us much. ... Especially in the scientific-mathematical field, we should better rethink which plays (which comply with the Covid-19 rules) to propose to encourage meaningful learning, useful for children in laying the foundations for future learning."

Arianna: "I add that we teachers in this historical moment need help (perhaps more than before), we need comparisons to improve ourselves and to protect children in their social and cognitive growth. Especially in the scientific-mathematical field, research should propose and encourage the dissemination of new playful-didactic solutions that can be implemented today in the classroom with anti-Covid regulations. The play we implement in the section has changed, the principles have changed, the roles, the rules, the aims have changed (the mathematical ones are the same but not the relational ones, for example). Often our efforts do not give us guarantees of goodness (I hope you understand me)!".

## **Discussion**

In the recent Covid-19, Chan et al. (2021) showed that new practices due to during Covid pandemic had an impact on teachers' beliefs. On the other hand, as discussed above, teachers' practice is strongly influenced by their beliefs (Ball, 1988). Taken together, we can conclude that practice and beliefs are mutually influenced by each other. Covid-19 has also adversely affected students cognitive and affective skills (Albano et al. in Chan et al., 2021).



All Italian involved teachers confirm these feeling, specifically regarding the important role of playing in PE. Preschool teachers in the implemented questionnaire evidenced related numerous pedagogical/didactic difficulties and, in some cases, possible different suggestions to solve them. We urge that teachers, researchers in Mathematics education and other different authorities consider these problems (Maciejewski, 2021) and solutions to rethinking the learning spaces in PE and to better “understand” new possible scenarios of playing in the same grade. We believe that this study can be useful to do it.

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