How do teachers metacognitive talk about math and writing support first-graders metacognition and self-regulation in everyday classrooms?

¿De qué manera el discurso metacognitivo docente en clases de matemáticas y escritura promueve la metacognición y la autorregulación de los niños de primer grado en las aulas cotidianas?

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Abstract

Our main research question was to examine how do teachers metacognitive talk about math and writing in everyday classrooms support first-graders metacognition and self-regulation. An exploratory and observational study was conducted with 40 children and two teachers in first-grade classrooms. We adapted the C.Ind.Le coding framework to analyze teacher metacognitive talk with young children. We coded metacognitive knowledge, metacognitive regulation, and emotional and motivational regulation. We identified 141 micro-episodes of teacher metacognitive talk during math and writing lessons. Our results discussing prior studies that showed elementary school teachers seldom evidence metacognitive talk with young children. Also, we found that teacher metacognitive talk was distinguished by the instructional style. The interdirect teacher spent more time promoting knowledge of tasks as well as emotional and motivational monitoring than the interconstructive teacher did, but she worked more time fostering planning, monitoring, and evaluation. These findings may support practices and policy to promote educational contexts that encourage metacognitive and self-regulatory development.

Keywords: early childhood education, teacher instructional styles, metacognitive knowledge, metacognitive regulation, emotional and motivational regulation.

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Resumen

Nuestra principal pregunta de investigación se centró en examinar cómo el discurso metacognitivo docente en clases de matemáticas y escritura en las aulas cotidianas fomenta la metacognición y la autorregulación de los niños de primer grado. Se realizó un estudio exploratorio y observacional con 40 niños y dos docentes en aulas de primer grado. Adaptamos el sistema de codificación C.Ind.Le para analizar el discurso metacognitivo docente. Codificamos el conocimiento metacognitivo, la regulación metacognitiva y la regulación emocional y motivacional. Identificamos 141 microepisodios de habla metacognitiva docente durante las clases de matemáticas y escritura. Nuestros resultados discuten estudios previos que mostraron que los docentes de educación primaria rara vez evidencian una conversación metacognitiva con niños pequeños. Además, encontramos que el discurso metacognitivo docente se distinguió por su estilo instruccional. La docente interdirecta dedicó más tiempo a promover el conocimiento de las tareas, así como el monitoreo emocional y motivacional que la docente interconstructiva, pero ella trabajó más tiempo fomentando la planificación, el monitoreo y la evaluación. Estos hallazgos pueden respaldar prácticas y políticas para promover contextos educativos que fomenten el desarrollo metacognitivo y de la autorregulación en el aprendizaje.

Palabras clave: educación inicial, estilos instruccionales docentes, conocimiento metacognitivo, regulación metacognitiva, regulación emocional y motivacional.

INTRODUCTION

The metacognition and self-regulation intervention literature is currently flourishing but it has now moved away from direct teaching programs of metacognitive and/or self-regulation skills towards the study of the scholar contexts, the teaching practices, and the learning tasks in the promotion of development of children's metacognition and self-regulation (Whitebread et al., 2019). Emphasis is now placed on supporting a meaningful environment and children's autonomy, relatedness, and competence (Grau & Whitebread, 2018). Recent research examines the interplay between metacognition, self-regulation, and contexts- including tasks, teaching practices, and interpersonal relationships in classrooms (van Loon et al., 2021; Zachariou & Whitebread, 2022).

Despite this, the need for more studies to understand how children's metacognition and self-regulation develops across classroom contexts is pertinent. The present paper focuses on exploring how first-grade teachers' support of metacognition and self-regulation in their classrooms. This type of research is invaluable to understand which learning environments, specifically classroom contexts, enable metacognitive and self-regulatory development. A review of the studies in this area reveals that (i) the results of recent studies are often inconsistent and that (ii) the majority of research studying the impact of different classroom

contexts tends to focus on studying the extremes of classroom contexts (i.e., comparing Teacher-directed and child-centered teaching practices or comparing direct teaching practices and constructivist teaching practices -e.g., Casas-Mas et al., 2019; Dignath & Büttner, 2018; López-Iñiguez & Pozo, 2016; van Loon et al., 2021-). However, in the everyday reality of the classroom context, teaching practices are not always polarized on these two extremes, but include a lot of teaching practices that lie somewhere in between. This case of study adopts a more fine-grained approach which also explores middle teaching practices between the two extremes (i.e., interdirect and interconstructive teaching practices). In this way, the project's results aim to further inform policy and practice in order to promote classroom contexts that support metacognitive and self-regulatory development.

THEORETICAL BACKGROUND

Metacognition and self-regulation in early years

According Chen and McDunn (2022)'s recent revision, the contribution of metacognition and self-regulation is somewhat overlooked in early childhood development and education. This oversight could be due to the varied definitions of metacognition and self-regulation and young children's limited verbal and working memory capacity, which leads to difficulty conceptualizing and measuring these constructs.

However, research conducted over the last two decades has revealed that metacognitive and self-regulatory processes can be deployed in younger children in favorable conditions (e.g., Perry et al., 2000, 2002; Robson & Zachariou, 2022; Ventura, 2022. Whitebread et al., 2009). Whitebread and colleagues (2009) identified a repertoire of verbal and non-verbal indicators of metacognition and self-regulation in 3-and-5-year-old children by means of three main areas: metacognitive knowledge, metacognitive regulation, and emotional and motivational regulation. Metacognitive knowledge refers to what people know about their cognition and entails the individual's knowledge about personal variables, task variables and strategy variables. Metacognitive regulation describes the metacognitive processes taking place during ongoing activities and involves planning, monitoring, control and evaluation. Finally, emotional and motivational regulation comprises the monitoring or control of emotions and motivational processes during tasks.

In early years, teachers play a critical role, acting as significant and experienced partners providing children with opportunities to engage metacognitive and self-regulatory activities. From a sociocultural perspective, the development of these higher-order processes has been conceptualized as an inherently social process within which gradual transitions from co-regulation to self-regulation occur as children participate in meaningful interactions with more experienced partners (Vygotsky, 1978; Wertsch et al., 1980).

Teacher support for early metacognition and self-regulation

Twenty years ago, Perry and colleagues (2000, 2002) observed second and third grade classrooms doing literacy activities over a period of six months. They identified two different types of classrooms: High- and Low- self-regulatory classrooms. Supporting this, similar findings emerged from Withebread and Coltman's (2010) study in preschool mathematical contexts. Authors demonstrated that the principles which have emerged within studies of older age groups also applied to 3-and-5 years old children in learning activities designed ad hoc by practitioners to facilitate metacognitive and self-regulatory processes. These four principles relate to the establishment of emotional warmth and sensitivity between the teacher and child, to pedagogical practices which give children feelings of control over their activities and learning, which present children with cognitive challenges, and which require children to articulate their thinking.

Interestingly, researchers working in the area of early metacognition and self-regulation have arrived at consistent conclusions about the type of activities, instructional practices, and, classroom organization that seem to be beneficial for students' self-regulated learning (for a broad review, see Pino-Pasternak et al., 2014). Contrary, other authors (e.g., Dignath & Büttner, 2018; Dignath & Mevarech, 2021; van Loon et al., 2021) informed that the promotion of metacognitive and self-regulatory skills is seldom in authentic primary classrooms.

Hence, many questions concerning metacognition and self-regulation in early years education remain unanswered in naturalistic schools' environments, such as, if and how do first-grade teachers metacognitive talk foster metacognition and self-regulation in their classrooms.

The role of teacher instructional style in everyday classrooms

Given the emphasis now placed on classroom contexts, practices, and tasks (Zachariou & Whitebread, 2022), it is important to consider the specific impact of the characteristics of teaching styles. Constructivist approach have suggested that teachers develop teaching practices in the classroom organized into three instructional styles: direct, interpretive, and constructive (Olson & Bruner, 1996; Pozo et al., 2006; Strauss & Shilony 1994).

According to Pozo (2008) a direct style, learning is to exactly copy the knowledge transmitted by the professor through exposition or practice. Accuracy and completeness of knowledge are the main factors for ensuring teaching quality. According to an interpretive style, learning involves the activation of students' cognitive processes that, guided by the teacher and deliberately executed, can lead to the generation of adequate copies of knowledge. According to a constructive style, learning is considered generate and redescribe representations whose epistemic and pragmatic potential depends on personal goals and

contextual factors. Teaching fosters higher levels of complexity, articulation, and elicitation of these representations.

It is important to note that these three kinds of instructional styles are differentiated by the outcomes and processes in relation to teaching and learning practices (Pozo, 2008): i) the outcomes refer to what is learned or what learning is intended; and ii) the processes refer to what processes and activities will enable the student to achieve those outcomes, how learning is managed cognitively, emotionally, and metacognitively and why.

Several authors found that the constructive style facilitates learners' metacognition and self-regulation because reality is considered to be multiple and it is encouraged that it should be constructed by the learner, so the acquisition of knowledge implies the transformation of both the content and the learner (Olson & Bruner, 1996; Pozo et al., 2006; Strauss & Shilony 1994). This style contrasts with a more direct style whereby the learner's mind is compared to a blank box, and learning is based on copying, repetition, and imitation, without the intention of integration with previous knowledge or transformation of the learner. It simply contemplates the quantitative acquisition of content.

Nevertheless, more recently, studies have shown that the same teacher could display more than one instructional style of teaching in classroom contexts (Martín et al., 2014. Ventura, 2017). Consequently, Martin and colleagues (2014) have reported that most primary school teachers articulated interpretive and constructive (from now on, interconstructive) teaching practices, and some of them, integrated direct and interpretive (from now on, interdirect) teaching practices in classroom context. To date, little is known about how do first-grade interdirect and interconstructive teachers metacognitive talk support metacognition and self-regulation in everyday classrooms.

THE CURRENT STUDY

Given the inconsistent results in the literature, the present study aspired to further connect teacher's instructional styles and their promotion of children's metacognition and self-regulation in authentic classrooms contexts. While previous research focused mainly on instructional extremes or poles (i.e., Direct vs. Constructivist, or Teacher-directed vs. child-centered), this case of study adopted an exploratory, observational and fine-grained approach which also explored middle instructional styles between these two extremes. The research questions were:

RQ1. How do first grade teachers metacognitive talk about math and writing support children's metacognition and self-regulation in everyday classrooms?

RQ2. Do first-grade teachers' metacognitive talk about math and writing differ by their instructional style (interdirect vs. interconstructive) in authentic classrooms?

Since this is the first study that explores how teachers metacognitive talk promote metacognition and self-regulation in authentic first grade classrooms, we cannot formulate specific hypotheses.

Participants

Forty first graders and two teachers in a primary school in country were participated. The school is located in an urban location of a middle-sized city in Patagonia, Argentina. Teachers were between the ages of 45 and 55 years and had more than 10 years' seniority. Teachers claimed to not have experience with the promotion of metacognition and self-regulation; none of them had ever attended specific training on metacognition and self-regulation.

They all participated voluntarily. Information sheets and forms were sent to all parents/caregivers of the children. Child-friendly oral information was also given to those children who had parental permission to participate in the study. They had the opportunity to ask questions, decline to participate, or withdraw from the study at any time. The role of the lead researcher (first author) was to document the learning and teaching processes in math and writing classes throughout the 2019 academic year.

Data collection methods

Data were collected by four research methods throughout the scholar year. First, teachers' and children's interactions in classrooms were video-recorded. Preliminary observations took place in the weeks before data collection, so that the children would become familiar with the presence of the observer. In this article, we focused on six classes (three for each teacher) which centered on math and writing activities. Each activity lasted, on average, 40 minutes. Classes consisted of 20 first grade children. Children were engaged in math and writing activities without facilitation metacognitive and self-regulatory processes ad hoc. Teachers were asked to teach in a natural way. Since participation was voluntary, the participating teachers were assumed to be fairly motivated and interested in the topic.

Second, reflective dialogues (Moyles et al., 2003) were conducted with the first-grade teachers after each class. Teachers articulated their reasons for selecting each tool and resource which had contributed to their pedagogical understandings of children's learning. The duration of each reflective dialogue varied between 30 and 60 minutes. These data were fully audio recorded and transcribed afterwards.

Third, individual dialogical interviews were conducted with children at the beginning, the middle and the end of the scholar year. The duration of each interview varied between 30 and 40 minutes. The interviews were video-recorder.

Fourth, the lead researcher in this study took photos and maintained a logbook in which she carefully noted all insights and reflections after each class, reflective dialogue or dialogical interview. These logs served as field notes.

Coding

Teacher metacognitive talk. One hundred and forty-one micro-episodes of teacher metacognitive talk were identified within math and writing classes. Each micro-episode were analyzed using an adaptation *ad hoc* of C.Ind.Le coding framework created by Whitebread and colleagues (2009).

The C. Ind. Le coding framework included verbal and non-verbal indicators of metacognitive knowledge (e.g., a young child might indicate a personal knowledge of strengths and weaknesses in their mathematical capabilities), metacognitive regulation (e.g., young children might show awareness of having made an error in calculation or counting, and use a different strategy, e.g., using fingers to check) and emotional and motivational regulation (e.g., young children might use self-commentary to help themselves to resist distraction or to persevere in the face of difficulty). This research tool has been validated and used internationally in early childhood (e.g., Aras & Erden 2020; Fridman et al., 2020; Robson, 2016; Ventura & Lazzeri, 2023; Whitebread & Pino-Pasternak, 2013; Zachariou & Whitebread, 2022). Table 1 presents the description of our coding scheme.

Table 1. Description of the codes for teacher metacognitive talk

Dimensions	Categories	Definition	Examples
Metacognitive knowledge	Knowledge of person	Units that provide general knowledge about cognition	*"Can you write your name?"* *"Can you count backwards?"*
	Knowledge of task	related to either person, task, or strategy variables.	*"Do you know how spell <table>?"*
	Knowledge of strategies		*"Is it easier drawing or writing the response? Think about it."*
Metacognitive regulation	Planning	Units that prompt children to set goals and make plans of their future actions.	*"Tell me about how you will count"*
	Monitoring	Units that provide explicit or implicit feedback to children by confirming or invalidating their performance.	*"Please see your notebook: are there any mistakes?"*
	Control	Units that prompt children to use control strategies, give information on how to use them and why they could be useful to improve the performance.	*"You can use this template in order to make the list."*
	Evaluation	Units that prompt children to make retrospective assessments of their performance.	*"Is <the number five> badly written?"*
Emotional and motivational regulation	Emotional and motivational monitoring	Units that prompt children to reflect on their emotional states (e.g., sad, happy, angry) or emotional behaviors (e.g., cry, laugh).	*"Are you a bit sad today? Why?"* *"Do you feel angry now?"*
	Emotional and motivational control	Units that prompt children to modulate and change the intensity, quality or duration of their emotional states and emotional behaviors.	*"Well done, you can encourage your partner on task!"* *"You can resolve it, keep trying!"*

We followed a micro-genetic, utterance-level coding procedure, where every time an utterance/action was identified as metacognitive and self-regulatory. Issues of reliability in analyzing the data were addressed in two steps. First, the two authors independently identified the micro-episodes across the six classes and coded teacher metacognitive talk in each one. Second, authors checked the coding for agreement. In instances in which coding was not aligned, re-reading and discussing the video-transcripts allowed to resolve the discrepancy. If disagreement persisted, a conservative criterion was applied and the category under discussion was not allocated. Additionally, reliability during the data analysis was guaranteed by triangulation of the four data sources: teacher's and learner's interactions, reflective dialogues, dialogical interviews, and field notes.

Teacher instructional style. Following Casas-Mas and colleagues (2019), we characterized teacher instructional style coding teacher's and learner's role, processes, and outcomes for each micro-episode (n=141). Table 2 presents the coding scheme.

Table 2. Description of the codes for teacher instructional style

	Direct instructional style	Constructive instructional style
Teacher's role	Highest hierarchy Gives orders Explains Corrects mistakes	Guide Helper Asks what to do and how to do it Mistakes as potential learning tools
Student's role	Non-autonomous Asks what to do and how to do it Follows orders	Autonomous Reflects on how to do it Thinker
Teaching and learning processes	Repetitive-rehearsal Extrinsic motivation Modelling	Collaborative assessment Reflection-on-action Intrinsic motivation Inner listening Attention management/ focusing Memory with transfer
Teaching and learning outcomes	Quantity of practice Psychomotor (position of fingers and hands)-centered approach Perfect exam Exact reproduction of the contents	Quality of the practice Learning how to practice/study Understanding of why we do things

All these categories were mutually exclusive and nominal features (for a detailed explanation, see López-Íñiguez & Pozo, 2016). The teacher instructional style inter-coder agreement was conducted using the same procedure to teacher metacognitive talk.

Data analyses

We analyzed teachers metacognitive talk about math and writing in everyday classrooms using descriptive statistics. In addition, we explored relations between teacher metacognitive talk and their instructional styles using Simple Correspondence Analysis (SPAD 5.5 software). The Correspondence Analysis showed associations between individuals and categories on factorial axes (for a detailed explanation, see Greenacre, 1984). We applied the Correspondence Analysis to the contingency table, whose rows were the micro-episodes of each teacher (1=interdirect; 2= interconstructive) and columns were the correspondingly codes of teacher metacognitive talk.

RESULTS

The results are divided into two sections. We begin describing how first grade teachers metacognitive talk about math and writing in authentic classrooms support children's metacognition and self-regulation. We then turn to analyze associations between teacher metacognitive talk and their instructional style using multidimensional techniques.
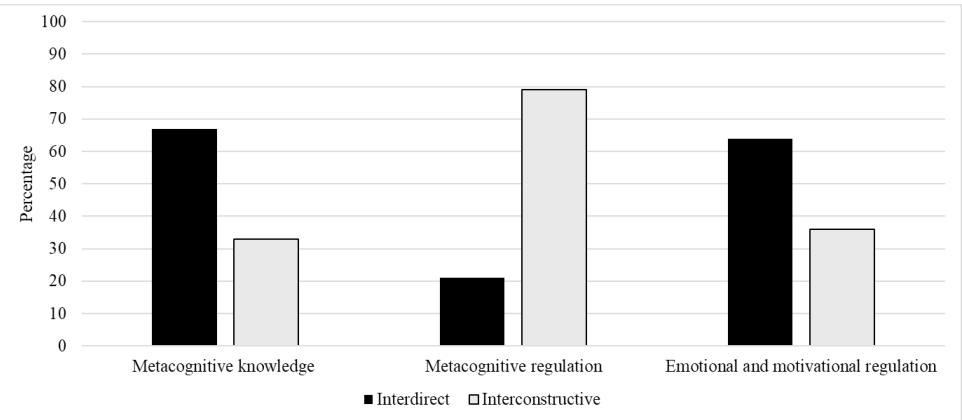
RQ1. How do first grade teachers metacognitive talk about math and writing support children's metacognition and self-regulation in authentic classrooms?

Figure 1 presents the percentage of teachers' metacognitive talk about math and writing in everyday classrooms. Interestingly, both teachers have supported children' fine-grained variety of metacognitive knowledge, metacognitive regulation and emotional and motivational regulation.

In one classroom, we identified 46 micro-episodes of teacher metacognitive talk about math and writing. This teacher promoted predominantly metacognitive knowledge as well as emotional and motivational regulation. This teacher emphasized an interdirect instructional style. She provided her students with a repeated sequence of actions so that they would have the information necessary for recognition of letters and numerals. Her classes had an expository structure. The few questions that teacher asked in her classes were aimed at verifying how the students reproduced the new information and action sequences. She did not offer any conclusions or summaries at the end of class. Evaluations determined

the appropriateness of the procedures applied by the students to the action sequences taught by teacher for solving specific notational tasks.

Figure 1. Teachers metacognitive talk dimensions in everyday classrooms

In another classroom, we identified 95 micro-episodes of teacher metacognitive talk about math and writing. The teacher has supported mainly metacognitive regulation. This teacher emphasized an interconstructive instructional style. She inquired into her students' prior knowledge in order to confirm it or restructure it through modeling activities seeking to activate cognitive processes and promote effective reasoning to solve problems quickly. Her classes had an expository dialogue structure. The teacher co-regulates student learning by guiding the learning process (typically through questioning rather than through giving directives) and provides assistance on an as-needed basis (often based on help-seeking by students). Her evaluations inquired into what and how the students' produced letters and numerals spontaneously at the end of the activity.

RQ2. Do first-grade teachers' metacognitive talk about math and writing differ by their instructional style in everyday classrooms?

Figure 2 presents the distribution of the categories of metacognition and self-regulation supported by both teachers. Regarding to metacognitive knowledge, knowledge of persons was not evidenced as well as knowledge of task was predominant in the indirect teacher. With regard to metacognitive regulation, notably comparisons were found to planning, monitoring, and evaluation between instructional styles. In contrast, control was a bit prevalent in the indirect teacher. Regarding emotional and motivational regulation,

monitoring was showed predominantly by interdirect teacher. However, emotional and motivational regulation was relatively similar in both.

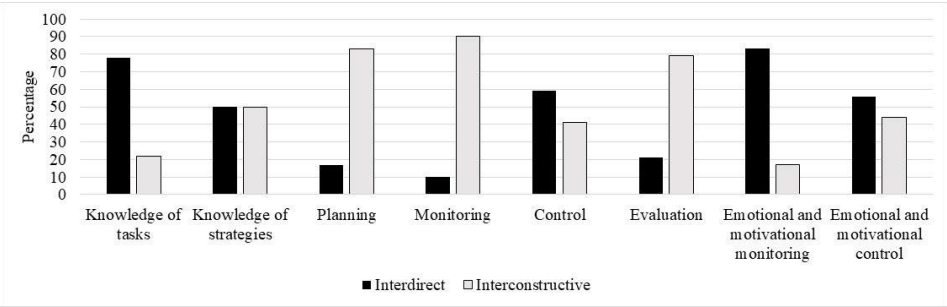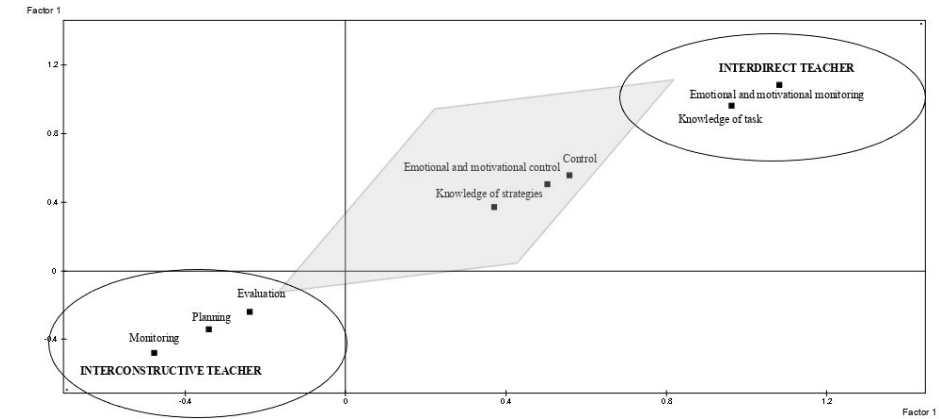**Figure 2.** Teachers metacognitive talk categories in everyday classrooms

Figure 3 presents the results from the Correspondence Analysis. Each teacher promotes differently metacognition and self-regulation. Factor 1 and Factor 2 distinguished the interdirect teacher from the interconstructive teacher.

Figure 3. Associations between teacher metacognitive talk and their instructional style

The interdirect teacher was characterized by supporting knowledge of tasks as well as emotional and motivational monitoring. The interconstructive teacher was characterized by fostering planning, monitoring, and evaluation. According to standard criteria (Grenacre,

1984), we considered the resulting categories that were projected between two teaching practices, next to the coordinates' origin, in order to give an account of what was common to the two teachers. As noted previously, knowledge of strategies, control, and emotional and motivational control were supported by both teachers.

In summary, we selected teachers with different teaching practices (interdirect and interconstructive) to distinguish how they promoted metacognition and self-regulation during math and writing activities in first-grade classroom context. Interestingly, both teachers promote the wide range of metacognitive and self-regulatory behaviors. The main difference is based on the quantity of metacognitive and self-regulatory opportunities afforded by each one.

Furthermore, both teachers have supported knowledge of strategies, control, and emotional and motivational control. Specifically, we found that the interdirect practice was associated with knowledge of tasks and emotional and motivational regulation as well as interconstructive practice was associated with planning, monitoring, and evaluation.

DISCUSSION

Recent research emphasizes the role of the everyday classroom context in the promotion of children's metacognition and self-regulation. However, research have focused mainly on studying the extremes of instructional styles (e.g., Teacher-directed vs Child-centered; Direct vs. Constructivist), which did not represent the authentic reality of the classroom environments. Hence, we set out to study how teacher metacognitive talk about math and writing support children's metacognition and self-regulation in everyday classrooms.

The relevance of the research lies in capturing how metacognitive knowledge, metacognitive regulation, and emotional and motivational regulation are supported in real time by interdirect and interconstructive teachers - rather than relying in self-report and / or laboratory-based methodologies (e.g., Braund & DeLuca, 2018). Indeed, there is increasing evidence that teachers' self-ratings of their promotion of metacognition and self-regulation did not correlate with direct classroom observation (Dignath & Büttner, 2018). Notably, this is the first case of study using an observational and fine-grained coding scheme to analyze how teacher metacognitive talk promote children's metacognition and self-regulation in first-grade everyday classrooms.

Regarding our first research question, findings on the teacher metacognitive talk variety across dimensions and categories supporting prior observational studies based on classroom activities designed ad hoc by practitioners to facilitate metacognitive and self-regulatory processes in preschool education (e.g., Aras & Tantekin Erden, 2020; Withebread et al., 2009; Whitebread & Coltman, 2010). Interestingly, our findings contrasting prior research that pointed out that primary school teachers focused mainly on cognitive strategies rather

than on metacognitive strategies (e.g., Dignath & Büttner, 2018; Dignath & Mevarech, 2021; van Loon et al., 2021). One explanation for this result is prior studies samples selected were based on teacher-directed styles. Several authors claim that teachers with a direct instructional style seldom structuring learning situations to encourage children to practice strategies in a self-regulated and autonomy manner, so they can construct their own insights about how and when to use these (Martin et al., 2014; Pozo, 2008. Ventura, 2017).

Regarding our second research question, we confirmed Dignath's (2021) results that teachers' practices regarding the promotion of metacognition and self-regulation did not differ qualitatively in the variety of processes fostered, but rather quantitatively in promotion levels (low vs. high) of their support. Indeed, we found that teachers with different instructional style have varied quantitatively in the way they promoted metacognition and self-regulation. The interdirect teacher spent more time promoting metacognitive knowledge and motivation than the interconstructive teacher did, but she worked more time fostering metacognitive regulation skills (i.e., planning, monitoring, and evaluation). It is reasonably because interdirect teacher conceives learning as the activation of students' previous knowledge and cognitive processes that, guided by the teacher, can lead to the generation of adequate copies of knowledge; while interconstructive teacher considers learning as generate and redescribe representations whose epistemic and pragmatic potential depends on personal goals and contextual factors (Pozo et al., 2006).

Beyond these characteristic styles, both teachers have shared the promotion of knowledge of strategies, control, and emotional and motivational control. This could be interpreted as the internalization of common teaching context at the beginning of schooling based on, with increasing age, experience, and competence, children are expected to internalize the strategies being taught and to take more control over their own learning (Vygotsky, 1978; Wertsch et al., 1980).

In summary, this study makes an important contribution to the literature by bridging early metacognitive and self-regulatory research and teaching practices. Making learning visible means to make external the internal perspectives the teacher applies to teach and thereby create a shared consciousness of the promotion of child's metacognitive and self-regulatory processes.

Limitations and future directions

This exploratory - case of study does not allow generalize their results. Further investigations require extending the sample and studying another instructional style nuances and knowledge domains.

Conclusions

Teachers are important socialization agents as children develop metacognition and self-regulation, and these skills are considered as an important milestone in early childhood education. Searching teaching changes aimed at an improvement of school practices and environments involves progressive noticing and expansion of child-centered classroom practices based on a combination of interpretive and constructive teaching practices. These research findings capture some of the complexity of the processes underlying children's metacognitive and self-regulatory development, and indicate that teachers' influences should not be neglected (Greene, 2021).

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REFERENCES

Aras, S., & Tantekin Erden, F. (2020). Documentation panels: supporting young children's self-regulatory and metacognitive abilities. *International Journal of Early Years Education, 28*(1), 63-80. https://doi.org/10.1080/09669760.2019.1592743

Braund, H., & DeLuca, C. (2018). Elementary students as active agents in their learning: an empirical study of the connections between assessment practices and student metacognition. *Aust. Educ. Res. 45*, 65–85. https://doi.org/10.1007/s13384-018-0265-z

Casas-Mas, A., López-Íñiguez, G., Pozo, J. I., & Montero, I. (2019). Function of private singing in instrumental music learning: A multiple case study of self-regulation and embodiment. *Musicae Scientiae, 23*(4), 442–464. https://doi.org/10.1177/1029864918759593

Chen, S., & McDunn, B. A. (2022). Metacognition: History, measurements, and the role in early childhood development and education. *Learning and Motivation, 78*, 101786. https://doi.org/10.1016/j.lmot.2022.101786

Dignath, C. (2021). For unto every one that hath shall be given: teachers' competence profiles regarding the promotion of self-regulated learning moderate the effectiveness of short-term teacher training. *Metacognition and Learning* 16, 555–594. https://doi.org/10.1007/s11409-021-09271-x

Dignath, C., & Büttner, G. (2018). Teachers' direct and indirect promotion of self-regulated learning in primary and secondary school mathematics classes – insights from video-based classroom observations and teacher interviews. *Metacognition and Learning, 13*, 127–157. https://doi.org/10.1007/s11409-018-9181-x

Dignath, C., & Mevarech, Z. (2021). Mind the gap between research and practice in the area of teachers' support of metacognition and SRL. *Metacognition and Learning, 16*(3), 517–521. https://doi.org/10.1007/s11409-021-09285-5

Fridman, R., Eden, S., & Spektor-Levy, O. (2020). Nascent Inquiry, Metacognitive, and Self-Regulation Capabilities Among Preschoolers During Scientific Exploration. *Front. Psychol., 11,* 1-16. https://doi.org/10.3389/fpsyg.2020.01790

Grau, V., & Whitebread, D. (2018). Relationships between classroom dialogue and support for metacognitive, self-regulatory development in educational contexts. *New Directions for Child and Adolescent Development, 162*, 7–10. https://doi.org/10.1002/cad.20258

Greene, J.A. (2021). Teacher support for metacognition and self-regulated learning: a compelling story and a prototypical model. *Metacognition and Learning, 16*, 651–666. https://doi.org/10.1007/s11409-021-09283-7

Greenacre, M. (1984). *Theory and applications of correspondence analysis.* Academic Press.

López-Íñiguez, G., & Pozo, J. I. (2016). Analysis of constructive practice in instrumental music education: Case study with an expert cello teacher. *Teaching and Teacher Education, 60,* 97–107. https://doi.org/10.1016/j.tate.2016.08.002

Martín, E., Pozo, J. I., Mateos, M., Martín, A., & Pérez Echeverría, M. P. (2014). Infant, primary and secondary teachers' conceptions of learning and teaching and their relation to educational variables. *Revista Latinoamericana de Psicología, 46*, 211–221. https://doi.org/10.1016/S0120-0534(14)70024-X

Moyles, J., Paterson, F., & Kitson, N. (2003). It wasn't as bad as I thought! Learning from reflective dialogues. In J. Moyles, L. Hargreaves, R. Merry, & F. Paterson (Eds.), *Interactive teaching in the primary school* (pp. 141–154). Open University Press.

Olson, D., & Bruner, J. (1996). Folk Psychology and Folk Pedagogy. En D. Olson & N. Torrance (Eds.), *Handbook of education and human development: New models of learning, teaching and schooling* (pp. 9-27). Blackwell.

Perry, N. E., & VandeKamp, K. J. O. (2000). Creating classroom contexts that support young children's development of self-regulated learning. *International Journal of Educational Research, 33*(7-8), 821-843. https://doi.org/10.1016/S0883-0355(00)00052-5

Perry, N. E., VandeKamp, K. J. O., Mercer, L. K., & Nordby, C. J. (2002). Investigating teacher–student interactions that foster self-regulated learning. *Educational Psychologist, 37*(1), 5–15. https://doi.org/10.1207/S15326985EP3701_2

Pino-Pasternak, D., Basilio, M., & Whitebread, D. (2014). Interventions and Classroom Contexts That Promote Self-Regulated Learning: Two Intervention Studies in United Kingdom Primary Classrooms. *Psykhe, 23*(2), 1-13. https://doi.org/10.7764/psykhe.23.2.739

Pozo, J. I. (2008). *Apprentices and teachers: The cognitive psychology of learning [Aprendices y maestros: La psicología cognitiva del aprendizaje].* Alianza

Pozo, J. I., Scheuer, N., Pérez Echeverría, M. P., Mateos, M., Martín, E., de la & Cruz, M. (Eds.). (2006). *New ways of thinking about teaching and learning: Conceptions held by teachers and students [Nuevas formas de pensar la enseñanza y el aprendizaje: Las concepciones de profesores y alumnos].* Graó.

Robson, S. (2016). Self-regulation, metacognition and child- and adult initiated activity: does it matter who initiates the task? *Early Child Development and Care, 186*(5), 764-784. https://doi.org/10.1080/03004430.2015.1057581

Robson, S., & Zachariou, A. (2022). *Self-Regulation in the Early Years.* Sage.

Strauss, S., & Shilony, T. (1994). Teachers' models of children's mind and learning. In L. Hirschfeld & S. Gelman (Eds.), *Mapping the mind* (pp. 455-473). Cambridge University Press.

van Loon, M.H., Bayard, N.S., Steiner, M., & Roebers, C. (2021). Connecting teachers' classroom instructions with children's metacognition and learning in elementary school. *Metacognition and Learning*, *16*, 623–650. https://doi.org/10.1007/s11409-020-09248-2

Ventura, A.C. (2017). University professor identity in a classroom and interview situation. Journal for the Study of Education and Development: Infancia y Aprendizaje, 40(3), 531-571. https://doi.org/10.1080/02103702.2017.1341104

Ventura, A.C. (2022). Metacognition and self-regulation in young children: Does it matter if metacognitive experiences are communicated? Early Years, 43(4-5), 1118-1130. https://doi.org/10.1080/09575146.2022.2065666

Ventura, A.C., & Lazzeri, M. (2023). Are there differences between first-grade children's display of metacognition and self-regulation when engaged in a graphic production task and when later revising it? The complementary roles of production and revision at the beginning of schooling. European Journal of Psychology of Education, 38, 1425–1442. https://doi.org/10.1007/s10212-022-00672-3

Vygotsky, L. (1978). *Mind in Society: The Development of Higher Psychological Processes.* Harvard University Press.

Wertsch, J. V., McNamee, G. D., McLane, J. B., and Budwig, N. A. (1980). The adult-child dyad as a problem-solving system. *Child Development, 51*, 1215–21.

Whitebread, D., & Pino-Pastenak, D. (2013). Video analysis of self-regulated learning in social and naturalistic contexts. The case of preschool and primary school children. In S. Volet, & M. Vauras (Eds.), *Interpersonal regulation of learning and motivation* (pp. 14-44). Routledge.

Whitebread, D., Basilio, M., O'Sullivan, L., & Zachariou, A. (2019). Conclusion: The Importance of Play, Oral Language and Self-Regulation in Children's Development and Learning: Implications for Quality in Early Childhood Education. In D. Whitebread (Ed.), *The SAGE Handbook of Developmental Psychology and Early Childhood Education* (pp. 554-569). SAGE.

Withebread, D., & Coltman, P. (2010). Aspects of pedagogy supporting metacognition and self-regulation in mathematical learning of young children: evidence from an observational study. *ZDM Mathematics Education, 42,* 163–178. https://doi.org/10.1007/s11858-009-0233-1

Whitebread, D., Coltman, P., Pasternak, D. P., Sangster, C., Grau Cardenas, V., Bingham, S., Almeqdad, Q., & Demetriou, D. (2009). The development of two observational tools for assessing metacognition and self-regulated learning in young children. *Metacognition and Learning, 4*(1), 63–85. https://doi.org/10.1007/s11409-008-9033-1

Zachariou, A., & Whitebread, D. (2022). The relation between early self-regulation and classroom context: The role of adult presence, the task's source of initiation, and social context. *British Journal of Educational Psychology,* e12476 https://doi.org/10.1111/bjep.12476