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Not just threats and weaknesses: Seeking opportunities for the teaching/learning of mathematics in prison schools

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Scientific literature about teaching/learning mathematics within the context of schools in prison is very scarce. Framed by Educational Design Research, the Learning Math in Prison project started with an exploration phase of the context, realised together with Italian mathematics teachers in prison schools. The analysis conducted till now pointed out several categories of characteristics of the process of teaching/learning mathematics in Italian prisons. With the desire to better understand the nature of this process, more than listing and defining these categories is required. In this contribution, we wonder what the relationships between these characteristics are, focusing on some of them in particular. Alongside several weaknesses relating to the specific context, mathematics teachers identify particular opportunities that may prove helpful to support design principles for mathematical tasks within the prison context.

Keywords: Prison education, theory-driven categories, data-driven categories, SWOT analysis, mathematics teachers.

Introduction

The literature on teaching and learning mathematics in prison is very scarce. There is a notable gap in research on mathematics teaching and learning in prison contexts (Gagnon & Barber, 2014), despite mathematics occupying a unique position among the subjects taught, acting as a source of personal satisfaction and a gateway to future educational or employment opportunities (Ahl & Helenius, 2021). In this type of context, many of the usual peculiarities of teaching to adults (Gal et al., 2020) intersect with other issues related to managing the process of learning mathematics for vulnerable adults in a non-native language, dealing with non-homogeneous class groups, and sustaining very different motivations for learning (Gagnon & Barber, 2014; Byrne & Carr, 2015; Gal et al., 2020; Ruhil & Gut, 2019). The literature on teaching/learning mathematics in prison is characterised by discontinuity in class attendance because students come from backgrounds marked by previous failures, low levels of self-efficacy and a negative view of mathematics (e.g., Gagnon & Barber, 2014; Byrne & Carr, 2015) or provides only general data about students' attainment (e.g., Ruhil & Gut, 2019) and does not provide recommendations for educational practice. Consequently, in order to address this gap, two years ago the Italian national research project "Learning Math in Prison" (LeMP) was launched. The LeMP project is an interventionist Educational Design Research project (EDR, McKenney & Reeves, 2018) which involves five universities and teachers from three different prison schools. As usually happens for EDR, our LeMP project is organised into three main phases: analysis and exploration, design and construction, evaluation and reflection (e.g., van den Akker et al., 2006; McKenney & Reeves, 2018). Each phase involves interaction with practitioners and contributes to an intervention's theoretical understanding and progressive development (McKenney & Reeves, 2018). Therefore, the general aim of LeMP is to fill this gap by developing a set of design principles for creating teaching materials for Italian prison schools based on close and

intensive collaboration between researchers and practitioners (teachers involved). Within the LeMP project, the prison context is framed as a context of multi-complexity. This term is used in medical research to refer to patients with multiple (often chronic) diagnoses, whose cure cannot be the simple sum of the therapies for each pathology. In our view, this term only emphasises the high degree of complexity in the prison context, resulting from the complex interaction between personal, relational and structural factors, not necessarily attributable to persons in prison. We are convinced that juxtaposing already available design principles developed in other contexts could not be sufficient.

Starting from these considerations, in this paper, we present the analysis of the initial exploration phase of our research framework, which was based on a systematic literature review and teachers' interviews. Specifically, this article reports on the first phases of a broader work stream that aims to describe practitioners' perspectives on their work context (Maffia et al., submitted). McKenney and Reeves (2018, pp. 78-79) pointed out that "collaboration with practitioners is sought to shape a better understanding of the educational problem to be addressed, the target context, and stakeholder needs". For this reason, we want to fine-grain describe the context, as no such description exists in the literature. In this contribution, we delve, from a theoretical point of view, into some of the categories identified in (Maffia et al., submitted) and ask whether they are disjoint or, if not, what are their mutual relationships. A more precise Research Question is presented after the next section.

Theoretical Framework

Based on the analysis of available literature and the data collected in the first exploration phase of our EDR, we have categorised characteristics of the teaching/learning mathematics process in the prison context (Maffia et al., submitted). Below, we present those categories. Then, to understand the relationship between the presented categories, we use SWOT analysis as a framework for our research.

Theory-driven and data-driven categories

To highlight the aspects that characterise the process of teaching mathematics in prisons, we identified and, at the same time, validated categories linked to the most discussed topics among mathematics teachers; we distinguish between *theory-driven categories* and *data-driven categories*. The *theory-driven categories* are the themes that have been considered a-priori based on the existing literature on teaching in prisons and previous research experiences in prisons (e.g. Maffia & Decembrotto, 2022). In the Methodology section, we will see that the *theory-driven categories* have been used as thought-provoking hints for the teachers' contributions on a Padlet. An example of a *theory-driven category* is the *Motivation to study*, which Maffia et al. (submitted) defined as "students' relationship with study, in general, and with educational institutions, including the purpose of the study".

On the other hand, the *data-driven categories* are the themes necessary to codify the posts in the Padlet, which are characterised by the teachers' observations and are not covered by the *theory-driven categories*. In this paper, we will refer to the following examples of *data-driven categories* defined by Maffia et al. (submitted) as: "*Class group composition*: characteristics of students, [...], high turnover, specific needs and any difficulties encountered (of social, cognitive, relational...)";

“*Personalisation*: individualisation and/or personalisation of teaching and/or training paths for students, including their flexibility”.

There are more *theory-driven* and *data-driven categories* than those we have listed as examples. Due to space limitations, we have restricted the presentation to those addressed in this contribution.

SWOT analysis

SWOT is the acronym for Strengths, Weaknesses, Opportunities, and Threats (Helms & Nixon, 2010). SWOT analysis provides a clear frame for gathering information from various sources, bringing out an overview of internal factors (i.e., Strengths and Weaknesses) and external factors (i.e., Opportunities and Threats) that could be useful in describing the characteristics of the teaching/learning mathematics process. In this contribution, we will refer to how the reciprocal relationships between the categories identified above (Maffia et al., submitted) could highlight Strengths, Weaknesses, Opportunities, or Threats characterising the teaching/learning of mathematics in prison. In our study, Strengths (S) are seen as the positive characteristics of the school where teachers work and supporting their work. Weaknesses (W) refer to the characteristics that make teachers’ work more difficult and hinder their aims. Opportunities (O) refer to the internal or external characteristics offered by the environment in which teachers work that could be exploited to benefit their work. Finally, Threats (T) can be seen as external difficulties independent of the teachers. Still, they undermine the successful functioning of their work in the classroom, thus limiting the achievement of their aims.

Using this theoretical framework, we intend to investigate the characteristics of teaching and learning mathematics in prison. To this end, we analyse teachers’ comments on a Padlet (see the next section), addressing the following research question: Which relations between categories (if any) can describe the characteristics (concerning SWOT) of the teaching/learning of mathematics in the prison context?

Methodology

The present study is part of the larger research project LeMP. LeMP is an Italian national project that arose from the collaboration between researchers in Mathematics Education and Special Pedagogy, and three prison schools. Participation is voluntary in the LeMP project, and the research presented in this paper has been proposed to all mathematics and science teachers in the schools involved, all of whom have a master’s degree in a scientific discipline but have not received specific training in teaching mathematics and science with adults, foreigners and/or in the prison context. However, our sample is characterised by various work experiences in prison, ranging from a single year to over 20 years. For this study, nine teachers have volunteered to represent all three school contexts involved in the LeMP project. The teachers involved have been asked to fill out a Padlet (described in more detail below) and then to participate in an online meeting to discuss some of the issues that emerged from the Padlet analysis. Due to the space limits, we focus our attention only on the content of the Padlet and its analysis.

To collect the teachers’ perspectives, we have created a Padlet by adding some thinking-provoking hints such as *Motivation to study*, *Classrooms*, *Equipment*, *Role and purpose of education in prison*, *School-prison relationship*, *Absence of INVALSI tests*, *Other*, chosen by the researchers as relevant

topics based on the existing literature, their previous research experiences in prison, and the analysis of the institutional documents from the schools. This tool helped us to point out the aspects considered relevant by the teachers to describe the characteristics of teaching/learning mathematics in prison. Beyond this, the choice of using Padlet to bring out aspects relevant to teachers for describing their context is motivated by the desire to collect data remotely from teachers working in dispersed prisons in Italy.

Initially, teachers were asked to access the Padlet individually and post their reflections about internal factors (S and W) and external factors (i.e., O and T). Only then were the posts on the Padlet made visible to all teachers. They were then asked to comment on other colleagues' posts. This phase of work ended with an online meeting to further explore some of the issues that emerged from the Padlet and refine the categories identified in the content analysis of the Padlet (Maffia et al., submitted). Collecting data through a focus group discussion is motivated by the desire to triangulate individual thinking and reflection at the group level (Cohen et al., 2007).

The analysis of the data from the Padlet was divided into several stages in which data-driven categories were identified using the principles of qualitative content analysis (Cho & Lee, 2014). More precisely, the analysis process followed several steps based on an initial parallel analysis of the data collected in the Padlet using the a-priori categories and an initial identification of possible new data-driven categories and then on the comparison and discussion of the parallel analyses of all researchers involved to reach an agreement on the coding of each post and finally, the shared identification of the data-driven categories. The results of this analysis have been presented in detail in another work (Maffia et al., submitted), and we are not introducing that analysis in this paper. In this study, with reference to the chosen theoretical framework, the data analysis aims to describe the relationships between some categories by emphasising the aspects linked to the internal and external factors that the teachers have considered relevant according to their different experiences. In the next section, we describe only the relationships between the following categories: *Motivation to study* (with a focus on the attitude towards mathematics), *Group class composition*, and *Personalisation*.

Results and Discussion

Teachers have described the three categories considered in this study as having positive and negative aspects. The category relating to the *Group class composition* is described by the teachers with critical aspects (5 posts for W and 3 posts for T) and positive aspects (3 posts for S and 4 for O). On the other hand, the category relating to *Personalization* is described mainly by focusing on positive aspects (4 posts for S and 7 posts refer to O) with only 1 post pointing out W. Finally, the category related to "*Motivation to study*" is described by teachers with both positive aspects (3 posts for S and 5 posts for O) and negative aspects (3 posts for W). To answer our research question, in this section, we analyse the data collected with the Padlet by highlighting the relationships between the categories of *Group class Composition*, *Personalization*, and *Motivation to study*, which allow us to describe S, W, O, and T, characterising the process of teaching/learning mathematics in prison also by highlighting the number of posts in which they appear.

Group class composition and Personalisation

A relationship between the categories *Group class composition* and *Personalisation* is highlighted in 2 posts for S, in one post for W, and in 4 posts for O, which could be helpful for us in describing the process of teaching/learning mathematics in the prison context. More specifically, an aspect considered relevant by teachers within the category of *Group class composition* is related to the high turnover of students entering and leaving prison throughout the school year. This aspect presents itself as a challenge that, in most cases, negatively affects teachers' work in the classroom (*High turnover of entries, transfers, and releases: partial or missing information on the educational path. The number of students in each class is constantly changing throughout the year [...]*). However, at the same time, it emerges that this aspect is seen as an opportunity to be stimulated (as teachers) to personalise their teaching practices by students' competencies (The high turnover of inmates, on the one hand, slows down the development of a full curriculum, but on the other hand allows the development of lessons focused on the actual deficiencies/needs of the students in the limited time available). This opportunity stems from the fact that, because of the high turnover of students in the classes, there is also a wide heterogeneity among the students as they have different age levels, different cultural backgrounds, different literacy levels, and different mathematical skills and competencies derived from their different educational and professional experiences. Although the high turnover and the vast heterogeneity of the group of students are considered negatively by teachers, it also emerges from the posts on the Padlet that working in these contexts requires teachers to pay more attention to personalising the educational program that considers the individual student's educational needs. Thus, the need to personalise students' educational programs offers teachers the opportunity to develop teaching strategies aiming at enhancing the mathematical competencies and skills of detained students based on their real and different learning needs (The opportunity to work effectively with multi-class groups of varying levels of proficiency in Italian, ages, and diverse cultures is undoubtedly complex but constitutes a great wealth). However, despite the difficulty linked to the need for teachers to pay specific attention to the needs of individual inmates, it is possible to see that the ability to personalise the education of students by taking into account both their skills and their real learning needs becomes a Strength of the process of teaching mathematics in prison context (The didactical activities are based on the personalisation of the re-educational path of each student [...]and take into account expressed and unexpressed interests and needs).

Group class composition and Motivation to study

It is important to highlight a relationship between the categories of *Group class composition* and *Motivation to study* with the internal and external factors that characterise the process of teaching/learning mathematics in prison. A relationship is highlighted in 2 posts for S, 1 for W, and 3 for O. More specifically, the first negative aspect concerning the category of *Motivation to study* is related to the fact that, in many cases, students have a low motivation towards mathematics. This depends on previous negative school experiences, or in the case of foreign students, it depends on a poor level of schooling (Many students have had negative experiences with school and in particular with mathematics, and also Difficulties with mathematics are more significant in those who have little schooling even in their country of origin). These situations could also provoke feelings of frustration and rejection towards mathematics. From this, it can be seen that different levels of schooling or

different school experiences result from the vast heterogeneity of the class group. Thus, the wide heterogeneity of the class group generally influences motivation towards study and, more specifically, towards the study of mathematics, making it different among students. In particular, in these cases, the students' motivation to study emerges as being associated with other purposes, such as the desire to have better job opportunities after prison (Some students are motivated to obtain a degree to be able to work once they are out of prison); the desire to have opportunities for socialisation (The school in prison is a fundamental element of the rehabilitation pathway for the future reintegration of the imprisoned person into society. It is a place for socialisation, confrontation, acceptance and reflection, as well as learning); the desire to have opportunities for redemption from a previous unsuccessful course of study; the desire to have a new chance in being able to study a subject one has always been fascinated by; the desire to have personal growth with positive effects on the students' self-confidence as they are encouraged by the gratification of studying mathematics and the wish to be distinguished from others; the desire to obtain a school certificate or a certificate recognising their exemplary conduct at school to get a possible reduction in their penalty. From the description of this relationship between the two categories under consideration, it also emerges that this relationship helps describe the S and O of teaching mathematics in the prison context. In particular, in many situations, the psychological and affective aspects of the students emerge as a decisive motivating factor, often having a positive attitude towards the study of mathematics. In these cases, teachers emphasise that this depends on the fact that school, and especially the study of mathematics, offers the students a chance to escape from the reality they are obliged to live by allowing them at that time to forget other negative thoughts (The prisoners are not just students, they must live with guilt, nostalgia, anger, anxiety... a mathematical question can momentarily distract them and keep this burden away for a while, respond to the need to take their head elsewhere).

Motivation to study and Personalisation

Among the Padlet posts, some tried to clarify this relationship by describing internal and external factors characterising the teaching/learning of mathematics in prison. In particular, 3 posts aimed to describe the S and O offered by the context in which the involved teachers work, and that could help improve their work in prison. In these posts, teachers highlighted that motivation towards studying mathematics could be positive when teachers design lessons encouraging students to discover mathematics collaboratively. In these cases, it could be observed that it helps bring out the creative aspect and the students' desire for manual skills and concreteness in an intense way, so that students' motivation might be continually stimulated. To have a greater involvement of the students, the teachers once again highlighted the need to personalise their teaching practices by using more experiential techniques rather than transmissive ones, by designing manual, concrete, and creative activities that – thanks to possible collaborations with experts from outside the institution – could be appropriate for each student, taking into account the real learning needs of individuals (The educational offer could be expanded by allowing and encouraging the entry of external experts who offer their availability also free of charge. [...] or also The didactical activities are carried out with the use of techniques that are mostly experiential as opposed to transmissive and are based on the personalisation of the re-educational path of each student [...] and take into account their expressed and unexpressed interests and needs, to reinforce their motivation to learn). Thus, teachers are given

an additional opportunity to design teaching programs that leverage these kinds of dynamics and are oriented towards personalising the educational pathway of each detained student. Through this classroom activity, the teacher could help students improve their self-confidence and push them to understand that, once the prison experience is over, they could go on in their lives outside with new awareness and tools (The classroom activity aims to recover self-esteem and a sense of self-efficacy, in the direction of a redefinition of oneself, to, once the detention experience is over, resume one's life "outside" the prison with new awareness and new tools). During this type of activity, teachers also pointed out that, to stimulate motivation towards mathematics in the students, they could support them by constantly showing the usefulness of studying mathematics within their educational paths.

Conclusion

The analysis of the individual teachers' posts on the Padlet reveals many weaknesses and threats linked to the difficulties of their work context. However, in this contribution, we have shown that the relationships between the three considered categories also highlight strengths and opportunities as closely connected to some of the characteristics of the teaching/learning mathematics process in the prison context and not always available in other educational contexts. From our analysis, it is possible to note that not only weaknesses and threats emerged as a first preliminary analysis of the categories, but they also seemed to point out mainly (Maffia et al., submitted).

Thus, with the analysis presented in this paper, we enriched the context description (still scarce in literature), also providing positive aspects that may provide a base for designing innovative teaching practices and, consequently, for improving the process of learning mathematics. Such a more detailed exploration and analysis of the context is the necessary first step in any EDR project (McKenney & Reeves, 2018). The results of this first phase of research inform a process of evaluation aimed at refining the problem definition (namely, evaluating the discrepancy between the existing situation and the aim of our project, decomposing the problem into its constitutive parts). As exemplified in this contribution, pointing out opportunities (and not only threats) allows determining the so-called "jurisdiction of change", but that is also, distinguishing what is possible to change from the unchangeable (McKenney & Reeves, 2018). Starting from this awareness, the next phase of our project consists of determining the "design requirements". According to van den Akker et al. (2006), such requirements will become design principles only when based on theoretical arguments (as those developed in this contribution) and empirical ones, which will be based on data to be collected in the future phase of the project.

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