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THE *DIALOGUE* BETWEEN MATHEMATICS EDUCATION AND ANTHROPOLOGY: THE CASE OF TERTIARY TRANSITION

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The discussion on the identity of the research in mathematics education has often underlined the distinction between mathematics education and many other fields of research. On the other hand, this discussion also highlighted how mathematics education research has traditionally drawn and still draws on other disciplines. Several studies in mathematics education referred to anthropological approaches and constructs over the last decades. This contribution is the result of a dialogue between a mathematics educator and an anthropologist: analyzing the use of the rite of passage model for describing the tertiary transition in mathematics, possible developments of this research are discussed, as well as the potential of a continuous dialogue between specialists in the two fields of research.

INTRODUCTION

In the last three decades, many scholars debated the nature of the research in mathematics education (Sierpinska et al., 1993; Schoenfeld, 2000; Presmeg, 2008). The distinction from other disciplines such as mathematics, psychology, sociology, anthropology, philosophy, epistemology, neuroscience, semiotics, etc. but, at the same time, the relationship with these disciplines were the main issues in this discussion. On the one hand, mathematics educators wanted to clarify what research in mathematics education and its results are, their specificities. On the other hand, the need for drawing upon the established knowledge bases and methodologies of other consolidated fields of research for understanding the complex process of teaching and learning mathematics has always been evident:

The central focus is, of course, the teaching and learning of mathematics, and thus the nature of mathematical activity and thinking are a crucial focus for study in the field. The nature of mathematical activity and thinking have to be studied using those fields, psychology, sociology, anthropology, philosophy, and so on. (Dreyfuss, 2014, p. 65).

In line with Romberg's work (1992), we can recognize four phases of the research process (see Fig. 1).

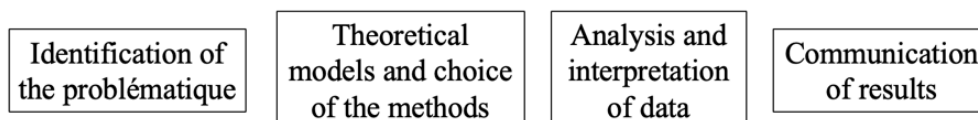


Fig. 1: the four phases of the research process

If the identification of the research problem and the development of the research (and, in particular, the interpretation of data) appear to be characteristic of research in mathematics education, in some sense defining it (Sierpiska & al., 1993), the second phase is where interaction with other disciplines is most evident:

why do we need psychology, sociology, and so on – even linguistics? I am convinced that the lenses of research methods used in these fields of the humanities are essential tools for mathematics education researchers to have at their disposal. The reason is simply because mathematics education involves *people*, with all their complexities. (Presmeg, 2014, p. 47).

Within the lenses mentioned by Presmeg, the anthropological point of view had and still has special relevance for the interest in developing a cultural perspective on mathematics education (Bishop, 1988), and for the recognition of the role of socio-cultural factors in the teaching-learning process (Presmeg, 2009).

In this frame, Chevallard (1992) developed the Anthropological Theory of Didactic (ATD) assuming that praxeologies underlying all human activities are strongly affected by cultural and environmental factors, and Cobb (1989) underlined the significance of the anthropological perspectives in mathematics education research. The main purpose of this anthropological perspective is the identification and analysis of regularities in the interaction between teachers and students, seen as “members of a classroom community with its own microculture” (Cobb, 1989, p. 33). This purpose requires appropriate research methods and, in this perspective, Eisenhart (1988) proposed the ethnographic approach in mathematics education, a significant approach for the typical anthropological interest of understanding the lifestyle of exotic groups from the native’s point of view. As Presmeg underlined:

the ethnographic methodology of anthropological research is peculiarly facilitative of the kinds of interpreted knowledge that are valuable to mathematics education researchers and practitioners. After all, each mathematics classroom may be considered to have its own culture. (Presmeg, 2009, p. 134).

The union of mathematics education and anthropology within phase 2 in Romberg’s model (Fig. 1) is not limited to the choice of methods: some theoretical models originally developed in anthropology were adapted to phenomena of interest to mathematics education.

On the other hand, as Connors warned:

such “borrowings” are often not successful; a researcher in one field is not always aware of the issues surrounding, or the current status of, a particular paradigm in another. Every discipline is dynamic (...) Unless the “borrower” is aware of this disciplinary debate, the result can be the application of an outmoded idea to a new field, where it may very well be accepted, and perpetuated, by naive readers. (Connors, 1990, p. 462).

For this reason, we strongly believe in the need of a retrospective comparison between mathematics educators and the specialists of the field where the used theoretical models or methods were originally developed (anthropology in our case).

In this paper, we will develop this retrospective analysis focusing on tertiary transition in mathematics and in particular, critically analysing the use of the theoretical model of the rite of passage to describe the phenomenon.

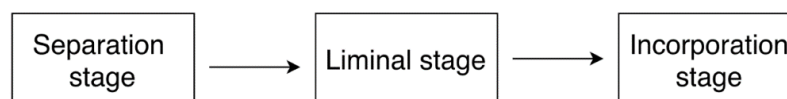
THE TERTIARY TRANSITION IN MATHEMATICS AS A RITE OF PASSAGE

Tinto described the generic transition from school to university as a modern rite of passage, making explicit reference to the rite of passage model (see Fig. 2) introduced by the anthropologist van Gennep (1909):

the problem of becoming a new member of a community that concerned van Gennep is conceptually similar to that of becoming a student in college, it follows that we may also conceive of the process of institutional persistence as consisting of three major stages or passages – separation, transition, and incorporation – through which students typically must pass in order to complete their degree programs. (Tinto, 1988, p. 442).

Clark and Lovric (2008), underlying how the existing body of research on the tertiary transition in mathematics was substantially characterized by the absence of a theoretical model, adapted the model of the rite of passage to fill this gap. They described the tertiary transition in mathematics as a modern-day rite of passage for students composed of three stages: *separation* (from secondary school), *liminal* (from secondary school to university) and *incorporation* (into university).

Fig. 2: The three stages of the rites of passage



How showed by a recent literature review (Di Martino et al., 2022a), the introduction and use of the rite of passage model has inspired much subsequent research on tertiary transition in mathematics, including those conducted by the first author of this report (Di Martino & Gregorio, 2019; Di Martino et al., 2022b).

The adoption of the rite of passage model permitted researchers to highlight some crucial issues in the research on students' difficulties in tertiary transition, until then characterized by a purely cognitive approach.

First, the rite of passage is always related to specific cultural routines, therefore sociocultural aspects cannot be neglected in the study of tertiary transition in mathematics. This means we should be extremely cautious about generalizing results across different university contexts and we need to develop more cross-cultural studies.

Second, the transition shock is inevitable: no passage and no incorporation in the new community are possible without putting into crisis the individual's routines and identity. These kinds of crisis are related to the emergence of strong affective reactions: in particular, feelings of inadequacy often emerge. Therefore, the rite of passage model also highlights the role of the affective component in the tertiary transition in mathematics and the consequent need of considering affective aspects for understanding students' difficulties in this transition.

The adoption of the rite of passage model has therefore led to an emphasis on the need to adopt a more holistic approach in tertiary transition research. Moreover, the rite of passage model points out that the actions for smoothing tertiary transition in mathematics cannot prevent students' crisis if we want the transition to be successful, their main goal should be to prepare students for the crisis and for dealing with it.

On the other hand, are we sure that the rite of passage model – originated in another field to describe different phenomena from a different era – has been used appropriately?

According to Connor (1990), the answer to this question cannot be given from an inner perspective (the perspective of mathematics education), but we need the answer from the perspective of an anthropologist.

THE ANTHROPOLOGICAL POINT OF VIEW: THE *PARS DESTRUENS*

Time, culture, and context are obviously crucial aspects of anthropological research and its interpretation of ethnographic data. van Gennep develops the theory of rites of passage at the beginning of the last century and he refers to *simple* societies, characterized by predictable life trajectories of its members, where deviations from the shared idea of normality are practically absent. In these realities, the transient moments can be ceremonially accompanied by the community and the ritual language is highly formalized and repetitive.

Cultural frames and practices for transitional phases are present also in the so-called *complex* societies of our era: anthropology recognizes that discontinuities and transitions are universal conditions of the individual life trajectories (Benedict, 1938), what changes is the meaning given to these transitions and the way they are overcome through rituals. The definitions and meanings attributed to the ritual category have changed over time: in this discussion we are adopting a generic definition of ritual as a shared cultural practice that symbolically accompanies moments in the calendar of people's and groups' lives.

In this frame, two main issues appear to be particularly critical in the use of the rite of passage model for tertiary transition in mathematics.

First, the cultural worlds considered by van Gennep for developing his model are historically and culturally very far from the tertiary transition contexts studied in mathematics education and, from an anthropological point of view, this cultural-historical distance does not appear to be sufficiently problematized in the use of the rite-of-passage model for tertiary transition made in mathematics education.

A second and more critical issue, the model is abstractly applied to a social unit considered indistinguishable (in some sense unique) and internally homogeneous (whose members have similar characteristics, living the discontinuities in similar ways): the mathematics class of the first year of undergraduate education. Both the assumptions are strongly questionable from an anthropological point of view. Members of any university cohort show differences relative to gender, generation, social class,

political horizon, background, schooling, socialization, etc. In her very famous book *Coming of age in Samoa*, Margareth Mead (1928) focused on the perception of adolescence in Samoan and U.S. girls, showing how a critical transitional phase in a culture (the adolescence in U.S.) cannot be perceived as critical in a different cultural context. This shows how the cultural contexts – in our case, the different universities in different countries – play a crucial role in identifying, defining and living the transitions. Therefore, it is important to identify the stages of growth in the different considered contexts for recognizing their cyclicities and, consequently, the stages of transition and status change. Cyclicity is a needed precondition of any ritual form, enabling individuals and groups to predict transitions.

The anthropological literature shows how various ritual forms exist in contemporary schooling systems (Segalen, 1998). Not all these ritual forms follow the logic of van Gennep's tripartite sequences, however, all of them are recognizable as ritual forms, even by external observers.

In this frame, the main questions we need to reply are: are we sure that the entrance to the university – in particular, in a Mathematics degree – is externally recognized as a moment of passage? If the answer to that first question is yes, what is the status transition cyclically produced by the ritual?

The answers to these questions are not obvious. It would be interesting to experiment new interdisciplinary research paths in order to find solid answers. This reflection is the right introduction for the *pars construens*.

THE ANTHROPOLOGICAL POINT OF VIEW: THE *PARS CONSTRUENS*

The critical study of the social and cultural phenomena through the connection between the emic perspectives (from inside the studied group) and the external perspectives is characteristic of anthropology. In our view, this characteristic represents the added value that anthropology can offer to the research in mathematics education for realizing the *social turn* evoked by Lerman (2000). This approach can be particularly significant for the understanding of the tertiary transition in mathematics, offering the main argument for the *pars construens* of our reflection.

As we said, the rite of passage cannot be considered an abstract model applicable to any transition: in particular, the tertiary transition in mathematics appears to be neither socially recognized as a passage nor ritually characterized.

Surely, it represents a critical phase of strong discontinuity for freshmen (Di Martino & Gregorio, 2019; Di Martino, Gregorio & Iannone, 2022b), but we need to know if and how much this is specific of the transition in mathematics. Comparisons with other kinds of tertiary transition would allow the recognition and distinction between the identifying elements of the transition in mathematics and those common to the different university transitions.

The identified elements (difficulties, trials, and coping strategies experienced in the first year) of the tertiary transition in mathematics could be interpreted as a form of

initiation into a specific community of initiands, representing the liminal stage within the van Gennep's sequential logics in a perspective that recognizes the cyclic nature of the rite of passage from freshmen to graduate. In this frame, the crisis – what Turner (1982) calls the social drama – would extend throughout the college period: the university enrolment would represent the separation stage and the graduation would represent the incorporation stage with the social recognition of the new status.

In this way, this phenomenon is recognizable as a rite of passage even outside the considered community (the undergraduate students in mathematics) and this external recognition is crucial to investigate any subcultural specificities of the transition in mathematics. Such perspective would allow for an in-depth study considering several crucial elements: the factors affecting the choice of the degree in mathematics, the social representations of mathematics, the students' expectations and experiences noted year by year. It would also allow for the collection and interpretation of quantitative and qualitative data on the mathematics cohort concerning the internal differences of gender, social membership, background, etc.

CONCLUSIONS

Our reflections bring to conclusions on two different levels.

Concerning the specific focus on the tertiary transition in mathematics, the discussion in the *pars costruens* paragraph offers ideas for developing a new research program, starting with the critical issues reported in the *pars destruens* paragraph: what characterizes a rite of passage? Which elements to consider for identifying the first-year mathematics class and its possible subculture from an internal and an external perspective? What are the elements connecting this subculture to other subcultures?

The interdisciplinary dialogue highlighted the limitations of the transposition of the rite of passage model and is therefore essential to take a step forward. However, the “naïve” use of the rite of passage in the research on the tertiary transition in mathematics was not at all useless: on the one hand, the result obtained are however significant having a crucial role in the development of research toward a more holistic approach, on the other hand, the critical analysis of these naïve use of the model suggests new and interesting directions of research.

In line with Connor's conclusion: “as mathematics educators become more familiar with the field of anthropology, their borrowing will become more sophisticated” (Connors, 1990, p. 467), this research program should necessarily be characterized by strong interdisciplinarity between mathematics education and anthropology, not limited to the phase 2 of Romberg's model (see Fig.1) but including the identification of the *problématique* (phase 1) and the interpretation and discussion of the results (phase 3).

At a more general level, we want to emphasize the significance of developing a retrospective dialogue when we conduct research based on constructs borrowed from other disciplines.

This interdisciplinary dialogue involves some evident difficulties related to the differences in language, communication styles, jargon, and modes of argumentation between our field of research and a different field such as anthropology. However, once this diversity is mutually understood and accepted, it is possible to create the basis for designing original and significant research without abdicating our respective disciplinary specificities.

Research in mathematics education and research in anthropology are particularly well suited for this kind of dialogue and contamination: they have proven it in the past and they will be able to continue to do so, with greater awareness, in the future.

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