

## Scaffolding and teaching reflexivity for equity In first-year university mathematics

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**Abstract.** Seeking to broaden the predominant approach in Chile in studies on university equity, which has mainly considered policy analysis and student perceptions, this study proposes a look at a first-year university mathematics leveling device from the perspective of classroom teaching practices, characterized as pedagogical scaffolding and the process of teaching reflexivity that is its correlate. Case study with a qualitative approach and based on the coding of class videos and teacher interviews. The research is carried out within the framework of the accompaniment of the pedagogical advisor who is a researcher and author of the study. The results show that: The teaching practice in the classroom can be characterized as scaffolding, observing 3 types of intervention that are distinguished by the level of intensity of the mediation. The process of teaching reflexivity translates into decision-making that adjusts the didactic approach to facilitate learning. Summarizing, assuming the equitable perspective frames the practice and reflection of teachers around it.

**Keywords:** Mathematics, didactics, undergraduate student.

### 1 Introduction

The predominant approach in Chile in studies on equity in the university has mainly considered the analysis of policies and perceptions of students (Santelices et al, 2018). This proposal, instead, seeks to broaden the debate on focusing on a first-year mathematics classroom to analyze teaching practices, characterized as pedagogical scaffolding and its reflexive correlate in teachers. The case study has been approached from the perspective of its results in the progression of the students. This contribution provides a deepening of teaching practices framed in the search for equity.

### 2 Theoretical Framework

Equity understood as the "fair distribution of learning opportunities" (Esmonde, 2009) is expressed in situations in which teaching is adjusted to the needs of the learners. For the students who benefit from equity policies and devices in universities, these needs are related to a school education that has not sufficiently developed in them the learning required to start their first year at the university in good conditions. (Cifuentes et al, 2017; Sobrero et al, 2014).

From the sociocultural perspective, mediation is crucial for development. This mediation can take the form of pedagogical scaffolding defined as an interactive process that occurs between teacher and learner in which both actively participate, identifying its key characteristics: it is contingent, that is, it adapts to the learner's needs; it fades as the learner is able to perform the task on their own and gradually transfers responsibility for the process to the learner (van de Pol, et al, 2010).

Pedagogical scaffolding at the service of equity enables teachers to reflect on their practice since "teachers' reflective analysis of their practices requires a framework of purposes and conditions" (Castorina, 2022). This reflexivity, framed in the purpose of fairly distributing the learning opportunities, is the necessary correlate so that the practices are constantly enriched.

### **2.1. Research Questions**

What characteristics does the pedagogical scaffolding have in the mathematics leveling workshop?

What is the reflective process of the workshop teachers about their purposes and means, framed in the search for equity?

### **2.2. Objectives**

**General Objective.** Characterize the classroom practice in terms of pedagogical scaffolding and the reflective process on its purposes and means, developed by the teachers of the mathematics leveling workshop.

#### **Specifics Objectives.**

- Characterize the practice of teachers in terms of pedagogical scaffolding.
- Characterize their reflective process around the purposes and means of their practice, framed in the search for equity.

## **3 Methods**

Case study (Stake, 1995), qualitative approach (Creswell, 2003).

### **3.1. Case study**

First-year math leveling workshop. The workshop is a weekly curricular activity, part Mathematics 2 subject. In the workshop, students solve exercises in groups, using a board and assisted by 2 teachers.

### **3.2. Participants and data**

**Participants.** 4 first-year mathematics teachers at a selective university in Chile. The teachers carry out the workshop for students with lower entrance scores in the mathematics admission test in relation to their cohort.

80 first-year students participating in the workshop, distributed into 2 sections.

**Data.** Video recordings of the work of 4 groups of students in 7 workshop sessions (28 records), interviews with teachers at the end of each session.

### 3.3. Analysis strategy

Video coding: deductive (first round: identification of scaffolding episodes in each record) and inductive (second round: identification of scaffolding features in the episodes). Content analysis of teacher interviews. The data were produced in the context of the accompaniment of the pedagogical advisor who is the researcher and author of the study.

## 4 Results

### 4.1. Scaffolding characteristics

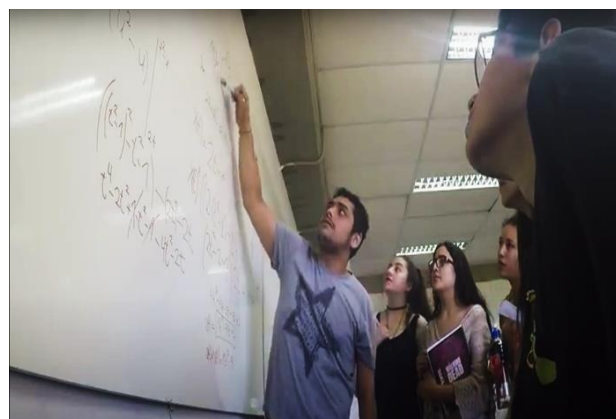
The teachers graduate the intensity of the mediation adjusting to the level at which the students work, this facilitates their active learning and the progressive development of independent work. There are 3 ways of scaffolding: observe, ask and intervene. In all of them, the support of the blackboard stands out as a facilitator of the teaching intervention (See Fig. 1, 2 and 3).



**Fig. 1.** Observe: The teacher silently monitors the students' work without taking part in it. It is the most distant type of scaffolding.



**Fig. 2. Ask:** The teacher intervenes in the conversation asking for explanations or clarifications about the students' work on the blackboard.



**Fig. 3. Intervene:** The teacher intervenes in the work developed by the students to amend, highlight, or show alternative solutions. It is the closest type of scaffolding.

#### **4.2. Characteristics of the teachers' reflective process**

Teachers report a mediating intention, framed in the search for equity, which translates into decisions about their practice, aimed at: Facilitating the approach to conceptual content, simplifying its presentation. Look for alternative modalities to approach the resolution of problems. Promote the exploration of diverse resolution strategies.

### **5 Discussion**

The study broadens the approach in studies on equity in the predominant university in Chile, incorporating classroom practices. This expansion has implications for

improving the effectiveness of leveling devices, since it emphasizes the way in which what happens in the classroom, from the perspective of teaching practices and its reflective correlate.

## **6 Conclusions**

There are 3 types of teaching interventions that are distinguished by the degree of closeness or intensity with respect to the activity of the students. These interventions can be characterized as pedagogical scaffolding since they are adjusted to the level of the students and are provoked by a contingent need expressed by the students or directly observed by the teacher (Van de Pol et al, 2010).

On the other hand, the process of teaching reflexivity translates into decision-making that adjusts the didactic approach to content to facilitate learning. For teachers, equity operates as a framework both for their practice in the classroom and for the parallel process of reflexivity around it (Castorina, 2022).

## **7 Limitations and Future Research**

The case is limited to the workshop activity, leaving out of analysis other components of the course (lecture and assistantship). Future research could include such components.

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