

MATHEMATICS ASSESSMENT AND TEACHER TRAINING: A PERSPECTIVE OF CHANGE IN VENEZUELA

Andrés Moya Romero

Universidad Pedagógica Experimental Libertador, Venezuela

This research raises the need to work with a new conceptualization of evaluation in mathematics in the context of teacher training in Venezuela. Curricular reforms in higher education have proposed assessment with an emphasis on ethical and social dimensions. This paper considers how to ensure that the evaluation is consistent with teacher education that promotes student learning of mathematics. We highlight the emergence of a student's awareness, the importance of collaborative work and the need to connect with everyday mathematical knowledge and to establish a link between their professional and social life.

APPROACHES TO THE PROBLEM

Currently we face profound changes in educational curricular design and a new conceptualization of evaluation has been developed in alignment with these transformations. The evaluation of learning is obliged to respond to a conception of the processes of teaching and learning in a cohesive and interactive way.

In such profound changes in curriculum design, assessment practice cannot be separated from teaching practice. In the area of mathematics education this also leads to a new conceptualization of what it means to evaluate (Kulm, 1990; Webb 1992; NCTM, 1995; Niss, 1993; Romberg, 1995; Moya, 2008).

Moreover, teacher training has been a recurring theme in educational research in Latin America countries. An alternative teacher education means understanding which are some of the mechanisms of power that it disguises (Becerra and Moya, 2008).

The curriculum reform in the Universidad Pedagógica Experimental Libertador (UPEL), the leading teacher-training center in Venezuela, prioritizes a qualitative approach to evaluation. It addresses ethical and social dimensions, stating that it must train teaching professionals who can develop assessment procedures relevant to the state of education in the classroom and beyond.

But, how can this new discourse on curriculum in Venezuela and other countries be developed to lead the practice? What new approaches and new ideas and conceptualizations regarding evaluation need to be made so that the theory and practice of tomorrow will not be as separate as they are today? In the fields of Mathematics Education and Teacher Education, how do we respond to proposed changes in curriculum design? How do we achieve a form of evaluation that is consistent with teacher education that promotes student learning?

Moreover, the changes cannot be enacted in isolation. They are determined by a number of factors that need to be supplemented in a consistent manner, so the need to

consider new ways of evaluating may arise. Several of these factors have been part of the research conducted over the last twenty years, where there has been growing interest in the teaching and learning of mathematics at higher education level. One of those aspects concerns how the conception, implicit or explicit, the teacher has about teaching and learning mathematics will influence, to a certain extent, how he/she evaluates. Wilson (1994) argues that in the field of mathematics importance is given to what is evaluated and, therefore, the assessment gives a clue about what mathematical knowledge is important for the teacher. Smith and Wood (2000) state that the evaluation leads to what students should learn and that can lead to them adopting a surface approach or a deep approach to learning mathematics.

Additionally, students' preconceptions about what mathematics is have an impact on their perceptions about its teaching, learning and assessment (Berry and Sahlberg, 1996, Berry and Nyman, 2002). Crawford et al (1998) report that students enter college with different conceptions of what math is and different approaches to learning. Most of them conceive of mathematics as a fragmented body of knowledge and this is associated with an approach to learning consisting of a set of rules, algorithms and routine activities.

We face a picture of Curriculum Design, particularly in Teacher Education, that proposes changes, such as practice based on reflection, the transformation of teaching methods from transmitting knowledge to the process of generating it or transforming students into active agents in their own training. Within this context it is important that the evaluation makes sense, in line with teaching that promotes student learning. We share the position of Leder (1992), who argues that our approaches to teaching and assessment in mathematics cannot be separated.

Despite of that proposed context, very few UPEL students succeed with appropriate levels of achievement in the initial courses in mathematics. The question arises whether the assessment made in the university classrooms has an impact on the low levels of achievement of our students. Matched to this question would be one that forces us to inquire whether, indeed, the professional practice of the university professor of mathematics in the classroom is consistent with what is required by the curriculum design and, at the same time, wonder if the assessment is influenced by the teaching models and the students' own perceptions of what it means to learn mathematics. Likewise, we should analyze our assumption that if an assessment is correlated with a particular teaching model it may lead to greater learning achievement in mathematics for our students.

Consequently, the central problem considered in the research was to examine whether current models of assessment in mathematics, implicit or explicit, which are used in university classrooms in teacher education, are promoting mathematics learning for students, or are directed mainly to certify the mathematical knowledge that teachers regarded as valid and that the student must exhibit as a sample of having achieved the goals. Depending on the results, it might be necessary to generate an alternative model of assessment in mathematics, to consider the specificity of the discipline and

the many facets of what could be conceptualized as mathematical knowledge. However, this model should be in correspondence with a teaching model, so it is necessary to unravel the ways of organizing and managing the process of teaching mathematics in university classrooms.

METHODOLOGICAL DIMENSION

Every research involves knowing, wanting to know about something. Thus it is necessary to make explicit our considerations about what is meant by a deep understanding of the topic being addressed. In the first place, we assume that knowing is always a process that does not end with the completion of an investigation. It is a successive approximation that shapes truths that may be temporary and shared. This leads to a demystification of knowledge as something static and unchanging, something that is done. As researchers, we undertook the search for a truth, where the investigator himself was a subject of knowledge. We shared Freire's position (1990): "the object of knowledge is not the end of knowledge for the subject of knowledge, but a mediation of knowledge" (p. 113).

We understand knowledge as a dialectical process, where "my vision" does not prevail over the "vision of the other", where my beliefs are not more valid than the beliefs of others. Therefore, dialogue is an essential tool in this research, understood as something more than a simple conversation or a lively exchange of ideas. This dialogue involves the confrontation of different views around common interests, not with the intention to impose an idea that we consider less successful than another one, but with the goal to understand, to know and to advance in the search for truth that is shared with others.

In that search for understanding and knowing, we consider it essential to understand the rationalities (Giroux, 1997). It is necessary to approach the set of assumptions and practices that allow individuals to understand and shape their own experiences and those of others. On the other hand, one must decipher the interests that define and qualify the way each one is facing the challenges presented by their experience. This understanding may enable us to avoid merely causal explanations or oversimplification of the complex relations that exist inside and outside the classroom. We assume a strategic rationality (Heler, 2005), from the standpoint that we work with individuals, not with objects; we do not reify people. This rationality is aimed at trying to order the action between individuals pursuing interests that could diverge but still maintain interdependence relations among themselves. This creates the need to understand the viewpoints of others in order to decide on courses of action that can offer the group a certain "degree of security" in the realization of interests that may become shared.

We worked with teachers of mathematics, students majoring in Mathematics at the university and the investigator with their rationales, their theories and practices. There were two methodological moments. The first was a study of theoretical development aiming to propose elements for an evaluation model that would function

as an explanatory and organizational principle, from critical analysis of empirical data and existing theories. This study was supplemented by documentary critical in-depth interviews conducted with teachers.

The second methodological point of the research came from the field work done with students in the Geometry course. This work allowed us to build reflections that nourish both teacher and student perspectives, depending on the search for missing links and the gathering of shared views.

We emphasize in this report the fact that our research is framed within an critical-interpretative perspective which used grounded theory.

SOME RESULTS

A conclusion regarding the teacher's perspective is that it is not possible to establish a direct correspondence between what teachers think and what they implement, between the desirable and feasible, between their epistemological and educational conceptions and the evaluative aspects. It is not possible to define a path-way, rather there is a complex framework that cannot be deciphered by a single approach or determined by a relation of transitivity. From that perspective, what we might consider contradictions are due to individual teachers' rationalities: their visions, assumptions about their practice and how they face it. That rationality is mediated by what Giroux (1997) calls *cultural capital* that is made, inter alia, by the forms of knowledge, linguistic practices, values and styles that make up the quality of each teacher.

The research raises a number of teacher's beliefs that are related to perceptions about students, learning and self-evaluation. As elements to emphasize, they perceive that mathematics' students value alternative forms of assessment lowly and have a "mechanistic conception" of the discipline that is a product of their experiences during the previous stage of their higher education that have developed a unique insight about solving problems. The problem of evaluation is seen as something external to the teacher's own practice, and responsibility for failure falls on the students themselves. They recognize assessment as an important and complex process but also recognize its limitations in this regard. A landmark opinion is that one of the teachers assumed: "I think the way we evaluate the student does not correspond with the things that I think about mathematics".

Although no one can say with absolute certainty that the prescriptive or normative conception (Ernest, 1989, 1991), represented mainly by the philosophical current of formalism, is what characterizes the group under study, we can see that for some of these teachers the values of objectivity, theoretical considerations of the discipline and the "universality of the mathematical knowledge" are fundamental components of its design. Despite some suggestions that the importance of the applicability arises as a concern, possibly linked to their condition as mathematics teacher trainers, the weight of the formal and conceptual seems to mark their views.

The students gave importance to the variety of assessment activities that expanded the single scheme of examination papers. They achieved a shared vision of evaluation as an instance that promotes mathematical learning. This finding is at odds with the belief that some teachers have about the "low value" that students give to alternative forms of assessment. There seems, therefore, to be a "student's consciousness", which they develop by joining the word with the action and theory and practice. But as Carr (1999) argues, this "has little to do with the" hostile "attitude of teachers or their inability to understand or implement the theories" (p. 52). It has to do with the conceptual foundations on which to build an educational practice.

The students argued for the acquisition of what might be called added value to the proposed activities, such as when they state: "One feeds as [...] sometimes not what you were looking for but you begin to nourish with other things from other parts of mathematics, then you say this is interesting, let me see other work and you get to read, read. " Here we get an important clue about evaluation as an instance promoting mathematical learning, which develops self-consciousness in individuals and groups. Evaluation is understood as a task that does not end with a final answer or product.

Students discussed their points of view, justified and supplemented them, they were able to bring into play different cognitive processes, assessing the importance of collective effort as more than the sum of individual efforts, the research opened the way for understanding social and cultural processes. The construction of students' knowledge consolidated their awareness. We worked to develop a critical view of education that promotes the development of democratic powers in the classroom and beyond (Amit and Fried, 2002; Bishop, 2007).

The constitution of working groups led students to commit themselves not only to learning but also to their peers. The collaborative work emerged as an essential, valued by students who believed that through a joint effort they could achieve "a more pluralistic vision of mathematics". Students appreciated that beyond the application of a technique there is an understanding of the why and wherefore of things. Also, they stressed the need to connect the mathematical knowledge of prospective teachers with the world around them and with their life. For this, an important element is the use of the student experience.

The ideas of interaction and integration are explained by a student who talked about the group strengthening and the importance of breaking with the single conception of individual work: "it also breaks that vision we, mathematics teachers, have or the ones that are preparing for that, of individual work, individual work that we see for what it's worth, I think at least in the case of my group, I think the fact that the group has emerged strengthened, **we realized that it was the group, that it wasn't a question of one individual** (highlighted in the original)". With these positions the strength of true dialogue has emerged as an essential nutrient of learning as an experience that allows an enriching exchange.

Students who have experienced a teaching model in which teaching practice and assessment practice are considered as integrated instances, giving importance to the group without neglecting the individual aspect, were able to develop a set of values where responsibility is not only placed on the teacher but students also made their own responsibilities. They had the intellectual honesty to put into play self-regulatory mechanisms that did not originate as rules imposed by the teacher, but arose through the commitments that were perceived as important.

SOME FINAL THOUGHTS

To carry out a proposed model to make an impact on assessment in mathematics teacher education it is essential to have a profound transformation of the mental models that are present in many educators and students, and in society itself. To avoid the possible danger that the proposal will be neutralized it is necessary to define new operators. The formation and progress of these new operators will be led by the concept of authentic assessment (Gulikers et al 2004, Rennert-Ariev, 2005).

Gulikers, Bastiaens, and Kirschner (2004) propose the following definition of authentic assessment: “An assessment requiring students to demonstrate the same (kind of) competences, or combinations of knowledge, skill and attitudes, that they need to apply in the criterion situation in professional life” (p. 69). This definition is a good starting point, but we believe that a revitalized notion of authentic assessment is necessary (Rennert-Ariev, 2005).

We must go beyond the proposal that the students “demonstrate the same (kind of) competences”. It is necessary for authentic assessment to enable the student to develop new emergent competences to face a changing society. Moreover, the application of knowledge and skills to the realm of “professional life” must be closely linked to the construction of a “social life”.

The development of authentic assessments must correspond to what we have called "new operators" which include things like: ways of learning, forms of appropriation of knowledge, field organizers and evaluative context. From the critical insight that we have assumed in this research we must pursue a proposal for mathematics assessment in teacher education with an emancipatory directionality, in the sense that there must be a shared goal of moral and ethical standards, understanding that authentic assessments are set within a social, cultural and political context. The proposal should be assumed in a context of equity and social justice, with tolerance for one another, involving the breakdown of hierarchical structures but nourishing a sense of responsibility and individual and social commitment.

The forms of learning should consider:

* *Collective learning* that involves ways of converging, managing and appropriating mathematical knowledge and its use in different contexts, by the groups.

* *Individual learning* to make effective the internalization of knowledge production processes and allows consideration and understanding of the different ways that individuals within a group "own" a certain knowledge.

* *Social learning* that involves a commitment to effective fields of production and access to knowledge beyond the formal school environment.

* *Self learning* conducive to self-awareness by both individuals and groups. This form of learning would strengthen the assessment as a task that does not end with a final answer or product within a formal classroom context.

These forms of learning are conceived as entities that provide feedback to enable the production of a continuous learning process.

Finally, we believe that this research, as it develops elements for an alternative model of assessment in mathematics, can become a point of reflection for the specific training of mathematics teachers. This concurs with the points made in the conclusions of the Inter-American Conference on Mathematics Education (1995): "It is imperative to have an adequate knowledge about the formation of mathematics teachers. And this training should be redirected, along the lines arising from the Mathematics Education". We recognize that the road may be arduous but, nevertheless, is necessary if we continue in the quest for the always cherished possible utopia.

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