Teacher assessment action in mathematics classes: a study with teachers from the 2nd cycle of Mozambican general high school education

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ABSTRACT

Background: Assessment is one of the components and objects of research in Mathematics Education that, among various functions, ensures/promotes student learning. In this sense, the teachers' assessment action, and the teaching ways of doing it in the classroom have implications for students' learning*.* **Objectives**: This paper intends to investigate what mathematics teachers do (say they do) when they assess students in their classes. **Design**: a descriptive qualitative study was carried out. **Setting and Participants**: Four mathematics teachers working in the 2nd Cycle of General High School Education of Mozambique were selected to participate in the research. **Data collection and analysis**: individual reflective interviews were conducted, and audio recorded. The accounts were transcribed and submitted to content analysis, in the light of which they were fragmented and grouped into categories of teachers' assessment actions. **Results**: Four categories of actions (stimulate, access, interpret, regulate) and nine subcategories (question, give task, request; look, supervise; verify, perceive; give feedback, reorient) emerged from the data collected. The teachers carried out a formative-type assessment, fulfilling a cycle of actions (assessment action cycle) that starts with the stimulus or access and closes in the regulation, from where any of the initial actions were resumed. **Conclusions**: It can be said that education assessment is one of the motives for reflection and knowledge production in teaching practice.

Keywords: Teacher assessment action; mathematic classes; Mozambican general high school education; regulation; assessment actions cycle

A ação docente avaliativa em aulas de matemática: um estudo com professores do 2º ciclo do ensino secundário geral moçambicano

RESUMO

Contexto: A avaliação é um dos componentes e objetos de investigação em Educação Matemática que, entre várias funções, assegura/promove a aprendizagem discente. Nesse sentido, a ação docente avaliativa e os modos docentes de procedê-la em sala de aula têm implicações para

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a aprendizagem dos alunos. **Objetivo**: Este trabalho pretende investigar o que os professores de matemática fazem (dizem fazer) quando avaliam nas suas aulas. *Design*: realizou-se um estudo qualitativo descritivo. **Ambiente e participantes**: Participaram 4 professores licenciados em matemática, selecionados por atuarem no 2º Ciclo do Ensino Secundário Geral de Moçambique. **Coleta e análise de dados**: A coleta foi realizada por meio de entrevistas reflexivas individuais, as quais foram gravadas em áudio. Os depoimentos foram transcritos e submetidos à análise de conteúdo, à luz da qual foram fragmentados e agrupados em categorias de ações docentes avaliativas. **Resultados**: Dos dados, emergiram 4 categorias de ações (estimular, acessar, interpretar, regular) e 9 subcategorias (questionar, dar tarefa, solicitar; ver, supervisionar; verificar, perceber; realimentar, reorientar). Os professores realizaram uma avaliação do tipo formativa, cumprindo um ciclo de ações (ciclo de ações avaliativas - CAA) que começa pelo estímulo ou acesso e fecha na regulação, de onde qualquer das ações iniciais pode ser retomada. **Conclusões**: Pode-se dizer que a avaliação formativa é um dos motes da reflexão e da produção de conhecimentos na prática docente.

Palavras-chave: Ação docente avaliativa; aulas de matemática; ensino secundário geral moçambicano; regulação; ciclo de ações avaliativas.

INTRODUCTION

This article exposes the results of a study whose objective was to investigate teachers' assessment knowledge and actions in mathematics classes in the 2nd cycle of Mozambican general high-school education. We chose the 2nd cycle to ensure that the data collection was made from teachers with specialised training in Mathematics, since it is rare to find teachers with generalist training in this cycle.

> The study is part of the research program of EDUCIM group[1], which investigates, among so many themes,
>
> "The elaboration of teaching knowledge, the action of the teacher in the classroom, the possibilities of informal learning and the relationship between formal and non-formal education[2]."

As part of the research program of the EDUCIM group, this work aims to continue and expand investigations around the teaching action in mathematics classes. The group has published studies about teaching action in math classes published (Dias et al., 2017; Andrade, Arruda & Passos, 2018); however, they do not mention assessment as part of such actions. This finding, confronted with the assumptions of the formative-type assessment, responsible for monitoring teaching actions, adjustments, and review of materials and procedures dedicated to teaching aimed at student learning's success (Widiastuti & Saukah, 2017), led to questions that encouraged this research, which aims to understand how the teachers evaluate in mathematics classes.

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[1] Group of Research and Education in Sciences and Mathematics of the State University of Londrina.

[2] Information available at http://educim.com.br/

Another reason for this study stems from our belief that the most general of the teaching objectives is to help the student learn, a goal that must be ensured through permanent collection and interpretation of evidence of this learning, followed by intervention throughout the teaching, when needed. In this way, the didactic relationship between teaching and learning presupposes the existence and inclusion of the assessment, an action that seeks to ensure coherence between teaching and learning or, at least, that learning is happening as expected.

Considering the presence of the assessment in the didactic teaching-learning relationship, the guiding question in this research was: What do math teachers do (say they do) when they assess students in their classes? To help us answer this question, we selected four teachers of the 2nd cycle of a Mozambican high school to share their knowledge and assessment practices through a reflective interview.

The article discusses knowledge and teaching actions in the classroom (in mathematics), assessment as action and agent of the teaching-learning process, data collection and analysis methods, the results and analysis, and final considerations and references.

THEORETICAL FRAMEWORK

Knowledge and teaching action in the classroom

Talking about teaching knowledge and action in the classroom immediately refers to teaching, "a craft of knowledge that evolves in the classroom context in which the teacher mobilises various kinds of professional knowledge" (Machado, 2016, p. 17). In this sense, teaching is what the teacher does in the classroom; it is to mobilise knowledge to lead the student to learn and, therefore, to know.

According to Tardif (2005, p. 167), teaching is the act of "[…] entering a classroom and placing oneself in front of a group of students, endeavoring to establish relationships and unleash with them a process of training mediated by a wide variety of interactions." It is a moment in which the teacher mobilises diverse knowledge amalgamated in a plural knowledge: knowledge of professional training, disciplinary knowledge, curricular knowledge, and experiential knowledge (Tardif, 2005).

In the exercise of their functions, teachers "develop specific knowledge, based on their daily work and on the knowledge of their environment," which are incorporated into the "individual and collective experience in the form of *habitus* and skills, know-how-to-do and know-how-to-be" (Tardif, 2005, p. 39). In the same sense, Charlot (2000) draws attention to the fact that teaching is not purely cognitive and didactic, as it leads the child to engage in a specific type of relationship with the world, with him/herself and with others. At the same time, teaching is a mobilisation of cognitive and pedagogical knowledge incorporated in training, in the institution (society) and knowledge produced in practice and context, driven by the objective of leading the students to establish

relationships with the world in three dimensions, the epistemic, of identity and the social dimension (Charlot, 2000).

In the epistemic dimension, learning is "appropriating a virtual object (knowledge) […]" (Charlot, 2000, p. 68), generally universal and represented by "purely intellectual or cognitive discourses" (Arruda & Passos, 2017, p. 99), or being able to use an object in a relevant way (Charlot, 2000). In the identity dimension, learning is configured in a personal and specific relationship. It refers to the way the individual defines him/herself and others: their history, expectations, references, life, and relationships with others (Charlot, 2000). Finally, the social (contextual-specific) dimension refers to the relationship with the world in which the subject lives and with the other, and is related to "'having a good profession,' to 'becoming someone,' etc." (Charlot, 2000, p. 73). Teaching directed towards these dimensions is related and similar to the training, whose mediation can be done in two ways: the practice of knowledge or the knowledge of the practice (Charlot, 2005).

The first form is, according to Charlot (2005, p. 93), "a practice: the concept does not have the status of an object to be contemplated or exposed in speech, but rather an instrument to solve problems, build other concepts, produce effects of knowledge." This form of mediation is related to training for application - technical rationality - where the individual is intelligent when he/she applies knowledge (Schön, 2003).

The practice of knowledge is also similar to using a *toolbox* (Keisar & Peled, 2018). More explicitly, when the teacher teaches by this approach, they act as a technician who reproduces knowledge that monitors prescriptions (Pimenta, 2005). The professional knowledge learned throughout their training (of school, didactic-pedagogical content, and others) becomes a set of tools that the teacher uses to lead the students to learn. Therefore, teachers are users of knowledge (Marquesin & Nacarato, 2011), so that, if teachers do not learn some content, they do not have it as a tool; therefore, they cannot teach.

The second form, knowledge of the practice, is a form of mediation whose knowledge about practice is produced by research (Charlot, 2005). The knowledge of practice is specific knowledge:

> "It deals with directed practices, therefore sequences, contextualised, and, therefore, subjected to variations that cannot be reduced to conceptual distinctions: it is knowing the achievement of objectives and contextualisation, at the same time that, as knowledge, it puts itself as valid in itself, escaping completion and contextualisation." (Charlot, 2005, p. 94)

Unlike the practice of knowledge, mediation for the knowledge of the practice seeks to overcome technical rationality or *toolbox* and represents the process that, although considering some elementary toolbox as a ground, is based on the production of knowledge throughout practice, aiming to answer the challenges intrinsic to the context (time and space).

In the knowledge of the practice, the teacher is a "[…] subject and an intellectual capable of producing knowledge, their profession is a space for the production of knowledge, social practice and reforms in the education curricula" (Machado, 2016, p. 15), meaning that they are not limited to what they learned during their training (their toolbox), but reflect, (re) create, innovate and learn throughout their experience, often in response to the challenges of the context in which they are inserted. Therefore, the teacher of this approach not only applies the *toolbox* acquired in education, but also produces know-how-to-dos based on the challenges that teaching places in his/her daily life, performs three important movements proposed by Schön (reflects in action, reflects on action and reflects on the reflection in action), and the teaching becomes the starting and arrival point of knowledge, promoting the authentic pedagogical return (Pimenta, 2005).

Assessment as a teaching and learning action

The assessment is an action (Passos, Passos & Arruda, 2018) and a complex process. Depending on the assessors, what they assess, and based on their relationship with the assessment, assessing can take on several characteristics such as measuring, estimating, intuiting, and others.

Defined as "a research practice and learning opportunity" (Mendes & Buriasco, 2018, p.654), educational assessment has been fragmented into diagnostic, formative or summative (Haydt, 1997; Hadji, 2001) and in the assessment of learning (Ao^3L), assessment as learning (AaL) or assessment for learning (AfL) (Earl, 2013). Those fragments are often associated with specificities such as functions and/or assessment processes in educational practices. The centrality in learning is expressive in all fragments, intuiting that learning is the educational assessment object.

Furthermore, the assessment's fragmentation has contributed to categorising teaching actions, promoting choices, or polarising teachers' and researchers' opinions. In this sense, it is common to observe opinions that repress the summative assessment, favouring the formative assessment. For example, Hadji (2001) and Earl (2013) observe that teachers use the summative assessment more, often through tests, inciting hierarchies among students. Perrenoud (1999) suggests making continuous regulation of learning the school's fundamental logic, not to accept school failure and inequality.

In a different movement from this disjunctive-excluding categorisation, current research suggests a critical and articulating view of the different fragments of educational assessment. In this sense, some studies link the test to the formative assessment, proposing the test in phases (Trevisan & Buriasco, 2016; Mendes & Buriasco, 2018), and others that criticise the use of adjectives and the polarisation of the summative and the formative assessments. In her review article, Lau (2016) questions the association of the formative assessment as good and the summative assessment as bad, whereas Shavelson (2018)

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[3] Acronym in English (Clark, 2012; Earl, 2013; Black, 2015).

calls attention to the false dichotomies in the approach of the formative (contextualised) and the summative (standardised) assessments and argues that "[…] the big question is not whether assessments should be 'standardised' or 'contextualised', but whether the evidence collected rigorously addresses the policy and/or practice issues that drive the assessment" (Shavelson, 2018, p. 2). We observe that those trends suggest a detailed work with the evaluative information, both in the sense of what, how much, and how to collect it, and in the way to process it and contribute to teaching-learning.

The differentiation and articulation of the several forms of assessment proposed in those trends are based on learning in the sense of the formative assessment, which "allows teachers to make adjustments and revision in learning materials and teaching techniques, in order to obtain more teaching success" (Widiastuti & Saukah, 2017, p. 51). This author considers it essential for teachers, and especially for students, in classroom practices,

Despite the emphasis on the formative assessment, its concept and practice have been controversial. These are not oppositions, but differences in descriptors, characterisations of what can be considered a formative assessment. Apparently, its conception remains open to (re)creations and/or (re)formulations. Hadji (2001) states that it is a utopia that indicates the objective but not the path, whereas Black (2015) considers it an optimistic but an incomplete view. What seems consensual is the recognition of its potential in improving student performance and the role of control to favour learning, with an emphasis on the ongoing teaching-learning process (Hadji, 2001, Earl, 2013, Mendes & Buriasco, 2018, Widiastuti & Saukah, 2017, Andersson & Palm, 2017). Specifically, Widiastuti & Saukah (2017, p. 52) present the following characteristics:

> "(a) it is an assessment teachers carry out daily during the teaching and learning process; (b) it provides *feedback* to teachers for immediate review; and, (c) it aims to modify teaching and learning activities to improve student performance."

Andersson & Palm (2017) brought together formative assessment strategies pointed out in different surveys: teaching adjustment based on evidence collected from student learning, *feedback*, self-regulation of learning, self-assessment, and peer-assisted learning. These strategies add elements of assessment for learning and assessment as learning (Earl, 2013; Clark, 2012; Black, 2015), two of the three approaches proposed by Lorena M. Earl that describe or characterise classroom assessment. This researcher considers that each of the three approaches (A*f*L, A*a*L, and A*o*L) contributes to some part of the classroom assessment.

The assessment for learning takes place "with *feedback* rotations to ensure that students receive tips to review their learning and move on" (Earl, 2013, p. 4), aiming to monitor student progress, from the current *status* to the desired result (Clark, 2012; Barlow, 2006). The teacher is the evaluator in this approach. He/She assesses through interactions and provides assistance and *feedback* more than once during the lesson (learning), using

observation, questioning in the classroom, conferences, or any other mechanism that gives him/her useful information for planning and teaching (Earl, 2013).

Assessment as learning is a "subset of assessment for learning that emphasises the use of assessment as a process for developing and supporting metacognition for students" (Earl, 2013, p. 28). The author argues that, with this approach, she reinforces and expands the role of the formative assessment, emphasising the student's role as a collaborator and the critical connector of the assessment and learning process. The student is the evaluator, and the assessment takes place through self-monitoring and self-correction (Earl, 2013).

In education, teachers plan their teaching and, simultaneously, define the objectives that must be achieved and, therefore, observed, through students' behaviour. The students' behaviour says something to the teacher and the students themselves, albeit by inference (Schunk, 2012) or by assumption (Barlow, 2006), since "we can only make assumptions about it from the establishment of observable behaviours, in the way the tasks were performed and, with that, the acquisitions in the field of knowledge and skills, which are translated in terms of results, progress or level reached now" (Barlow, 2006, p. 80).

What we infer or suppose when evaluating refers to learning, which "involves acquiring and modifying knowledge, skills, strategies, beliefs, attitudes and behaviours" (Schunk, 2012, p. 2). When these acquisitions or modifications are not evident or are inappropriate, the assessment can add, besides learning, teaching (teaching action), content (complexity), etc., seeking explanations and, most importantly, favouring reflections, decision-making that can trigger actions that aim to create opportunities/ optimise learning.

According to Hadji (2001), the assessment takes place in three stages: i) collecting information - regarding the progress made and the learning difficulties encountered by the student; ii) interpreting that information - seeking to diagnose any difficulties; and iii) adapting teaching/learning activities. This sequence is also summarised by Hoffmann (2008, p. 161), who advocates that "in addition to judging, evaluating is 'seeing, reflecting and acting,'" meaning that the assessment should help make and implement decisions based on findings.

In the conditions exposed, classroom assessment can make teaching work a teaching praxis, "reinvented at each teaching action in a reasoned action-reflection dynamic: reflected action" (Silva, 2010, p. 48) or in which "the unity theory and practice is characterised by action-reflection-action" (Azzi, 2005, p. 38). Considering reflection as an assessing moment or an echo of action (Barlow, 2006), the teaching educational praxis would be represented by the alternation between teaching and assessment actions, in which the teaching actions followed by the assessment are developed to (re)orient teaching towards learning.

METHODOLOGY

Researching teaching knowledge means, in some way, understanding how teachers relate to the school world, it means researching "the knowledge, skills, abilities (or aptitudes) and teachers' attitudes, i.e., what was often called knowledge, know-how-to-do, and know-how-to-be" (Tardif, 2005, p. 60). In this study, we researched actions related to assessment in mathematics classes, seeking to understand what math teachers actually do when they evaluate in their classes.

The study followed a descriptive qualitative approach by focusing on the process, not just the results or products. It also characterised what the participants do or say they do when they evaluate (Bogdan & Biklen, 1994; Fiorentini & Lorenzato, 2006).

Data were collected[4] through a reflective interview, as theorised by Szymanski, Almeida, and Prandini (2018), and considered as "a situation of human interaction, in which the perceptions of the other and themselves, expectations, feelings, prejudices, and interpretations are at stake for the protagonists: interviewer and interviewee" (Szymanski, Almeida & Prandini, 2018, p. 12). We chose the interview because of its interactive nature, allowing for the exchange of impressions, which helped to deepen information by asking questions in this regard and requesting clarifications whenever necessary. Whenever necessary, the interview fulfilled the route proposed by Szymanski, Almeida, and Prandini (2018): warm-up, triggering question, expression of understanding, syntheses, clarification, focus, deepening questions, and, finally, the return.

The interviews took place in two high schools in Montepuez (a city in the province of Cabo Delgado - Mozambique, a Portuguese-speaking country as the official language), and all activities were recorded in audio, transcribed, and returned. In the first moment of the transcription work, we wrote a draft and the accounts of the recordings, and, in the second moment, we produced the reference text, where we "cleaned language vices" (Szymanski, Almeida & Prandini, 2018, p. 72). The return consisted of presenting the respondents' transcripts of the accounts and helped us disclose the information collected and obtain modifications and/or extensions where necessary.

Study participants (the respondents) are four mathematics teachers working in the 2nd cycle of high-school education (three from Montepuez High School and one from 15 de Outubro High School), here called P_i, P_{ii}, P_{iii}, and P_{iv}, to preserve their identities. The choice for teachers in practice was inspired by Dubar, as cited in Tardif (2005, p. 56), who argues that "working is not exclusively transforming an object or situation into something else, it is also transforming oneself in and through work." Therefore, we believe that teachers with some work time have experience with assessment practice, in such a way that they may have consolidated and innovated their assessments throughout their working time, in the sense of knowledge, know-how-to-do, and know-how-to-be.

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[4] We inform that this research and the disclosure of the results were approved by the Ethics Committee CAAE: 57663716.9.0000.5231. Review number: 1.666.360.

Data analysis was carried out from the perspective of Bardin's content analysis (CA) (2011), more particularly the thematic analysis. The thematic analysis uses, according to Bardin (2011, p. 77), the "count of one or more themes or items of significance, in a previously determined coding unit." In this sense, the coding unit (CU) previously determined in this analysis is the sentence fragment of each teacher's account, containing at least two essential sentence structure elements: the subject and the (verbal) predicate. Those fragments, which are also recording units (RU) in this study, were numbered and encoded in the form $\mathbf{P}_m\mathbf{n}$, where $\mathbf{P}_m$ (with m= i, ii, iii,…) is the teacher, and $\mathbf{n}$ (n = 1, 2, 3,...) is the excerpt of their speech or the recording unit.

Although the accounts with the characteristics indicated above have been fragmented and numbered, in this study, we present fragments whose statement's significant nuclei are the verbs or verbal forms that express teachers' assessment action, on the basis of which the themes and, therefore, the categories, were defined - "rubrics or classes, which bring together a group of elements (recording units, in the case of content analysis) under the generic title, a grouping carried out due to the common characteristics of those elements" (Bardin, 2011, p. 145). The actions (verbs) identified in each RU were grouped into categories whenever they referred to a specific and broad type of action and used as items of meaning or indicators to justify the formation of themes/categories of the assessing actions captured in the teachers' statements.

DATA PRESENTATION AND ANALYSIS

We read and reread the reference text of the interviews conducted with the teachers involved, and, after analysing and interpreting them based on the literature and our own experiences and understandings, we obtained the evidence and understandings shown below. The triggering question posed to the respondents was: What have you been doing to evaluate in your classes?

Teachers' accounts were fragmented, and we obtained the quantities of recording units per participating teacher, shown in Table 1. The percentages refer to the amount of RUs of each teacher's assessment actions in all their RUs.

Table 1
Recording Units (Assessment) per Teacher

Teacher	Recording units	Assessment recording units	
		Quantity	%
P_i	32	16	50.0
P_{ii}	23	11	47.8
P_{iii}	29	22	75.9
P_{iv}	22	18	81.8

These RUs are fragments of accounts that refer to descriptions and knowledge related to assessment pedagogical actions. Although P_i stood out in the number of URs (32), P_{iii} and P_{iv} were more neutral in their statements when referring to more assessing actions (75.9% and 81.8%, respectively). P_{ii}, with 23 RUs, just surpassed P_{iv}, who had 22 RUs and his assessment actions were below half of his RUs - 11 (47%). The distribution of each teacher's RUs by the categories obtained is shown in Figure 2.

Categories of the teachers' assessment actions identified

As described in the collection methods and data analysis, the respondents' statements were fragmented, considering the explicit or implicit presence of the subject and the (verbal) predicate. After this movement, the fragments that refer to the teachers' assessment action were selected and grouped into categories or rubrics at three levels: macro actions, actions, and micro-actions, representing categories, subcategories, and accounts. In this movement, it was possible to capture nine subcategories distributed in four categories of teachers' assessment action: stimulate (question, give task and request), access (look and supervise), interpret (verify and perceive), and regulate (give feedback and reorient).

Stimulate Category

The Stimulate category, which stems from the notion of stimulus - "designates in psychology, in the first place, any event in the world that can excite one of the organism's receiving apparatuses and therefore be the source of a response" (Doron & Parot, 2001, p. 307). It refers to actions that the teacher takes to mobilise the students to express themselves and expose their learning in the classroom through behaviours. This category includes the actions of questioning, giving tasks, and requesting, meaning, respectively: putting questions (whether reflective or not) that require students' responses through which the teacher gauges their learning or knowledge; giving exercises, activities, or work; and, finally, indicating or asking a volunteer student to express him/herself orally or in writing. Table 2 shows the distribution of micro-actions (UR) in each subcategory of the Stimulate category.

Table 2
Actions Associated to Stimulate as an Assessment Action

Action	Micro action
Question	*P_i11: Then, I ask oral, written questions.*
	P_{ii}16: I explore, as I finish the motivation, I introduce the class itself.
	P_{ii}18: But in some cases, I can also ask questions during the class;

Action	Micro action
Give a task	P_i12: I give exercises.
	P_{ii}6: After all the development work for this class, I ask questions about the consolidation of the class, I'm talking about application exercises.
	P_{iii}2: After listening, finishing the class, almost at the end, I give a job or exercise.
	P_{iii}13: I give an exercise.
	P_{iii}23: the primary way is to give an activity or work.
	P_{iii}26: Another activity is to give exercises to solve at home.
	P_{iv}2: After the notes, I soon give [them] exercises.
	P_{iv}11: I leave others to evaluate again.
	P_{iv}18: I use exercises more.
Request	P_i18: I guide the student (volunteer or indicated) to go to the board to solve an exercise.
	P_i14: The questions help to get the student to participate.
	P_{ii}9: So, in this process, I tell a student to go to the blackboard.
	P_{ii}10: I ask some volunteers to present the work on the board, much more if they are bigger examples.
	P_{ii}11: So, I ask students to solve an item each.
	P_{iii}8: After this correction, I call a student to interact with the others, solving [the problem] on the board.
	P_{iii}9: Initially, I call two or more (students).
	P_{iii}14: I ask for a volunteer to resolve [it] on the board.
	P_{iii}15: After the volunteer resolves [the problem], I indicate two or three students, and then the whole class, to correct it, I mean, to say whether the colleague is right.
	P_{iii}16: If he/she is wrong, I tell the student who said that the resolution is wrong to [go to the board and] solve it.
	P_{iv}5: I ask some volunteers to go there to the board to correct (solve) the exercises I gave.
	P_{iv}7: Depending on the situation, I indicate the students.

Access Category

In the Access category, the teacher uses the sensory-motor organs to collect and record evidence of learning in student production from which they gauge the nature or characteristics of students' learning. This is related to the information collection stage (Hadji, 2001) or evaluative record, which "is the notational and systematic monitoring of student productions and teaching dynamics" (Silva, 2010, p. 68). The actions of looking and supervising are part of this category. Table 3 below shows the distribution of excerpts (micro actions) for each of the actions (look or supervise).

Table 3
Actions Related to Access as an Assessment Action

Action	Micro action
Look	P_i15: This participation shows me whether the student understands [it].
	P_i17: To see how they are doing.
	P_{iii}6: Then, the following day, I see the students' homework.
	P_{iii}12: Then, to see whether the students assimilated the content.
	P_{iii}21: To see how the work is going, in the case of the exercises.
	P_{iii}22: I also see the way students participate in class.
	P_{iv}19: I use the contributions.
Supervise	P_i16: Regarding the exercises, I give the students some time to work on their notebooks while I move from desk to desk or group to group.
	P_i21: During the PEA, I guide the exercise resultion in groups.
	P_i22: As they are doing it, I then start to check what the students are actually doing because I can't just stop and let students do it on their own because this is a colaborative work.
	P_i23: I must let the student express themselves too.
	P_{ii}7: But in this process of applying exercises I go desk by desk.
	P_{ii}13: I never stop going desk by desk.
	P_{iii}20: Depending on the case, I go desk by desk or group by group.
	P_{iii}24: Be in control personally.
	P_{iii}29: The teacher controls.
	P_{iv}3: So, the students do the exercises while I go desk by desk.

Interprete Category

This category represents the intellectual actions of "attributing a predicate to a subject: A is B" (Barlow, 2006, p. 16), in the act of reading and confronting an observable reality and the desired reality, seeking evidence of what is desired (Hadji, 1994). In other words, this category represents the mechanisms of deciphering or signifying the students' production, of "its mistakes and successes, according to the theories of education and the context it works" (Silva, 2010, p. 51). It is the process of relationship between two behavioural objects, the one emerging from practice (observed) and the other predicted by the teacher - theoretical and ideal, and is related to the stage of interpretation by Hadji (2001). The actions of verifying (with a comparative bias) and perceiving (with a focus on recognising the learning/difficulty or attributing meaning to the student's behaviour) are part of this category. Table 4 shows the excerpts of each action.

Table 4

Actions Related to Interprete as an Assessment Action

Action	Micro action
Verify	P_i13: To check whether what I am giving is actually what the student is grasping.
	P_i19: Then I check whether, in fact, the student can solve correctly the exercise I gave [him/her].
	$P_{ii}8$: To try to see what the student is doing according to the class given.
	$P_{ii}12$: To verify whether the content was perceived.
	$P_{iv}4$: To check.
Perceive	$P_{iv}6$: In this context, I can tell that this one succeeded, assimilated the subject, this one did not.
	$P_{iv}20$: It is from them that we can tell that this student perceived something or not.
	$P_{iv}21$: It is easy to notice that when a student solving [a problem] on the board is making a mistake, the others react.
	$P_{iv}22$: I soon realise that they have grasped something.
	P_i20: Then I am aware that, in fact, the objective has been reached.
	$P_{ii}14$: To try to understand whether all students reached the same purpose of the class.
	$P_{iii}10$: To evaluate whether they reached the same result or not.
	$P_{iii}28$: Those exercises allow you to see whether they have assimilated [it] or not, because the 45 minutes may not be enough for students to learn everything.
	$P_{iv}12$: If I notice that they have more difficulties.
	$P_{iv}15$: If I see that by that way they don't understand.

Regulate Category

The Regulate category interrelates assessment, teaching and learning. It is related to the adaptation stage of Hadji's teaching-learning activities (2001) and represents the set of actions through which the teachers adjust their pedagogical actions according to the reading they make of the results that emerge from the practice during class (Perrenoud, 1999). Broadly, we could say that it is a kind of interventional correction (personalised or not), aiming to direct a student or the class towards the desired behaviour and, therefore, to provide opportunities/optimise the learning. This category includes the actions of giving a feedback, emitting "a return message, *feedback* in response to a previous communication authored by the student" (Barlow, 2006, p. 14), and (re)orienting, which represents focusing actions in order to put them on the right path (Barlow, 2006). The statements corresponding to this understanding were distributed according to Table 5 below.

Table 5
Actions Related to Regulate as an Assessment Action

Action	Micro action
Give Feedback	P_i26: As I am checking, I have to explain how to do it.
	P_i30: So, during the PEA, if the student goes to the board to solve an exercise and fails, I automatically have to solve that exercise, to show the student how it should be.
	P_{iii}17: If he/she doesn't get it right, I decide to show how it should be.
(Re)orient.	P_{iv}14: I have to repeat it.
	P_i31: I have to change the strategy or method when the student does not understand.
	P_{iii}7: I correct it.
	P_{iii}25: So, whoever is wrong can correct with him/her.
	P_{iii}27: In the next class, if you can't solve it, I recap the previous class so we can move forward together.
	P_{iv}9: I repeat the explanation using other identical exercises.
	P_{iv}10: I resolve some points.
	P_{iv}16: I have to use another strategy so that they understand.

Brief exercise of a general interpretation of the teachers' assessment actions captured

As seen in the categorisation of actions, we understood that the four respondents' assessment in mathematics classes occurs in four major dimensions of action, here called by categories: stimulate, access, interpret and regulate. The reference of actions of these categories is shown in Figure 1, which presents the distribution of each teacher's RUs by categories.

Figure 1
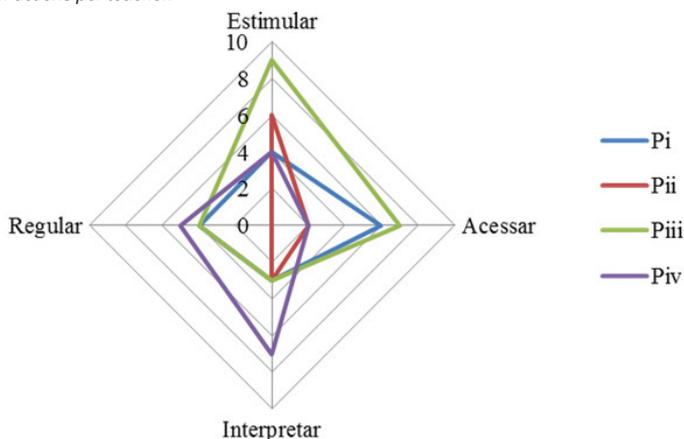*Distribution of actions per teacher.*

Figure 1 shows that in terms of the distribution of assessment actions among teachers, P_{iii} was the teacher who most mentioned such actions, whereas P_{ii} was the one who least referred to them. Except for P_{ii}, the other teachers mentioned actions in the four categories. P_{iii} stood out in the Stimulate and Access actions, and P_{iv} the Interprete and Regulate actions.

Although there is a separation between the teachers' assessment actions, we observed that teachers fulfill those actions in a cycle of assessment actions (CAA) in a recursive sequence. Thus, the class assessment begins with the act of stimulating or accessing it, after with the other actions follow. At the end of the CAA, interpreting or regulating occurs, and then any initial action can be resumed. This CAA includes indications of characteristics and strategies of formative assessment mentioned by Widiastuti and Saukah (2017) and Andersson and Palm (2017).

Together with all teachers' excerpts, it is possible to assess the CAA, as we noted that the actions expressed are interrelated functionally starting from the Stimulate category to the Regulate category. For example, P_i said that he asks questions (P_i11), gives exercises (P_i12) - (Stimulate), to observe the resolution of exercises (P_i17) - Access. This access helps to check the student's understanding (P_i19) - Interpret. In excerpt P_i30, teacher P_i says he intervenes (Regulate) when the student cannot solve [the problem]. Teacher P_{iv} indicated in the excerpt $P_{iv}11$ that he evaluates again.

Those actions are not necessarily fulfilled at the end of the cycle, and being resuming soon afterward; it occurs back and forth or simultaneously, as the excerpts P_i22, $P_{ii}18$, and $P_{iii}20$ *attest*. Figure 2 below shows a scheme representing the cycle of assessment actions for the case presented in this article.

Picture 2
The cycle of assessment actions - CAA.
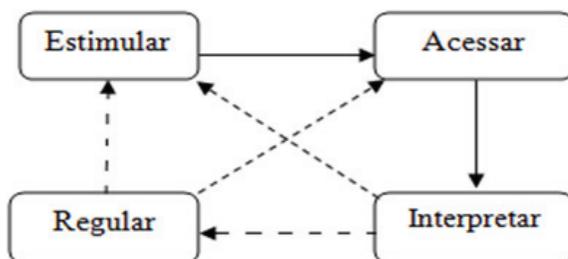
In this cycle, each dashed arrow is conditioned to the result of the action at the arrow's origin, obtained through reflection during class, and, above all, during assessment. In this sense, the teacher performs a kind of reflection-in-action, when he/she "strives to go toward the student and understand his/her own knowledge process, helping him/her

to articulate his/her knowledge-in-action with school knowledge" (Schön, 1997, p. 82). The following accounts support our understanding:

> P_{iii}(20-25): *Depending on the case, I go desk by desk or group by group to see how the work is going, in the case of exercises. I also look at how the students participate in the class, but the primary way is to give an activity or work and be in control personally, so that whoever is wrong can correct with him/her.*

> P_{iv}(7-10): *Depending on the situation, I tell students that I think to have assimilated [the subject] to go [to the board] to show how [the problem] should be solved or I explain again using other identical exercises, so, I solve some items and let others assess again.*

In those statements, the words 'depending/depends' corroborate the unpredictability of events in the classroom, the presence of reflection in the assessment, as they make it clear that the class, although planned, provides surprises that demand responses produced in the classroom in the sense of the 'here and now.' Therefore, teachers are almost always challenged to make decisions, make changes, and provide answers to occasional problematic situations to guide their class and students towards the expected teaching objective. Excerpt P_{iv} 16 shows that the unpredictable situations in the classroom demand the production of responses or interventions aimed at ensuring learning:

> P_{iv}16: *It depends a lot on the circumstances, and you need creativity and instant innovation.*

Considering what was registered, the verified assessment reflection-in-action configures and supports the practice of education assessment, in which "agents in the classroom (teacher, classmate, and student) collect evidence of students' learning and, based on this information, adjust teaching and/or learning" (Andersson & Palm, 2017, p. 105, *our translation*). This education assessment, more characterised as assessment for learning (Earl, 2013; Dann, 2014; Black, 2015), is evidenced and justified by the actions of regulation, assistance to the student throughout the class using observation, questions, and others, explicitly driven by the teaching interest of ensuring and providing opportunities for student learning.

There is an explicit teacher concern with student error among several indications, from which pedagogical actions, including assessment actions, are resumed to adjust learning, as can be seen in the *feedback* and (re)orienting actions (Table 5). Therefore, regulation is, at least, a consequence of previous actions and a point of resumption of the same actions, i.e., when reflection and interpretation reveal gaps in learning, and there is a teacher interest in providing opportunities/optimising learning, the teacher fulfills the cycle, even if going back and forth.

FINAL CONSIDERATIONS

This research, focused on mathematics teachers' knowledge and assessment actions in the 2nd cycle of Mozambican high-school education, sought to understand how teachers assessed students in their mathematics classes. The study was guided by the question: What do mathematics teachers do (say they do) when they evaluate students in their classes? We proceeded by collecting data through a reflective interview with four mathematics teachers from the 2nd cycle of two high schools in Montepuez, which was analysed with the help of the content analysis proposed by Bardin (2011). Once the data collection and analysis process was completed, we could draw significant conclusions about the issue and research objectives that must be mentioned here.

The study allowed us to understand that the teachers who participated in this research have some theoretical knowledge of classroom assessment (Hadji, 1994, 2001; Haydt, 1997; Perrenoud, 1999; Barlow, 2006; Earl, 2013; Dann, 2014; Black, 2015; Andersson & Palm, 2017) and practice it through actions that were grouped into nine subcategories, which, in turn, were divided into four categories: stimulate, access, interpret and regulate. Those actions configure a recursive sequence in the way they are disposed, and a cycle justified by the interest of creating opportunities/optimising learning. In this sense, teachers carry out the education assessment (assessment for learning), fulfilling a cycle of actions (cycle of assessment action) that begins with the stimulus or access and closes with the regulation, from where any of the initial actions can be resumed. This cycle extends the assessment stages (in the classroom) from three, proposed by Hadji (2001) and Hoffmann (2008), to four, including the stimulus stage.

The education assessment was characterised according to the conceptions of Earl (2013), Black (2015), and Hadji (2001): with an objective, but without an explicitly defined path, since the teachers did not reveal standards or uniformities in their assessment actions, but showed that they move abruptly back and forth between actions. The cycle includes characteristics and education assessment strategies mentioned by Widiastuti and Saukah (2017) and Andersson and Palm (2017), respectively, and is related to the potential presence of reflection in assessment action, and to mediation, by the model of the knowledge of the practice, since teachers explained that they are often challenged by occasional problematic situations for which they must make decisions and act instantly, providing answers and carrying out continuous reformulations of pedagogical actions, in the regulatory sense.

This finding highlights the production of experiential knowledge (Tardif, 2005), the inclusion of mediation through the knowledge of the practice (Charlot, 2005), and the course of reflection *in* and *about* Schön's practice (Pimenta, 2005). Therefore, we can say that education assessment is one of the motives for reflection and knowledge production in teaching practice.

The study also showed that the assessment in those teachers' mathematics classes assumed a functional character that, according to Haydt (1997, p. 53), "[...] takes place according to the expected objectives." This conclusion is subsidised by the records

of expressions such as 'I do this to...', implying that the assessment in those teachers' classes has no end in itself; it is an instrument or means by which evidence of learning is investigated, in the face of which they decide to cease the pedagogical actions carried out and resume others; or to improve them by resuming them and/or reformulating them, in an effort to reduce the breadth of the angle between the current and the intended *status*.

CONTRIBUTION OF EACH AUTHOR

G.M.M. collected the data. S. M. A. was responsible for supervising the research. All authors discussed the results and contributed to the final version of the manuscript.

DATA AVAILABILITY

Readers can access the data at the following *link*: https://drive.google.com/drive/f olders/1Py0nABT6o950XLTQonM1MHpth8Ay3cTY?usp=sharing

ACKNOWLEDGEMENTS

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