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Teacher collaborative knowledge building in Reciprocal Peer Observation

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Abstract
This research focuses on the interaction between pairs of teachers who carry out Reciprocal Peer Observation (RPO) practices. The aim is to identify how teachers learn by building knowledge collaboratively during their participation in feedback meetings (the third stage of the RPO cycle). From an initial sample of 400 voluntary in-service teachers, audio files recorded during feedback meetings are collected. Teacher pair interaction is analyzed in 94 meetings using a system of categories and subcodes. Discourse moves related to collaborative knowledge building (CKB) and non-CKB are analyzed to check if there are differences between the two roles carried out (observer and observee). The study combines descriptive and inferential analysis, and results indicate that there is a greater use of discourse moves related to CKB. Differences between observer and observee roles are identified, indicating that RPO can be an adequate practice for teacher learning because it allows each teacher to take advantage of the opportunities of both roles. It is concluded that enriching feedback meetings with the use of informed knowledge, support of tools, and quality feedback can promote even more CKB in RPO feedback meetings and therefore continue to move forward to practices in which teachers can collaboratively learn from each other.

Keywords Collaborative knowledge building · Feedback · Reciprocal Peer Observation · Teacher learning · Teacher professional development

In the international context, peer learning practices are identified as a good mechanism for the professional development of teachers (OECD, 2019). However, there are few studies that present evidence of how teachers collaboratively learn from each other in these situations (Guskey, 2014; Lefstein et al., 2020; Walkoe & Luna, 2020). According to Webster-Wright (2009), a distinction must be made between professional development and professional learning. Several studies have identified the collaborative activities that facilitate the professional development and promotion of teacher learning (e.g. Borko et al., 2010;

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Kellner & Attorps, 2024; Van Veen et al., 2012). However, more studies are needed to advance the knowledge of how teachers learn during their participation in these activities.

The research presented focuses on the analysis of a specific peer learning practice, Reciprocal Peer Observation (RPO). The study aims to identify how teachers engaging in these practices collaboratively learn from one another.

Teacher learning through social interaction

There is a broad consensus among scholars in analysing the learning process considering that it is mediated by social interaction, through discourse. Lefstein et al. (2020) have carried out a systematic review of 64 articles about teacher team discourse and interaction, in which a need to examine how teachers can use language to work together effectively coexists (Littleton & Mercer, 2013; Mercer, 2004). They use language to make sense of their shared experience and create new understandings that each one separately would not have achieved. Social discourse allows the collective knowledge of a group promoting joint knowledge building to increase (Hmelo-Silver & Barrows, 2008).

Some studies of discourse among teachers focus on the joint work carried out in the school, in its day-to-day activities (Horn & Kane, 2015; Horn & Little, 2010). Other studies are designed to look further into specific situations of teacher professional development, such as learning communities (Popp & Goldman, 2016; Prenger et al., 2021) or other collaborative professional development activities, such as Lesson Study (Vrikki et al., 2017; Warwick et al., 2016), video-based professional development processes (Borko et al., 2008; Chua & Tan, 2021), or problem-based learning approaches (Zhang et al., 2011). All these educational situations are designed to facilitate an organizational structure between participants supporting knowledge building.

An initial study by Hmelo-Silver and Barrows (2008) considers the discourse mediated by a facilitator (teacher) to students working in a team and identifies the most important discourse moves for knowledge building: questioning (to initiate dialogues or help advance ideas), statement (development or reworking of ideas), regulatory statements (dedicated to favoring collaboration within the team). Although more studies will be needed to qualify these findings, the foundations are established for a coding system that allows analysis of how collaborative knowledge building is carried out.

Several authors have been interested in the analysis of these collaborative discussions (e.g. Bannister, 2015; Lantz-Andersson et al., 2022; Postholm, 2018), which are found in the literature as "dialogic discourse," "reflective discourse," "generative dialogue," or "progressive knowledge-building discourse." They have advanced in the analysis of the role of a "facilitator" in verbal interactions in teams, composed not of students from a classroom, but teachers. Different discursive strategies and the combinations between them that are used by the facilitator to promote a collaborative discourse among teachers are identified. Emerging ideas, more elaborate responses, and reflections are promoted, which ultimately allow, from dialogue, collaborative knowledge building to be facilitated (De Jong et al., 2021; Onrubia et al., 2022; Zhang et al., 2011).

Warwick et al. (2016) highlight the importance of a discussion focus within the team of teachers who jointly discuss an item of content. The focus of discussion, the content, acts as a mediating artifact for collaborative knowledge building among teachers, leading to improved pedagogical practice. Therefore, they advocate three lines of analysis in collaborative teacher discussions: the content, the characteristics of the discourse, and the nature

of teacher learning. Vrikki et al. (2017) analyze data from the previous study from the perspective of how teacher learning occurs and characterize the typology of dialogue between teachers in the context of Lesson Study, based on the Sociocultural Discourse Analysis Methodology by Mercer (2004). Their results show that different forms of interaction in dialogues produce different effects on learning processes.

Collaborative dialogue in peer observation practices

The research presented here is based on the educational practice of Reciprocal Peer Observation (RPO). RPO involves a pair of teachers with similar degrees of experience and status who mutually agree to observe each other's class practice (Corcelles et al., 2023). Both act as observer and observee. Mutual constructive feedback is offered, which allows the sharing of ideas and knowledge to identify professional learning goals (O'Leary, 2020). Teachers who participate in RPO practices report learning perceived: they learn new approaches or strategies to incorporate into their own teaching practices (Motallebzadeh et al., 2017; Thomson et al., 2015) or they become aware of and improve more deficient aspects of their practice (Alam et al., 2020; Flores et al., 2024; Miquel et al., 2024; Tenenberg, 2016). Learning all of them favors greater self-reflection and self-efficacy (Hendry et al., 2020; O'Leary & Savage, 2020). But rarely are studies found linking features of teacher discourse with evidence of individual change (Lefstein et al., 2020).

As with other collaborative professional development activities, RPO needs to provide mechanisms to support collaborative discussion (De Jong et al., 2021; Warwick et al., 2016). Even so, research shows that the biggest challenge in RPO has to do with teachers' peer feedback (Corcelles et al., 2023; Jeffs et al., 2023).

RPO will be a good opportunity for teacher professional learning when teachers are able to offer and accept feedback, forming part of a constructive dialogue. This dialogue must aim at jointly analyzing observations made in the classroom (Yiend et al., 2014). Therefore, to obtain maximum benefit and provide learning opportunities during discussions in feedback meetings, teachers must be previously trained in offering and accepting constructive feedback (O'Leary, 2020; Rosselló & De la Iglesia, 2021). However, despite this, many teachers still find this phase the most challenging of the entire RPO process (Parr & Hawe, 2017).

Collaborative knowledge building

Popp and Goldman (2016) analyze the discourse of different primary education teaching teams organized in professional learning communities. These authors, from the studies of Scardamalia and Bereiter (2003), characterize the type of interactions that lead to collaborative knowledge building (CKB) and identify their key aspects. Since CKB can occur in different situations or environments (e.g., Chua & Tan, 2021; Scardamalia & Bereiter, 2006), it would also be expected to be found in peers participating in RPO practices.

Situations that lead to CKB are based on three aspects. Firstly, there is the presence of interactive talk (dialogue between participants), contrasted with monological talk (uninterrupted turns of talk by one speaker) (Scott et al., 2006). The contributions of all participants are valuable and necessary to advance the understanding of the subject treated. This collaboration between participants promoting interactive speech is basic in RPO feedback

meetings. However, monological talk can also occur, when one peer monopolizes the entire conversation (Huang et al., 2020), and in this case, the situation would be understood as not suitable for CKB.

Secondly, and specifically in situations of "interactive talk," exploratory talk (involving joint questioning and elaboration of ideas which can lead to CKB) can be contrasted with expository talk (not associated with CKB) (Scardamalia & Bereiter, 2006; Zhang et al., 2011). Ideas discussed in the team can be improved and the action of discussing and exploring in more depth helps the participants' learning. Therefore, at feedback time in the RPO, if peers use an exploratory discourse learning opportunities appear. On the other hand, we will be facing a non-CKB (NCKB) situation if the discourse is expository, part of the narrative without questioning, and enhancing an individual position.

And thirdly, the team decides to improve ideas related to authentic questions that aim to solve common problems (Popp & Goldman, 2016). This is the case of RPO where peers focus observation and subsequent feedback on selected indicators of their real practice and their performance during the observed lesson.

Research objectives

From this characterization, Popp and Goldman (2016) elaborate on a system of categories and subcodes used in the data analysis in this article. This system was adapted to the context of the study, thus allowing the research objectives to be addressed.

The research objectives are as follows:

(1) To classify feedback meetings in RPO practices according to whether they are characterized by monological or interactive talk.
(2) To identify and analyze the discourse moves associated with CKB and NCKB that occur in feedback meetings with interactive talk.
(3) To identify and analyze the differences between the observer and the observee role during the feedback meetings in relation to CKB and NCKB.

Methodology

Research context

Based on previous research (Corcelles et al., 2023; Duran et al., 2020), the procedure followed in the RPO practice of this study was concretized in a four-stage cycle, following the contributions of O'Leary (2020) and O'Leary and Savage (2020), which is carried out reciprocally: (1) Pre-observation: both teachers agree on the objective of observation and some indicators, for instance, in relation to classroom management or creating a positive learning environment. Teachers also review guides to support a constructive feedback session. (2) Observation in the classroom and a brief report of the observee. (3) Feedback session: observer initiates the dialogue inviting the observee to make a self-assessment based on the previous report. Observer then presents their observations and observee actively participates in the conversation. Together they specify the professional learning goal of the observee. (4) Reflective synthesis of the observee specifying the own learning goal.

Participants

The study collected an initial sample of 400 voluntary in-service teachers from 123 schools, organized in pairs, where each teacher acted once as an observer and once as an observee. It is a diverse sample made up of compulsory education teachers (6–16) (73%), post-compulsory (17–18) (14.7%), early childhood (3–5) (10.8%), and adults (1.5%) of two Spanish areas (Catalonia and Balearic Islands). The mean age of the sample was 41.3 ± 8.7 years old (mean $\pm$ SD); with 13.2 ± 8.9 years of teaching experience, and women were the majority (77.3%). Thirty-five percent of the participants have previous peer observation experience.

The Ethics Committee of the Universitat Autònoma de Barcelona of Catalonia approved the study, respecting the obligations derived from the Organic Law 3/2018 on Personal Data Protection and Digital Rights, General Data Protection Regulation (EU) 2016/679 and the current complementary legislation. All participants received written information about the project and gave their consent to participate according to the ethics compliance procedures.

Data collection procedure

Data were collected from audio recordings. During feedback, the third phase of RPO, the participants were asked to voluntarily record on audio the two feedback meetings they carried out. First, one participated as observer and the other as observee, and they exchanged roles in the second.

To respond to the first objective, a sample of 400 participants was selected (Table 1) of which 273 sent the audio files. For the other two objectives, a random subsample of 94 audio files of the feedback meetings was selected, corresponding to 47 pairs of teachers.

Data analysis

From a quantitative approach, the study combines descriptive and inferential analysis to respond to proposed objectives. The first step of the analysis of Objective 1 was to identify the audio files of the feedback meetings that were interactive, and therefore, a dialogue occurred between the participants (Scott et al., 2006). A frequency table is made that allows discrimination of interactive audios from monologues.

For Objectives 2 and 3, to ensure that there is no bias in the final subsample (responding pairs) with respect to the rest of the initial sample (non-responding pairs), the characteristics of the participants were compared between the final subsample to be analyzed ($N = 94$) and the rest of the participants in the study ($N = 306$). First, descriptive statistics mean and standard deviation (SD) were obtained for quantitative variables and frequencies for qualitative variables.

Table 1 Sample and subsample

N	*N* audios delivered		*N* not audios delivered
	N sample analysis (Objective 1)	*N* subsample analysis (Objective 2 and 3)	
400	273 (68.25%)	94 (34.43% of 273)	127 (31.75%)

Next, for normal quantitative variables, Student's *T*-test was performed for independent samples to compare the means of both samples. For discrete or non-normal quantitative variables, a Mann–Whitney *U* test was performed. The normality of the variable was verified based on the Shapiro–Wilk test. For qualitative variables, a chi-square test of homogeneity was calculated.

To analyze feedback meetings, Popp and Goldman's (2016) system of categories and subcodes was chosen. These authors suggest the importance of examining meeting focus or purpose in relation to the presence of knowledge building. In this research, the main purpose is to review self and partner practice in the feedback meetings, based on constructive comments that entail being able to recognize specific, previously agreed actions observed in the classroom and give them a value. For this reason, a category was added in the system. It includes classroom practice assessment, specified in reflecting on practice, and its associated subcodes: recognizing an example of good practice, identifying an improvement and appropriating and incorporating practices. Once adapted to the context, it was translated into Catalan (Table 2).

The unit of analysis is based on each speaking turn with discourse moves (Popp & Goldman, 2016), preferably. Each unit should have a sense and meaning of its own. Each new turn begins when the participant changes. A participant's intervention is divided when the topic of conversation changes or when a different type of discourse move is observed. For example, if a teacher makes a statement on one topic and then asks a question on another topic in the same turn, the teacher's turn is divided into two units (Hmelo-Silver & Barrows, 2008). The analysis was carried out from the audio file, without transcription, using Nvivo 12, and considered both the number of times each discourse move occurred (frequency) and the time it took (in seconds).

Once the category system was adapted and the unit of analysis was defined, a detailed coding manual was prepared. Theoretical justification and the complete category system, with a definition of each category and the different subcodes, were explained. Illustrative examples of each subcode (also ambiguous cases) were included.

With the objective of validating the interpretability of the category system an expert judgment with two independent judges was carried out. They analyzed 30 audio files of 94 (32%), chosen randomly. The inter-coder reliability coefficient (Cohen's Kappa) was 79%, an agreement that could almost be classified as "excellent" (Landis & Koch, 1977). The cases of disagreement were discussed until a consensus was reached. After that, one of the judges completed the rest of the coding.

To carry out the analysis of the second research objective, firstly, the frequencies of the most used categories and those with the greatest time dedication were identified. In this part of the study, the interest is focused on the categories related to CKB to account for the learning opportunities that occur in the feedback meetings.

In the third objective, the focus was on identifying whether there are differences between the role of observer and observee in the feedback meetings for each of the identified categories and sub-codes, both in frequency and in time.

In both cases, if the variable of interest had a normal distribution, Student's *T*-test for related samples was performed, and if the assumption of normality was not met, the Wilcoxon rank test was performed to identify statistically significant differences between CKB and NCKB (Objective 2) and between roles (Objective 3). The effect size (ES) was calculated based on the biserial correlation coefficient or Cohen's *d*, as appropriate.

Table 2 Category system (adapted from Popp and Goldman, 2016)

COLLABORATIVE KNOWLEDGE BUILDING	
Categories and - Subcodes	*Description*
Questioning	Searching for information (to know more, to have more details, more knowledge or more data without starting from an uncertainty and without generating discussion).
- Prompting	Activating ideas on the topic.
- Probing	Inviting, directly or indirectly, to provide more explanations or more details about a previous piece of information or an event that happened in the classroom.
- Asking for clarification	Asking the partner to reaffirm or confirm the meaning of the ideas.
Proposing	Presenting a new idea.
- Proposing initial idea	Exposing a new idea directly or indirectly, waiting for a peer reply and opinion.
- Counter proposing	Exposing an idea that negates or opposes the initial idea.
Elaborating proposals	Re-elaborating practical proposals based on those previously proposed.
- Rephrasing	Remaking your own proposal or someone else's, using different words and phrases.
- Refining	Reviewing your own or someone else's proposal by specifying it, generalizing it or adding more details.
- Giving example	Providing an example to illustrate the proposal being discussed.
Negotiating	Challenging and confronting ideas (to discuss and to deepen the understanding, reaching or not reaching agreements).
- Disagreeing	Explicitly communicating a proposal disapproval in a way that does not invite discussion.
- Challenging	Indicating uncertainty about something or questioning the proposal validity in a way that invites discussion.
- Disconfirming	Providing a rejection as a clarifying response.
- Asking for agreement	Asking the partner about proposal/idea understanding or asking to corroborate the idea that has just been discussed.
Explaining thinking	Developing the argument in a reasoned way.
- Explaining reasoning	Providing an explanation of the meaning of something or providing a justification for one's own or another's proposal or action (for example, explain the reason for a good practice or an aspect of improvement, without hesitation).
- Admitting uncertainty	Describing a topic difficulty or uncertainty (for example, explaining reason for a good practice or an aspect for improvement, without being clear about it).
Reflecting on practice	Reflecting on some idea of your own or your partner's teaching practice (including RPO).
- Recognising good practice	Identifying a good practice without adding any justification.
- Recognising an improvement	Identifying an aspect of practice improvement without adding any justification.
- Appropriating	Expressing intention to reproduce a peer's good practice (explained or observed).
- Incorporating	Making an improvement proposal on the practice itself (without waiting for any kind of response or assent).
NON-COLLABORATIVE KNOWLEDGE BUILDING	
Agreeing	Indicating that you agree.

Table 2 (continued)

- Agreeing	Directly express agreement with an idea, proposal... (does not include a simple follow-up of the conversation).
- Agreeing through repeating	Agreeing with a proposal by repeating it, using the same words or phrases.
- Confirming	Providing a validation as an answer to a previous question.
- Affirming	Indicating understanding or support for a proposal or idea.
Describing	Exposing the event details. Reporting visible aspects, sensations and/or feelings and specific facts of the observed session (without value judgment). Reading or review of the observation script or the support documentation provided for carrying out the OEI is included.
Off-topic	Any comments not related to the task.

Results

Objective 1: To classify feedback meetings in RPO practices according to whether they are characterized by monological or interactive talk

In response to Objective 1 (Table 3), it is observed that almost 80% of the audio files delivered correspond to interactive sessions. Both participants actively participate in the feedback session and, therefore, are likely to generate CKB opportunities.

Objective 2: To identify and analyze the discourse moves associated with CKB and NCKB that occur in feedback meetings with interactive talk.

Before answering Objective 2 (and subsequently 3), the random subsample of 94 teachers who participate in feedback meetings with interactive talk is compared with the rest of the research participants to check for response bias (Table 4).

Based on the results obtained from the aspects analyzed (age, sex, educational stage, years of teaching experience, and previous experience in peer observation), it can be concluded that there are no statistically significant differences between the

Table 3 Interactive vs monological feedback meetings

Feedback	*F*	%
Interactive	217	79.5
Monological	56	20.5
Total	273	100

Table 4 Sample and subsample teachers in Objectives 2 and 3

Sample, *N* teachers	Subsample, *N* teachers	Random subsample, *N* teachers (pairs)
400	306	94 (47)
100%	76.5%	23.5%

final subsample evaluated and the rest of the research participants. Both samples are homogeneous.

In relation to Objective 2, the results indicate that there are statistically significant differences between the total discourse moves associated with CKB and the total NCKB (Table 5), both in frequencies ($W = 3176.0$; $p < 0.0001$; ES = 0.6) as in the time-spending by these discourse moves ($W = 3766.50$; $p < 0.0001$, ES = 0.7).

Focusing on each dimension, the two most used categories in CKB, both in frequency and time, have been "Explaining thinking" and "Reflecting on practice."

Reviewing the subcodes within the "Explaining thinking," "Explaining reasoning":

> The objective of 'symbolic play' is to develop oral language and this is the objective when I do these lessons.

has been used more widely both frequency and time, in relation to "Admitting uncertainty."

Within "Reflecting on practice," "Recognizing a good practice":

> I really liked how you had the classroom organized, you took care of the organization and the presentation of the materials,

is the most used subcode above "Recognizing an improvement":

> Yes, sometimes we anticipate and put the words, and we don't let them express themselves. Little by little we are changing it.

The rest of the categories ("Elaborating proposals," "Proposing and Negotiating") get much lower scores. Among these, the only category in which scores do not follow the same tone is "Questioning." Although the frequency at which it has been asked is higher, time-spending asking is less than in the rest of the categories. The subcode "Probing" is the most used:

The only thing that surprised me is that in the scientific space maybe they didn't know the tools to use, how did you see that?

In relation to NCKB dimension, categories with the highest frequencies and the time-spending also go in the same direction. "Describing":

> Learning spaces is a methodological proposal that consists of having the classroom distributed in small micro spaces,

is clearly the most often and longest-used above "Agreeing."

It should be noted that the time-spending on this second category was very low considering its frequency and that there is no subcode that stands out, especially from the others.

In summary, the evidence indicates that several discourse moves associated with CKB are used during the feedback session. The most frequent discourse moves used associated with CKB involve providing an explanation of the meaning of something or providing a justification, such as clarifying the reason for a recognized good practice.

Less often, questioning is used to seek more information about what is being discussed but using short questions. And some challenging ideas are also presented, reworking those previously proposed.

Discourse moves that are not useful for CKB, such as describing the observed session or simply showing agreement, indicate that the feedback meetings are not being used to their full potential. Some of the time spent on these could be better allocated to other discourse moves that are more beneficial for CKB.

Table 5 Means, standard deviation (SD) and weighting (%) of frequencies and time (in seconds) for each category and subcode

COLLABORATIVE KNOWLEDGE BUILDING				
Categories and subcodes	*Frequency*	Weighting	*Time* (s)	Weighting
Questioning	3.09*(3.03)*	6.71	24.54*(33.20)*	3.52
- Prompting	0.31*(0.78)*	0.67	3.88*(10.89)*	0.56
- Probing	2.41*(2.45)*	5.25	18.98*(24.18)*	2.72
- Asking for clarification	0.36*(0.69)*	0.79	1.68*(5.16)*	0.24
Proposing	1.9*(2.21)*	4.14	32.44*(41.87)*	4.65
- Proposing initial idea	1.5*(1.84)*	3.26	24.05*(31.49)*	3.45
- Counter proposing	0.4*(0.78)*	0.88	8.38*(23.49)*	1.20
Elaborating proposals	2.35*(3.13)*	5.11	33.14*(49.76)*	4.75
- Rephrasing	0.66*(1.08)*	1.43	9.72*(18.36)*	1.39
- Refining	1.21*(1.96)*	2.64	17.73*(34.75)*	2.54
- Giving examples	0.48*(1.05)*	1.04	5.68*(13.64)*	0.81
Negotiating	1.62*(2.23)*	3.52	24.84*(33.73)*	3.56
- Disagreeing	0.07*(0.30)*	0.16	0.99*(4.28)*	0.14
- Challenging	0.96*(1.38)*	2.08	17.30*(25.94)*	2.48
- Disconfirming	0.19*(0.63)*	0.42	2.03*(7.28)*	0.29
- Asking for agreement	0.39*(0.87)*	0.86	4.52*(9.33)*	0.65
Explaining thinking	11.07*(9.59)*	24.09	229.64*(190.50)*	32.89
- Explaining reasoning	8.97*(8.27)*	19.51	186.91*(165.68)*	26.77
- Admitting uncertainty	2.11*(2.73)*	4.58	38.84*(51.62)*	5.56
Reflecting on practice	5.82*(3.25)*	12.66	91.70*(63.71)*	13.13
- Recognising good practice	3.79*(2.84)*	8.24	61.78*(51.73)*	8.85
- Recognising an improvement	1.71*(1.57)*	3.73	26.24*(33.42)*	3.76
- Appropriating	0.32*(0.57)*	0.69	2.27*(5.73)*	0.32
- Incorporating	0.07*(0.37)*	0.16	1.41*(7.49)*	0.20
Total CKB	25.85*(17.26)*	56.23	432.41*(273.66)*	61.94
NON-COLLABORATIVE KNOWLEDGE BUILDING				
Agreeing	5.81*(5.57)*	12.64	15.37*(13.21)*	2.20
- Agreeing	1.69*(1.65)*	3.68	6.73*(7.46)*	0.96
- Agreeing through repeating	0.72*(1.26)*	1.57	1.77*(3.60)*	0.25
- Confirming	1.96*(2.49)*	4.26	3.93*(5.01)*	0.56
- Affirming	1.44*(1.90)*	3.12	2.95*(4.33)*	0.42
Describing	13.61*(12.49)*	29.60	237.95*(195.31)*	34.08
Total NCKB	19.41*(16.99)*	42.23	253.32*(200.40)*	36.28
Off-topic	0.7*(1.22)*	1.54	12.43*(49.58)*	1.78
Total CKB+NCKB+OFF-TOPIC	45.95	100	698.16	100

Objective 3: To identify and analyze the differences between the observer and the observee role during the feedback meetings in relation to CKB and NCKB

The results obtained by categories (Table 6) show statistically significant differences between observer and observee in the overall mean frequency across both dimensions (CKB-NCKB). Specifically, the observer role performs more interventions than

Table 6 Differences in mean frequencies per session between roles (*N*=94). Wilcoxon signed rank test

COLLABORATIVE KNOWLEDGE BUILDING					
Categories and subcodes	Observer *M(SD)*	Observee *M(SD)*	*W*	*p*	Rank biserial correlation
Questioning	2.53*(2.66)*	0.55*(1.11)*	2602.50	<.0001	0.83
- Prompting	0.28*(0.72)*	0.03*(0.18)*	163.00	<.0001	0.91
- Probing	2.04*(2.21)*	0.37*(0.76)*	2089.50	<.0001	0.89
- Asking for clarification	0.21*(0.55)*	0.15*(0.46)*	160.00	0.50	0.16
Proposing	1.26*(1.35)*	0.65*(1.46)*	1126.50	<.0001	0.57
- Proposing initial idea	1.00*(1.15)*	0.50*(1.37)*	1120.00	<.0001	0.57
- Counter proposing	0.26*(0.55)*	0.15*(0.44)*	205.50	0.09	0.37
Elaborating proposals	1.29*(1.88)*	1.06*(1.48)*	759.00	0.14	0.24
- Rephrasing	0.32*(0.75)*	0.34*(0.63)*	269.50	0.84	−0.04
- Refining	0.63*(1.14)*	0.59*(1.05)*	284.50	0.70	0.08
- Giving example	0.34*(0.8)*	0.14*(0.40)*	230.00	0.02*	0.53
Negotiating	0.81*(1.21)*	0.81*(1.31)*	398.50	0.91	0.02
- Disagreeing	0.03*(0.18)*	0.04*(0.20)*	6.00	0.77	−0.20
- Challenging	0.62*(0.96)*	0.34*(0.73)*	586.00	0.01*	0.43
- Disconfirming	0.07*(0.37)*	0.12*(0.41)*	23.50	0.40	−0.29
- Asking for agreement	0.09*(0.38)*	0.31*(0.64)*	31.50	<.0001	−0.77
Explaining thinking	5.38*(5.57)*	5.69*(4.79)*	1528.0	0.53	−0.08
- Explaining reasoning	4.62*(5.16)*	4.35*(3.81)*	1743.5	0.70	0.05
- Admitting uncertainty	0.77*(1.22)*	1.34*(1.89)*	454.50	<.0001	−0.49
Reflecting on practice	4.60*(2.83)*	1.30*(1.49)*	3948.0	<.0001	0.89
- Recognising good practice	3.52*(2.68)*	0.27*(0.72)*	3240.0	<.0001	1.00
- Recognising an improvement	0.91*(1.24)*	0.80*(1.01)*	996.00	0.54	0.09
- Appropriating	0.14*(0.38)*	0.18*(0.44)*	116.50	0.49	−0.16
- Incorporating	0.02*(0.15)*	0.05*(0.34)*	5.00	0.57	−0.33
Total CKB	15.86*(10.36)*	10.06*(8.07*	3591.00	<.0001	0.83
NON-COLLABORATIVE KNOWLEDGE BUILDING					
Agreeing	2.38*(2.81)*	3.43*(3.85)*	581.00	<.0001	−0.50
- Agreeing	0.60*(0.93)*	1.10*(1.20)*	328.50	<.0001	−0.56
- Agreeing through repeating	0.47*(0.85)*	0.26*(0.67)*	386.50	0.02*	0.46
- Confirming	0.66*(1.07)*	1.30*(1.83)*	368.00	<.0001	−0.52
- Affirming	0.66*(1.21)*	0.78*(1.41)*	440.50	0.52	−0.11
Describing	8.07*(7.24)*	5.53*(5.69)*	2790.0	<.0001	0.81
Total NCKB	10.46*(9.27)*	8.96*(8.13)*	2724.0	<.0001	0.42

*p <.05

the observee role. The discourse moves associated with CKB show a large effect size ($ES = 0.83$). The difference in the discourse moves related to NCKB shows a medium effect size (ES = 0.42).

Regarding CKB, some categories show statistically significant differences, others do not. Differences are shown in the categories of "Questioning," "Proposing," and "Reflecting on practice," all of which reveal a large effect size (ES > 0.5). Conversely, categories

related to "Elaborating proposals," "Negotiating," and "Explaining thinking" do not show statistically significant differences between roles.

In the categories with no differences shown between observer and observee, and therefore the roles behave similarly, we can see some differences in the subcodes that do not follow the general trend, and the observee performs more interventions than the observer, in particular, "Asking for agreement" (a subcode of "Negotiation") and "Admitting uncertainty" (a subcode of "Explaining thinking").

Finally, in the NCKB categories, it is worth noting that the "Agreeing" subcode shows a higher frequency in the observee, while the "Describing" category is more frequent in the observer role.

The analysis performed on the differences in mean times between roles does not provide new results to those already shown in the frequency analysis, so a detailed presentation of these results is dismissed.

In summary, the results show that the observer intervenes more frequently than the observee during feedback meetings. The observer activates ideas and invites to the observee, directly or indirectly, to provide further explanations or more details. At the same time, the observer exposes new ideas if necessary and identifies the good practices of the observee.

On the other hand, the observee is the one who asks more to corroborate the idea that has just been discussed and the one who admits the most difficulties or uncertainties about some topics.

In other aspects such as confronting ideas or providing an explanation of the meaning of something and re-elaborating practical proposals based on those previously proposed, both observer and observee perform in a similar way.

Regarding the differences related to the NCKB dimension during feedback meetings, the observer is the one who most often describes specific facts of the observed session by reading or reviewing the observation script, and the observee is the one who most often expresses agreement with an idea or proposal.

Discussion

This study focused on the analysis of feedback meetings conducted within the RPO cycle. Throughout this process, opportunities for both teachers to review and reflect on their practice through collaborative dialogue are among the most valuable elements (O'Leary, 2022).

Collaborative knowledge building in feedback meetings of RPO practices

The aim of the research was to analyze the extent to which feedback meetings provided learning opportunities for the two teachers, both in the role of observer and observee, and therefore whether teachers built knowledge collaboratively during these meetings. Data analysis provides a detailed and real picture of what happens in feedback meetings in RPO practices in this study.

Results show that a large majority of teachers carry out feedback meetings based on interactive discourse. However, some teachers carry out monological talk not taking advantage of the interactive feedback potential. This issue underlines the teachers' challenge related to understanding that reflection on practice is most effective when

conducted through dialogue with others rather than in solitary contemplation (Mau & Harkness, 2020).

Feedback meetings do offer the possibility of peer learning between teachers thanks to the constructive dialogue that takes place, understanding this as a learning mechanism (Khong, et al., 2023; Miquel et al., 2024). In this dialogue, the most frequent and longest interventions are in categories related to exploratory discourse, responsible for CKB. This kind of discourse move suggests that learning between teachers is taking place. Most of the interventions carried out in the CKB dimension focus on providing an explanation and reflecting on some idea. The other categories from the CKB dimension are used to a lesser extent, both in terms of frequency and time.

Different explanations may lie behind the less frequent use of discourse moves related to questioning some aspects of the observed practice (i.e., inquiring, asking for more information, refuting, making, or reformulating alternative proposals). Firstly, it is likely that teachers would rather avoid direct confrontation with peers, dodging conflict (Nelson et al., 2010), despite the research tells us that openly and constructively discussing professional disagreements is a desirable collaborative process (Vangrieken & Kyndt, 2020). Secondly, they might opt for complacency over the use of constructive criticism, at the risk of reinforcing resistance to change (Gosling, 2014; Shortland, 2004). Thirdly, there might be a lack of practice in the use of correct discursive strategies in feedback situations since dialogical competence is independent of knowledge, skills, and teaching experience (Butler & Yeum, 2016).

Taking this into account, a recent systematic literature review (De la Iglesia et al., 2024) examining the empirical evidence on the benefits of peer, collaborative, and symmetric feedback states that for teachers to fully benefit from RPO practices, they must first be trained to offer and accept constructive comments and be able to provide critical, specific, and high-quality feedback comments (Drew et al., 2017).

This study shows that CKB takes place in RPO practices, but at the same time, it points out some aspects that could be improved to enhance its benefits. Firstly, teachers might be provided with explicit information underlining the learning benefits of using interactive rather than monological talk. Secondly, there is room for improvement in terms of the time that is devoted to CKB. Emphasis should be placed on:

(a) Quality feedback: Promoting a dialogical and bidirectional feedback interaction based on co-responsibility and consensus among participants. It should be used in a recurrent and cyclical way to make the practice sustainable and to promote self-regulation processes. It should also be adaptable and personalised, considering teachers' prior beliefs (Rosselló & De la Iglesia, 2021). The observer could be guided to avoid value judgments, offer practical suggestions, ask reflective questions, and highlight positive aspects. The observee could view feedback as an opportunity for growth, stay objective, engage actively, seek clarifications, and prioritize areas for improvement (O'Leary, 2020).
(b) Support mechanisms: Some research suggests that the differences in teachers' collaborative learning outcomes are partly due to differences in support for effective teacher collaboration (De Jong et al., 2021). Therefore, providing support mechanisms for collaborative discussion is paramount.
(c) Tools to avoid the description of facts and situations observed: The use of videotape (Borko et al., 2008; Körkkö et al., 2019) could be a good way to focus attention on specific situations of classroom practice for instance, through clips previously chosen

by the observer, which could promote co-construction of knowledge (Chua & Tan, 2021). In addition, tools are already available for use in RPO (Baran et al., 2023).

(d) Constructive use of authoritative information to promote discussions based on scientific evidence as a key aspect in the process of CKB (Scardamalia & Bereiter, 2006).

The observer and observee roles in CKB

Differences between roles also suggest some implications for the improvement of RPO practices. Rather than the observee, it is the observer who plays a prominent role as a promoter of interaction directed at CKB, which accounts for its importance in the feedback meetings. The observer acts as a leader to guide the feedback session towards an exploratory dialogue and promote CKB. The learning opportunities for the observer occur by observing different teaching and learning strategies. Observation allows them to compare their own practices with those of their partner (Tenenberg, 2016). Therefore, in this context, the observer can analyze these strategies and consider whether to incorporate them into their own teaching practice (Hendry & Oliver, 2012). In other words, through observing the practices of others, observers learn and reflect on their own practice (Sullivan et al., 2012).

The observee role also involves learning opportunities for professional development. In fact, research on peer observation has frequently focused on the learning of the observee through critical peer comments and self-reflection (Tenenberg, 2016). In this role, the benefits are especially related to the feedback received from the observer (Hendry & Oliver, 2012). That is to say, the observee can learn by viewing their own practice through another person's eyes.

In RPO, teachers learning is fostered when observer and observee engage in a cycle of questioning, reflecting on evidence, and acting (Corcelles et al., 2023); if both teachers improve their ability to provide and receive feedback, CKB is likely to increase, and consequently, it can contribute to their professional learning.

Previous literature highlights the learning opportunities that arise for both observers and observees when engaging in RPO (Kanuka & Sadowski, 2020; Tenenberg, 2016; Yiend et al., 2014). The potential of RPO lies in the opportunity for participants to alternate roles and benefit from the learning gained from each perspective. This study suggests that feedback meetings framed within the RPO cycle can provide the necessary stimulus to introduce innovation in the classroom (Hendry et al., 2020; Motallebzadeh et al., 2017; O'Leary & Savage, 2020; Rosselló & De la Iglesia, 2021).

Limitations

One limitation of this study can be found in the composition of the sample. Teachers have voluntarily participated in the RPO practice, and this could bias the findings, since they were especially willing to participate in the intervention. Although voluntariness is a necessary condition for the development of RPO, participants may be more open to CKB to improve their educational practices.

Another limitation of this work is the small sample analyzed to generalize the results. The analysis of interaction in real cases implies a limited analysis of cases, given the time to carry it out (Jones et al., 2021) and also methodological issues when trying to clearly identify learning episodes of the micro-level analysis carried out (Duran et al., 2021; Hennessy et al., 2020), which can be supplemented in future research. Furthermore, the

processes of knowledge building could be complemented by content analysis or by considering other aspects such as the development of agency and identity of the teachers involved.

Future research

Future studies should explore RPO practices with more diverse pairs of teachers, as this could lead to more varied results and a better understanding of the context, ultimately helping to propose improvements to the approach. A longitudinal study analyzing the evolution of professional development through new RPO cycles would probably help to strengthen the findings of this research (Flores et al., 2024).

Undoubtedly, the ultimate goal of researching ways to promote professional development, such as through RPO practices, is to enhance student learning (Ridge and Lavigne (2020). Therefore, future research should explore the impact of collaborative knowledge building (CKB) within the context of Reciprocal Peer Observation (RPO) on student learning outcomes.

Conclusion

This research provides valuable information on how teachers build knowledge collaboratively during feedback meetings in RPO practices. The main strength of this study lies in focusing the analysis on the interaction between teachers during feedback sessions. It contrasts with previous research that has relied mainly on teacher self-reports or other self-constructed instruments. This approach sheds light on the potential of CKB in an area with limited prior research. Although these results should be interpreted with caution, this study enhances our understanding of how these interactions can foster professional learning, positioning RPO as a powerful form of teacher professional development. While the findings offer valuable insights into the potential of CKB in RPO, the challenge remains to explore in greater depth how this learning mechanism supports teachers' long-term professional development.

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Code availability The materials and data are in the University database.

Declarations

Ethics approval The Ethics Committee of the Universitat Autònoma de Barcelona of Catalonia approved the study, respecting the obligations derived from the Organic Law 3/2018 on Personal Data Protection and Digital Rights, General Data Protection Regulation (EU) 2016/679 and the current complementary legislation. All participants received written information about the project and gave their consent to participate according to the ethics compliance procedures.

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Current themes of interest:

Peer learning and peer tutoring.

Most relevant publications in the field of Psychology of Education:

Flores, M., Sala, I., Ortiz, M, & Duran, D. (2024). Does reciprocal peer observation promote the transfer of learning to teaching practice? *Psychology in the Schools, 61*(10), 3873–3890. https://doi.org/10.1002/pits.23259.

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Current themes of interest:

Peer learning among teachers and Inclusive Education.

Most relevant publications in the field of Psychology of Education:

Miquel, E., Monguillot, M., Soler, M., & Duran, D. (2024). Reciprocal peer observation: A mechanism to identify professional learning goals. *Education Inquiry*, 1–17. https://doi.org/10.1080/20004508.2024.2370116.

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Current themes of interest:

Peer learning and peer tutoring.

Most relevant publications in the field of Psychology of Education:

Duran, D. (2023). Can students learn by teaching their peers during cooperative learning? In R. M. Gillies, B. Millis & N. Davidson (Eds.), *Contemporary global perspectives on cooperative learning: Applications across educational contexts*. Routledge.

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