Didactical Suitability Criteria in Videos of Lesson Study

Article *in* Quaderni di Ricerca in Didattica · July 2020

4 authors:

Viviane Beatriz Hummes
University of Barcelona

Adriana Breda
University of Barcelona

Alicia Sánchez
University of Barcelona

Vicenç Font
University of Barcelona

Commission internationale pour l'étude et l'amélioration de l'enseignement des mathématiques.
www.cieaem.org

International commission for the study and improvement of mathematics education
www.cieaem.org

Proceedings / Actes

CIEAEM 71

Braga (Portugal)

July, 22 - 26 2019

CONNECTIONS AND UNDERSTANDING IN MATHEMATICS EDUCATION: MAKING SENSE OF A COMPLEX WORLD

***

CONNEXIONS ET COMPREHENSION DANS L'ENSEIGNEMENT DES MATHEMATIQUES: DONNER UN SENS A UN MONDE COMPLEXE

Editor: Benedetto Di Paola, Pedro Palhares
Editor of the Journal : Benedetto Di Paola

International Program Committee / Comité International de Programme:
Alexandra Gomes - Portugal
Ana Serradó – Espagne
Andreas Moutsios-Rentzos - Grèce
Ema Mamede - Portugal
Fragkiskos Kalavasis - Grèce
Gail FitzSimons - Australie
Gilles Aldon - France
Javier Díez-Palomar - Espagne
Lisa Boistrup - Suède
Marcelo Bairral - Brésil
Monica Panero - Suisse
Pedro Palhares - Portugal
René Screve - Belgique

Local Organizing Committee / Comité Organisateur Local:
Alexandra Gomes
Ema Mamede
Filipa Balinha
Joana Tinoco
Letícia Martins
Maria Helena Martinho
Paula Cardoso
Pedro Palhares
Sara Ribeiro

"Quaderni di Ricerca in Didattica (Mathematics)", Numero speciale n. 7, 2020
G.R.I.M. (Departimento di Matematica e Informatica, University of Palermo, Italy)

Didactical Suitability Criteria in Videos of Lesson Study

Viviane Hummes, Adriana Breda, Alicia Sánchez, Vicenç Font

University of Barcelona

E-mail: vivihummes@gmail.com, adriana.breda@ub.edu, asanchezb@ub.edu, vfont@ub.edu

Abstract. This work aims to identify what are the criteria used by groups of teachers, in the instructional processes (design, implementation and reflection/redesign), carried out in Lesson Study (LS) experiences. The theoretical tool Didactical Suitability is used for the qualitative analysis of two videos. As a result, it is inferred that groups of professors implicitly use some of the components and indicators of the Didactical Suitability Criteria (DSC). In addition, it is concluded that the LS methodology becomes a type of training device that promotes that some of the indicators and components of the DSC arise as consensus in the reflection of the group of professors.

Résumé : Ce travail vise à identifier quels sont les critères utilisés par les groupes d'enseignants, dans les processus pédagogiques (conception, mise en œuvre et réflexion/redéfinition), menés dans les expériences de Lesson Study. L'outil théorique de pertinence didactique est utilisé pour l'analyse qualitative de deux vidéos. On en déduit que des groupes de professeurs utilisent implicitement certains des éléments et indicateurs des Critères de pertinence didactique. En outre, il est conclu que la méthodologie des lesson-studies devient un type de dispositif de formation qui favorise l'utilisation de certains indicateurs et composants des critères de pertinence didactique comme consensus dans la réflexion du groupe de professeurs.

1. Introduction

Many trends related to teacher training, whether initial or continuous, suggest that teacher research and reflection on their own practice are key elements for professional development and the improvement of teaching. In that sense, since the Didactics of Mathematics, different proposals have emerged that provide conceptual frameworks related to the development of reflexive competence, such as: the competence to look meaningfully (Mason, 2002), the professional look (Llinares, 2012), the methodology of the study of the concept (Davis, 2008), the mathematical knowledge for a quality mathematical teaching (Hill et al., 2008), the Lesson Study (LS) methodology (Fernández & Yoshida, 2004) and the notion of didactical suitability (Font et al., 2010; Godino et al., 2019).

LS has to do with a research activity in the classroom (Burghes & Robinson, 2010; Ponte et al., 2012), since it allows the development of reflexive competence during the realization of the teaching activity. On the other hand, the Ontosemiotic Approach of Mathematical Knowledge and Instruction (OSA) (Godino et al., 2019) provides us with the Didactical Suitability Criteria (DSC), and its breakdown into components and indicators, as a tool to structure the reflection teacher. From this perspective, these criteria can be used to guide the teaching and learning processes of mathematics and to evaluate their implementation. As has been done in different training processes in some countries (Font et al., 2017; Pochulu et al., 2016; Seckel & Font, 2016). Therefore, DSC are, first of all, principles that indicate how things should be done and, secondly, they help in the

evaluation of the study process carried out (Breda et al., 2015; Breda et al., 2018). Each of these methodologies has advantages and limitations.
In line with investigating the role of teacher reflection as a strategy for their professional development and as a tool for the improvement of teaching and learning of mathematics, the objective of this work is to identify what are the criteria used by two groups of teachers of primary - to guide their practices - in the phases of design, implementation and reflection of the instructional processes carried out within the framework of an experimentation of the LS methodology.
After this introduction, the second section of this document presents the theoretical framework used and a review of the literature on this topic: Lesson Study and Didactical Suitability Criteria. In the third section, the methodology used is presented. In the fourth section the analyses of the data are presented and, in the fifth, a discussion about the results and some final considerations.

2. Theoretical Framework

This section presents the theoretical framework used: the Lesson Study (LS) methodology and the Didactical Suitability Criteria (DSC) tool and a brief review of the literature is made.

2.1 Lesson Study (LS)

The LS methodology emerged in Japan as a teacher professional development strategy. It focuses on collective learning based on teaching practice. It basically consists of the collaborative design of a class, its implementation and direct observation in the classroom, and a subsequent group analysis (Fernandez & Yoshida, 2004; Lewis, 2002; Murata & Takahashi, 2002; Wang-Iverson & Yoshida, 2005; Hart et al., 2011). LS are methodologies of teaching work supported by research attitudes and collaborative practices among teachers, which seek, at the same time, the improvement of teaching practice and student learning and the professional development of teachers.
The idea is that teachers meet with a common problem about their students' learning, plan a lesson for the student to learn, and, finally, examine and discuss what they observe in such implementation. Through multiple interactions, teachers have many opportunities to discuss student learning and how teaching affects them. This methodology can consists of four stages: class planning; class performance and observation; joint reflection on the recorded data and redesign; but there is no explicit guideline that guides reflection and decision making. To investigate what are the criteria that guide the practices and how they are generated in an LS experience, the notion of didactical suitability has been used.

2.1 Didactical Suitability Criteria (DSC)

The DSC proposed in the theoretical framework OSA, are intended to be a partial response to the following problem: What criteria should be used to design a sequence of tasks that allow the evaluation and development of students' mathematical competence and what changes must be made in their redesign to improve the development of this competence? DSC can first serve to guide the teaching and learning processes of mathematics and, second, to assess their implementations. In the OSA the following DSC are considered (Breda et al., 2017): 1) Epistemic Suitability refers to the teaching of "good mathematics". In order to achieve this, in addition to considering the approved curriculum, the intention is to refer to institutional mathematics that have been incorporated into the curriculum. 2) Cognitive Suitability refers to the extent to which applied/desired learning is within the parameters of the students' potential development, as well as the correlation between what the

students indeed learn and the applied/desired learning. 3) Interactional Suitability is the extent to which the means of interaction allow conflicts of meaning to be identified and solved and how interaction methods favour autonomous learning. 4) Mediational Suitability is the degree of availability and aptness of time and material resources necessary for the development of teaching-learning processes. 5) Affective Suitability refers to the degree of the students' involvement (interest, motivation) in the study processes. 6) Ecological Suitability is the extent to which the process of study is adapted to the centre's educational project, the curricular norms and the social environment.
The operability of the DSC requires defining a set of observable indicators, which allow assessing the degree of suitability of each of these criteria. For example, there is a consensus that it is necessary to implement "good" mathematics, but it is possible to understand very different things about it. In Breda and Lima (2016), Seckel and Font (2016), Breda et al. (2017) and Breda et al. (2018) a system of indicators is provided that serves as a guide for the analysis and assessment of didactical suitability, which is intended for an instructional process at any educational stage and explains how these criteria have been generated and their respective components and indicators. The criteria and components of didactical suitability are detailed below (more details in Breda et al., 2018) (Table 1).

Table 1. Didactical Suitability Criteria and components.

DSC	Component
Epistemic	(IE1) Errors, (IE2) Ambiguities, (IE3) Process wealth, (IE4) Representativeness
Cognitive	(IC1) Prior knowledge, (IC2) Curricular adaptation to individual differences, (IC3) Learning, (IC4) High cognitive demand
Interactional	(II1) Teacher-student interaction, (II2) Student interaction, (II3) Autonomy, (II4) Formative evaluation
Mediational	(IM1) Material resources, (IM2) Number of students, class schedule and conditions, (IM3) Time
Affective	(IA1) Interests and needs, (IA2) Attitudes, (IA3) Emotions
Ecological	(IEC1) Curriculum adaptation, (IEC2) Intra and interdisciplinary connections, (IEC3) Socio-labor utility, (IEC4) Didactic innovation

As shown in the literature review conducted in Breda et al. (2015), the notion of didactical suitability had a relevant impact on teacher training in different countries (Mallart et al., 2015; Seckel & Font, 2015; Pochulu et al., 2016). This impact is related to the idea that one of the components of the teacher's didactic-mathematical knowledge is one that allows the assessment and justification of the improvement of the teaching and learning processes of mathematics.

3. Methodology

In this research, exploratory and analytical-interpretive, the qualitative analysis of two videos that present different stages of LS experiments is carried out, with the purpose of examining what were the criteria used by the groups of teachers to guide their instructional processes (design, implementation and reflection).
After a search for different videos about LS on the *YouTube* web platform, these two videos were selected for three reasons. The first was the significant number of visualizations they present on the web platform. The second is because in these videos the LS process can be observed almost

completely, that is, there is a design phase, an implementation phase and a reflection phase. And third, because one of the videos is about an experience of LS in Japan, the East, and the other is about an experience of LS in Chile, the West.
In the analysis process, we first sought to select considerations used by teachers to support the sequence of tasks proposed in their classes. Secondly, it was analysed whether these considerations can be considered as evidence of implicit use of some of the components and indicators of DSC. In a way it is a "content analysis" of the interventions. To do this, the two videos were first transcribed, so that the information units were all the interventions of the participating teachers. Next, the consecutive interventions that the authors considered as evidence of an implicit use of a component or indicator of a DSC were grouped. Finally, this analysis was triangulated with an expert in the use of DSC.

4. Analysis of videos of Lesson Study

4.1 Japanese Lesson Study Video

The first video analysed is an instructional process carried out by a second grade teacher at the Japanese primary school. At the end of the classes, professor P starts planning the class he will implement in the following week. The theme of the class he is planning is the subtraction. In particular, the class focuses on subtracting from a three-digit number a two-digit number, so that the result is a one-digit number, and, for that, the teacher uses subtraction problems in which you have to fill in the blanks when only the result is known.
Now, the teacher's first formulation is not very clear since it literally says the following:
P: With that kind of problem only one or two digits are hidden. I will not hide the two numbers in the subtraction problem. The answer is there. Students have to find out the subtraction equation that leads to that answer. I think it will be enough to attract your attention to the problem.
From what is observed in the subsequent implementation, when he says digits he is referring to numbers (minuend and subtracting), and despite saying that he will not hide the two numbers, it turns out that he hides the miniature and the subtrahend and, when he says subtraction equation, is referring to the combinations of minuend and subtracting that give the result supplied.

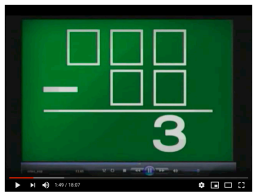

Figure 1. Task proposed by Professor P.

However, regardless of the difference observed between this first formulation of the objective and the subsequent implementation, we can observe that P is making a positive assessment of certain aspects in the expected LS experience. Specifically, it is implicitly using the indicator "selection of tasks of interest to students" of the "interests and needs" component of the affective suitability, since it positively values the fact of developing an activity that promotes the interest of the students. In addition, this motivation will be achieved by presenting a task of high cognitive demand (another component of cognitive suitability).
In addition to motivation, P also intended for students to find certain hidden rules in the answers to the problem. The first rule was that given a result and found a combination of minuend and subtracting that give such result, if the minuend and the subtrahend are increased by one unit, then

the same result is obtained. The second rule was that for a value of the difference x there are a number x of combinations of minuend and subtracting possible. For example, there are three combinations when the difference is three, five combinations when the difference is five and so on. By discovering these rules, you can find all the combinations of the minuend and subtracting more quickly.

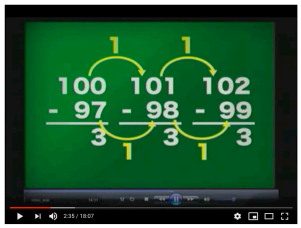

Figure 2. Problem rule.

The class supervisor (S) visits the teacher at the time he is planning his class. At this moment professor P asks for his opinion.

P: You see that the difference and the number of equations is the same. I believe that students will see that there is something here.

S: Yes, from there you move depending on how the students react. You don't need to push them, just go where they take you. Then, at some point he throws a word that leads them to the right path.

In this dialogue we can first infer that P and S are interested in designing a task that is at a reasonable distance from what students know, but at the same time requires a high cognitive demand, in the sense that leads them to perform processes relevant to the mathematical activity (in this case, observe a regularity and formulate a conjecture (*<<I believe that students will notice that there is something here>>*). Secondly, we can observe how they comment on the type of management that the teacher must do to get the students to succeed, but without overly scheduling the task (*<<Yes, from there you move depending on how the students react. You do not need to push them, just go where they take you. Then, at some point throw a word that leads them to the right path >>*).

Later, we can observe how P insists that he has designed the task with the objective that the students make conjectures that allow them to formulate the rules discussed above:

P: I think that students will sooner or later discover certain rules while dealing with 1, 2 and 3 as answers to the equation. I am looking forward to the moment you discover the rules. I will highlight things that they can say about the rules, so that the rest of the class understands how far we are going. Finally, I will ask you "How many equations can you make when the answer is 9?" Getting to the point where I can ask this question is crucial.

Subsequently, at the time of reflection on the class taught, when asked about whether the class had developed as he had planned it, he comments as follows:

P: It developed very much according to what I wanted to happen. The children reached the exact conclusions that I wanted them to discover. However, I could have gathered or connected thoughts and explanations in a better way to help everyone understand what some students were saying.

In this paragraph we can infer in the P discourse the importance given to the indicator "the different modes of evaluation show the appropriation of the knowledge/competences intended or implemented" of the component of the cognitive suitability "learning" of the students. The implicit use of the indicator "assess whether the interactions managed in class resolve students' doubts and difficulties" of the component of the interactional suitability "teacher-student interaction" is also evident.

Later, the professor reflects because some students had difficulties:

P: It is interesting to note that students who are usually good at math had difficulties at first. I wondered why later and said to myself: Those who are good at math were trying to find the number that goes in the tens column, when the difference was 3. Those who unexpectedly got the correct

answer looked at the Problem as a whole. Because the difference was 3, they simply reached 100 and 97 immediately.

In this reflection, the implicit use of the "systematic observation of students' cognitive progress" indicator that is part of the "formative evaluation" component of the interactional suitability can be inferred.

A teacher (M1) proposes to the teacher an alternative way of presenting the problem:

M1: I was wondering why you didn't allow children to try number one. I think it would be good to start with one, because that way you can explain everything that should be covered in today's class. Those who are not good at math will probably have problems with it. If the problem were for example 9 - 8 = 1, working with the number one could give children a better clue as to what is happening.

The reflection made by M1 emphasizes that the intended meanings must present a manageable difficulty, an indicator of cognitive suitability. In return, the professor argues that:

P: Today I used number three and 27 or 28 students got it right away. There were approximately 10 students that took a long time to solve. If you look at the average, I think presenting the problem using number three was a good solution.

In that statement, what the teacher does not take into account is the diversity in the pace of learning of his students, that is, he does not contemplate the "curricular adaptation to individual differences" component of the cognitive suitability.

Another teacher (M2) proposes to the teacher an alternative way of developing the task:

M2: You have those letters, right? The problem with subtracting a two-digit number from a three-digit one that gives a difference of five is, well, I was wondering why you are immediately giving them the answers. (Comment that the teacher had given the students the answers very quickly). *If you let the children solve the problems, it would be much more interesting. Choose some children at random, call them on the board and ask them to write the answers. I think that will make it more interesting. In this way there is no order in your answers. If they say, "there are five answers" then you say, "let's choose 5 students." If you ask them to write the answers, then you will not present that perfect order. There may be duplicate answers too. That way they can clearly see what is needed. If you do that, won't it make the students work together to "put the equations in the right order"?*

In this reflection, the M2 teacher suggests that the "high cognitive demand" component of the cognitive suitability be promoted. In particular, that the relevant cognitive processes (generalization, intra-mathematical connections, representation changes, conjectures, etc.) present in the "process richness" component (the sequence of tasks contemplates the realization of relevant processes in the mathematical activity) be contemplated: modelling, argumentation, problem solving, connections, etc) of epistemic suitability ".

Although the teacher, in his class did not take into account the diversity in the pace of learning of his students (cognitive criteria), another teacher (M3) has this aspect in mind in his reflection:

M3: Because each child can take a different path to discover the rules the teacher uses, it would be better to focus on how each child discovers. In doing so, such discoveries would be shared with the entire class to deepen everyone's understanding.

On the other hand, the teacher (M4) makes a comment related to the affectivity between the teacher and his students, contemplating the affective suitability.

M4: The teacher has a wonderful relationship with the children. I don't think anyone can build such a relationship in one day. He has had to put a great effort day by day with the children to reach such a relationship.

At the end of the video professor P presents a redesign of the class taking into account the improvement observations suggested by the other teachers who have participated in this LS experience.

4.2 Chilean Lesson Study Video

In the second video, a group of Chilean teachers met to collectively plan a math class based on a performance standard that appears in the Chilean curriculum for basic level 2 "They characterize straight prisms and pyramids considering the number and shape of faces and the number of edges and vertices. They select networks of prisms and pyramids to assemble a geometric body given some characteristics of this ". Professor T, who later teaches the class, starts the discussion by presenting a task to his colleagues:
T: Based on this generic activity, I looked for a regularity that is what we had planned, of always having a challenge or something. True? Then I took a base three pyramid, the vertices increase by one and the edges increase twice as much as the base.
In this comment it can be inferred that the group takes as a first criterion the design of a task, that it presents a challenge for students (it is, above all, the high cognitive demand component of the cognitive suitability).
A teacher (N1) questions T what the specific objectives are and what students are expected to learn in class:
N1: What is the objective and what is the learning we are going to expect from the students? What do the pyramids conclude? What transforms us into a class of [not understood] by putting together the pyramids and counting the vertices and edges or what?
The N2 teacher (who has the role of moderator of the group) intervenes the other members of the group:
N2: What do the other colleagues think?
A teacher from group (N3) argues:
N3: In other words, what is important is not construction, but rather the child relies on the material and then comes to reflect, look at what he built and get to reflect on that, the material he was able to elaborate.
In this comment, it is inferred that the teacher considers that in these ages it is convenient to use manipulative material to facilitate being able to find regularities. Although they do not say it explicitly, it is inferred that the other colleagues assume this criterion (it is the material resources component of the mediational suitability).
Next, more teachers intervene and the following dialogue takes place in which N4, with the support of N2, points out the importance of taking into account the students' prior knowledge (a component of the criterion of cognitive suitability):
N4: I think that we must first see this if children really know well and identify well what is vertex, what is edge and what is side.
N2: Previous learning?
N4: Sure.
Consistent with the fact of wanting to design a challenging task, then a dialogue takes place in which one can infer the interest in designing a task that leads students to carry out a generalization process, which allows them to guess a relationship between the number of sides of the base of the pyramid, the number of edges and the number of vertices (this is the process richness component of the epistemic suitability).
N3: That is, the children would start by building the geometric bodies and from there they can make a record, go counting, looking, watching, counting the number of vertices, counting the number of edges, making a record, perhaps in their notebook, to generalize all the work that is being done, take it to a table on the board ...
T: [Going to the board] *Let's see!* [Pointing at the board] *We have the base number of the pyramid.*
N2: The number of sides of the base.
N4: It is clear.
T: So, the idea is that the children register ... They themselves pass these records ... [Point in the column "base number of the pyramid" on a table that he builds on the board] base 3, base 4, and we

leave a base free and we move on to 6.
The teacher completes the table with the number of vertices and corresponding edges.
The group then focuses on analysing whether the task can be solved by the students and how to manage it so that they can solve it. In the first part of the dialogue, it is the indicator the intended meanings can be achieved (being in the area of the student's next development) and the learning component of the criterion of cognitive suitability, and also the indicator contemplates moments in the students assume responsibility for the study (exploration, formulation and validation) of the autonomy component of the criterion of interactional suitability:
N1: What are we going to expect in response from the students? That they realize that there is a relationship between the number of sides of the base, the amount of vertices and the number of edges. True?
N5: Because they would have to take a vertical or horizontal look at the picture we are doing there
N1: For them it will be very easy to look down and they will find a rule, immediately regularity, but they will see it down. That is, they will not see the relationship horizontally, which is what we expect. [Gesturing with your hands pointing down and horizontally.]
N2: What questions are we going to try to bring the children to find the regularity?
T: Are we going to let the kids analyse the shot [at the moment]? Or first record several pyramids and analyse the table at the end? Or do they already place in base three and then to the side, to the side and in that minute they analyse the shot or first it is allowed to make several, they register and in the end the table?
N4: Yes, there they will discover. If they do several exercises they will discover regularities, if they do one they will not discover.
Once the first stage of an LS (the planning) has been completed, the video continues with the implementation of professor T of the planned class (second stage of the LS). Then, the video shows fragments of the third stage (analysis and reflection of the implemented class). In this third stage, it is intended to generate a work space that allows sharpening the eye paying attention to how students reacted in the classroom, how they expressed their ideas and how the teacher has led the learning processes. In any case, for professor T it was an impact to see himself teaching a class.
T: The truth is that I almost got excited [Laughs]. *Already, it is very impressive one does not really appreciate the children when they are in the moment, as if they can perceive there* [points to the screen where they have seen the video of their class] *those faces, that joy, those desire to participate in the kids.*
Next, the video presents a fragment whose objective is to show what happened with the reading of the table (figure 3). In particular, if there is evidence of the expected learning in students.

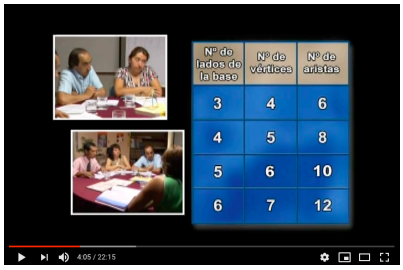

Figure 3. Table proposed by Professor T.

Their conclusion is that they did not reach the goal of finding a relationship between the number of sides of the base, the number of vertices and the number of edges (what they call horizontal table reading), but recognize the realization of relevant processes as the transition from the concrete to the abstract and the importance of the "table" resource to facilitate it. This dialog shows the learning component of the criterion of cognitive suitability and the component use of material resources of the mediational suitability:

N2: As teacher N4 said, at one point the children saw the table vertically.
N4: Yes.
N2: The reading was vertical. Ya! And our goal, what was it?
T: Our goal was to be horizontal. To make the children know that at the base they would only have to add one to know how many vertices and that the double will always be the edges.
N2: When does T allude to base five and an A1 student instantly starts raising her hand, before he asks the question, did she expect the children to give answers as quickly, as it emerged in the video?
T: No, I think, when we planned it, if you remember, we had some doubts about whether they would be able to get to this soon, right? To respond to those spaces that we had left within that table we made. And I didn't think it was going to be so fast.
N4: I really believe that the action of the student A1 clearly demonstrates that the children there at that minute abandoned the concrete and went to the abstract. That really is the ultimate goal of a math class. Let them jump and what, she didn't build to pyramid 5, but she immediately jumped into the mental.
N1: Now I think that the fundamental vehicle here is not it? In achieving the results and that the student A1 responded so quickly was the table. [Point to the table] *This table that we raised when we did the planning, was the one that gave the very clear indicator to establish a merely abstract order, that is, work in numerical form.*
Next, the group goes on to make positive assessments about the interaction between students (this is a component of the interactional criteria):
N1: In the video, the group caught my attention when I was working where they couldn't put together the pyramid.
N3: The collaborative learning. It was the first point, I think, it seems to me, upon hearing you, that it was what immediately caught our attention. That is, the boy began to build the pyramid and if he was wrong and the girl immediately began to interact with him in the sense of correcting him.
Later, they begin to reflect on the treatment of diversity, in particular on the lack of extension and reinforcement activities (an indicator of the curricular adaptation component to the individual differences of the criterion of cognitive suitability). Also, the indicator is inferred, it facilitates the inclusion of students in the class dynamics and not the exclusion, of the teacher-student interaction component of the criterion of interactional suitability:
N4: Like Cecilia, I have seen some boys who after finishing the completion on the board, the vertices, the edges, if they started playing, to take the straws. So, I think that there we would have to rethink some activity in which we would leave this situation and those children will not be left without doing anything.
N3: It seems to me that when she appeared, the first student A1 came out, to put the numbers forward there it seems to me that there was perhaps a question left to integrate the other children who were very quiet some behind. Working yes, but quieter because there was another who was with another personality that participated a lot.
N2: Something then we will have to aim for the next planning that we do, for the reorganization it is to think about the most advanced and the most backward children, not only in general.
Based on this reflection, teachers propose changes in tasks to generate an interaction that facilitates the integration of students and the treatment of diversity (cognitive and interactional suitability):
N4: Speaking a little what the colleague says the closing was that the closing challenge we did it we planned it orally and maybe it should, so that he had participated, because in the oral some children participate ...
T: A small template should have been made with the three bases at hand and maybe it is three challenges to have them inserted, one gives the base, the other gives the edge and the other gives the truth the vertices and that the children They have delivered and so one is having the detail of the course.
The video ends with a comment that makes an assessment related to emotional aspects (emotions component of the criterion of affective suitability):

N2: Any other comments?
N1: I was very attracted to a guy who, in the end, when he was finishing, right? With the closure. But I was desperate [to give the right answer]. *I already knew I had it ... I mean, there I find, for example, a face of happiness, and that happiness is enthusiasm because he learned. That is, in fact, for example, a student who learns is a happy student.*

5. Discussion of the results and final considerations

In the analysis carried out, it is evident that in classes based on the LS methodology implicit consensus emerges between the teacher who develops the class and the other participating teachers on aspects that are positively valued, which can be reinterpreted in terms of indicators and components of the DSC−is a result that coincides with those obtained in Hummes, Font and Breda (2019). The results obtained show how in the planning and reflection stages some of the components and indicators of the DSC appear implicitly in the reflections of the participants.
In particular, both in the experience of LS conducted in the Japanese context, and in the Chilean context, teachers use the interactional and cognitive criteria very significantly. On the other hand, in both scenarios, there is little reflection on the mediational and affective criteria and there is almost no reflection on the criteria of ecological suitability. This result can generate other inquiries, such as: Why does this regularity arise in an experience of LS in two different contexts? Why do groups of teachers attribute more emphasis to interactional and cognitive issues, less emphasis on issues related to emotions and resources and have almost no reflections related to environmental issues? Questions like these demonstrate the importance of doing research that seeks to analyse the experiments of LS carried out in different contexts.
One of the advantages of working with the dynamics of LS is that some of the aspects that are not present in the reflection of the teacher himself may be present in the reflection of the other teachers who participate in the instructional process. That is, the LS methodology becomes a type of training device that promote that some of the indicators and components of the DSC arise as consensus in the reflection of the group of teachers (Hummes et al., 2019).
Regarding the results obtained, one aspect to be explained is the reason why the DSC implicitly function as regularities in the teachers' discourse without being taught the use of this tool to guide their reflection. A plausible explanation (Breda et al., 2018; Hummes et al., 2019) is that DSC reflect consensus on how good mathematics teaching should be widely assumed in the community of educators; and it is plausible to think that the implicit use made by DSC teachers is due to their previous training and experience, which makes them partakers of such consensus. Now, another explanation, also plausible, is that the teacher who uses these criteria, having not participated in the process of generating the consensus that supports them, assumes them as regularities in his speech simply because, in the training he has received, they are presented as something naturalized and unquestionable in the training they have received.

6. Thanks

Work developed within the framework of research projects in teacher training: PGC2018-098603-B-I00 (MCIU / AEI / FEDER, UE), REDICE18-2000 (ICE-UB) and 434218 (Development of reflective competence in the context of progressive practices of future professors *Educación General Básica con Mencion en Matemática*, Chile). And with the support of the *Doutorado Pleno no Exterior* program process number 88881.173616 / 2018-01 (Capes).

References

Breda, A., Font, V. Lima, V. M. R. (2015). A noção de idoneidade didática e seu uso na formação de professores de matemática. *Jornal Internacional de Estudos em Educação Matemática*, *8*(2), 1-41. Doi: 10.17921/2176-5634.2015v8n2p%25p.

Breda, A., Font, V., Lima, V. M. R., Pereira, M. V. (2018). Componentes e indicadores de los criterios de idoneidad didáctica desde la perspectiva del enfoque ontosemiótico. *Transformación*, *14*(2), 162-176.

Breda, A., Font, V., Pino-Fan, L. (2018) Criterios Valorativos y Normativos en La Didáctica de las Matemáticas: el Caso del Constructo Idoneidad Didáctica. *Bolema*, *32*(60), 255-278. Doi: 10.1590/1980-4415v32n60a13.

Breda, A., & Lima, V.M.R. (2016). Estudio de caso sobre el análisis didáctico realizado en un trabajo final de un master para profesores de matemáticas en servicio. *REDIMAT*, *5*(1), 74-103. Doi: 10.4471/redimat.2016.1955.

Breda, A., Pino-Fan, L. R., Font, V. (2017). Meta didactic-mathematical knowledge of teachers: criteria for the reflection and assessment on teaching practice. *EURASIA Journal of Mathematics, Science and Technology Education*, *13*(6), 1893-1918. Doi: 10.12973/eurasia.2017.01207a.

Burghes, D. N., & Robinson, D. (2010). *Lesson study: enhancing mathematics teaching and learning*. CfBT Education Trust.

Davis, B. (2008). Is 1 a prime number? Developing teacher knowledge through concept study. *Mathematics Teaching in the Middle School (NCTM)*, *14*(2), 86-91.

Fernández, C., & Yoshida, M. (2004). *Lesson study: a Japanese approach to improving mathematics teaching and learning*. Mahwah: Erlbaum.

Font, V., Breda, A., Pino-Fan, L. (2017). Análisis didáctico en un trabajo de fin de máster de un futuro profesor. En J.M. Muñoz-Escolano, A. Arnal-Bailera, P. Beltrán-Pellicer, M.L. Callejo y J. Carrillo (Eds.), *Investigación en Educación Matemática XXI* (pp. 247-256). Zaragoza: SEIEM.

Font, V., Planas, N., Godino, J. D. (2010). Modelo para el análisis didáctico en educación matemática. *Infancia y Aprendizaje*, *33*(1), 89-105.

Godino, J. D., Batanero, C. y Font, V. (2019). The onto-semiotic approach: implications for the prescriptive character of didactics. *For the Learning of Mathematics, 39*(1), 37- 42.

Hart, L. C., Alston, A. S., Murata, A. (2011). *Lesson Study Research and Practice in Mathematics Education*. Netherlands: Springer.

Hill, H. C., Blunk, M. L., Charalambous, C. Y., Lewis, J. M., Phelps, G. C., Sleep, L., y Ball, D. L. (2008). Mathematical Knowledge for Teaching and the Mathematical Quality of Instruction: An Exploratory Study. *Cognition and Instruction, 26*(4), 430-511.

Hummes, V. B., Font, V., Breda, A. (2019). Combined Use of the Lesson Study and the Didactic Suitability for the Development of the Reflection on the own Practice in the Training of Mathematics Teachers. *Acta Scientiae*, *21*(1), 64-82.

Lewis, C. C. (2002). *Lesson study: A handbook of teacher-led instructional change*. Research for Better Schools. Inc. & Global Education Resources: LLC.

Llinares, S. (2012). Construcción de conocimiento y desarrollo de una mirada profesional para la práctica de enseñar matemáticas en entornos en línea. *Avances de Investigación en Educación Matemática*, *2*, 53-70.

Mallart, A., Font, V., Malaspina, U. (2015). Reflexión sobre el significado de qué es un buen problema en la formación inicial de maestros. *Perfiles Educativos, 38*(152), 14-30.

Mason, J. (2002). *Researching your own practice. The discipline of noticing*. London: Routledge-Falmer.

Murata, A., & Takahashi, A. (2002). Vehicle To Connect Theory, Research, and Practice: How Teacher Thinking Changes in District-Level Lesson Study in Japan. *Teaching children mathematics*, 436-443.

Pochulu, M., Font, V., Rodríguez, M. (2016). Desarrollo de la competencia en análisis didáctico

de formadores de futuros profesores de matemática a través del diseño de tareas. *Revista Latinoamericana de Investigación en Matemática Educativa-RELIME, 19*(1), 71-98

Ponte, J. P. D., Baptista, M., Velez, I., Costa, E. (2012). Aprendizagens profissionais dos professores de Matemática através dos estudos de aula. *Perspectivas da Educação Matemática*, *1*(1), 7-24.

Seckel. M. J., & Font, V. (2015). Competencia de reflexión en la formación inicial de profesores de matemática en Chile. *Praxis Educacional, 11*(19), 55-75.

Seckel, M. J., & Font, V. (2016). El portafolio como herramienta para desarrollar y evaluar la competencia reflexiva en futuros profesores de matemática. En J. A. Macías, A. Jiménez, J. L. González, M. T. Sánchez, P. Hernández, C. Fernández, F. J. Ruiz, T. Fernández y A. Berciano (Eds.), *Investigación en Educación Matemática XX*(pp. 499-508). Málaga: SEIEM.

Wang-Iverson, P., & Yoshida, M. (Eds.). (2005). *Building our understanding of lesson study*. Research for Better Schools, Inc. & Global Education Resources: LL.