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Impact of reciprocal peer observation on teacher collaboration perceptions

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Abstract

This study aims to assess the effectiveness of reciprocal peer observation (RPO) as a form of professional collaboration among teachers in enhancing their perceptions of teacher collaboration within a school setting. The Teacher Collaboration Perceptions Questionnaire (TCPQ) was specifically designed and validated for this purpose, using exploratory factor analysis and confirmatory factor analysis. The study employed a longitudinal observational design, with 400 teachers in a pre/post-test study. The impact of RPO was examined on three dimensions related to professional collaboration: collaborative school culture, collective agency and teachers' attitudes towards collaboration. The results revealed that participants' perceptions of collaboration improved significantly after the implementation of RPO. The study confirms the utility of RPO as a professional collaborative practice that can foster changes in teachers' perceptions of the collaborative school culture, teachers' sense of collective agency and teachers' preference for collaboration over individual work. The study concludes with a discussion of its educational implications.

KEYWORDS

attitudes towards collaboration, collaborative school culture, collective agency, peer observation, reciprocal peer observation, teacher collaboration

[Corrections made on 1 February 2024, after first online publication: Affiliation 2 has been updated in this version for clarity.]

Key insights

What is the main issue that the paper addresses?

Teacher collaboration, despite its challenges, is crucial to the improvement of teaching in schools. Using an ad hoc designed and validated pre/post-intervention questionnaire (TCPQ), our study analyses whether reciprocal peer observation can increase teachers' perceptions of collaborative school culture, collective agency and attitudes towards collaboration.

What are the main insights that the paper provides?

- The TCPQ is a valuable tool for school leaders to measure the level of teacher collaboration in their school and identify which dimensions related to professional collaboration need improvement.
- After the RPO intervention, teachers significantly increased their perceptions of the school's collaborative culture, collective agency and preference for collaborating over working alone.

INTRODUCTION

In recent decades, the importance of teacher collaboration has been recognised as a crucial aspect of professional development (Darling-Hammond et al., 2017; OECD, 2020). Collaboration enables teachers to learn from each other and improve their teaching practices, leading to better student outcomes (Goddard et al., 2007; Gruenert, 2005; Ronfeldt et al., 2015). Therefore, one of the issues that must be addressed today is to recast teaching as a collaborative profession (International Commission on the Futures of Education, 2021; OECD, 2020). There is a current requirement for teachers to work together to transform schools into institutions that prioritise learning. Moreover, teacher collaboration is relevant considering the increased collaboration in society and the role of education as a means of teaching students how to effectively collaborate, preparing them for the future (Vangrieken et al., 2015). Research has highlighted numerous benefits of teacher collaboration, such as increased teaching competence (Graham, 2007; Hattie, 2015; Jackson & Bruegmann, 2009) and job satisfaction (Ainley & Carstens, 2018; Ostovar-Nameghi & Sheikhahmadi, 2016). Therefore, teacher collaboration is essential to improving teaching and school effectiveness (Darling-Hammond et al., 2017; Hargreaves & O'Connor, 2018; OECD, 2020; Vangrieken et al., 2015). However, despite its benefits, breaking teacher isolation and building a collaborative culture in schools remains a challenge (Hargreaves & O'Connor, 2018; OECD, 2020; Ostovar-Nameghi & Sheikhahmadi, 2016; Vangrieken et al., 2015).

Based on the nature of teacher interactions, collaborative activities can be categorised into (a) exchanges and coordination and (b) professional collaboration (OECD, 2020). According to the Teaching and Learning International Survey (OECD, 2020), teachers commonly engage in exchange and coordination activities, including discussing the learning progress of individual students, sharing teaching materials with colleagues and attending team conferences. However, there is a notable lack of teacher participation in professional collaboration activities. Professional collaboration involves teachers working together with greater interdependence and a deeper sense of cooperation, which requires more teacher interaction and institutional support to foster teacher collaborative learning. It includes team

teaching, peer observation, joint activities across different classes and age groups, and participation in collaborative professional learning initiatives such as book studies, analysis of student work samples, learning walks or lesson study (Blackburn & Williamson, 2015; Duran et al., 2021; OECD, 2020).

Given the challenge of overcoming teacher isolation and fostering a collaborative culture through teacher collaboration in schools (Hargreaves & O'Connor, 2018; OECD, 2020; Ostovar-Nameghi & Sheikhahmadi, 2016; Vangrieken et al., 2015), the present study aims to analyse the impact of one of the deepest forms of teacher professional collaboration—reciprocal peer observation (RPO)—on improving teachers' collaboration in schools.

Reciprocal peer observation

From a collaborative approach to peer observation (Gosling, 2002, 2005, 2014), RPO can be defined as a pair or group of teachers working together as equal partners who agree to observe one or more pedagogical aspects of one another's practice. Following the main phases of the peer observation process—pre-observation, observation and feedback—teachers collect evidence of their practices to offer mutual and constructive feedback with the final goal of improving their teaching (Corcelles-Seuba et al., 2022; O'Leary & Savage, 2020).

Findings from previous empirical research indicate that RPO is a promising training strategy with numerous benefits for teachers' learning when they perform both roles, observee and observer (Corcelles-Seuba et al., 2022; Duran et al., 2020; Rosselló & de la Iglesia, 2021). Observers can learn new teaching strategies by watching how a colleague manages a classroom (Hendry & Oliver, 2012; Motallebzadeh et al., 2017; Tenenberg, 2016; Thomson et al., 2015). Observees can receive constructive feedback to improve self-efficacy, self-reflection and self-confidence in their teaching (Bruce & Ross, 2008; Motallebzadeh et al., 2017; O'Leary & Savage, 2020; Shousha, 2015).

Considering the socially situated nature of teaching and learning (Lave & Wenger, 1991), RPO expands opportunities for teachers to actively learn through collaborative interactions with their peers (Vygotsky, 1978; Wertsch, 1991). Peer learning is rooted in sociocultural theory and is defined as the construction of knowledge and abilities through interactions between teachers, with none acting as an expert for the other (Topping et al., 2017). Colleagues play a central role in providing support and guidance within teachers' proximal development zone, facilitating learning within the specific context of their daily teaching practice. RPO involves teachers' agency in selecting a relevant focus of observation and setting goals to improve their practice (Corcelles-Seuba et al., 2022; O'Leary & Savage, 2020; Shortland, 2004, 2010). By observing each other's practice and engaging in reciprocal feedback exchanges, teachers can enhance their learning by observing a colleague (Bandura, 1977) and by sharing and contrasting different perspectives and ideas about teaching. These dialogical interactions can stimulate teachers' cognitive conflict and deepen their reflection on their own and their colleagues' instructional approaches (Wertsch, 1991). Therefore, participating in this form of teacher collaboration can create a collaborative work environment with opportunities for teachers' reflection and continuous professional learning. Consequently, through RPO, teachers can improve their perceptions of the collaborative school culture and positively impact in their perceptions of collective agency and attitudes towards teacher collaboration.

Teacher collaboration

Teacher collaboration stems from two or more teachers interacting or working together to accomplish a common goal of enhancing student learning and school development. It

involves sharing ideas, resources and experiences to create a supportive and collaborative school environment (OECD, 2020). The present study focuses on professional collaboration examining teachers' perception of their collaborative school culture, their sense of collective agency in their school setting and their attitudes towards collaboration. These dimensions were chosen due to their significant role in facilitating or hindering teacher collaboration in schools, as explained in the following sections.

Collaborative school culture

Collaborative school culture is defined as a professional working environment where collegiality is characterised by shared responsibility for school issues, mutual support and teachers' reliance on each other (Hargreaves & O'Connor, 2018; Kelchtermans, 2006). In a collaborative school culture, teachers are supported and encouraged to work together and to actively participate in school decisions. Not only do they share responsibility for school issues, but they also have common goals and values about teaching and learning that encourage them to improve their classroom performance continuously and lead new initiatives (Kelchtermans, 2006; OECD, 2020; Pyhältö et al., 2015). A collaborative school culture creates the necessary conditions for teachers to engage in collaborative activities, emphasising the importance of working together to benefit students. Therefore, in a collaborative school culture, teacher collaboration is an essential element (Hargreaves & O'Connor, 2018). Consequently, teachers' view of the collaborative culture in their school can affect collaboration with other teachers. Teachers may be less inclined to engage in collaborative efforts without a collaborative school culture.

Collective agency

Teacher agency is critical for school transformation (Durrant, 2019; Lau, 2021). Beauchamp and Thomas (2010) defined teachers' agency as ‘empowerment to move ideas forward, to reach goals or even to transform the context’ (p. 183). Teacher collaboration is needed to encourage teachers to take ownership of innovations and changes (Hargreaves & O'Connor, 2018). Through collaboration, teachers can display their collective agency, connected to their autonomous capacity to collaborate, support other teachers and receive support from their colleagues to improve their teaching and overall school effectiveness. Collective agency involves a positive interdependence between teachers—both intentionally, using others as a resource for learning and acting as a support for them (Edwards, 2005; Pyhältö et al., 2015)—and transformative practice—teachers' willingness to share ideas and discussions with colleagues and use their critical feedback to improve teaching practices (Pyhältö et al., 2015). When teachers have a sense of collective agency, they feel empowered and capable of making a difference through collaboration. Teachers with a strong collective agency are more likely to initiate and participate in collaborative activities, seek out opportunities for collaboration and take ownership of their professional learning. When teachers perceive a supportive and collaborative relationship with colleagues, teachers' collective agency grows, primarily when focused on achieving common goals for school improvement (Strahan, 2016). Conversely, a lack of collective agency can hinder collaboration, as teachers may feel disempowered and less motivated to collaborate with their colleagues.

Teachers' attitudes towards collaboration

Considering teacher collaboration as a challenge, teachers' positive attitudes towards collaboration are key to its success (Vangrieken et al., 2017). The concept of teachers' attitudes towards collaboration refers to teachers' willingness to engage in collaborative practices and teachers' beliefs and feelings towards teacher collaboration. To analyse teachers' attitudes towards collaboration, teachers' preference for collaborative practices over individual work in their daily professional tasks—lesson planning, implementation and assessment (Vangrieken et al., 2017)—and their resistance to teacher collaboration should be considered. Some of these resistances reported in the literature are work intensification, loss of autonomy, interpersonal conflicts (Johnson, 2003), need for effort, unwillingness to collaborate and lack of skills or training (Vangrieken et al., 2015). Teachers with positive attitudes are more likely to engage in collaborative practices, actively contribute to group discussions and embrace the ideas and feedback of their colleagues. On the other hand, negative attitudes—such as resistance to change or a preference for individual work—can hinder collaboration and limit the effectiveness of collaborative efforts.

In summary, teachers' perceptions of their school's collaborative culture, their sense of collective agency and their attitudes towards collaboration influence teacher collaboration in the school setting. A collaborative school culture provides the necessary structure and support to enhance teacher collaboration, while collective agency requires collaboration to empower teachers to take ownership of their professional development. In addition, positive attitudes towards collaboration foster a mindset that values and actively seeks opportunities for collaboration. Therefore, by analysing these dimensions, school leaders can measure the level of teacher collaboration perceptions in their school setting.

Impact of reciprocal peer observation on teacher collaboration

Concerning the impact of reciprocal peer observation on teacher collaboration perceptions, previous studies implemented within school settings have indicated that participating teachers perceived augmented collaboration and collegiality as a result of undergoing an RPO process. Rosselló and de la Iglesia (2021) concluded that providing and receiving feedback improved cohesion among teachers. Other studies with a small sample found that RPO reduced teacher isolation (Slater & Simmons, 2001), increased teachers' mutual responsibility and collaboration (Motallebzadeh et al., 2017) and fostered trusting relationships and collegiality (Arnau et al., 2004; Hamilton, 2013; Sider, 2019). However, it is worth noting that all the above studies were qualitative in nature and did not explore the potential of RPO as a mechanism for enhancing teachers' collaboration in terms of their perceptions of a collaborative school culture, their sense of collective agency and their attitudes towards collaboration. Moreover, none of these studies have employed a pre/post design using a validated instrument. Therefore, there is a need for further in-depth exploration in this area. Several validated and reliable instruments are available for measuring teacher collaboration from different perspectives. For instance, Woodland et al. (2013) developed the Teacher Collaboration Assessment Survey, which focuses on evaluating the quality of teacher teamwork in four essential areas: dialogue, decision-making, action and evaluation. Additionally, Doppenberg et al. (2012) introduced the Collaborative Teacher Learning Scale, which examines how teacher collaboration enhances their learning, specifically in implementing new instructional materials, pedagogical approaches or teaching at a particular grade level. Other instruments have explored teachers' collaboration through the lens of collegial relationships, such as the Teaching and Learning International Survey (González, 2020; OECD, 2020), or teachers' professional agency, using scales that measure

teachers' collective efficacy, interdependence, mutual agreement, active help-seeking and transformative practice (Pyhältö et al., 2015). However, no previously validated questionnaire specifically addresses teachers' attitudes towards collaboration. Therefore, none of these existing instruments comprehensively analyse teacher collaboration considering the teachers' perceptions of their collaborative school culture, their sense of collective agency and their attitudes towards collaboration.

Given this research gap, the objectives of the present study are as follows:

- To design and validate a questionnaire to measure teachers' perceptions of collaboration in school, considering teachers' views of the collaborative school culture, teachers' sense of collective agency and teachers' attitudes towards collaboration.
- To analyse whether there are improvements in teachers' perceptions of teacher collaboration in school after they participated in RPO.

METHOD

The study adopted a single-group pre/post-test longitudinal observational design. The study's hypothesis is as follows: after RPO, teachers will significantly increase their perceptions of teacher collaboration.

Participants

The study involved 400 voluntary in-service teachers from 123 schools, with 227 teachers belonging to a Catalan network of schools (Xarxa de Competències) and 173 belonging to schools from the Balearic Islands. The sample comprised 83 (20.75%) males, 309 (77.25%) females, 1 (0.25%) no-binary and 7 (1.75%) non-responding participants. Participant teachers were from high schools ($n = 171$; 42.75%), primary schools ($n = 121$; 30.25%), preschools ($n = 43$; 10.75%), baccalaureate and vocational training ($n = 59$; 14.75%) and adult education ($n = 6$; 1.5%). The mean age was 41.37 years (SD = 8.613).

The sample of teachers was drawn from a non-probabilistic sample of volunteers. Before recruiting participants for the study, the Ethical Committee of the university approved the study, respecting the obligations derived from the Organic Law 3/2018 on Personal Data Protection and Digital Rights, General Regulation on Data Protection (UE) 2016/679 and the current complementary legislation. All participants received written information about the project and consented to participate according to the ethics compliance procedures.

Intervention description

The RPO intervention was carried out during the 2021–22 academic year. Teachers were asked to voluntarily participate in the RPO process as part of their training and professional development programme. It was essential to ensure voluntary participation and data confidentiality to promote a secure environment for peer learning (Hammersley-Fletcher & Orsmond, 2005; O'Leary & Savage, 2020; Sider, 2019). Participants were asked to choose a pair from their school for the RPO process following the symmetry criteria in experience and status. Mutual trust and respect between peers were important to ensure the success of observation for developmental purposes (Gosling, 2005; O'Leary & Savage, 2020).

Prior to the intervention, teachers attended a training session that consisted of a presentation of the purpose and structure of the peer observation process, offering guidelines

to perform both the observer and observee roles and practical activities to develop observational skills and abilities to give and receive constructive feedback (adapted from O'Leary, 2020). This previous training is essential to ensure the quality of teachers' interactions, reduce teachers' resistance to PO and engage them in a meaningful peer interaction process for learning and improving their practices (Hammersley-Fletcher & Orsmond, 2005; O'Leary & Savage, 2020).

The RPO procedure was implemented for 4 months (February to May 2022) and was divided into four phases: pre-observation meeting, classroom observation, feedback meeting and individual reflection (Martin & Double, 1998; O'Leary, 2020). Given that the success of peer observation is the product of a planned and intentional pedagogical discussion based on evidence from teaching practice (O'Leary & Savage, 2020), participants in the pre-observation meeting were encouraged to agree on a clear and relevant focus of observation. Establishing a focus of observation is essential for providing a shared point of reference for collaborative dialogue between peers (O'Leary & Savage, 2020). They were to gather evidence related to this focus during the observation session through observation guidelines, notes and/or audio or video recordings. Two classroom observations were required, one in each role (observer and observee). The observer was asked to observe discreetly and respectfully without intervening during observation. At the end of the session, the observee was asked to write a brief report. One feedback meeting was required for each teacher, based on a conversational format. It was recommended that the feedback meeting begins with the observee presenting ideas from the brief report. Afterwards, the observer presented their observations, supported by the collected evidence, and identified at least one strength and one action that required explanation. Finally, at the end of the RPO process, the observee was asked to write a reflective synthesis that included the objectives for improving one's teaching practice. This structured process aimed to establish an appropriate and ongoing relationship for mutual engagement between teachers (Fletcher, 2018).

Procedure

Instrument and data collection

The participating teachers completed the Teacher Collaboration Perceptions Questionnaire (TCPQ) before and after the intervention. It consisted of 28 items on a Likert scale (1 strongly disagree, 4 strongly agree). This questionnaire was designed considering previous research instruments and was organised considering the three dimensions of teacher collaboration described in the introduction (Table 1).

Dimension 1: Collaborative school culture ($\alpha = 0.937$)
This dimension consisted of 10 items, developed by adapting previous scales reported in research to evaluate teachers' collegial relationships (González, 2020; OECD, 2020) and collective efficacy in the school community (Pyhältö et al., 2015).

Dimension 2: Collective agency ($\alpha = 0.907$)
This dimension consisted of 8 items, organised into two subdimensions: positive interdependence (3 items, $\alpha = 0.707$) and transformative practice (5 items, $\alpha = 0.855$). This scale was elaborated by adapting previous subscales of teachers' professional agency in the teachers' community survey (Pyhältö et al., 2015).

TABLE 1 Teacher Collaboration Perceptions Questionnaire.

Dimension 1: Collaborative school culture ($\alpha = 0.937$)	Items source
1. At school, we can deal with challenging school situations together	Collective efficacy subscale[a]
2. At school, teachers work together to meet all student needs	Collective efficacy subscale adapted[a]
3. The common development work in our school has made it easier to carry out my own teaching	Collective efficacy subscale[a]
4. In our teacher community, we encourage each other to advance professionally	Collective efficacy subscale adapted[a]
5. The school has a culture of shared responsibility for school issues	TALIS[b]
6. There is a collaborative school culture characterised by mutual support	TALIS[b]
7. The school staff share a common set of beliefs about teaching and learning	TALIS[b]
8. The school encourages staff to lead new initiatives	TALIS[b]
9. The school provides staff with opportunities to actively participate in school decisions	TALIS adapted[a]
10. Teachers can rely on each other	TALIS[b]
Dimension 2: Collective agency ($\alpha = 0.907$)	Items source
Positive interdependence ($\alpha = 0.707$)	
11. I'm willing to offer help to my colleagues	Ad hoc
12. I encourage my teacher colleagues to collaborate	Positive interdependence scale[a]
13. I'm willing to act to advance the best of our entire teacher community	Positive interdependence scale[a]
Transformative practice ($\alpha = 0.855$)	
14. Other teachers' ideas encourage me to advance my own teaching	Transformative practice subscale adapted[a]
15. I'm willing to discuss my own work with my teacher colleagues	Transformative practice subscale[a]
16. The discussions with my colleagues inspire my work	Transformative Ppactice subscale adapted[a]
17. I use the feedback from teacher colleagues to improve my teaching	Transformative practice subscale adapted[a]
18. I use the critical feedback I get from my colleagues	Ad hoc
Dimension 3: Attitudes towards collaboration ($\alpha = 0.83$)	Items source
Teachers' preference for collaboration over individual work ($\alpha = 0.763$)	
19. When planning and preparing for classes, I prefer to do it collaboratively with my colleagues rather than individually	Ad hoc

TABLE 1 (Continued)

20. I would rather teach jointly with a colleague as a team in the same class than by myself	Ad hoc
21. When assessing and reflecting on my lessons, I prefer to do it collaboratively with my colleagues rather than individually	Ad hoc
Teachers' resistance to collaboration ($\alpha = 0.832$)	
22. Collaborative work increases my working hours more than needed	Ad hoc
23. Collaborative work conditions myself to follow other colleagues' ideas	Ad hoc
24. Collaborative work with colleagues can lead to more interpersonal conflicts than I would otherwise have	Ad hoc
25. Collaborative work requires excessive long-term commitment from me	Ad hoc
26. Collaborative work does not fit well with my teamwork skills	Ad hoc
27. Collaborative work limits my autonomy and decision-making	Ad hoc
28. Collaborative work discourages me	Ad hoc

[a]Teachers' professional agency in the teacher community survey (Pyhältö et al., 2015).
[b]Teacher collegial relationships (González, 2020; OECD, 2020).
Abbreviation: TALIS, Teaching and Learning International Survey.

Dimension 3: Teachers' attitudes towards collaboration ($\alpha = 0.83$)

This dimension consisted of 10 items, developed by researchers through a review of the literature (Vangrieken et al., 2015) and grouped into two subdimensions: teachers' preference for collaboration over individual work (3 items, $\alpha = 0.763$) and teachers' resistance to collaboration (7 items, $\alpha = 0.832$).

Instrument validation

Content validity

First, items extracted from previous scales (OECD, 2020; Pyhältö et al., 2015) were translated into Catalan. Second, a panel of five experts in the field of peer learning and teacher collaboration was asked to comment on the content validity of the 28 items. They were asked to review, comment and clarify the meaning of the wording for each item. They provided feedback on the appropriateness of each item to ensure that all items were relevant to the local context. Finally, based on their contributions, some adjustments were made to the wording of some items.

Construct validity

To determine the best factor structure to represent the TCPQ, exploratory factor analysis (EFA) (Brown, 2015) was first performed using data from the pre-test sample ($n = 536$ teachers). Factors were selected based on parallel analysis and rotated based on oblimin rotation. Loadings greater than 0.4 are considered stable (Guadagnoli & Velicer, 1988). Second, a confirmatory factor analysis (CFA) (Kline, 2016) was performed with the post-test sample of the present study ($n = 400$ teachers). Finally, using a structural equation modelling (SEM) approach, a second-order CFA was conducted with the post-test sample of the present study ($n = 400$ teachers) to confirm the three dimensions of teacher collaboration and their underlying subdimensions.

Model goodness-of-fit was evaluated using several indices: comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA) and standardised root mean square residual (SRMR) (Hooper et al., 2008). CFI and TLI values of 0.90 or higher indicate good model fit (Schumacker & Lomax, 2016). RMSEA values of less than 0.06 also indicate good model fit (Hu & Bentler, 1999; Schumacker & Lomax, 2016). Internal consistency of the scales was validated by calculating Cronbach's alpha (Crutzen & Peters, 2017).

Data analysis for the pre/post-test

To respond to the pre/post-test analysis, the Shapiro–Wilk test was first performed to test data for normality. It suggested a deviation from normality ($p < 0.001$). Therefore, a nonparametric Wilcoxon signed rank test was applied to measure the impact of RPO on the three dimensions of teacher professional collaboration (collaborative school culture, collective agency and attitudes towards collaboration). Descriptive statistics (means and standard deviation) and effect size for the nonparametric Wilcoxon signed rank test (rank biserial correlation coefficient) were calculated for subdimensions and dimensions of the questionnaire. Item scores of teachers' resistance to collaboration were reversed to calculate the dimension of attitudes towards collaboration.

All statistical analyses were performed using JASP 0.16.4.0.

RESULTS

The results of the validation of the instrument and the pre/post-test analysis are presented in the following sections.

Validation of TCPQ

Regarding EFA (Brown, 2015), the Kaiser–Meyer–Olkin measure of sampling adequacy (Kaiser, 1970) was 0.922, and Bartlett's test of sphericity was significant ($\chi^2(378) = 7101.81$, $p < 0.001$), indicating the suitability of the correlation matrix for factor analysis. Results showed that the 28 items were organised in five factors: Factor 1 (collaborative school culture, 10 items); Factor 2 (positive interdependence, 3 items); Factor 3 (transformative practice through collaboration, 5 items); Factor 4 (teachers' preference for collaboration, 3 items); and Factor 5 (teachers' resistance to collaboration, 7 items). These five factors empirically confirmed the theorised dimensions and subdimensions of teacher collaboration (see Appendix A). All items had factor loading scores larger than 0.4. The cumulative variance was 50%. The properties of the model showed good fit indices (RMSEA = 0.050; TLI = 0.924).

Second, CFA results showed sufficient fit indices to confirm the model with five factors (CFI = 0.911; TLI = 0.901; RMSEA = 0.061; SRMR = 0.050). All items in each factor significantly contributed to the corresponding factor ($p < 0.001$) (see Appendix B).

Finally, the second-order factor analysis using SEM was applied to empirically confirm the theoretical underlying subdimensions of teacher collaboration. Results confirmed Dimension 1 related to Factor 1—with all 10 items significantly contributing to the factor ($p < 0.001$); Dimension 2 related to Factor 2 and Factor 3; and Dimension 3 related to Factor 4 and Factor 5. All these factors significantly contributed to the second-order factor ($p < 0.001$), and all items from each factor significantly contributed to the corresponding factor ($p < 0.001$) (Table 2).

The results showed sufficient fit indices to empirically confirm the three theoretical dimensions related to teacher collaboration perceptions and their subdimensions (baseline test < 0.001; difference test < 0.001; CFI = 0.910; TLI = 0.901; RMSEA = 0.061; SRMR = 0.051) (Table 2). Therefore, the questionnaire was considered validated.

RPO impact on teacher collaboration

Considering the overall results of the TCPQ (Table 3), it is important to note that teachers from this study already had a positive perception of teachers' collaboration before the intervention, as mean scores in the pre-test were high ($M = 3.18$; SD = 0.38). However, despite high scores in the pre-test, comparison between the pre-test and post-test revealed a significant increase in teachers' collaboration after participating in the RPO intervention ($p = 0.001$; $r_{rb} = -0.18$).

Regarding the three dimensions of the questionnaire, data show that after participating in an RPO process, teachers significantly increased their perceptions of the collaborative school culture ($p = 0.002$; $r_{rb} = -0.186$) and their sense of collective agency ($p = 0.037$; $r_{rb} = -0.115$), but no differences in attitudes towards collaboration were found ($p = 0.080$).

TABLE 2 Factor loadings of second-order factor analysis model.

Factor	Item	Std. Est. (std. error)	95% confidence interval
Factor 1: Collaborative school culture (F1)	1	0.84 (0.03)	(0.59, 0.71)
	2	0.83 (0.03)	(0.54, 0.66)
	3	0.80 (0.03)	(0.55, 0.68)
	4	0.76 (0.03)	(0.50, 0.63)
	5	0.86 (0.03)	(0.62, 0.75)
	6	0.85 (0.03)	(0.62, 0.75)
	7	0.78 (0.03)	(0.47, 0.59)
	8	0.69 (0.04)	(0.49, 0.63)
	9	0.66 (0.04)	(0.47, 0.61)
	10	0.68 (0.03)	(0.37, 0.48)
Factor 2: Positive interdependence (F2)	11	0.68 (0.03)	(0.14, 0.27)
	12	0.78 (0.04)	(0.16, 0.31)
	13	0.57 (0.02)	(0.08, 0.16)
Factor 3: Transformative practice (F3)	14	0.83 (0.02)	(0.22, 0.32)
	15	0.71 (0.02)	(0.17, 0.25)
	16	0.80 (0.03)	(0.24, 0.34)
	17	0.69 (0.02)	(0.20, 0.29)
	18	0.43 (0.02)	(0.11, 0.19)
Factor 4: Preference for collaboration (F4)	19	0.77 (0.04)	(0.30, 0.45)
	20	0.68 (0.04)	(0.27, 0.41)
	21	0.72 (0.03)	(0.25, 0.38)
Factor 5: Resistance to collaboration (F5)	22	0.52 (0.03)	(0.22, 0.35)
	23	0.68 (0.03)	(0.27, 0.39)
	24	0.68 (0.03)	(0.30, 0.42)
	25	0.71 (0.03)	(0.31, 0.43)
	26	0.52 (0.03)	(0.22, 0.35)
	27	0.76 (0.03)	(0.31, 0.43)
	28	0.69 (0.02)	(0.23, 0.32)
Second-order factor: Collective agency	F2	0.81 (0.18)	(1.05, 1.74)
	F3	0.88 (0.34)	(1.17, 2.50)
Second-order factor: Attitudes towards collaboration	F4	0.71 (0.16)	(0.70, 1.33)
	F5	−0.68 (0.13)	(−1.19, −0.67)

Note: All coefficients are statistically significant at $p < 0.01$.

In collective agency, teachers increased their perception of positive interdependence between colleagues ($p = 0.042$; $r_{rb} = -0.124$), but non-significant differences were found in transformative practice ($p = 0.094$).

Regarding attitudes towards collaboration, although no significant differences were found overall, a significant increase in preference for collaboration was observed among teachers ($p = 0.004$; $r_{rb} = -0.188$) after participating in the RPO intervention. However, no changes were observed in their resistance to collaboration. Both pre- and post-intervention scores were low, ranging from 1 to 2 on a scale of 4. This indicates that teachers had low resistance

TABLE 3 Teacher collaboration perceptions.

	Pre-test		Post-test				
	Mean	SD	Mean	SD	*W*	*p*	Rank biserial correlation (effect size)
1. Teacher collaboration	3.18	0.38	3.22	0.37	32,566.000	0.001**	−0.180
1.1 Collaborative school culture ($\alpha = 0.937$)	2.98	0.61	3.04	0.61	22,919.500	0.002*	−0.186
1.2 Collective agency ($\alpha = 0.907$)	3.47	0.42	3.49	0.41	22,164.500	0.037*	−0.115
1.2.1 Positive interdependence	3.49	0.47	3.52	0.46	13,963.000	0.042*	−0.124
1.2.2 Transformative practice	3.45	0.47	3.48	0.45	16,611.500	0.094	−0.092
1.3 Teachers' attitudes towards collaboration ($\alpha = 0.83$)	3.11	0.42	3.19	0.43	32,478.000	0.080	−0.084
1.3.1 Teachers' preference for collaboration over individual work	3.04	0.57	3.11	0.56	13,455.000	0.004**	−0.188
1.3.2 Teachers' resistance to collaboration	1.82	0.45	1.83	0.49	27,887.500	0.557	0.063

Note: Wilcoxon signed-rank test. *$p < 0.05$; **$p < 0.001$; Likert scale 1 to 4.

to collaboration before and after the RPO intervention, and this resistance did not significantly decrease after the intervention.

DISCUSSION

One of the main educational challenges today is to improve teacher collaboration in schools (OECD, 2020; Vangrieken et al., 2015). Considering this, the present study aimed to analyse the impact of one of the deepest forms of teacher professional collaboration—RPO—on improving teacher collaborations in school.

Given the lack of a reliable instrument to measure teachers' collaboration across its three dimensions (collaborative school culture, collective agency and teachers' attitudes towards collaboration), a new instrument, the TCPQ, was developed and validated.

Results suggest that teachers' perception of increased teacher collaboration was associated with their participation in an RPO intervention, aligning with the hypothesis of this study, which implies that RPO may serve as a potential mechanism for enhancing teacher collaboration within the school context. The limited effect size observed can be attributed to the participants' high initial scores in the pre-test, which created a ceiling effect where further improvement could not be attained.

Considering the three dimensions that contribute to teacher collaboration, it seems that RPO impacts on enhancing collaborative school culture and teachers' collective agency.

First, RPO's positive impact on collaborative school culture can be explained because RPO enables the creation of collaborative professional relationships in practice, that is, progressing from a collaborative discourse to a collaborative action, and thus promoting schools in which educators work together and learn from one another, sharing goals and values about teaching to meet the school educational challenges (Corcelles-Seuba et al., 2022; O'Leary & Savage, 2020). Using the validated TCPQ instrument and a pre/post research design, our research contributes to reinforcing previous results obtained from qualitative studies that reported an increase in teachers' collegiality after RPO intervention (Arnau et al., 2004; Hamilton, 2013; Motallebzadeh et al., 2017; Rosselló & de la Iglesia, 2021; Sider, 2019; Slater & Simmons, 2001). Therefore, RPO can potentially serve as a mechanism to establish more supportive and trusting collaborative relationships between peers and promote professional learning communities' development (Darling-Hammond et al., 2017; Hargreaves & O'Connor, 2018).

Second, RPO increased teachers' sense of collective agency, specifically teachers' perceptions of higher positive interdependence between them. This can be explained because RPO enables a mutual helping relationship between teachers. Teachers need to cooperate in setting a focus of observation, observing each other in the classroom, collecting evidence related to the focus agreed upon, offering each other feedback and helping each other to set aims to improve their teaching practices (O'Leary, 2020). These elements reinforce the importance of establishing a relationship of collaboration and mutual understanding during RPO to advance towards the same goal, being willing to reflect and use the partner's feedback to identify elements for improving teaching practice. All of these elements are identified as factors that promote teachers' agency (Durrant, 2019). Building these dialogic spaces where teachers help each other in their pedagogical practice is undoubtedly relevant to enhancing teacher collaboration in schools. It appears to have had a crucial impact on building a sense of collective agency (Beauchamp & Thomas, 2010; Hargreaves & O'Connor, 2018). These findings also provide further support to the research conducted by Charteris and Smardon (2015), which highlighted the significance of reflective dialogue and constructive feedback within RPO in strengthening teachers' sense of agency.

However, RPO did not impact teachers' perceptions of transformative practice, that is, using RPO insights obtained from constructive feedback to improve one's own practice, which is at the heart of RPO (O'Leary & Savage, 2020). These results may be attributed to the challenge of transferring teachers' learning from RPO insights into changes in their teaching practices. From situated learning theory, learning and cognition are grounded and fostered through purposeful engagement in authentic activities within social contexts. Consequently, effective learning and the ability to transfer knowledge occur when learners are provided with opportunities to observe and practice within real-life contexts (Lave & Wenger, 1991). RPO provides teachers with opportunities to observe each other and practice in real teaching contexts. However, the intervention was short (only 4 months) and based on a single observation cycle, which may not be enough time to practice to transfer teachers' learning and enable them to perceive changes in their teaching practices. Previous studies that analyse knowledge transfers in practice suggest that adequate time is needed to affirm with certainty the presence of transference (Baldwin & Ford, 1988; Blume et al., 2019). This opens the possibility of exploring RPO based on enriched procedures, emphasising the relevance of increasing the number of observation cycles with subsequent feedback spaces to share and discuss their ideas and transfer them into their teaching practice.

Finally, regarding teachers' attitudes towards collaboration, teachers' resistance to collaboration remained stable before and after the RPO intervention. Probably the characteristic mentioned above of voluntariness and willingness for RPO is part of the interpretation of the lack of changes in resistance to collaboration since the initial scores were already noticeably low. However, after performing RPO, participants significantly increased their preference for collaboration over individual work, that is, their preference for co-teaching instead of teaching alone, for preparing lessons together and for reflection and evaluation of one's teaching. This offers the possibility of understanding RPO as a gateway to co-teaching, in line with many authors who have included observation among the six variants of co-teaching (Baeten & Simons, 2014). In turn, the increased preference for professional collaboration to reflect on and evaluate one's practice reinforces the value of regular collaborative spaces in schools. In practice, this constitutes opportunities for professional learning and development within the dynamics of the school itself (Darling-Hammond et al., 2017).

Educational implications

The validation of TCPQ with only 28 items in a Likert scale format provides a valuable and easy tool for school leaders, stakeholders and researchers to measure the degree of teacher collaboration in a school setting based on teachers' perceptions. Acknowledging these perceptions is necessary to identify which dimensions of teacher professional collaboration need to be improved in a specific school context and to provide evidence of its improvement after any intervention. TCPQ can be used to assess teacher collaboration perceptions in RPO and other activities involving different forms of professional collaboration, such as co-teaching, joint activities across different classes and age groups and collaborative professional learning initiatives (OECD, 2020).

Considering that teachers' professional collaborative practices in schools are still unfortunately infrequent (OECD, 2020), the study provides preliminary empirical evidence suggesting the potential relevance of RPO, even in simple procedures based on one cycle of observation, to increase teachers' collaboration in the school setting to foster a higher sense of teachers' collective agency and a higher perception of collaborative school culture. Therefore, this study should encourage educational leaders to use RPO in school settings

to increase teacher willingness for collaboration, which is a crucial aspect today for schools to become learning organisations that struggle for the effectiveness of teaching and student learning (Darling-Hammond et al., 2017; Hargreaves & O'Connor, 2018; Vangrieken et al., 2015).

Limitations and future research

This study used a pre/post-test design with no control group and voluntary intentional sampling, which may compromise internal validity (confidence in the cause-and-effect relationship). However, a within-subjects design was used to control for participant characteristics and minimise individual variation. Although the results are relevant, they must be interpreted with caution due to the lack of a control group and participants' intentional and voluntary sampling (they may already have had a high degree of willingness towards RPO and teacher collaboration). This could have influenced the results, as evidenced by the high initial scores regarding collaborative school culture and collective agency, the low scores in teachers' resistance to collaboration and the small effect size. Another significant limitation is the exclusive use of self-report as the data collection method. This raises concerns about the accuracy and objectivity of the information provided by participants, potentially affecting the validity of the results. It would be prudent to supplement self-reports with additional data collection methods, such as direct observation or ratings by external observers, to obtain a completer and more reliable picture of the effects of the intervention. Finally, a single observation cycle did not allow teachers to transfer knowledge and perceive changes in teaching practices.

To address these limitations and advance the understanding of RPO, several areas of future research are suggested. First, it is recommended that the sampling process be improved by adopting a randomised approach and selecting more representative samples of the target population. This would allow for more generalisable results and increase the external validity of the findings. In this regard, it would also be interesting to replicate the results in other settings and countries. Second, to increase the validity of the findings, it is suggested that a control group and multiple data collection methods be used, such as direct observations or ratings by external observers. This would allow for data triangulation and provide a more complete and accurate understanding of the effects of the intervention. Moreover, more than one observation cycle is recommended to analyse how teachers can transfer RPO's insights into improving their teaching practice. Finally, to further advance the understanding of RPO, it is critical to examine the mediators and moderators that may influence the outcomes of RPO. Exploring and understanding the underlying mechanisms and conditions under which the intervention may significantly impact teacher collaboration would contribute to a better understanding of how and why RPO can generate positive changes in teacher collaboration. Addressing these research areas in future studies would help overcome the identified limitations and provide a more robust and comprehensive understanding of the findings and their potential application in education.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author.

ETHICS STATEMENT

This study was conducted in accordance with the ethical standards laid down in the 2013 Fortaleza version of the Declaration of Helsinki. The study was approved by the Ethical Committee of the Universitat Autònoma de Barcelona (approval number 5894). Informed consent was obtained from each participant.

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APPENDIX A

FACTOR LOADING IN EFA

Item	Factor 1: Collaborative school culture (F1)	Factor 2: Positive interdependence (F2)	Factor 3: Transformative practice (F3)	Factor 4: Preference for collaboration (F4)	Factor 5: Resistance to collaboration (F5)	Uniqueness
6	0.88					0.26
5	0.88					0.28
2	0.81					0.38
1	0.80					0.33
3	0.76					0.38
7	0.73					0.39
4	0.68					0.41
9	0.67					0.52
8	0.63					0.54
10	0.57					0.57
12		0.59				0.50
13		0.55				0.53
11		0.41				0.66
16			0.75			0.42
14			0.70			0.43
17			0.60			0.49
15			0.56			0.44
18			0.42			0.52
20				0.80		0.42
19				0.68		0.48
21				0.62		0.52
23					0.63	0.63
22					0.61	0.65
25					0.60	0.60
24					0.58	0.66
27					0.58	0.52
26					0.50	0.64
28					0.47	0.63

Note: Applied rotation method is oblimin.

EFA, exploratory factor analysis.

APPENDIX B

FACTOR LOADINGS IN CFA

Factor	Item	Std. Est. (std. error)	95% confidence interval
Factor 1: Collaborative school culture (F1)	1	0.84 (0.03)	(0.59, 0.71)
	2	0.83 (0.03)	(0.55, 0.66)
	3	0.80 (0.03)	(0.55, 0.68)
	4	0.76 (0.03)	(0.50, 0.63)
	5	0.86 (0.03)	(0.62, 0.75)
	6	0.84 (0.03)	(0.62, 0.75)
	7	0.78 (0.03)	(0.47, 0.59)
	8	0.69 (0.04)	(0.49, 0.63)
	9	0.66 (0.04)	(0.47, 0.61)
	10	0.68 (0.03)	(0.37, 0.48)
Factor 2: Positive interdependence (F2)	11	0.68 (0.03)	(0.37, 0.49)
	12	0.79 (0.03)	(0.44, 0.56)
	13	0.57 (0.02)	(0.21, 0.30)
Factor 3: Transformative practice (F3)	14	0.83 (0.02)	(0.42, 0.51)
	15	0.71 (0.02)	(0.31, 0.41)
	16	0.81 (0.03)	(0.44, 0.55)
	17	0.69 (0.03)	(0.36, 0.47)
	18	0.43 (0.03)	(0.20, 0.31)
Factor 4: Preference for collaboration (F4)	19	0.77 (0.03)	(0.46, 0.60)
	20	0.68 (0.04)	(0.42, 0.56)
	21	0.72 (0.03)	(0.39, 0.52)
Factor 5: Resistance to collaboration (F5)	22	0.52 (0.04)	(0.32, 0.46)
	23	0.68 (0.03)	(0.39, 0.51)
	24	0.68 (0.03)	(0.43, 0.56)
	25	0.71 (0.03)	(0.44, 0.57)
	26	0.52 (0.04)	(0.32, 0.46)
	27	0.76 (0.03)	(0.45, 0.56)
	28	0.69 (0.03)	(0.32, 0.42)

Note: All coefficients are statistically significant at $p < 0.01$.