

# Collaborative Learning in an Introductory Database Course

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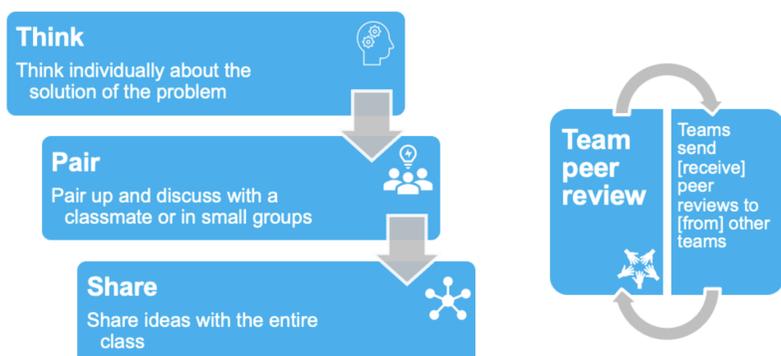
## A Study with Think-Pair-Share and Team Peer-Review

### Introduction

Our research aims to investigate how to prevent the early dropout phenomenon that affects most Bachelor's Degrees in CS by experimenting with constructivist teaching methods, examining their impact on students' engagement and motivation and how novices build a consistent mental model of the notional machine. We here focus on introductory database (DB) education.

### Motivation and Context

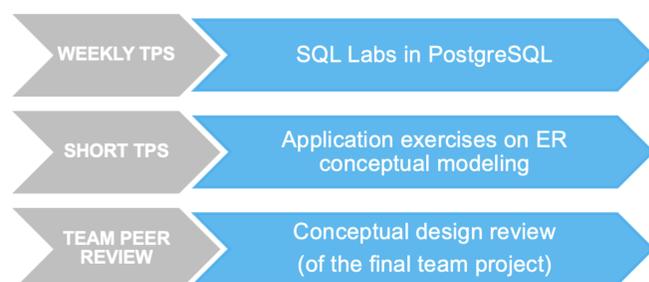
- In most DB courses, project-based learning is the active method that is widely used, but it does not always ensure the satisfactory achievement of all learning objectives [1, 2].
- The latter are quite broad and range from [data modeling](#) to [query specification skills](#), both in SQL and in relational algebra.
- [Collaborative learning](#) (CL) has been successfully applied to DB courses [3], but its effectiveness for hands-on data modeling activities and SQL labs has not been investigated. In our experimental study, we examine the impact of CL in an introductory DB course in terms of learning outcomes, for the different skills to be acquired. We focus on two instructional approaches, think-pair-share (TPS) and team peer-review.



### Population & Setting

- Bachelor students of CS and statistics who have passed the DB exam.
- The study sample consisted of 95 students, 72 enrolled in CS and 23 in statistics.
- Non-randomized controlled trial.
  - **Experimental Group:** students who participated in CL activities (50 students, 13 teams).
  - **Control Group:** students who attended in the traditional modality (45 students).
- "Basi di Dati" course, University of Genoa (DIBRIS), a.y. 2020/21.
- Distance learning environment (Microsoft Teams, Moodle).

### Intervention



Activity	Lab/Session	Topic
Weekly TPS	1	DDL: create table, foreign/primary key
	2	QL: select project join queries
	3	QL: outer join and group by
	4	QL: subqueries
	5	QL: updates and constraints
	6	QL: views
Short TPS	1-2	Core entity identification Attribute vs relationship Identifiers Relationship vs (weak) entity Hierarchies
	Exam project	ER conceptual model review (evaluation grid provided by teachers)

- The duration of each weekly cycle TPS lab is 1 week [Think: Days 1–2, Pair: Days 3–5, Share: Day 7].
- Each short cycle TPS session consists of 4–5 sub-tasks in TPS mode [Think: 10 minutes, Pair: 12 minutes, Share: 12 minutes].
- The duration of the team peer-review is 1 week.

### Results

Group	N	Mean	SD	t
Experimental Group	50	0.90	0.84	$t = -2.1907$
Control Group	45	1.36	1.16	

$p < 0.05$

- The [partial evaluations](#) on the different artifacts are [significantly more homogeneous](#) for the students participating in the CL activities (more balanced learning effort).
- CL appears to be [effective in terms of learning goals](#) measured in terms of partial exam results.
- The techniques also demonstrated quite engaging and appreciated by the students, with [team discussion](#) as the most useful source of learning. [Providing review](#) is deemed more effective than receiving it.

### Threats to validity

- Non-random assignment of participants to the control and experimental group.
- Team formation design (criteria and algorithm).
- Results not generalizable to the face-to-face edition.

### Forthcoming Research

As a first future work direction, we plan to check whether similar results will be obtained for the current a.y. in which the same activities are being proposed in presence.

### References

- [1] Thomas Connolly and Carolyn Begg. A constructivist-based approach to teaching database analysis and design. *Journal of Information Systems Education*, 17, 01 2006.
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- [3] Carme Martín, Toni Urpí, M José Casany, Xavier Burgués Illa, Carme Quer, M Elena Rodríguez, and Alberto Abello. Improving learning in a database course using collaborative learning techniques. *The International Journal of Engineering Education*, 29(4):986–997, 2013.

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