education sciences

MDPI

Article

Students' Mathematics Anxiety at Distance and In-Person Learning Conditions during COVID-19 Pandemic: Are There Any Differences? An Exploratory Study

Concetta Pirrone [1], Donatella Di Corrado [2,*], Alessandra Privitera [3], Sabrina Castellano [1] and Simone Varrasi [1]

1 Department of Education Sciences, University of Catania, 95131 Catania, Italy; concetta.pirrone@unict.it (C.P.); sabrina.castellano@unict.it (S.C.); simone.varrasi@unict.it (S.V.)
2 Department of Sport Sciences, Kore University, 94100 Enna, Italy
3 Independent Researcher, 95131 Catania, Italy; alessandraprivitera0@gmail.com
* Correspondence: donatella.dicorrado@unikore.it

Abstract: The COVID-19 pandemic has caused unprecedented changes in the educational system, requiring students to continually switch between distance and in-person learning conditions. Recent studies have revealed that students experienced severe levels of anxiety in the COVID-19 period. Considering the close relationship that has always linked anxiety to mathematics, the present study explores the differences in the anxiety levels of students towards mathematics during distance or in-person school learning. During the second wave of COVID-19, 405 students, recruited from twelve middle schools of Catania province (Italy), completed an online version of the MeMa questionnaire, answering each item twice and imagining themselves to be, respectively, in distance and in-person learning conditions. The items explored generalized school anxiety, learning and evaluation mathematics anxiety, mental states, and the metacognitive awareness associated with mathematical tasks. The results showed a minor state of anxiety experienced during distance learning. However, the students who preferred to learn mathematics in person revealed less mathematics anxiety and better mental states and metacognitive awareness; the same results were found in those who reported higher math marks and who preferred scientific subjects. It seems that math anxiety is not one of the various flaws that are imputed to distance learning. Our findings encourage a reflection on possible interventions to reduce students' anxiety by working on motivation and dysfunctional beliefs.

Keywords: mathematics anxiety; distance learning; in-person learning; metacognition; COVID-19 pandemic

check for updates

Citation: Pirrone, C.; Di Corrado, D.; Privitera, A.; Castellano, S.; Varrasi, S. Students' Mathematics Anxiety at Distance and In-Person Learning Conditions during COVID-19 Pandemic: Are There Any Differences? An Exploratory Study. *Educ. Sci.* **2022**, *12*, 379. https://doi.org/10.3390/educsci12060379

Academic Editor: James Albright

Received: 7 March 2022
Accepted: 28 May 2022
Published: 31 May 2022

1. Introduction

For two years now, the COVID-19 infection has changed the way students experience school. Indeed, as is generally known, their habits have been upset by shifting many times from in-person learning (PL) to distance learning (DL) conditions to manage and reduce the risk of contagion. Focusing on the Italian context, since March 2020 pupils have been experiencing the advantages and drawbacks of e-learning platforms, whose global market had already surpassed 200 billion in 2019 and was expected to have a compound annual growth rate of over 8% between 2020–2026 [1]. Although it is clear that historical events related to the COVID-19 pandemic have determined a major development of this technological sector, the cognitive, emotional, and social implications of distance, blended, and in-person learning conditions still need to be fully explored.

Sabirova et al. [2], for instance, wondered how those changes influenced pupils' academic stress and school wellbeing, defined, respectively, as the whole spectrum of negative physical and emotional states associated with the educational process and as a multidimensional construct comprising emotional and cognitive components connected to the scholastic environment [3]. This important question needs to be framed within a general worsening of pupils' mental health: according to many authors, during the COVID-19 pandemic more than one-fifth of junior high and high school students experienced negative psychological effects, such as severe levels of anxiety, depression, and stress [4–6]. Moreover, as pointed out by Bignardi et al. [7], who cited a longitudinal study of 13–14-year-old pupils in the UK, anxiety and depression increased after the first COVID-19 wave and decreased slightly during the second one, but the pupils have not fully recovered yet. Lanius et al. [8], in a study that explored undergraduate students' experience with the emergency transition to remote learning and measured their math anxiety before and after the transition, revealed that "factors that directly impacted a student's learning experience with a high impact on changes in math anxiety include communication with the instructor as well as technology quality and access" (p. 168). Due to the transition to online education, which involved much more time spent on e-platforms, with a consequent loss of social interactions, lockdown-related mental health complaints were directly associated with distance learning [9]. Within this general framework, we focused on students' experience with mathematics anxiety (MA) in distance and in-person learning conditions.

1.1. Students' Mathematics Anxiety

Mathematical skills are an essential ability for life, and they allow better outcomes in studies and job careers [10]. However, when compared to other subjects, one of the most frequently reported emotions linked to mathematics is anxiety, which increases with age and hinders math skills, causing avoidance and low mastery of mathematical abilities [11]. MA is defined as the apprehension that one has about the capacity to do mathematics or 'an illogical feeling of panic, embarrassment, flurry, avoidance, failing and fear, which are physically visible, and which prevent solution, learning and success about mathematics' [12] (p. 312). It is linked to several factors: the influence of teachers, the influence of parents, the impact of the teaching method, the perception of math difficulty, the pressure of time limits on tests, the fear of public embarrassment, and the belief that math performances are a measure of intelligence [13]. It has been documented that MA produces its effects on physiological, cognitive, and emotional levels. Higher-math-anxious students reported increased heart rates [14], clammy hands, and when they face an upcoming mathematical task, they show neural activations similar to those found when individuals experience physical pain [15]. MA impairs the proper functioning of working memory, which is crucial as it is involved in more complex calculations such as multistep mathematical problems [16,17]. Students with MA describe feelings of nervousness, apprehension, and worry [18]. It is clear, therefore, that MA is not related to cognitive difficulties only, but also to affective factors and beliefs [19]. This calls for a specific attention towards the mental states associated with mathematics, encompassing the beliefs on personal mathematical skills and the motivation and attitudes towards the subject [20].

There is a negative relationship between MA and math performance [21,22]. Moreover, the literature shows higher levels of mathematics anxiety in females than in males [23,24] and in higher levels of education [25–27]. Moreover, metacognition seems to moderate math anxiety and predicts that performance will decrease as anxiety increases, except at high metacognition levels; furthermore, metacognition predicts confidence in accuracy: people with higher metacognition are more confident in their ability to answer problems correctly [28]. Therefore, in our opinion, metacognition is another crucial factor included in students' approach to mathematics.

Moreover, according to Lukowski et al. [29], MA should be approached as a multidimensional construct as it encompasses anxiety in performing mathematical calculations, anxiety about math in classroom situations, and anxiety about math tests. In other words, tension in both learning and doing mathematics and in being evaluated on mathematical skills are included.

Considering that which is mentioned above, our research interest focused on how, with regard to mathematics, anxiety, mental states—which are, as stated before, the beliefs about personal mathematical skills and the motivation and attitudes towards the subject—

and metacognitive awareness, which is understood as the personal knowledge on the mathematical learning process, vary in distance and in-person learning settings. The impact of the two conditions on metacognition, beliefs, and anxiety has not been explored yet, considering the exceptionality of the COVID-19 emergency, even if some empirical data regarding the differences between online and face-to-face schooling have been published recently [30]. In our opinion, this is a critical point that should be addressed by research, in order to improve the quality of learning and the efficacy of teaching methods.

1.2. The Present Study

We used a prospective approach to build up our research design. Thanks to the literature, we pointed out the significant increase in psychological distress in students during this long COVID-19 pandemic [31,32], and the different ways of schooling they have been experiencing for the first time in their scholastic history. As a consequence, we selected our general goal and the constructs relevant for the research: we intended to explore the differences in anxiety, mental states, and metacognitive awareness towards mathematics in both distance and in-person learning conditions among middle school students in Italy. With regard to our methodological approach, keeping in mind our main objective, we assumed PL and DL as independent variables and all the variables belonging to our online questionnaire (see below for further information) as our dependent variables. Considering the exceptionality of the situation, our main interrogatives were: as teaching conditions vary, DL or PL, did math anxiety and its correlates change? Did having high or low marks relate to the preference towards DL or PL? Our objective was threefold: (1) we wanted to understand whether students experience different levels of MA (distinguished by learning, evaluation, and general anxiety), mental states, and metacognitive awareness in distance vs. in-person learning conditions; (2) we wanted to verify the existence of differences between those who prefer the DL or PL of mathematics in terms of MA, mental states, metacognitive awareness, math marks, and favorite subject; and (3) we wanted to evaluate gender differences for all the variables considered in this study. The final goal, in conclusion, was to understand whether MA is related to learning conditions and whether other variables should be taken into account.

2. Materials and Methods

2.1. Participants

Even though N = 462 participants were enrolled in the online survey, N = 57 questionnaires were unfinished and consequently removed from the final dataset. A total of N = 405 Italian students, 222 females and 183 males, aged between 11 and 14 years (M = 12.56; SD = 0.64) took part in the study.

At the beginning of the study, we contacted about 25 middle schools in Catania and its province (Italy), but only 12 decided to participate in our research. In the Italian schooling system, middle schools last three years and are attended after the first level of education (i.e., primary school) from the ages of 11 to 14. Prior to the beginning of the study, ethical approval was granted from the first author's university ethics committee. The study obtained ethical permission from the Department of Educational Sciences Catania University Internal Ethics Review Board for psychological research (16 June 2020).

2.2. Procedure

After the selection of the psychometric tool to administer, the questions were transferred to the Google Form platform and sent to many school principals. Twelve of them accepted the invitation to participate in the research. The form, therefore, was sent to math teachers who, in turn, sent it via email or WhatsApp to the students. They completed it at home in the afternoon.

All the questions were mandatory, and their completion lasted about 10 min. The administration took place during the COVID-19 pandemic, and the pupils had already experienced at least 3/4 months of distance learning, divided into different times, depending on the trend of the infections and the closure of schools.

Each participant received a full description of the scope and the protocol of the study. The confidentiality of the responses was also assured. Before starting the protocol, a consent form was signed by their parents. Institutional approval was granted.

2.3. Materials

The first part of the questionnaire consisted of sociodemographic questions on age, gender, and class; moreover, the following four questions were administered in order to investigate the general relationship of each student with mathematics and the learning conditions:

(1) What is your favorite school subject?—Possible answers: Italian, Mathematics, History, Geography, English, French, Art, Music, Technology.
(2) What is your mark in math?—In the Italian school evaluation system, for all the taught subjects marks range between 0 (worst performance) and 10 (best performance), and they are obtained through written and oral tests. For more detail, we asked for the average mark in mathematics of the first four months of the school year.
(3) Do you prefer distance or in-person learning?
(4) Do you prefer distance or in-person math learning?

The second part of the questionnaire included three subscales of the MeMa test—student version [20]. The MeMa test is an adapted version of the Mathematics Anxiety Rating Scale (MARS) test [33]. The MeMa test is a psychometric tool built and validated by the Italian population that measures the emotional, motivational, and metacognitive factors influencing mathematical performance at school. The original version included 24 items [34] and showed good psychometric properties. The Cronbach alpha of 0.96 indicated high internal consistency, while the test–retest reliability was 0.90 ($p < 0.00$) [35]. For our research, we used three subscales to assess anxiety, mental states, and metacognition strategies in mathematics. For each of these scales, we calculated the Cronbach alphas in both the PL and the DL versions (see below), and they showed a robust internal coherence (i.e., reliability) of the measures.

The 'MeMa Mathematical Anxiety Scale' consists of 30 items. Students must indicate their emotional response to the described situations using a 4-point Likert scale, ranging from 1 (little fear/anxiety) to 4 (high fear/anxiety). High scores indicate high levels of MA. The MeMa allows the assessment of two different dimensions of mathematics anxiety and one control dimension: math learning anxiety (PL α: 0.925; DL α: 0.914), math evaluation anxiety (PL α: 0.906; DL α: 0.891), and generalized school anxiety (PL α: 0.750; DL α: 0.753). The items related to the dimension of math-learning anxiety concern situations and activities related to learning mathematics (e.g., 'Observing a teacher explaining an equation on the blackboard', 'Starting a new chapter in a math book', and 'Listening to a classmate who explains a math rule'). The items related to the dimension of math evaluation anxiety concern the contexts and situations in which the student is assessed in mathematics (e.g., 'Thinking about the math test you have to take tomorrow', 'Solving a square root or other complex mathematical operations', and 'Preparing to be tested in math'). The third control dimension is related to generalized school anxiety. The items, in this case, concern anxiety in other school subjects (e.g., 'Answering some questions about a text you have read', 'Being tested in history', and 'Reading a musical score').

The part called 'section A' of the MeMa test is devised to detect the most frequent math-related mental states (PL α: 0.788; DL α: 0.752), namely the beliefs about competences, emotional connotates, and motivational conditions associated with mathematical tasks. This section describes 15 situations that students may encounter while solving math problems, operations, and exercises (e.g., 'I feel more tired for math than for other subjects', 'When I fail my math exercise, I feel very bad and I give up', and 'When I solve a problem, I try to be sure about what the task requires'). Students must indicate for each item how often they experience the described situation (often, sometimes, or never). Higher scores indicate better mental states.

The part called 'section B' of the MeMa test concerns metacognitive awareness (PL α: 0.721; DL α: 0.714). It is composed of 9 items about the most common thoughts related to math (e.g., 'If I fail in math, I think that I am stupid', 'If you don't understand the definition, it is useless to memorize it', and 'Being good at math is something mysterious that does not depend on us'). Students are invited to choose whether the statement is false or true. Higher scores indicate better metacognition strategies.

The MeMa was re-arranged with the aim of investigating the differences between distance versus in-person learning. The participants had to answer each item twice, imagining themselves to be, respectively, in DL and PL. We report an example: "I feel more tired for math than for other subjects":

in DL: often, sometimes, or never

in PL: often, sometimes, or never

Thus, for each participant we obtained two separated scores for the three MeMa subscales: one referred to the distance learning experience, and the other one referred to the in-person learning experience.

2.4. Statistical Analyses

Analyses were carried out using the Statistical Package for the Social Sciences (SPSS) version 25.0 (Armonk, NY, USA: IBM Corp.). Paired and independent t tests and one-way ANOVA were performed to explore the differences in constructs between DL and PL. Pearson correlations were calculated to explore the relationships between variables. To simplify the analyses, school subjects were grouped in four clusters (Humanities: Italian, History, and Geography; Science: Mathematics and Technology; Languages: English and French; Art: Art and Music).

3. Results

Most of the participants prefer in-person learning (71.6%) rather than distance learning (28.4%). This pattern becomes more evident when the students choose between the PL and DL of mathematics. In fact, a higher percentage of participants (85.4%) prefer in-person math classes rather than distance math classes (14.6%).

3.1. Differences between DL and PL of Math on Anxiety, Mental States, and Metacognitive Awareness

To begin, we performed a paired t test to understand in which learning condition students experience more math anxiety, as well as better mental states and higher metacognitive awareness.

As shown in Table 1, the students participating in our study reveal a higher in-person math learning and evaluation anxiety, which is a major tension induced, respectively, by the teacher's explanations and by having to perform difficult tasks; they also show a higher generalized school anxiety in PL; that is, anxiety is extended to all other disciplines, not just math. Moreover, our sample refers to having a higher metacognitive awareness in mathematics, namely the beliefs that students have about mathematics skills, discipline, and learning, during DL.

There are no significant differences regarding mental states.

Table 1. Paired t test on MeMa subscales between DL and PL of math.

	M	SD	t	p	d
DL math learning anxiety	24.68	9.06	−6.03	0.001	−0.2
PL math learning anxiety	26.03	10.00			
DL math evaluation anxiety	18.94	6.60	−8.46	0.001	−0.4
PL math evaluation anxiety	20.47	6.87			
DL generalized school anxiety	11.19	3.80	−8.58	0.001	−0.4
PL generalized school anxiety	12.15	4.00			
DL mental states	34.89	4.91	−0.06	0.947	−0.0
PL mental states	34.90	5.24			
DL metacognitive awareness	10.88	2.65	2.97	0.003	0.1
PL metacognitive awareness	10.66	2.85			

M = mean; SD = standard deviation; DL = distance learning; PL = in-person learning.

3.2. Gender Differences on Anxiety, Considered Both in DL and PL

Considering these first results, and considering the novelty of this study, we wanted to verify whether there were gender differences. Females experience higher levels of math evaluation anxiety both in person (females M = 21.85, SD = 6.73; males M = 18.79, SD = 6.69; t =−4.55, p = 0.002, d = −0.4) and online (females M = 20.33, SD = 6.40; males M = 17.26, SD = 6.47; t = −4.77, p = 0.002, d = −0.4). Gender also affects generalized school anxiety with females reporting higher scores both in person (females M = 12.86, SD = 4.10; males M = 11.28, SD = 3.70; t = −4.00, p = 0.002, d = −0.4) and online (females M = 11.90, SD = 3.91; males M = 10.33, SD = 3.50; t = −4.21, p = 0.002, d = −0.4).

3.3. Differences between Students Who Prefer Math by Distance Learning or Math by In-Person Learning

The results obtained in Table 1 prompted us to investigate whether the preference for mathematics in PL affected the variables we investigated. As shown in Table 2, those who prefer to learn math in person obtained better scores on mental states, metacognitive awareness, and math learning anxiety, both when mathematics is learnt in person and when it is learnt by distance learning.

Table 2. Independent t test on MeMA subscales (both DL and PL) between those who prefer DL or PL of math.

	LM D. P.	Mean	SD	t	p	d
DL mental states	Math DL	33.29	5.73	−2.42	0.007	−0.3
	Math PL	35.16	4.71			
PL mental states	Math DL	31.42	5.73	−5.71	0.001	−0.8
	Math PL	35.49	4.92			
DL math learning anxiety	Math DL	28.41	12.59	3.45	0.001	0.4
	Math PL	24.05	8.17			
PL math learning anxiety	Math DL	32.00	13.71	5.11	0.001	0.7
	Math PL	25.01	8.85			
DL math evaluation anxiety	Math DL	18.69	7.44	−0.70	0.755	−0.0
	Math PL	18.99	6.45			
PL math evaluation anxiety	Math DL	21.05	7.84	0.48	0.481	0.1
	Math PL	20.37	6.70			
DL generalized school anxiety	Math DL	11.71	4.27	1.14	0.253	0.2
	Math PL	11.10	3.72			
PL generalized school anxiety	Math DL	12.90	4.43	1.56	0.118	0.2
	Math PL	12.02	3.91			
DL metacognitive awareness	Math DL	9.86	2.89	−3.22	0.001	−0.4
	Math PL	11.06	2.57			
PL metacognitive awareness	Math DL	9.59	3.16	−3.14	0.002	−0.4
	Math PL	10.84	2.76			

LM D. P.= learning math in person or at a distance; M= mean; SD= standard deviation; DL = distance learning; PL = in-person learning.

3.4. Students' Math Marks and MeMa Variables

There is a relationship between math marks and the expressed preference towards the DL and PL of mathematics, as well as between math marks and the MeMa results. Indeed, the participants who prefer the PL of math have better grades in math (M = 7.48, SD =

1.48) than the group that prefers DL (M = 6.54, SD = 1.43), with t = −4.53 and p = 0.001. Furthermore, Pearson correlations indicate a negative correlation between math marks and the three MeMa anxiety subscales, both in PL and DL (PL math learning anxiety r =−0.364; p = < 0.001; DL math learning anxiety r = −0.34; p = 0.001; PL math evaluation anxiety r = −0.23; p = < 0.001; DL math evaluation anxiety r = −0.23; p = < 0.001; PL generalized school anxiety r = −0.16; p = < 0.001; DL generalized school anxiety r = −0.14; p = < 0.001). Moreover, we observed a positive correlation between math marks and mental states and metacognitive awareness both in DL and PL (PL mental states r = 0.52; p = 0.001; DL mental states r = 0.49; p = 0.001; PL metacognitive awareness r = 0.34; p = 0.001; DL metacognitive awareness r = 0.37; p = 0.001).

3.5. Differences in Anxiety between Students Who Chose Their Favorite Subject

Considering those last results, we also chose to explore the differences in MeMa anxiety between students who expressed a preference for a certain subject (grouped into Humanities, Science, Languages, and Art subjects). Table 3 highlights that students who prefer scientific subjects present significantly lower levels of anxiety in all its three dimensions, both in the DL and the PL of math.

Table 3. One-way ANOVA between students' preferred subjects and MeMa anxiety.

		N	M	SD	F	p	η^2
DL math learning anxiety	Human S	118	26.36	9.36	7.75	0.001	0.05
	Scien S	116	21.52	7.08			
	Lang S	88	24.74	9.06			
	Art S	83	26.66	10.00			
PL math learning anxiety	Human S	118	28.74	10.80	11.91	0.001	0.08
	Scien S	116	21.74	6.90			
	Lang S	88	26.24	9.91			
	Art S	83	27.95	10.72			
DL math evaluation anxiety	Human S	118	20.30	6.21	7.42	0.001	0.05
	Scien S	116	16.60	6.05			
	Lang S	88	19.69	6.80			
	Art S	83	19.49	6.90			
PL math evaluation anxiety	Human S	118	22.20	6.64	10.86	0.001	0.07
	Scien S	116	17.60	6.25			
	Lang S	88	21.66	6.41			
	Art S	83	20.73	7.35			
DL generalized school anxiety	Human S	118	10.88	3.50	2.72	0.044	0.02
	Scien S	116	10.71	3.45			
	Lang S	88	11.32	3.91			
	Art S	83	12.16	4.41			
PL generalized school anxiety	Human S	118	11.97	3.82	2.64	0.049	0.01
	Scien S	116	11.54	3.55			
	Lang S	88	12.25	4.11			
	Art S	83	13.12	4.54			

S = humanities subjects; Scien S= science subjects; Lang S= languages subjects; Art S= art subjects.

4. Discussion

In the context of the COVID-19 pandemic, in which students experienced severe psychological distress, even due to the necessary but strict measures to avoid the spread of infection, we wanted to explore possible changes towards one of the most feared subjects: mathematics. First of all, our work intended to verify whether levels of math anxiety vary across learning conditions.

With our analyses, we saw a preference for PL and especially for the PL of mathematics, even though the students reported less math learning and math evaluation and generalized anxiety when classes were delivered online, as well as a higher metacognitive awareness. Those findings confirm the results of previous research stating that during online school there is less emotional tension, better use of study resources (e.g., books, online encyclopedias, and school notes), higher study flexibility, and more active processing [30,36]. From this point of view, it seems that computer screens might 'shield' students from mathematics-induced anxiety and, therefore, improve some aspects of the learning process.

One question could be raised on why students should prefer the PL of mathematics if they feel less tense during DL. To answer, it is important to widen the point of view on the sample, as it is composed of adolescents. For them, school is a venue of socialization and, more generally, for personal development as the relationship with peers in the educational context is an important determinant of school engagement [37]. This could explain why anxiety is not sufficient for students to prefer schooling at home. Moreover, we could hypothesize that although students feel more anxious about mathematics in person, they still think that the learning process might be better facilitated in the classroom rather than at home through a computer screen. This argument is supported by the literature as other studies have found a student preference for learning mathematics in person due to some of the flaws of mathematical DL: distraction [38], insufficient support for mathematics content [39], difficulty in monitoring student ability, failures of the internet infrastructure [40], and so on. The effects of female gender on anxiety have been confirmed even in our study about math evaluation and general school anxiety, independently of the teaching modality, replicating what the literature already shows on the topic and that it is usually explained by a stereotype threat [41–43].

Given those first results, we wanted to deepen the profile of students who prefer the PL of mathematics, given that they are even more than the ones who prefer the PL of all subjects. They suffer less from math-learning anxiety; they have more functional beliefs and attitudes towards mathematics; and they are more metacognitively aware, both in DL and PL, when compared to those who would prefer DL. In other words, they feel less tension in learning mathematics, and they think of themselves as being more competent, more motivated, and also more conscious of the way they learn. Those students are not intimidated by the discipline, and they know they can afford it in any form. On the other hand, pupils who prefer the DL of mathematics are more anxious when they learn the discipline; they have more negative beliefs about their competences, and they have worse metacognitive awareness, both in DL and in PL.

Our results are corroborated by the consideration of math marks as higher achievements are associated with a preference for PL, less anxiety in all its forms, more functional mental states, and better metacognitive awareness in whatever way mathematics is learnt. As an additional confirmation of this, the students who prefer scientific subjects always have lower levels of MA in whatever form and independently of the way of administration. Expressing a preference for a subject implies many aspects, including, first of all, high motivation, positive attitudes, good metacognition, satisfying perceived self-efficacy, and actual success [44,45]. All those determinants of a preferred subject are coherent with the constructs we have explored so far, indicating that, independently of the way of teaching, the performance, beliefs, metacognition, and MA influence each other, so that—according to our correlational results—those with less anxiety achieve better results and vice versa, and those with better results develop more functional mental states and metacognitive awareness and vice versa.

5. Limitations

Our study suffers from some limitations that need to be taken into account. Firstly, its correlational design does not allow it to support causal claims. Secondly, there is the size of the sample and its derivation from the same geographical area. Moreover, during the completion of the questionnaire, the pupils relied on their memories of DL as they were attending school in person in that period. However, our results—although exploratory—lead us to reflect on the actual impact of distance learning, which has been highly targeted with some allegations, such as that it causes difficulties in the assimilation of new material and has lower didactic effects.

6. Conclusions

The first result obtained from this study could have easily misled us: although the students prefer to attend school as well as learn mathematics in PL, they experience lower levels of anxiety in math in DL rather than in PL. However, an in-depth investigation prompted us to observe the data from a different perspective, which highlighted that preferring mathematics and having good marks could decrease the importance attributed to the fact that math is taught in DL or PL. The preference for mathematics, which describes those who like it, plays an important role. On the one hand, if students perceive themselves to be good and well-evaluated, the way in which mathematics is taught does not matter, the anxiety will be lower because at the root there is the fact of loving mathematics. On the other hand, it is also true that lower levels of anxiety could facilitate the development of a better mathematics self-esteem and a preference for the subject. Further studies could investigate the causal direction of this relationship.

However, according to our results, the recent development of learning technologies, boosted by public health concerns, should not be the only target for interventions focused on the emotional connotations of mathematics, whose reputation is one of being an anxiogenic subject. According to our work, MA needs, rather, to be addressed by interventions focused on the attitudes of students and on their beliefs, metacognition, and motivation. To the best of our knowledge, this is one of the first studies investigating the subject-related emotions between different conditions of learning; so, few materials for comparisons could be found. We look forward to more development of the studies on the topic so that specific schooling strategies can be defined and applied for the wellbeing of students.

Author Contributions: Conceptualization, C.P. and S.V.; methodology, S.V. and A.P.; investigation, C.P. and D.D.C.; data curation, S.V. and A.P.; writing—original draft preparation, C.P., S.C. and D.D.C.; writing—review and editing, C.P., S.C. and D.D.C.; visualization, S.V.; supervision, C.P., S.C. and D.D.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of the Department of Educational Sciences, Catania University Internal Ethics Review Board for psychological research (GDPR 2016/679, 16 June 2020).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author (P.C.), upon reasonable request.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Wadhwani, P.; Gankar, S. E-Learning Market Size By Technology (Online E-Learning, Learning Management System (LMS), Mobile E-Learning, Rapid E-Learning, Virtual Classroom), By Provider (Service, Content), By Application (Academic [K-12, Higher Education, Vocational Training], Corporate [SMBs, Large Enterprises], Government), Industry Analysis Report, Regional Outlook, Growth Potential, Competitive Market Share & Forecast, 2020–2026. 2019. Available online: https://www.gminsights.com/industry-reports/sustainable-and-smart-technologies (accessed on 6 April 2021).
2. Sabirova, R.; Umurkulova, M.; Kuo, B.C.H. Academic Stress at Different Years of Study. *Bull. Karaganda Univ. Pedagog. Ser.* **2020**, *100*, 71–78. [CrossRef]
3. Løhre, A.; Moksnes, U.K.; Lillefjell, M. Gender differences in predictors of school wellbeing? *Health Educ. J.* **2014**, *73*, 90–100. [CrossRef]
4. Zhang, C.; Ye, M.; Fu, Y.; Yang, M.; Luo, F.; Yuan, J.; Tao, Q. The Psychological Impact of the COVID-19 Pandemic on Teenagers in China. *J. Adolesc. Health* **2020**, *67*, 747–755. [CrossRef] [PubMed]
5. Thakur, A. Mental Health in High School Students at the Time of COVID-19: A Student's Perspective. *J. Am. Acad. Child Adolesc. Psychiatry* **2020**, *59*, 1303–1309. [CrossRef] [PubMed]
6. Radwan, E.; Radwan, A.; Radwan, W.; Pandey, D. Prevalence of depression, anxiety and stress during the COVID-19 pandemic: A cross-sectional study among Palestinian students (10–18 years). *BMC Psychol.* **2021**, *9*, 187. [CrossRef]
7. Bignardi, G.; Dalmaijer, E.S.; Anwyl-Irvine, A.L.; Smith, T.A.; Siugzdaite, R.; Uh, S.; Astle, D.E. Longitudinal increases in childhood depression symptoms during the COVID-19 lockdown,". *Arch. Dis. Child.* **2021**, *106*, 791–797. [CrossRef]
8. Lanius, M.; Jones, T.; Kao, S.; Lazarus, T.; Farrell, A. Unmotivated, Depressed, Anxious: Impact of the COVID-19 Emergency Transition to Remote Learning on Undergraduates' Math Anxiety. *J. Humanist. Math.* **2022**, *12*, 148–171. [CrossRef]

9. Hawrilenko, M.; Kroshus, E.; Tandon, P.; Christakis, D. The Association between School Closures and Child Mental Health during COVID-19. *JAMA Netw. Open* **2021**, *4*, e2124092. [CrossRef]
10. Vijayan, K. Unit-4 Mathematics in School Curriculum. 2018. Available online: https://egyankosh.ac.in/handle/123456789/46783 (accessed on 6 March 2022).
11. Elizondo, A.M. I Don't Know What to Do: A Mixed Method Study of Math Anxiety as Perceived by Students and Their Parents. 2021. Available online: https://hdl.handle.net/1969.6/89786 (accessed on 6 March 2022).
12. Bekdemir, M. The pre-service teachers' mathematics anxiety related to depth of negative experiences in mathematics classroom while they were students. *Educ. Stud. Math.* **2010**, *75*, 311–328. [CrossRef]
13. Wani, I.U. Math anxiety: Causes, symptoms and strategies to reduce. In Proceedings of the 9th National Conference on Mathematics Education, Bhopal, India, 20–22 December 2020.
14. Faust, M.W. Analysis of physiological reactivity in mathematics anxiety. *Diss. Abstr. Int.* **1993**, *54*, 0539.
15. Ramirez, G.; Shaw, S.T.; Maloney, E.A. Math Anxiety: Past Research, Promising Interventions, and a New Interpretation Framework. *Educ. Psychol.* **2018**, *53*, 145–164. [CrossRef]
16. Ashcraft, M.H.; Krause, J.A. Working memory, math performance, and math anxiety. *Psychon. Bull. Rev.* **2007**, *14*, 243–248. [CrossRef] [PubMed]
17. Luttenberger, S.; Wimmer, S.; Paechter, M. Spotlight on math anxiety. *Psychol. Res. Behav. Manag.* **2018**, *11*, 311–322. [CrossRef] [PubMed]
18. Macher, D.; Paechter, M.; Papousek, I.; Ruggeri, K. Statistics anxiety, trait anxiety, learning behavior, and academic performance. *Eur. J. Psychol. Educ.* **2012**, *27*, 483–498. [CrossRef]
19. Hembree, R. The Nature, Effects, and Relief of Mathematics Anxiety. *J. Res. Math. Educ.* **2020**, *21*, 33–46. [CrossRef]
20. Caponi, B.; Cornoldi, C.; Falco, G.; Focchiatti, R.; Lucangeli, D. *MeMa. Valutare la Metacognizione, Gli Atteggiamenti Negativi e L'ansia in Matematica*; Erikson: Trento, Italy, 2012.
21. Zakaria, E.; Zain, N.M.; Ahmad, N.A.; Erlina, A. Mathematics anxiety and achievement among secondary school students. *Am. J. Appl. Sci.* **2012**, *9*, 1828–1832. [CrossRef]
22. Andrews, A.; Brown, J. The Effects of Math Anxiety. *Education* **2015**, *135*, 362–370.
23. Wigfield, A.; Meece, J.L. Math Anxiety in Elementary and Secondary School Students. *J. Educ. Psychol.* **1988**, *80*, 210–216. [CrossRef]
24. Mutodi, P.; Ngirande, H. Exploring mathematics anxiety: Mathematics students' experiences. *Mediterr. J. Soc. Sci.* **2014**, *5*, 050039. [CrossRef]
25. Randolph, T.D. An Assessment of Mathematics Anxiety in Students from Grades Four Through Eight. 1997. Available online: https://www.proquest.com/openview/3c24ab823fab144f0cef4b2553048aea/1?pq-origsite=gscholar&cbl=18750&diss=y (accessed on 6 March 2022).
26. Birgin, O.; Baloğlu, M.; Hakan, H.Ç.; Ramazan, R.G. An investigation of mathematics anxiety among sixth through eighth grade students in Turkey. *Learn. Individ. Differ.* **2010**, *20*, 654–658. [CrossRef]
27. Erdem, E. A current study on grade/age and gender-related change in math anxiety. *Eur. J. Educ. Stud.* **2017**, *3*, 396–413. [CrossRef]
28. Legg, A.M.; Locker, L. Math performance and its relationship to math anxiety and metacognition. *North Am. J. Psychol.* **2009**, *11*, 471–485.
29. Lukowski, S.L.; DiTrapani, J.; Jeon, M.; Wang, Z.; Schenker, V.J.; Doran, M.M.; Hart, S.A.; Mazzocco, M.M.; Willcutt, E.G.; Thompson, L.A.; et al. Multidimensionality in the measurement of math-specific anxiety and its relationship with mathematical performance. *Learn. Individ. Differ.* **2019**, *70*, 228–235. [CrossRef] [PubMed]
30. Pirrone, C.; Varrasi, S.; Platania, G.A.; Castellano, S. Face-to-face and online learning: The role of technology in students' metacognition. In Proceedings of the First Workshop on Technology Enhanced Learning Environments for Blended Education, Foggia, Italy, 21–22 January 2021.
31. Ma, Z.; Idris, S.; Zhang, Y.; Zewen, L.; Wali, A.; Ji, Y.; Pan, Q.; Baloch, Z. The impact of COVID-19 pandemic outbreak on education and mental health of Chinese children aged 7–15 years: An online survey. *BMC Pediatrics* **2021**, *21*, 1–8. [CrossRef] [PubMed]
32. Bachir, B.; Naji, A.; Tfayli, A. The educational and psychological impact of the COVID-19 pandemic on medical students: A descriptive survey at the American University of Beirut. *Medicine* **2021**, *100*, e26646. [CrossRef]
33. Richardson, F.C.; Suinn, R.M. The Mathematics Anxiety Rating Scale: Psychometric data. *J. Couns. Psychol.* **1972**, *19*, 551–554. [CrossRef]
34. Saccani, M.; Cornoldi, C. Ansia per la matematica: La scala MARS-R per la valutazione e l'intervento metacognitivo. In *Difficoltà in Matematica*; Erikson: Trento, India, 2005; pp. 133–152.
35. Suinn, R.M. The Mathematics Anxiety Rating Scale, a brief version: Psychometric data. *Psychol. Rep.* **2003**, *92*, 167–173. [CrossRef]
36. Martin, S.; Valdivia, I.M.A. Students' feedback beliefs and anxiety in online foreign language oral tasks. *Int. J. Educ. Technol. High. Educ.* **2017**, *14*, 1–15. [CrossRef]
37. Perdue, N.H.; Manzeske, D.P.; Estell, D.B. Early predictors of school engagement: Exploring the role of peer relationships. *Psychol. Sch.* **2009**, *46*, 1084–1097. [CrossRef]
38. Pereira, L. Students' satisfaction with distance learning mathematics in higher technical professional courses. *ICERI2021 Proc.* **2021**, *1*, 7147–7155. [CrossRef]

39. Golubski, C.; Navarrete, C.; Azua, E. Improving student outcomes in distance learning mathematics classes. In Proceedings of the 2013 IEEE Frontiers in Education Conference (FIE), Oklahoma City, OK, USA, 23–26 Oct. 2013.
40. Ratnadewi, R. The Analysis of Students and Teachers Readiness On Distance Learning Mathematics In New Normal. *J. Educ. Technol.* **2021**, *4*, 400–411. [CrossRef]
41. Maloney, E.A.; Schaeffer, M.W.; Beilock, S.L. Mathematics anxiety and stereotype threat: Shared mechanisms, negative consequences and promising interventions. *Res. Math. Educ.* **2013**, *15*, 115–128. [CrossRef]
42. Devine, A.; Fawcett, K.; Szucs, D.; Dowker, A. Gender differences in mathematics anxiety and the relation to mathematics performance while controlling for test anxiety. *Behav. Brain Funct.* **2012**, *8*, 33. [CrossRef] [PubMed]
43. Zhang, J.; Zhao, N.; Kong, Q.P. The relationship between math anxiety and math performance: A meta-analytic investigation. *Front. Psychol.* **2019**, *10*, 1613. [CrossRef]
44. Bergem, O.K. "Mathematics is my favorite subject!": Variation in instructional practices boosting students' attitudes towards mathematics. In *Teaching and Learning in Lower Secondary Schools in the Era of PISA and TIMSS*; Springer: Berlin/Heidelberg, Germany, 2016; pp. 165–179. [CrossRef]
45. Pirrone, C.; Tienken, C.H.; Pagano, T.; Di Nuovo, S. The influence of building block play on mathematics achievement and logical and divergent thinking in Italian primary school mathematics classes. *Educ. Forum* **2018**, *82*, 40–58. [CrossRef]