



# Parents' Influence on Children Mathematical Activity During Lockdown

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**Citation:** Maffia, A. (2022). Parents' Influence on Children Mathematical Activity During Lockdown. *European Journal of Science and Mathematics Education*, 10(4), 547-554. <https://doi.org/10.30935/scimath/12402>

## ARTICLE INFO

Received: 11 Jul 2022

Accepted: 19 Aug 2022

## ABSTRACT

Parents can play a key role in their children's homework activities; this has been particularly true during the home-schooling caused by the pandemic. However, how parents affect students' mathematical activity is scarcely researched, in particular in the case of primary school students. Within the framework of activity theory, in this contribution two case studies are compared and contrasted to investigate how parents can influence the different aspects of their child's mathematical activity at home. Findings show that parents may play a role in many homework activities, including interpretation of the tasks. In particular, parents can influence the division of labor and the rules, in particular the normative aspects about the solution to be given that is the outcome of the homework activity.

**Keywords:** parents, homework, primary school, pandemic

## INTRODUCTION

The COVID-19 pandemic had a strong impact on mathematical education during the last few years, especially for younger and more disadvantaged children. The experience of lockdown has greatly changed the activity of schooling for all the involved subjects: teachers, children, and parents. In literature—as in colloquial discourses—we usually refer to school as a context reflecting a deliberate intention towards academic learning, where teachers and students are the central actors in an expert-novice type of relationship (Bronkhorst & Akkerman, 2016).

Furthermore, the word 'school' can refer to a building, and for many children the activity of schooling is defined by the location in which it takes place, while activities happening elsewhere are considered play or something else (Zhao, 2020).

During the lockdown experience, the house became the place of schooling; the boundaries between home and school became thinner and thinner; even well-educated parents faced important difficulties in helping their children with their homework (Bakker & Wagner, 2020) and we do have very little knowledge about the mathematical activity in which children engaged at home and how parents influenced such activity. This is true more in general: there is a lack of research literature about the relationship of parents with their children's mathematical activity at home, especially in the case of primary school students (Jackson, 2011).

We can exploit the potentialities of these times to better understand the role of parents in children's learning of mathematics, and the emergency we are living in can help in rethinking education for post-COVID-19 times (Zhao, 2020).

In this contribution two cases of different behaviors by parents of primary students are contrasted. The aim is to describe the 'how' of parents' influence on their children's mathematical activity. Specifically, the analyzed data will refer to parents' influence on children's activity during the lockdown due to the COVID-19 pandemic.

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## LITERATURE OVERVIEW

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Parents could play a key role in their children academic achievement, not only in case of home-schooling, but within the homework activity more in general. Homework usually legitimates the presence of schooling activities at home. The tasks provided by teachers are boundary objects between the school community and the family (Bronkhorst & Akkerman, 2016; Hughes & Greenhough, 2008) since they “both inhabit several intersecting worlds and satisfy the informational requirements of each of them” (Star & Griesemer, 1989, p. 393 as quoted in Akkerman & Bakker, 2011). Mathematics is, on average, the subject requiring the largest amount of homework (Fan et al., 2017) and for this reason it is particularly interesting to study the homework activity in the specific case of this academic subject. Pedagogically, facing mathematical tasks in a non-academic context could provide the opportunity to connect school and out-of-school learning experiences; however, the small amount of available research suggests that this rarely happens (Hughes, 2001; Winter et al., 2004).

Parents intervene in their children’s homework because they believe it is their parental duty. Often, parents (with a high sense of self-efficacy) declare that their scaffolding have a positive effect on their children’s academic achievement (Hoover-Dempsey et al., 2001). Such belief is hold by interviewed subjects, but there are only few empirical data providing support to this belief, and the effect of parental involvement in students’ homework is different according to the school grade, with a more positive effect for primary and high school rather than middle school (Fan et al., 2017). In particular, parents’ involvement appears to affect positively students’ motivation, self-efficacy, and attitude towards mathematics (Hoover-Dempsey et al., 2001; Jackson, 2011; Santana et al., 2021).

Parents’ intervention on homework may also be the cause of tensions within the family because of different interpretation of tasks. They may find discrepancies with their school experience (e.g., how they have been taught to do their computations), or they could misinterpret the teachers’ goals in assigning a task (Jackson, 2011). For instance, there are documented cases of parents searching on the internet to find solution procedures that may differ from what their children learn at school; such differences cause conflicts and prompt the students to doubt their parents’ mathematical abilities and their help with homework more in general (Jackson, 2011; Hughes & Greenhough, 2008). On the other side, it is also possible that teachers misinterpret parents’ intentions when they try to help children with their homework (Jackson, 2011).

The aforementioned literature refers mainly to the *effects* of parents’ involvement; less is known about *how* they act while trying to assist their children. According to Hoover-Dempsey et al. (2001), parents’ behavior depends on several factors, including parents’ beliefs about children’s education, their understanding of the task, and their personal knowledge. Depending on these factors, it is possible to observe different types of behavior. Two different types of behaviors are observed and described by Jackson (2011), whose work seems the only one specific to mathematics in K-8 grades as far as the author of this contribution knows. According to her ethnographic qualitative analysis of a family, sometimes the child looks for parents’ help and the parent acts as tutor; in other occasions the child and the parent work together (as peers) in solving the task. However, Jackson (2011) analyzed only one case, in which parents had a low self-efficacy towards mathematics, which may be extremely specific. Then, more case studies appear as desirable to provide a more general picture of parents’ involvement and influence on primary students’ mathematical activity at home.

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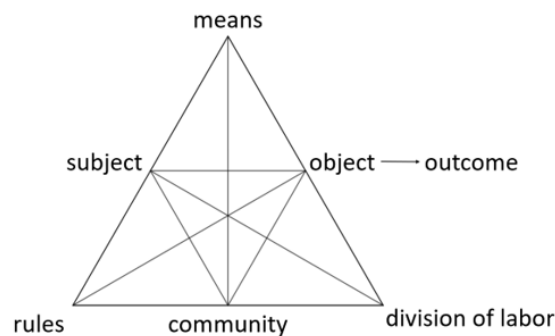
## THEORETICAL FRAMEWORK

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When assigning homework to their students, teachers provide tasks. These tasks could be the same for all students or differentiated.

“Pupils will always interpret [...] tasks in the light of their previous experiences and current understandings. However carefully a teacher sets up a task, one cannot assume that the individual pupils’ interpretations of the task, the activities that they engage in, are either similar to each other’s, or fit with the activity expectations of the teacher” (Askew, 2004, p. 74).

In the analysis of our data, we will use the word ‘task’ to refer to the instruction provided by the teacher through a video, shared with her students through a web-link.



**Figure 1.** Triangular representation of the aspects of activity as it is described by Roth (2012)

For describing and comparing students' mathematical activity as it is influenced by their parents, we need to define 'activity' and to operationalize this construct for the data analysis. In this contribution we adhere to activity theory as it is described by Roth (2012), which is different from the more diffused third-generation framework proposed by Engeström (2001). In this framework, activity is the unit of analysis and, while it is understood as shaped by several interrelated aspects (Figure 1), "we cannot understand any action of a subject on the object of activity outside of all the relations to other aspects of the activity, which in fact mediate every other moment and relation" (Roth, 2012, p. 88). The *subject* of the activity is the individual (or group) who is engaged in the activity, while the *object* of the activity is the product that is transformed into an *outcome* (Jonassen et al., 1998). In our case, we will use the expression *homework activities* to refer to those activities having the children as subject, and the task provided by their teacher as object. One or more solutions of the task (to be shown to the teacher) are the expected outcome.

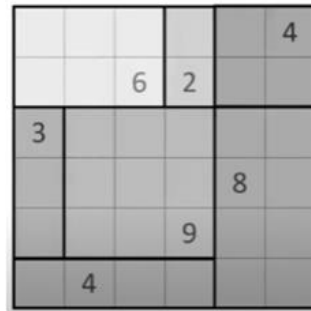
Thus, in order to describe and distinguish the different types of children's homework activities, we will need to identify the other aspects of the activity (Figure 1), which are the means of production, the community that defines the legitimate practices, the division of labor, and the rules.

1. The *means of production* are all the artifacts (material or symbolic ones) which are used by the subject to act on the object.
2. In a very general sense, the *community* is "the social group that the subject belongs to while engaged in an activity" (Yamagata-Lynch, 2010, p. 2). In the case of homework activity, the community can be the family. Virtually, the teacher and the class-group can be considered as part of the community since the rules of the activity have been established in the classroom context.
3. The *division of labor* "refers to the explicit and implicit organization of a community as related to the transformation process of the object into the outcome" (Kuutti, 1996, p. 28).
4. *Rules* may be general social norms regulating the community or norms about the specific activity – in our case, *socio-mathematical norms*, meaning "normative aspects of mathematics discussions specific to students' mathematical activity" (Yackel & Cobb, 1996, p. 461). Within the homework activity, socio-mathematical norms could be already established in the classroom.

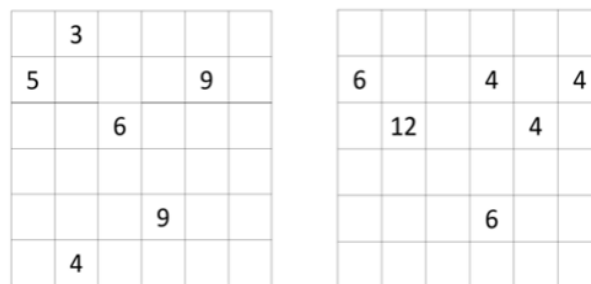
Activity is realized through *goal-oriented actions* which constitute the activity in a whole-part relation. Activity must be understood as ever-changing since change is the effect of activity itself. If one aspect of the activity changes, we have a new activity. Therefore, the initiation of a new homework activity should be described in terms of changes of means, rules, community, or division of labor (since the subject, the object and the outcome are designated by the definition of homework activities given above). Within this theoretical framework, the research question of this study can be stated as follow: Which aspects of homework activities are influenced by parents and how?

## METHODS

We contrast two case studies with the aim of describing parents' actions within their children's homework activity. Qualitative descriptive methods are selected because we aim at describing the different aspects of activities and thus the new activities in which the children engage; a micro-analytical approach appears as appropriate (Radford & Sabena, 2015).



**Figure 2.** Correct final solution of the example of grid provided by the teacher in the video. Each number in the grid corresponds to the area of the rectangle which is written in



**Figure 3.** The two grids that are presented in the task as they are shown in the video

According to Scheff (1990), micro-analytical approaches require “video and audiotapes, or at least verbatim texts, which provide the data for discourse analysis” (p. 28). In our case, direct collection of video or audio-taped data during lockdown was impossible, because national normative restrictions did not allow the researchers to visit children’s houses. The video-recordings used in this research were realized by the parents themselves. The analyzed videos show the activity realized by two third graders belonging to the same class; we will refer to them with the pseudonyms Fabio and Guido. The collection of data was realized during the first lockdown in Italy (April 2020). The teacher (which is the same for both children) sent a video to her pupils by mean of an online link. In the video, the voice of the teacher presents the task by mean of an example. A grid is described and shown in the video, and it is completed step by step. The unique final solution is then shown on the screen (Figure 2).

Then, the voice of the teacher in the video asks children to work autonomously on two new grids (Figure 3), dividing them in rectangles. The two grids are presented one after the other. Numbers appear on the grid and the rectangles must be drawn so that each rectangle contains only one number which must correspond to its area. A printed version of the grids is not provided; children must reproduce the grids on their notebooks by copying them from the screen. In the video, the teacher explicitly says that the first grid has only one possible solution, while the second one has more solutions. The children have not faced this kind of task before.

The teacher asked the parents to video-record their child while solving the task; no specific instruction about the expected interventions of the parent were provided. The intention of analyzing parents’ actions during the video was declared only after, when the consent to use the video for this research was asked. The teacher shared with the author only the videos for which the consent was provided. Dialogues were transcribed verbatim, including representations of gestures and inscriptions, and notes about the involved artifacts (Radford & Sabena, 2015).

Parents’ actions—as described in the transcript—have been labelled referring to the aspects of the activity on which they have an influence (means, community, rules, or division of labor, as described in the previous section). In the following, some excerpts from the whole transcript will be reported to exemplify the obtained results.

## RESULTS

At the beginning of each of the two analyzed videos, it is possible to see the different contexts in which the children are working. Both are working on a desk, with a laptop in front of them. Guido is working in his room and, in front of him, there are several means: a sheet of squared paper (1 cm×1 cm squares), a pencil, a pen, and a ruler. Fabio is working in the kitchen, having at his disposal a sheet of squared paper (0.5 cm×0.5 cm squares), several colored pencils and pens. Thus, a first important difference in their activities is observable in the available means. Guido's parents have already watched the video and they decided that the 1 cm-by-1 cm paper and the ruler should be provided to their son.

Another relevant difference is identifiable in the community: Fabio is working only with his father (who is also recording the video) while both Guido's parents are present (the father is recording). We will call the first activity *watching the video*. The laptop is the mean in both cases. When the presentation of the example and of the first grid is done, the teacher (in the video) says to stop the video and complete the first grid. Then, the duration of this activity is decided by the teacher who takes part virtually and asynchronously to the community. Both in the case of Guido and Fabio, the video is interrupted after the teacher's prompt, but the division of labor is different: Fabio takes the responsibility of interrupting the video by clicking a button on the laptop while his father asks him if he understood all the instructions. In the case of Guido, the child asks his father to stop the video and then he initiates a new activity: *drawing the first grid*. There is not any intervention by parents while the children are drawing the grid on their notebook. However, the two activities differ substantially because Guido uses the ruler as mean to bold some of the lines of the 1 cm-by-1 cm paper, while Fabio draws by free hand, realizing a grid of squared cells with a side of 1.5 cm (three squares on his 0.5 cm×0.5 cm paper sheet). The different outcomes are the effects of the different means provided by the parents before of the beginning of the activity.

After the drawing activity, both children engage an activity of *clarification of the task*. The two activities are quite different. Guido initiates a dialogue with both his parents.

Guido: So: I shall circle them, the spaces containing the number five.

Mother: You should create rectangles, as it was said by...

Father: As you think they should be.

Mother: You should create rectangles forming the...

Guido: Like: number five, does that square count as well? [he points to the cell of the grid in which the number 5 is written].

Both: Of course.

Mother: Of course, even the one in which you wrote the number.

Guido: One, two, three. Can I do like that? [using the tip of the pencil, he draws a L-shaped figure]

Father: It must be a rectangle or a square.

In the case of Fabio, his father suggests him to watch the video again with the aim of listening to the task for a second time. We notice that during this activity of clarification of the task, the work is distributed between Guido and his parents, while the responsibility for the understanding of the task is given to Fabio (and to the teacher) by his father. This behavior may be the result of an implicit rule for which he does not want to interfere with the teacher's task. The video is the mean of this activity for Fabio, while it is not used by Guido.

The following activity of *solution of the first grid* appear quite similar; the outcomes are different because Fabio colors the rectangles (since colored pencils are available to him). Then, both the children continue watching the video. The teacher presents the second grid and says that it may have more than one solution. Again, major differences are observable in the following activity of *interpretation of the task* realized by the two

children. In the case of Guido, after watching the video, his parents' opinions about the number of solutions seem to differ.

Father: Ok. It is enough if you do just one.

Mother: You can start with one, then you do what you can.

Fabio, right after watching the video, states that he already has found a solution and describes it verbally by pointing to the grid shown on the screen. His father tries to suggest that other solutions could be possible.

Father: Twelve could be this one as well [he draws a 6×2 rectangle with his finger on the screen] and the six, this one [he draws a 6×1 rectangle with his finger].

Fabio: That's ok, but I did it differently.

Father: [chuckling] Ok then.

While Guido's father clearly states that providing one solution is enough, Fabio's father suggests that a second solution may be possible. He takes part to the activity of finding a solution by suggesting possible alternatives for two of the rectangles on the grid. This intervention acts on the rules for the following activity of *providing a solution for the second grid*. Furthermore, Fabio's father does not insist with Fabio to provide a second solution and accept the child's desire to provide only one solution. This could be the result of an implicit rule for which the parents should not intervene strongly in the child's interpretation of the task. At the end of the homework activities, both the children provide a solution for each of the grids as outcome. These outcomes will appear different to the teacher because the children found different solutions for the second grid (even if both provided only one solution). Other relevant differences are observable in the size of the grids (as described before) and in the presence of colors in Fabio's case. While some of the characteristics do not depend on the parents' interventions (e.g., the specific solution chosen by the child for the second grid), other features are strongly influenced by the provided means and parents' negotiation about the rules (e.g., about the number of solutions to be drawn for the second grid).

## DISCUSSION AND CONCLUSION

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General education research suggests that parents can act in different ways to aid their children's during their homework activities: they structure the activities (e.g., arranging the environment, establishing schedules for time use); they interact with the school; they provide a general oversight of the activities; they respond to the child's performance; they engage in the solution of tasks with the child (Hoover-Dempsey et al., 2001). Jackson (2011) provided ethnographical observations of parents while helping their child with his mathematics homework. She showed that parents' intervention may be both in the form of tutoring/scaffolding or in a sort of peer-to-peer interaction. The behaviors observed in her research appear similar to Hoover-Dempsey et al.'s (2001) categories of 'respond to child's performance', 'interact with the school/teacher', and 'engage in tasks with the child'.

In the present study we observed that also the parents' 'structuring' (in terms of arranging the environment, Hoover-Dempsey et al., 2001) may influence deeply the child's mathematical activity. For instance, we noticed how different means resulted in different outcomes, then—more generally—in different activities. This might be particularly relevant for primary students that are less autonomous than older ones. Other differences are observable in the community, the division of labor, and the rules.

In the case of Guido, the community was formed by two parents and the role of the teacher (through the video) was minimized. Fabio's father tried to impact as less as possible in his son's interpretation of the task and prompted the child to resort to the teacher's video to clarify his doubts. More generally, Fabio has most of the responsibility of his work, taking decisions on when to stop or play the video, on how to draw the grid, on how many solutions to provide. The division of labor in the case of Guido was more distributed towards the parents, who took decisions for him.

We noticed that parents' involvement was particularly different in the activities of interpretation and clarification of the task. In the case of the second task, where multiple solutions were possible, it was possible to notice the actions of parents in establishing different rules about the number of solutions to be provided. While several parents' actions described in the literature (e.g., Hoover-Dempsey et al., 2001) usually set what Yackel and Cobb (1996) would call social norms (that would apply to any subject), the particular case of the number of solutions is a socio-mathematical norm. In academic mathematics, when a task has more than one solution, all the solutions should be specified. The teacher's disclosure (in the video) of the presence of more than one solution appeared as intended to prompt students to provide as many solutions as they could. We observed that this was prevented by one of Guido's parents, while it was suggested (with no success) by Fabio's father.

The last observations lead us to reflect on the importance of parents' influence on the attitude towards mathematics (Jackson, 2011; Santana et al., 2021), especially in the case of young children. Teachers are aware of the potentialities of the tasks they provide to their students as homework; hence they can analyze the outcomes of their activities. However, they cannot know the activity realized by children and the influence of parents on such activity. Evidence from studies like the one presented in this paper may help in providing suggestions about the aspects of activities on which teachers and parents may agree on before a task is given as homework. This seems particularly important in the case of long periods of home-schooling like those imposed by the pandemic.

This study presents some limits as well. The fact that this study was conducted during lockdown prevents us to assume that the same behaviors would have been observed for homework in a different historical period. Indeed, parents may feel a higher responsibility for their children's education while normal schooling is not possible (Bakker & Wagner, 2020). Another important limit of this study is given by the fact that the parents recorded themselves knowing that the teacher would see the video. Then, they may have acted less naturally, trying to meet the teacher's expectations (as they imagined them). Then, any of the provided results should not be considered as general or frequent, but only descriptive of these two cases.

The analysis shown provides evidence of the important differences in children homework activities (in terms of means, rules, division of labor, community, and outcomes) because of the influence of parents. Differences in rules appear particularly relevant in the presented cases because of their specificity for mathematics. While this stream of research is still underdeveloped within mathematics education, it could be the basis for realizing the bridging between school and out-of-school mathematical activities, as well exemplified by Winter et al. (2004). Thus, comparing additional micro-analytical studies may be the initial step for developing a macro-descriptive theory (Sheff, 1990) which may have relevant practical implications as well.

**Funding:** The author received no financial support for the research and/or authorship of this article.

**Declaration of interest:** Author declares no competing interest.

**Data availability:** Data generated or analyzed during this study are available from the author on request.

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