



Research paper

Co-teaching in non-linear projects: A contextualised model of co-teaching to support educational change

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HIGHLIGHTS

- Traditionally, co-teaching and team teaching have been used as tools to transform educational practices.
- Successful transformations require committed teachers but also support from school-, regional- and national-level actors.
- Highly functional co-teaching is characterised by shared regulation of teaching practices.
- A contextualised model of co-teaching supports recognition of beneficial practices at all relevant levels.

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ABSTRACT

Co-teaching is regularly paired with school improvements and educational reforms, yet research does not clearly separate the challenges of co-teaching for teacher professional development, course improvement and for wider reforms. We explored how co-teaching emerged and what barriers teachers experienced as meaningful for their co-teaching after a national core curriculum reform. Two cross-sectional data sets were collected. Three qualitatively different co-teaching profiles emerged: highly collaborative, collaborative, and imbalanced co-operative co-teaching. However, teachers' experiences of the meaningful barriers varied. Finally, we propose a model of contextualised co-teaching that supports implementing and researching co-teaching as a part of second-order educational changes.

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1. Introduction

Education systems worldwide have recently pursued school reforms with the introduction of novel curriculum content and pedagogical approaches aimed at so-called 21st-century skills (for a review of the frameworks, see Dede, 2009). These skills include critical thinking and problem-solving, collaboration, creativity and innovation. Learning objectives are shifting from the reproduction of taught content to higher level learning. However, this level of reform requires both the teachers and wider school communities to build new capabilities. The teachers themselves need to master

these skills, alongside developing effective pedagogical models to teach those skills, whereas schools must become learning organisations for both pupils and teachers alike (Saavedra & Opfer, 2012).

Educational changes and reforms come in different shapes and sizes. *First-order change* is incremental and subtle, fine-tuning the system through a series of small developmental steps and leaving underlying beliefs unchallenged. *Second-order change* entails a paradigm shift, confronts fundamental beliefs about current practice and leads to new goals, roles, structures, as well as ways of thinking and working (Ertmer, 1999; Marzano, Waters, & McNulty, 2005). Change implementations can face extrinsic and intrinsic obstacles – first- and second-order barriers (Brickner 1995; according to (Ertmer, 1999). From the teacher-centred view on educational change, first-order barriers appear to be outside of the teachers' control, such as insufficient planning time or material resources. Second-order barriers involve teachers' underlying beliefs about teaching and learning, and a reluctance to change. Even

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though first-order barriers can create significant problems, some teachers creatively navigate their way through, while others are overwhelmed (Ertmer, 1999). Numerous complaints about first-order barriers could imply that second-order barriers exist and that second-order barriers might not be apparent, even to the teachers themselves (Ertmer, 1999).

Educational changes and reforms require change drivers, such as co-teaching. Co-teaching offers a unique context for professional development (Rytivaara & Kershner, 2012) and continuous practice for teachers' advanced collaboration capabilities (Pratt, 2014) that are a vital part of 21st-century skills. Moreover, co-teaching brings teachers' unique perspectives and strengths together to create teaching approaches that would not otherwise actualise (Friend, Reising, & Cook, 1993).

Having similar perspectives or using individual strengths to complement each other is referred to as co-teacher compatibility (Pratt, 2014). However, some differences, such as disagreements in teaching philosophies, cannot be turned to compatibility but need to be resolved (Pratt, 2014). Despite the recognised importance of shared teaching philosophies (e.g. Cook & Friend, 1995; Pratt, 2014) and having a shared goal (Cook & Friend, 1991), co-teaching definitions dismiss a shared vision (Fluijt, Bakker, & Struyf, 2016).

Instead, what is common to the current co-teaching definitions (as reviewed by Baeten and Simons, 2014; Fluijt et al., 2016) is a concentration on classroom logistics, while ignoring pedagogics (Anderson & Speck, 1998), as well as the resources and actors outside of the classroom. These co-teaching definitions involve several constructs referring to teacher collaboration when planning, teaching and assessing student work. *Co-teaching* frequently refers to working relationships between general and special educators or when in inclusive classrooms (Fluijt et al., 2016). Other constructs include *co-operative teaching* (Bauwens, Hourcade, & Friend, 1989), *collaborative teaching* (Nevin, Thousand, & Villa, 2009) and *team teaching* – the latter having no single popular definition (Baeten & Simons, 2014).

With well-founded reasons, co-teaching research has targeted teachers and teacher interaction, but has also shown the critical role of support structures (Friend, Cook, Hurley-Chamberlain, & Shamberger, 2010; Howard & Potts, 2009; Murawski & Dieker, 2004; Pratt, 2014; Stefanidis, King-Sears, & Brawand, 2019; Tannock, 2009). Researchers have neglected the contextual factors that provide the conditions for transforming teaching (Opfer & Pedder, 2011). Meanwhile, co-teachers, in their daily practice, are working in school systems that have unique histories, values, practices, goals and rules that shape the processes of learning and teaching (Hudson, Nykvist, & Mukherjee, 2016). Recently, expanded theoretical orientations regarding co-teaching that knit these influential components, teacher practice and learning together in a more comprehensive manner have been called for (Hackett, Bang, Goulter, & Battista, 2019).

Furthermore, there is a paucity of knowledge regarding how these dynamics give rise to tensions and the possibilities for co-teaching aimed at supporting educational change. The development of co-teaching practices faces different possibilities and challenges when individual teachers join forces for self-initiated professional development purposes or to develop their teaching practices, when a course is incrementally developed, or when a larger educational reform is implemented. We argue that instead of examining co-teaching as isolated from its context, it is important to recognise the wider circumstances (first- or second-order changes) and to develop co-teaching conceptualisations accordingly. Otherwise, the interacting contextual factors that create barriers and opportunities for educational transformation are undermined. From these premises, *the aim of this research is to develop a contextualised model of co-teaching during a second-order*

educational change.

In the following sections, we revisit the history of co-teaching for school reforms and review the research literature on co-teaching barriers during second-order changes. Next, we present our research setting: a second-order change and the pedagogical approach (a non-linear pedagogy) that guided our studies on co-teaching projects aiming to develop students' 21st-century skills. Finally, we evaluate and synthesise the theoretical insights with empirical data in order to propose a contextualised model for co-teaching.

2. Co-teaching and educational change

2.1. Driving change by co-teaching

Co-teaching has been repeatedly promoted as a vehicle of change and has been connected to successful school-improvement programmes (Murata, 2002). In the late 1950s in the USA, co-teaching facilitated overcoming a teacher shortage and answering the needs of an increasingly diverse student body (Friend, Reising, & Cook, 1993). During the 1960s, co-teaching facilitated the creation of student-centred environments in England, and in the following decades, co-teaching was applied at several levels, for many subjects and in numerous countries (Friend, Reising, & Cook, 1993). Since the Salamanca Declaration (United Nations Educational, Scientific and Cultural Organization [UNESCO], 1994), several countries have adopted co-teaching to promote inclusive education (Jurkowski & Müller, 2018; Mavropalias, 2019; Scruggs, Mastropieri, & McDuffie, 2007; Strogilos, Stefanidis, & Tragoulia, 2016; Takala & Uusitalo-Malmivaara, 2012). *To summarise, co-teaching has a strong history as a change driver during second-order educational changes.*

In addition to these reforms shaking the very foundations of teaching, co-teaching programmes have had various local implications. For example, the first Vietnamese business school was created via co-teaching (Napier, Hang, Mai, Thang, & Tuan, 2002) and co-teaching represented a tool for teacher desegregation in Tennessee (Office Of Education, 1967). Higher-education initiatives have responded to the need for transdisciplinary content, such as for social neuroscience (Flint & Dorr, 2010) and for environmental science and policies (Scholberg & Sisk, 2000). While co-teaching in teacher education is beyond the scope of this research, we note that teacher education in various countries has been transformed with co-teaching (e.g. Jeffery & Polleck, 2010; Richard & Treichel, 2013; Syh-Jong, 2008; Toft, 1990).

2.2. Co-teaching barriers during a second-order change

To capture the barriers faced by co-teaching implementations related to second-order educational change, a literature review was undertaken that centred on titles framing their co-teaching implementation within an educational reform, transformation or change. Web of Science Core Collection database was searched for articles with the following search clause: (co-teaching OR team teaching) AND (reform OR transformation OR transition OR change) NOT (teacher education OR pre-service) in the topic (title, abstract or keywords). The search, conducted in May 29th, produced a list of 168 titles, of which 100 were English language journal articles. Based on the abstracts, the list was reduced to 39 second-order educational change articles. Six articles could not be obtained. Reading of the full texts eliminated twelve articles, which resulted in 21 titles. Elimination criteria included 1) research on a first-order educational change, i.e. improvement of a course without explicated wider reform, 2) co-teaching as a mere (side) feature, 3) temporary pairing of teachers with students or researchers, and 4)

no empirical findings. A list of the included articles is provided in [Appendix A](#). The following is not intended to be a comprehensive review of the vast literature on co-teaching and educational change. Rather, the aim is to investigate co-teaching barriers seen through the analytical lens of second-order educational changes. The review results are arranged according to the actors within the educational system.

2.2.1. Teachers

Teachers are in the frontline of any educational change, and the way they decide to organize their work is central to the success of the change. Empirical accounts of second-order barriers include teacher competence (Bullough, 2015; Dillon & Gallagher, 2019; Graue, Hatch, Rao, & Oen, 2007; Machida & Walsh, 2015; Strogilos & Tragoulia, 2013; Trent et al., 2003), beliefs and attitudes (Austin, 2001; Besic, Paleczek, Krammer, & Gasteiger-Klicpera, 2017; Douglas, Rynearson, Yoon Yoon, & Diefes-Dux, 2016; Minke, Bear, Deemer, & Griffin, 1996; [Murata, 2002](#)), teacher identity and values (Bullough, 2015; Strogilos & Tragoulia, 2013), teaching philosophy ([Murata, 2002](#)), teaching styles (Jang, 2006), teaching practices (Kinshuk, Chen, Cheng, & Chew, 2016) and teacher resistance (Probart, McDonnell, Achtenberger, & Anger, 1997). On closer inspection, not many of these issues are independent of actors who are extrinsic to teachers (Mackey, O'Reilly, Jansen, & Fletcher, 2018). Teacher education and school communities socialise teachers' professional practices, such as through 'one teacher, one classroom' (Besic et al., 2017; Jang, 2008). Teachers' attitudes and co-teaching relationships are influenced by the availability of support and the required resources (Besic et al., 2017; Dillon & Gallagher, 2019), alongside teachers' feelings of confidence, fear of failure and coping mechanisms (Bullough, 2015). Moreover, when a reform relies on co-teaching, teachers do not act alone but in interacting pairs. *What exactly should be treated as an intrinsic second-order barrier?*

2.2.2. The school

Depending on the school community, teachers' experiences and the sustainability of an educational reform can vary. According to Douglas et al. (2016), a sustainable reform requires a buy-in from the entire school community. Douglas et al. (2016) compared two schools that received the same national- and district-level support while integrating engineering lessons into elementary classrooms. The teachers in both schools were interested in peer collaboration, yet their realities differed. The school that managed to sustain the reform adopted multiple school-wide methods for collaboration and teachers engaged in co-teaching until each teacher felt comfortable with any novel content. In the other school, the principal was concerned about the school's success in standardised tests and a lack of partners prevented teachers from co-planning or co-teaching. The individual teachers failed to integrate engineering while supporting the tests, and the reform was compromised.

A successful transformation rests on a safe and solution-oriented culture: employees feel safe when raising concerns or expressing conflicting views without the fear of being ignored, opportunities are identified in the conflicts and solutions are synthesised (Bullough, 2015; Vesikivi, Lakkala, Holvikivi, & Muukkonen, 2019). In such a culture, systemic barriers can be overcome with dynamic communication. Trent et al. (2003) found that flexible, frequent and non-hierarchical communication between teachers and local administration about scheduling, problems, solutions and novel practices solved several problems that were in their control.

2.2.3. School administration

Having 'basic co-teaching support' provided by the school administration is not always enough. Austin (2001) discovered that

teachers with access to shared planning time, adequate supplies, administrative support and training considered those less valuable in practice than in theory. Maybe the support was not as effective as the teachers had anticipated (Austin, 2001), or maybe something else was missing: Leadership?

Key stakeholders should be prepared for co-teaching implementations ([Friend et al., 2010](#)). Probart et al. (1997) described how a teacher was nominated as the project manager and was tasked to introduce the novel curriculum and to help others to co-teach. Defining clear roles and expectations, managing material resources and schedules, providing training, coaching and other forms of professional development, and professionally socialising teachers to partner and share in teaching (Dillon & Gallagher, 2019; [Friend et al., 2010](#)) are the responsibility of reform leaders: local, regional or national. Moreover, leaders can generate interest and enthusiasm through school-wide promotional activities, such as morning announcements, contests, theme weeks and assemblies (Probart et al., 1997). However, non-reform-related school-wide activities that regularly interrupt co-teaching could create a substantial barrier (Thomas, Emery, Prain, Papageorgious, & McKendrick, 2018). Likewise, instead of mere partnering of teachers, leaders can support and avoid losing or dismantling well-matched co-teaching partnerships ([Friend et al., 2010](#); Trent et al., 2003).

Scrutinising first-order barriers from the teacher's perspective hides a potentially lacking layer of professional development. Mackey et al.'s (2018) study took the school leadership viewpoint. The interviewed teachers identified leadership's critical role in establishing a vision, ensuring a school-wide collective approach and challenging existing beliefs, as well as providing professional development opportunities, sufficient resources and facilities for teachers. Teachers felt empowered when leadership championed and actively communicated the vision. However, the leaders themselves received no formal professional development or support to lead the change. With a lack of leadership and a lack of direction from the Ministry of Education, the principals had a lot of leeway, and their attitudes towards key elements of the reform impacted on resourcing, appraisal, team selection and curriculum development.

2.2.4. School extramural authorities

Individual teachers, co-teaching dyads, school administrators and principals appear to face barriers of their own. Second-order educational change is initiated outside the school walls, but the leadership and support that are provided varies. The initiative-taking bodies at the national or regional level should assume a central role in the *thorough* planning of the reform (Machida & Walsh, 2015). The planning involves communicating the underlying reform rationale and any suitable professional development activities (Machida & Walsh, 2015). Neglecting to ensure that the objectives, priorities and necessary activities are aligned at different levels of the educational system could have detrimental effects on the implementation of the reform (Douglas et al., 2016; Graue et al., 2007; Strogilos & Tragoulia, 2013).

2.2.5. Potential barriers

To conclude, several contextual issues give rise to tensions and possibilities for co-teaching and educational transformation. At least some second-order barriers can be lowered by external activities and, at times, the same issues appear as barriers to be mitigated and as enablers of change, depending on (if) how they are approached. Furthermore, when examining an educational change with multiple relevant actors, what should count as external and intrinsic barriers? It appears that all actors should be included. We support Hackett et al.'s (2019) call for more comprehensive and context-sensitive co-teaching constructs, with an additional

agenda: reframing co-teaching as a practice that has the objective of supporting the implementation of educational change.

2.3. Co-constructing and regulating

Based on the review above, it would be tempting to claim that top-down leadership and communication are the silver bullets of second-order educational change. However, each actor within the educational system is accountable for his/her own part. Successful co-teaching practices are co-constructed, which requires sustained engagement, communication, negotiation and commitment (Cook & Friend, 1995; Rytivaara, Pulkkinen, & de Bruin, 2019). While this co-construction should not be limited to teachers, we also claim that *the current co-teaching definitions do not offer teachers practical models of how to co-construct*.

Reflection – a professional practice recommended for co-teachers (e.g. Fluijt et al., 2016) – has been criticised for lacking solution-orientatedness and a ‘how to’ model (Marcos, Sanchez, & Tilleman, 2011). The review above suggests that reforms often lack shared and clearly communicated goals. Pursuing a shared goal differs from working in agreement, but having more or less autonomous goals is a key difference between collaboration and co-ordination (Hord, 1986). *For co-teaching to support a second-order change, collaborative rather than co-operative co-construction is required*. When such process involves sustained pursuit of shared objects of pedagogical improvement, collaboration may become knowledge creation (Paavola, Lipponen, & Hakkarainen, 2004). We suggest adopting the concept of regulation from the learning sciences. *Regulation* involves the intentional negotiation of goals and approaches, optimising performance, monitoring progress and intervening if the results deviate from what was planned (Järvelä & Hadwin, 2013). Team-level regulation can occur either as co-regulation or as socially shared regulation. In *co-regulation*, individuals’ regulatory activities are guided, supported, shaped or constrained by other team members, and in *socially shared regulation*, team members make the decisions and undertake regulatory activities together (Järvelä & Hadwin, 2013). *Ideally, co-teachers should engage in socially shared regulation, whereas co-regulation is a sign of an imbalanced relationship*.

To summarise, co-teaching practices are under constant regulation, iteration and development throughout the co-teaching relationship situated within school-level structures (Trent et al., 2003), which, in turn, are directed by regional and national policies and curriculums. Capturing these interrelated and changing interactions requires contextualised models of co-teaching that are not limited to scrutinising teachers and their activities, but that also accounts for other factors that are meaningful to educational transformation. Towards that aim, we set out to explore the following questions:

1. How does co-teaching emerge in an implementation of a second-order educational change?
2. What barriers do teachers bring up as meaningful for their co-teaching?

3. Research design

3.1. Context: a curriculum reform

Our study is situated within a Finnish school context, a few years after the Finnish National Core Curriculum for Basic Education (NCCBE) introduced a significant reform to meet the requirements of the future; that is, 21st-century skills. The NCCBE (2014) emphasises cross-curricular themes and the development of

transversal competences such as participation, learning to learn, building a sustainable future, working life competence and entrepreneurship, as well as ICT competence. For each subject, the NCCBE gives general-level objectives and a great amount of autonomy for teachers to construct their teaching practices (Niemi, Toom, Kallioniemi, & Lavonen, 2018).

For the subject of crafts, introduced into the Finnish school curriculum in 1866, the reform was significant. Crafts has been taught as two different subjects (textile craft and technical craft), both with their own highly technologically-oriented makerspaces and specialised subject-teacher education (master-level study programmes with a minimum of 300 European Credit Transfer and Accumulation System credit units), having different technological and pedagogical content. In the reformed NCCBE, crafts is defined as one subject. However, very few in-service teachers have professional credentials and skills to teach ‘both halves’ of the subject; the reformed crafts subject has a cross-curricular flavour. The NCCBE does not instruct pedagogical models, products to be prepared or techniques to be used, which has created confusion amongst crafts teachers (Kokko, Kouhia, & Kangas, 2020). *Under these circumstances, co-teaching appears as a natural way to co-construct novel pedagogical practices and to teach reformed crafts*.

3.2. Context: development programme

This reform triggered a national-level development programme funded by the Finnish Ministry of Education and Culture. In co-operation with in-service teachers, the programme aimed at developing teaching practices modelling the reformed crafts, while this sub-study focused on co-teaching. The two-year programme organised several workshops that introduced design principles and models – non-linear learning projects – complying with the NCCBE policies, as well as providing practical training for relevant technologies such as laser cutting, programming, robotics and e-Textiles. Co-teaching was encouraged, yet no related training was provided. A key principle was to engage teachers in co-innovating pedagogical practices rather than in merely implementing them. Thus, teachers chose their own training sessions and the technologies they would introduce to the non-linear projects in their schools. For the teachers developing their technical skills and orchestrating these types of projects, co-teaching appeared to be both a resource and a learning objective.

3.3. Context: pedagogical principles

A non-linear pedagogy utilises open-ended learning activities in which the student groups create solutions to ill-defined, authentic and complex problems or design challenges (Lahti, Seitamaa-Hakkarainen, & Hakkarainen, 2004; Seitamaa-Hakkarainen, Viilo, & Hakkarainen, 2010). Such tasks are characterised by emergent goals that are formed and modified collaboratively by students during the course of pursuing them (Scardamalia, Bransford, Kozma, & Quellmalz, 2011). Student groups’ own ideas and questions are intentionally brought into play, and the groups are encouraged to pursue and develop their own interests. Projects often extend the boundaries of school subjects, which makes co-teaching a natural resource.

The emphasis on self-directed learning, experimentation and harnessing failures as learning opportunities yields divergent and unanticipated learning trajectories requiring novel formative assessment practices. Concurrently, knowing how and when to provide tailored guidance and scaffolding is becoming increasingly challenging for teachers. Teachers need to create adaptive structures that provide scaffolding throughout the learning process and facilitate collaboration, yet they also need to flexibly provide on-

demand scaffolding in response to each pupil's unique needs (Riikonen, Seitamaa-Hakkarainen, & Hakkarainen, 2018). Sawyer (2011) describes such an adaptive process of teaching and learning as collective improvisation and invention. The improvisation metaphor emphasises how teachers and students are collectively generating epistemic practices and an environment that affords their evolving process of learning and collaboration (Markauskaite & Goodyear, 2016). These circumstances provide novel opportunities for teacher collaboration – the co-construction of 21st-century co-teaching practices.

As such, the above pedagogical principles are not totally new. There has been pioneering work and admirable efforts to bring knowledge creation and inquiry learning to schools (Ching & Kafai, 2008; Kolodner et al., 2003; Paavola, Lipponen, & Hakkarainen, 2004; Zhang, Scardamalia, Reeve, & Messina, 2009). However, this previous research has focused more on student activities and learning than on teaching, with few exceptions, such as (Viilo, Seitamaa-Hakkarainen, & Hakkarainen, 2018). For Finnish crafts, the principles are relatively novel, yet there are wide differences between schools. Introducing co-teaching to this pedagogical context adds a novel viewpoint to previous research on co-teaching during second-order educational changes.

3.4. Research participants

To explore the differences and similarities between emerging co-teaching practices in their different contexts, a collective (i.e. multiple) case-study approach (Goddard, 2010) was selected for this two-year study. Based on voluntariness and availability for a term-end interview, teachers from six of the comprehensive schools involved in the development programme were selected. Three schools were located in the capital city and three in Eastern Finland's rural areas. The teachers had collaborated with each other before, but only this closely in Rural C. After the first year, two technical craft teachers resigned, and new teachers were hired. In total, we interviewed eight teacher teams: four once and four two times during the study. The teams and durations of their co-taught projects are presented in Table 1.

3.5. Data collection

Two sets of cross-sectional data were collected via semi-

structured team interviews (Kallio, Pietilä, Johnson, & Kangasniemi, 2016) at the end of the school projects in 2018 and 2019. In total, 13 teachers were interviewed, as one teacher who had resigned could not attend. The teachers were interviewed in pairs, as the assumption was that team interviews provide co-teachers with an opportunity for collaborative sense-making (cf. Fluijt et al., 2016) and co-construction. The interview scheduling difficulties emphasised the teachers' struggles to find shared time, which rendered shared time even more important for the development of their co-teaching practices.

The interviews were based on an interview guide with formulated questions, yet the interviewers were not restricted to these particular formulations as long as the topics (Table 2) were covered. The semi-structured approach gave the freedom to the teachers to discuss issues they had experienced as relevant, yet sufficient comparability between the teams was accomplished (Barriball & While, 1994). Before the interviews, internal testing (Barriball & While, 1994) was conducted: A senior colleague reviewed the questions and her feedback was incorporated into the interview guide. The first and second authors, both experienced interviewers and known to the teachers from programme workshops, conducted the interviews in places chosen by the teachers. The teachers eagerly shared the ups and downs of their non-linear projects, and at times, the interviews resembled teacher-led discussions rather than interviews. The interviews resulted in a total of 9.5 h of audio data, which was transcribed verbatim.

3.6. Data analysis

The data analysis followed Goddard (2010), as detailed by Crowe et al. (2011). First, the transcripts were read closely several times to get a thorough understanding of the characteristics of each case. Second, thick descriptions of the central topics were written and shared between the first and second authors (the interviewers). Third, cross-case comparisons based on the thick descriptions and transcripts were completed through a qualitative content analysis (Zhang & Wildermuth, 2009) with the Atlas.ti qualitative analysis software. Across the interviews, three mutually exclusive themes were inductively induced: 1) pedagogical issues, 2) co-teaching issues, and 3) teacher professional development. Fig. 1 presents the themes and sub-themes. Fourth, the statements related to the sub-themes were coded from the viewpoint of teacher

Table 1
Schools' teacher teams and the co-taught project durations (in calendar months).

School	Capital A	Capital B	Capital C	Rural A	Rural B	Rural C
1st year Team	Mila & Henry 2	Netta & Ray 3	Bea & Kai 3	Vince & Miriam 5	Liz & Megan 5	Nora & Trent 5
2nd year Team	Mila & Iiro 2	Netta & Ann 5	Bea & Kai 5	Vince & Miriam 5	Liz & Megan 5	Nora & Trent 5

Table 2
Semi-structured interview topics and examples of the guiding questions.

Topic	Example questions
Project planning	How did you come up with the project theme? How did you compose overall plan and lesson plans for the project?
Co-teaching	How did you share the work? In case of a replay, would you divide the work differently?
Shared reflection-on-action during the project	Did you discuss together after the lessons? On what topics?
Structural support	Did you have enough time and possibilities to plan and discuss?
Non-linear pedagogy	What project elements you plan to incorporate into your teaching in the future? Did the project change your thinking about teaching or Crafts? What was the most valuable learning from the project?

Pedagogical issues	Co-teaching issues	Teacher professional development
Planning	Values and priorities	Reflection on teacher identity
Teaching	Shared regulation of teacher collaboration	Change in teacher identity
Assessment	Support from school administration	Learning
Shared regulation of pedagogical work	School community-level support	
Physical learning environment	Regional-/national-level support	

Fig. 1. Themes and sub-themes discussed by the teachers.

participation and commitment to the co-taught non-linear project as 1) strong positive ++ (highly collaborative, supportive, committed); 2) positive +; 3) neutral 0 (not taking a stance, reflecting on what to do); 4) negative - (uncollaborative, unsupportive, or the teachers' statements were contradictory, implying that something was wrong); and 5) strong negative -- (Fig. 2). Examples of the schemes are presented in the Results and findings section.

To answer our first research question, three profiles of emergent co-teaching were identified. Further, the potential barriers (as reviewed in section 2.2) that were discussed by teachers were identified and coded either as 'barrier' (B), 'challenge' (C), 'neutral' (N), 'enabler' (E) or 'not discussed' (/), which provided an answer to the second research question.

3.7. Trustworthiness and limitations

The study aimed to develop a model of contextualised co-teaching during a second-order educational change. The change in question, a curriculum reform that changed a subject with two distinct content areas into a single subject, challenged the subject teachers' competence and caused turmoil in the field (Kokko et al., 2020). As the case-study approach is suited to capturing how a change is being implemented and received in the field (Crowe et al., 2011), a collective case-study approach was chosen. As the reform was national, half of the schools were in the capital city and half in rural areas – a selection based on voluntariness and availability.

Early on in the development programme, it became obvious that

the teachers had different resources for participation and our data-collection activities had to be adjusted accordingly. The compromise was considered fair, as the two sets of cross-sectional interview data often involved quite personal reflections and direct statements from the teachers. The interviewers both have professional credentials for teaching crafts and were known to the teachers well before the interviews. The team interviews provided the chance to see the educational system through the lens of the teachers working within this system and capture their experiences of the reform. The timing of the interviews – at the end of the non-linear projects – ensured that the teachers had fresh recollections regarding the significant issues, and the semi-structured approach and informal atmosphere let the teachers lead the conversation whenever they wanted to 'speak their mind'.

The study involved eight co-teaching teams. Not many co-teaching studies have involved this many cases over two years. Cross-case comparisons provided the basis for data triangulation. The thick descriptions and transcripts revealed multiple commonalities and differences, despite the teachers' different focus and level of reflection during the interviews. Perhaps interviewing the principals or gathering ethnographic observations from the teacher community could have provided more information about the school-level support and could have allowed for the possibility of comparing 'actual' support with the teachers' experiences, which could differ (cf. Austin, 2001). However, with the programme resources that were available, this was not possible due to the extent of the collective case study. The study could have benefited from a member-checking routine done shortly after the interviews to

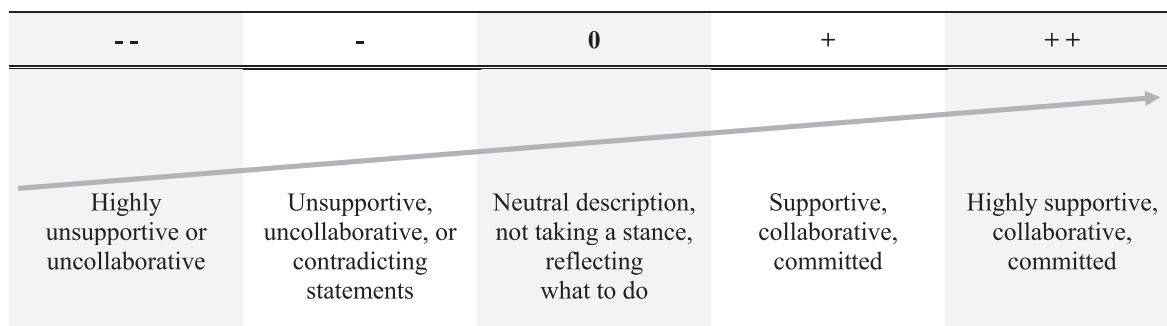


Fig. 2. Coding scheme for teachers' participation and commitment to the co-taught project.

preserve the cross-sectional character of the data. An additional questionnaire after the member-checking routine could have been administered to triangulate the teachers' views on all the barriers that were listed. That could also have changed the teachers' interview responses for the second round.

Despite the benefits of its multiple case-study design, this study has some limitations. The results cannot be generalised to the teacher population as a whole, or to full (e.g. nationwide) implementations of any educational reform, because as in any research, non-believers and less development-oriented teachers did not volunteer their participation. The supportive actions were not as complete as (for instance) suggested by [Walther-Thomas, Bryant, and Land \(1996\)](#); yet, the lack of certain support activities (such as initial co-teaching training or scheduled regular co-planning time) made their role clearer than a comprehensive support programme would have done. Moreover, initial co-teaching training could have implied that teachers were to implement certain co-teaching models, which was not the intention of the programme. Firstly, many co-teaching models accentuate teacher co-presence, which was impossible for craft teachers, and secondly, the programme aimed at teachers developing co-teaching practices that made sense in their particular school contexts.

Opfer and Pedder (2010, p. 396) emphasise the need for research strategies that 'allow for a useful balance between attending to both a) the contextual specificity of systems and b) their common affordances and patterns of evolution'. The high level of teacher autonomy in Finland in terms of teachers being able to decide on teaching and assessment methods ([Niemi, Toom, Kallioniemi, & Lavonen, 2018](#)) could pose an additional challenge to co-teaching research. As noted by [Rytivaara, Pulkkinen, and Bruin \(2019\)](#), in high-autonomy settings, a number of issues are negotiable between individual teachers, whereas teachers who are more controlled by national standards and teachers' professional assessments could

benefit from clearer (binding) structures for co-teaching. However, we tried to maintain our analysis at a level of granularity that we believe can also serve international audiences, without sacrificing any central features or findings from a national perspective.

4. Results and findings

In this section, the teachers' descriptions of their co-teaching in the non-linear projects are initially approached from the themes and sub-themes that evolved. These results were then compiled to determine answers to the two research questions.

4.1. Themes and sub-themes

4.1.1. Pedagogical issues

The pedagogical issues that were raised were rather similar across teams, as all the teachers were learning to adopt and adapt the specifics of the non-linear pedagogy into their own teaching and school contexts. The examples of typical statements [sts] and how they were coded according to the 'Participation and commitment' coding scheme ([Fig. 2](#)) are presented in [Table 3](#).

The teachers typically described their efforts through their students' reactions, struggles and achievements, which could be understood as them measuring the success of their developed practices. The teachers' commitment to the non-linear approach and the reformed crafts were implied if teachers raised negative issues without providing solutions (st1, st3, st7, st10), or positive issues and found (or vigorously sought for) solutions (st2, sts4–6, st9, st11). For instance, st10 raises a problem (serious safety issues in technical makerspaces), whereas st11 provides a solution to this problem (careful planning before letting students enter the making phase).

A new level of flexibility was required from teachers (st7). Many

Table 3
Typical pedagogical issues coded according to the 'Participation and commitment' scheme.

Sub-theme	Teachers' statements	Coding
Planning	1) B: When the [pupil's learning] task is to invent, it's quite challenging because [the teachers] don't know what will come out. So a pupil needs to a) find out what to do and b) learn how to do it. It is challenging, it would be easier if it were about just doing. B&K, 2019.	–
	2) A: We thought a lot, how to form groups [...] then the point is that if we form the groups, the pupils probably need to do some compromises in planning. So that the artefact is not necessarily [as ambitious as it could], but now in this case the artefacts were good and some others were really nothing [...] we thought this a lot! N&A, 2019.	++
Teaching	3) H: Yes, and the pupils have this, rather short fuse. If ... they fail, try, fail, ... They often leave the work after the first failed attempt, -- it doesn't ... They don't even want to try [anything]. M&H, 2019.	–
	4) L: [The pupils] were all so distressed because of the designing and "what should I do" but then in the end, when they realized ++ that they pulled through and were ... so enthusiastic ... experience that this was really fun and cool. Like, they got confidence. L&M, 2018.	++
Assessment	5) V: Assessment was much easier to do together than alone. M: Yes, and the perspective was broader, as a pupil can be at professional level with hard materials but not so much with soft materials, so one doesn't give too low a grade just because one wasn't there to witness [the pupil's work in] the other [makerspace]. V&M, 2018.	++
Shared regulation of pedagogical work	6) N: ... we need to cope with uncertainty and that ... if I think about a regular maths lesson where I have everything under my control, I know all that is going on, all is like ... I have total control over how the lesson proceeds and what will happen and where we end up ... [but with these projects] one just doesn't know and you have to live with it. N&T, 2018.	+
	7) H: Earlier you didn't have to control so many things [simultaneously], but now you have in a class, for instance, sixteen, you -- could have sixteen different projects. M&H, 2019.	–
	8) B: One ponders if it is ok, can you ... is it wise to let [pupils] to continue [as they have planned] or should you say that "hey, this is 0 really not going to work like this". B&K, 2019	0
	9) N: In the beginning we thought a lot about in which [of the two makerspaces] we'll teach ... because our [makerspaces] are one ++ in downstairs and one in upstairs. N&T, 2018.	++
Physical learning environment	10) H: One needs to consider that the character of the subject changes down there [in the technical crafts makerspace] where the -- heavy machines are. What the pupils are allowed to use, and on which machines they have no experience [they need constant supervision]. M&H, 2019.	–
	11) T: In the planning one needs to consider how the artefact can be done, so that one teacher is not forced to spend 2 hours + supervising [one pupil group] working with one particular machine. N&T, 2018.	+

Notes for [Tables 3–5](#).

... short pause.

[...] part of the transcript left out as it is non-relevant for this particular example.

[expression] an expression that was not voiced but was implied from the wider context of the interview, added for the benefit of the readers.

pupils protested about such an explorative way of working and did not see the value in productive failure (st3). As the work proceeded, many pupils' frustration turned to enthusiasm as they realized that they were achieving on new levels – novel products that they themselves had planned and made (st4). However, for many pupils, this way of working was apparently too demanding. Committed teachers described how they planned more and varied the scaffolds.

A frequent source of headaches was the learning environment involving two makerspaces. Several pupil groups frequently moved between makerspaces to get suitable tools, which caused additional stress regarding lesson planning and class management. Moreover, teaching for a considerable amount of time in separate locations interfered with the shared regulation and the co-construction of shared classroom practices, which remained at a low level.

Despite every teacher listing multiple challenges and several describing intermittent struggles to support their pupil groups' agency, the majority of the teachers declared that they were committed to the non-linear pedagogy and the reformed crafts. Many teams described how they had successfully co-constructed co-assessing practices, which resulted in more accurate student grading due to the teachers' combined perspectives.

4.1.2. Co-teaching issues

Whereas co-teachers' pedagogical statements mostly revolved around the same key issues, the teachers' statements about co-teaching appeared to be more diverse (Table 4). Co-teaching was approached as a professional practice rather than as being a matter of compatibility between different personalities (st12). Some teachers frequently praised their partners and their smooth collaboration (st14, sts16–17), but mostly, collaboration was expressed by the use of 'I' versus 'we' and 'together' (st15 versus

sts16–17, but also in Table 3, st2, st5 and st9), rather than it being discussed directly.

The sub-theme 'Values and priorities' reflected how objectives for the non-linear projects were set. If the teacher's own values contradicted the reformed crafts, the teacher would try to realign his or her values by (temporarily) re-prioritising them. This compromise often failed, and the teacher lacking commitment to the reformed crafts subject left the planning and decision making to his/her partner (st15). Some teachers clearly addressed the serious differences between each other's pedagogical contributions, values and priorities (st13). These value discussions did not bring about any resolutions as they typically indicated the individual teacher's strong subject-teacher identity. On the other hand, shared values coincided with fluent and equal co-teaching (st14). In general, the level of shared regulation varied from time to time: When partners trusted each other, less time and formality were required (sts16–17).

References to support from actors outside the teacher team were typically negative and short, with one exception, where teachers discussed these topics at considerable length. Some asked for more technical training and on-site support from the programme, but no one asked for any support regarding co-teaching, not even in the obviously dysfunctional teams.

4.1.3. Professional development

Professional development was an infrequent topic, even if the teachers were interviewed after they had undertaken projects that were heavily loaded with novel pedagogical and technical aspects. Learning was implied rather than explicated in their reflective statements. However, some teachers discussed professional development issues at length and some teachers' professional identities were clearly shaken by the shift from delivering pre-prepared content to flexibly identifying pupil groups' support

Table 4
Co-teaching issues coded according to the 'Participation and commitment' scheme.

Sub-theme	Teachers' statements	Coding
Values and priorities	12) M: This [co-teaching] works well here ... quite well, and it requires ... that one has such a partner with whom one can collaborate well ... No, actually, one has to be able to collaborate even if the so-called chemistry is not there. L&M, 2018.	+
	13) N: Maybe we disagree in what [Crafts] could be. Well, I have a strong vision and understanding what it could be, it hasn't changed at all. R: [...] For me, this [reform] has been quite a challenge. There is less and less time for the kids to [practice manual skills] ... first you have to learn the skills and only then, then you have better basis for researching [designing]. N&R, 2018.	---
	14) T: ... and our values in this subject are pretty much the same, which shows in our teaching. We don't have to think about what the other one is going to say next but one can continue where the other one stopped. N&T, 2019.	++
Shared regulation of teacher collaboration	15) H: Mila did [plan and decide] and I was just "yeah, everything goes". M&H, 2019.	-
	16) N: We met always, well in the beginning actually after each lesson [and discussed] like this "and next we need to do this, this and this". But then [our meetings] become less frequent because it was more like under our control, we knew what [the pupils] would do even if we didn't talk more than during some short walk [in the school corridor]. N&T, 2018.	++
	17) A: We had no clear-cut division of labour. We just did it together. N: We just talked. A: Yeah, and sent WhatsApp messages like "here we could do this and this". It was quite, not just limited to some particular [working] hours but it goes on and continues. N&A, 2019.	++
Support from school administration	18) B: I heard that there was a discussion with principals so that they'd be committed to this [supporting co-teaching]. But at least we did not have [scheduled time to plan and reflect]. B&K, 2019.	-
	19) T: I have to give credit to our principal for letting us, when we told him that we have this [project], he thought its important and reacted like "oh, you cannot come to this [event] because you have your [co-teaching project]". N&T, 2019.	+
School community-level support	20) M: I wish that we could collaborate with other subjects. Collaborate with maths, physics, chemistry, arts, mother tongue [...] We shouldn't fixate on thinking that lessons at the same time is a definite prerequisite for co-teaching [...] We also need to get other teachers interested in collaborating with Crafts. M&I, 2018	-
	21) B: It was nice to organize our own maker fair for this smart artefact project. For the game development project we had a play hour [for other pupils and teachers to come and play] but the class teachers didn't [come] maybe five or six [only]. B&K, 2019	-
Regional and national level support	22) M: This kind of collaborative projects, I've tried with one and another subject, but these structures [curriculum and scheduling] in lower secondary don't really permit cross-curricular collaboration. This time, luckily, the class had a math course at the same time. M&H, 2019	---
	23) N: We got no resources, like the city could have trained us, there are quite many Crafts teachers here [in the city]. So they could have trained us or something like, how this [new Crafts] could be, what skills in situation like this ... N&R, 2018	---
	24) M: Yet I think that we've got extremely poor guidance [from authorities] in how to actually teach this multi-material Crafts. L&M, 2018	---

Table 5
Teacher professional development coded according to the 'Participation and commitment' scheme.

Sub-theme	Teachers' statements	Coding
Reflection on teacher identity	25) B: You're never ready in this job. One thing is certain: you can always become better. B&K, 2019.	++
	26) N: Well ... it does require that ... that the very first lessons when we did the first things, it was really awful that I wasn't able to do + anything ... and but, not that I'm in any crisis here and now thinking that I'm no good and cannot support [pupils] and so. You just sort of grow into the feeling that this is my job but I can't [starts to laugh]. N&T, 2018.	+
	27) M: So one could think outside of the box, that it's not only the soft materials that I teach, but that one could think that what it could be + ... and I have begun to think, well yeah, if I could teach ... well, one realizes that there are plenty of development needs here. V&M, 2018.	+
Change in teacher identity	28) M: What I have been thinking during this spring is that my teaching has changed to, maybe, facilitation, well, yeah. Especially, to, 0 supporting pupil's working. M&H, 2019.	0
	29) T: We selected techniques that are time-consuming but don't need much safety training, so that N could supervise those. She was ++ responsible for those, particular kinds of sawing and grinding. N: I learned to grind and other such techniques so that I could supervise [and give T more time to teach more demanding techniques to pupils]. N&T, 2018.	++
Learning	30) M: In a way, this project was fruitful because one learned how to lead if this project is done again. V&M, 2019.	+

THEME	CAPITAL					RURAL		
	A		B		C	A	B	C
	M&H	M&I	N&R	N&A	B&K	V&M	L&M	N&T
Planning	-	+	-	++	-	+	+	++
Teaching	+	+	0	++	+	+	+	++
Assessing	++	0	0	++	+	+	+	++
Shared regulation	+	++	//	++	+	+	+	++
Values and priorities	--	++	--	++	0	++	++	++
Professional development	0	++	0	++	++	+	+	++

Fig. 3. Emergence of co-teaching in different teams.

needs. Some typical statements regarding professional development are shown in Table 5.

Some teams had shared ambitions and development orientations aligned with the reformed crafts, whereas in some teams, the needs were individually oriented in directions that were not immediately supportive of the non-linear pedagogy. Some teachers learned new technical skills to balance the workload between partners. Only one teacher mentioned what was probably the most common learning outcome – the basics of implementing non-linear projects.¹

4.2. The emergence of co-teaching

The answer to our first research question – How does co-teaching emerge in an implementation of a second-order educational change? – was compiled from the results based on the 'Teacher participation and commitment to the co-taught project' scheme (the signs are '++', '+', '0', '-' and '--', as explained in Fig. 2, elaborated in Tables 3–5 and compiled at the team level in Fig. 3). According to coded statements, three profiles of emergent co-teaching were identified: highly functioning collaboration, collaboration and imbalanced co-operation (respectively, in dark blue, light blue and in grey in Fig. 3).

Highly functioning collaboration (Capital B: N&A, Rural C: N&T) is characterised by the teachers firmly trusting each other, sharing values, being committed to the reformed crafts and to further co-developing their teaching practices. Contrastingly, N&T had a

long history together and a collaborative school community, whereas N&A were new to each other. However, they had similar approaches: They were flexible, ambitious in terms of developing teaching practices to benefit their pupils and resilient when facing obstacles (such as seriously frustrated pupils or persistent technological issues). Collaboration (Rural A: V&M, Rural B: L&M) represents well-functioning co-teaching that, in time, could become highly functional. The key difference between highly functioning collaboration and collaboration is the level of socially shared regulation, co-construction and professional drive. The highly functioning teams were within their comfort zone despite serious pedagogical challenges and appeared to be 'true believers' in reformed crafts and the non-linear pedagogy. On the other hand, the well-functioning teams were getting a feel for the non-linear principles and were starting to challenge themselves with novel technologies.

The third profile, imbalanced co-operation (Capital A: M&H, Capital B: N&R, Capital C: B&K) is characterised by perfunctory co-teaching – a lack of co-planning, co-regulation, shared values and priorities, as well as wide disagreements regarding the content. The committed teacher bore the load of planning and regulation, while his or her partner duly handled issues with an immediate effect on his or her own teaching performance, but otherwise, his or her participation and initiative were lacking.

4.3. Meaningful barriers

The answer to our second research question – What barriers do the teachers bring up as meaningful for their co-teaching? – was based on how the teachers referred to the potential barriers (as reviewed in Chapter 2). The coding results are presented in Fig. 4.

¹ All the sub-themes of 'Professional development' were collapsed under one row for further discussion, as it was such a rare topic.

	CAPITAL					RURAL		
	A		B		C	A	B	C
	M&H	M&I	N&R	N&A	B&K	V&M	L&M	N&T
Values & priorities	B	E	B	E	N	/	E	C=>E&E
Teacher partnership	C	E	B	E	C	E	E	E
Teacher competence	C	C	N&C	C	C	C	C	C
Shared planning time	N	E	/	C	C	C	C	C=>N
Physical environment	C&B	B	C	C	C	C	/	C
School community	/	C	/	/	C	/	/	/
Principal	/	/	N	/	/	/	/	E
Class pupil size & integration	/	/	C	C	/	/	/	C
School Curriculum & schedules	/	C	/	/	/	/	E=> B	/
Regional/National support	C	/	C&B	/	C	/	B	/

Fig. 4. Potential barriers and whether teachers saw them as a barrier, a challenge, neutral, an enabler, or whether the barrier was not brought up.

When teachers' experiences differed, both experiences were coded ('&' sign). When the experience changed between the first and second interviews, both are presented ('=>' sign).

The interview questions probed shared planning time and the physical learning environment, but other potential barriers were spontaneously brought up by the teachers. A divided learning environment, national-level support, teachers' differing values and dysfunctional partnerships, as well as school schedules were each brought up as actual barriers (Bs) by 1–2 teams. The physical environment, competence (regarding the non-linear pedagogy and crafts technologies) and shared planning time received the most negative ratings (B+C). No team had a regular 'official' planning time agreed with the principal, but some had a day or so for their initial planning. Some had (accidentally) their teaching breaks at the same time and some were committed to 'finding the time'.

The school community (other teachers' indifference) and school curriculums and schedules received varied ratings. Regional- and national-level support (the same for all the teams) was described as lacking (regional training, compensation for the teacher's work, attitudes towards crafts) or as being of extremely poor quality (guidance regarding the reformed crafts, IT systems needed for pupil portfolios). The one principal with 'a supportive attitude' did not officially dedicate a regular time slot for the teachers to plan and reflect together, but let them co-plan during some events that were obligatory for other teachers (yet the team was very pleased with the principal being supportive, st19, Table 4). Class size and having many special needs' students were an issue for some.²

There is consistency between the ratings for partnerships (i.e. teacher compatibility) and values. Teams with imbalanced co-operation either had significant value differences or avoided bringing the topic to the interview table. The highly functioning

teams described values as an enabler, saw several challenges, but saw no actual barriers to their co-teaching. To summarise, teachers' spontaneous comments on the potential barriers produced no recognisable patterns other than the one related to partnerships and values.

5. Discussion

According to our results, three co-teaching profiles emerged: highly functional collaboration, collaboration and imbalanced co-operation. However, national- and regional-level support activities regarding the reform implementation were the same for all six participating schools and eight teacher teams. The teams had no 'officially' allocated shared planning time during their non-linear projects, nor did they describe any school-specific supportive activities. All the teachers were challenged by the learning environment being divided in two, yet teaching in two different locations did not prevent highly functional collaboration from emerging. This challenges the understanding that the defining feature of co-teaching is teachers' co-presence in a classroom. *According to our results, the defining feature is socially shared regulation.*

Assuming that the teachers brought up the issues that they considered meaningful for their co-teaching, they experienced these extrinsic supports differently. Still, these experiences do not coincide with co-teaching profiles: all teams, despite their profile, brought up several challenges and half of the teams brought up one or two barriers. It appears that the highly collaborative teams successfully navigated their way through the first-order barriers (Ertmer, 1999): When there is a will, there is a way? Moreover, the length of their shared history did not explain their success, as one of the highly collaborative teams shared a long history while the other one was fresh. Furthermore, all teams were challenged by the non-linear pedagogy. What remains is individual teachers' commitment to values and priorities, and their more or less collaborative interactions – their co-teaching relationship. Additionally, one

² Co-teaching in crafts does not reduce the pupil–teacher ratio, as both teachers bring their groups to the class.

imbalanced and one highly functional team emerged in the same school; the committed teacher had different partners for the first and the second year. This further emphasises the critical role of an individual teacher and corroborates the findings of several reviewed articles (Bullough, 2015; Douglas et al., 2016; Murata, 2002; Probart et al., 1997; Strogilos & Tragoulia, 2013; Trent et al., 2003).

Teachers have a critical role in educational change, of that there is no doubt. Research suggests that providing external support factors is not enough to build a functioning and effective co-teaching partnership (Austin, 2001; Pratt, 2014). Contrasting claims (Opfer & Pedder, 2011, p. 379) suggest that teachers act within a system: 'any attempt to understand teachers' professional learning' (i.e. changes in their practices, priorities and values) 'at only a subsystem level' (e.g. the level of the individual teacher) 'must be understood as partial, incomplete, and biased'. Teachers do not live and operate in a void, but their attitudes and co-teaching relationships could be influenced by the availability of support and the required resources (Besic et al., 2017; Dillon & Gallagher, 2019). Teacher education and school communities are responsible for professional socialisation and for providing development-oriented professional communities. Furthermore, teachers expect change leadership and react to a lack of it (Mackey et al., 2018; Vesikivi et al., 2019). According to our review, the same structural issues can become barriers or enablers of a change, depending on how they are approached. While being critical for the success of educational reform, teachers are neither immovable nor the only actors in a school system.

The need to bring the context into co-teaching research was voiced by almost all of the reviewed second-order change articles. Many lines of educational research overlook the misalignment between an individual's and an organization's values, goals and beliefs (Hackett et al., 2019). In our data, the value conflict manifested itself at the level of the team. Yet, the value conflict was primarily between one of the partners and the reformed crafts. In such a situation, it should not be the task of an individual teacher to convince his or her co-teaching partner, but the national-, regional- and school-level actors need to bear responsibility for change leadership. The larger context is significant during a value conflict, which is often a signature feature of a second-order change.

According to our results, co-teachers could overcome the lack of external support if they were motivated and capable of flexible time management. We can only speculate if school-level support or regional training emphasising the learning theory behind the subject transformation (i.e. targeting teachers' values and priorities) could have changed the results. At the very least, having dedicated co-planning time during school hours would have complicated the freeriding of certain individuals. We conclude that for a successful second-order change, providing external support is a necessary, but not necessarily sufficient, condition.

On the other hand, we could say that the reform – a national core curriculum reform and the transformation of crafts from two separate content areas to one undivided school subject – was successful. The Finnish educational system does not involve standardised testing, auditing or outside teaching supervision, and teachers have high levels of autonomy, but the NCCBE is considered obligatory. In the studied cases, all students were taught according to the reformed crafts. However, the sustainability of such success remains debatable. Even if the project was delivered, all the teachers in imbalanced co-ordinated co-teaching situations were dissatisfied due to them having to make too many compromises regarding important aspects of their work, or because they felt held back by their partners and not supported by other actors in the educational system. For them, co-teaching was an additional burden.

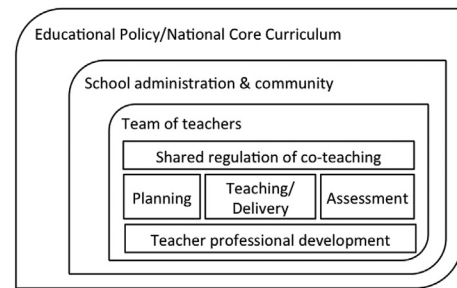


Fig. 5. A model of contextualised co-teaching.

From these premises, we propose a model of contextualised co-teaching (Fig. 5). The model complements the earlier co-teaching research and offers a view on the contextual realities enabling and constraining co-teacher teams' practical co-construction of shared teaching practices during a second-order change.

Contextualised co-teaching involves actors at several levels: Teachers, the school administration and school community, as well as educational authorities (at the national/regional level) that decide on educational policy and the core curriculum. A key element in co-teaching is shared regulation, which oversees planning, teaching, assessment and teacher professional development. All in all, effective co-teaching practices are co-constructed, and this co-construction is not limited to teachers but should involve all the actors.

Recently, Hackett et al. (2019) introduced a set of tools for co-teaching implementations created from the activity-system viewpoint. Our proposed model complements previous research by providing a tool to analyse and plan co-teaching implementations within a set context. The need to involve actors other than co-teachers depends on the type of change studied – whether individual teachers join their forces for self-initiated professional development purposes or to develop their teaching practices, when a course is incrementally developed, or when a larger educational reform is implemented. Classifying co-teaching studies according to (for instance) these three types of educational change could also facilitate in composing a strong theory base for different kinds of co-teaching implementations.

5.1. Implications of the contextualised co-teaching model

The model of contextualised co-teaching has two main implications: research-oriented and practically-oriented. Firstly, this model supports co-teaching research in recognising policies, practices and activities behind co-teaching implementations at the level of schools, and regional- and national-level educational authorities and decision makers. Secondly, the model supports actors at different levels who are planning to use co-teaching as part of an educational transformation: The model offers a set of frames of reference to measure development and evaluate if the targets (set preferably at all levels) have been achieved.

5.2. Co-teaching has potential for sustainable change if the context is supportive

Educational change can be targeted to implement changes that last – a difficult enough target. A *sustained change* not only maintains the level acquired but promotes deepening changes that keep practice responsive to changes in pupils, content and contexts (Hargreaves & Fullan, 1998; as cited in McLaughlin & Mitra, 2001). This ambitious level of change sets the objectives for an educational system at the same level as initiatives for teaching 21st-century

skills to students – building the capabilities for changing and adapting (Lee & Tan, 2018).

Effective transformation programmes appear to share seven design elements: 1) A focus on the content that the teachers teach; 2) active learning that engages teachers directly in the practices they are learning, preferably in connection with teachers' classrooms and students; 3) engaging teachers in collaboration, typically in job-embedded contexts; 4) modelling effective practice; 5) coaching and expert support; 6) feedback and reflection; and 7) sustained duration (Darling-Hammond, Hyster, & Gardner, 2017). From the listed elements, co-teaching (by definition) scores on items 1–3, and, if successful, also on items 6 and 7. Additional supportive elements include sufficient physical and human resources, and support from active and development-oriented communities of practice, school leadership and a compatible educational policy (Coburn, Russel, Health Kaufman, & Stein, 2012; Galosy & Gillespie, 2013; McLaughlin & Mitra, 2001). Thus, the context matters.

Co-teaching is not a simple pedagogical tool one can select and readily apply (Rytivaara et al., 2019). Co-teaching is a collaborative practice that entails a developmental trajectory (Pratt, 2014) and a shared learning path specific to each co-teaching team. As 'the quality of an educational system cannot exceed the quality of its teachers' (Barber & Mourshed, 2007; as cited by Low, 2018, p. 126), teachers deserve all possible support – in general, and in teaching

21st-century skills, and with a linear or non-linear pedagogy.

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Declaration of competing interest

The authors have no competing interests to declare.

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Appendix A. Articles selected for in-depth analysis after applying the sampling and selection process

Year	Authors	Title	Journal
1996	Minke, K.M., Bear, G. G., Deemer, S. A. & Griffin, S. M.	Teachers' experiences with inclusive classrooms: Implications for special education reform	Journal of Special Education
1997	Probart, C., McDonnell, E., Achterberg, C. & Anger, S.	Evaluation of implementation of an interdisciplinary nutrition curriculum in middle schools	Journal of Nutrition Education
2001	Austin, V. L.	Teachers' beliefs about co-teaching	Remedial and Special Education
2002	Murata, R.	What does team teaching mean? A case study of interdisciplinary teaming	Journal of Educational Research
2003	Trent, S. C., Driver, B. L., Wood, M. H., Parrot, P. S., Martin, T. F. & Smith, W. G.	Creating and sustaining a special education/general education partnership: a story of a change and uncertainty	Teaching and Teacher Education
2006	Jang, S.-J.	Research on the effects of team teaching upon two secondary school teachers	Educational Researcher
2006	Jang, S.-J.	The effects of incorporating web-assisted learning with team teaching in seventh-grade science classes	International Journal of Science Education
2007	Graue, E., Hatch, K., Rao, K. & Oen, D.	The wisdom of class-size reduction	American Educational Research Journal
2009	Henderson, C., Beach, A. & Famiano, M.	Promoting instructional change via co-teaching	American Journal of Physics
2010	Friend, M., Cook, L., Hurley-Chamberlain, D. & Shamberger, C.	Co-Teaching: An Illustration of the Complexity of Collaboration in Special Education	Journal of Educational and Psychological Consultation
2010	Scribner, S. M. P. & Bradley-Levine, J.	The Meaning(s) of Teacher Leadership in an Urban High School Reform	Educational Administration Quarterly
2013	Strogilos, V. & Tragoulia, E.	Inclusive and collaborative practices in co-taught classrooms: Roles and responsibilities for teachers and parents	Teaching and Teacher Education
2015	Machida, T. & Walsh, D. J.	Implementing EFL policy reform in elementary schools in Japan: a case study	Current Issues in Language Planning
2015	Bullough, R. V.	Teaming and Teaching in ECE: Neoliberal Reforms, Teacher Metaphors, and Identity in Head Start	Journal of Research in Childhood Education
2016	Douglas, K. A., Rynearson, A., Yoon, S. Y. & Diefes-Dux, H.	Two elementary schools' developing potential for sustainability of engineering education	International Journal of Technology and Design Education
2017	Besic, E., Paleczek, L., Krammer, M., Gasteiger-Klicpera, B.	Inclusive practices at the teacher and class level: the experts' view	European Journal of Special Needs Education
2018	DeMartino, P. & Specht, P.	Collaborative co-teaching models and specially designed instruction in secondary education: A new inclusive consultation model	Preventing School Failure
2018	Mackey, J., O'Reilly, N., Jansen, C. & Fletcher, J.	Leading change to co-teaching in primary schools: a "Down Under" experience	Educational Review
2019	Vesikivi, P., Lakkala, M., Holvikivi, J., Muukkonen, H.	Team teaching implementation in engineering education: teacher perceptions and experiences	European Journal of Engineering Education
2019	Dillon, A. M. & Gallagher, K.	The Experience of Co-Teaching for Emergent Arab-English Literacy	Qualitative Report
2019	Thomas, D. P., Emery, S., Prain, V., Papageorgiou, J. & McKendrick, A. M.	Influences on local curriculum innovation in times of change: a literacy case study	Australian Educational Researcher

References

- Anderson, R. S., & Speck, B. W. (1998). "Oh what a difference a team makes": Why team teaching makes a difference. *Teaching and Teacher Education*, 14(7), 671–686.
- Baeten, M., & Simons, M. (2014). Student teachers' team teaching: Models, effects, and conditions for implementation. *Teaching and Teacher Education*, 41, 92–110.
- Barriball, K. L., & While, A. (1994). Collecting data using a semi-structured interview: A discussion paper. *Journal of Advanced Nursing*, 19(2), 328–335.
- Bauwens, J., Hourcade, J. J., & Friend, M. (1989). Cooperative teaching: A model for general and special education integration. *Remedial and Special Education*, 10(2), 17–22.
- Ching, C. C., & Kafai, Y. (2008). Peer pedagogy: Student collaboration and reflection in a learning-through-design project. *Teachers College Record*, 110(12), 2601–2632.
- Coburn, C. E., Russel, J. L., Health Kaufman, J., & Stein, M. K. (2012). Supporting sustainability: Teachers' advice networks and ambitious instructional reform. *American Journal of Education*, 119, 137–182.
- Cook, L., & Friend, M. (1991). Principles for the practice of collaboration in schools. *Preventing School Failure*, 35(4), 6–9. <https://doi.org/10.1080/1045988X.1991.9944251>
- Cook, L., & Friend, M. (1995). Co-teaching: Guidelines for creative effective practices. *Focus on Exceptional Children*, 28(3), 1–16.
- Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A., & Sheikh, A. (2011). The case study approach. *Medical Research Methodology*, 11(100), 1–9.
- Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective teacher professional development*. Palo Alto, CA: Learning Policy Institute.
- Dede, C. (2009). Comparing Frameworks for "21st century skills". In J. Bellance, & R. Brands (Eds.), *21st century skills: Rethinking how students learn* (pp. 51–76). Bloomington: Solution Tree Press.
- Ertmer, P. A. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology, Research and Development*, 47(4), 47–61.
- Flint, R. W., Jr., & Dorr, N. (2010). Social neuroscience at the college of saint rose: The art of team teaching in emerging areas of psychological science. *Journal of Undergraduate Neuroscience Education*, 8(2), 122–127.
- Fluijt, D., Bakker, C., & Struyf, E. (2016). Team-reflection: The missing link in co-teaching teams. *European Journal of Special Needs Education*, 31(2), 187–201.
- Friend, M., Cook, L., Hurley-Chamberlain, D., & Shamberger, C. (2010). Co-Teaching: An illustration of the complexity of collaboration in special education. *Journal of Educational and Psychological Consultation*, 20(1), 9–27.
- Friend, M., Reising, M., & Cook, L. (1993). Co-teaching: An overview of the past, a glimpse at the present, and considerations for the future. *Preventing School Failure*, 37(3), 6–10.
- Galosy, J., & Gillespie, N. M. (2013). Community, inquiry, leadership: Exploring early career opportunities that support STEM teacher growth and sustainability. *The Clearing House*, 86, 207–215.
- Goddard, T. J. (2010). Collective case study. In *Encyclopedia of case study research* (pp. 164–165). Thousand Oaks: Sage.
- Hackett, J., Bang, M., Goulter, A., & Battista, M. (2019). Crossing risky boundaries: Learning to authentically and equitably co-teach through design and practice. *Teaching and Teacher Education*, 86, 102889.
- Hord, S. M. (1986). A synthesis of research on organizational collaboration. *Educational Leadership*, 43(5), 22–26.
- Howard, L., & Potts, E. A. (2009). Using Co-planning time: Strategies for a successful Co-teaching marriage. *Teaching Exceptional Children Plus*, 5(4). Article 2.
- Hudson, P., Nykvist, S., & Mukherjee, M. (2016). Self-reported learning from Co-teaching primary science lessons to peers at university. *Education Reform Journal*, 1(2), 34–48.
- Järvelä, S., & Hadwin, A. F. (2013). New frontiers: Regulating learning in CSCL. *Educational Psychologist*, 48(1), 25–39.
- Jeffery, J. V., & Polleck, J. N. (2010). Reciprocity through Co-instructed site-based courses: Perceived benefit and challenge overlap in an urban school-university partnership. *Teacher Education Quarterly*, 37(3), 81–99.
- Jurkowski, S., & Müller, B. (2018). Co-teaching in inclusive classes: The development of multi-professional cooperation in teaching dyads. *Teaching and Teacher Education*, 75, 224–231.
- Kallio, H., Pietilä, A.-M., Johnson, M., & Kangasniemi, M. (2016). Systematic methodological review: Developing a framework for a qualitative semi-structured interview guide. *Journal of Advanced Nursing*, 72(12), 2954–2965.
- Kokko, S., Kouhia, A., & Kangas, K. (2020). Finnish craft education in turbulence: Conflicting debates on the current National Core Curriculum. *Techné Series A*, 27(1), 1–19.
- Kolodner, J. L., Camp, P. J., Crismond, D., Fasse, B., Gray, J., Holbrook, et al. (2003). Problem-based learning meets case-based reasoning in the middle-school science classroom: Putting learning by Design™ into practice. *The Journal of the Learning Sciences*, 12(4), 495–547.
- Lahti, H., Seitamaa-Hakkarainen, P., & Hakkarainen, K. (2004). Collaboration patterns in computer supported collaborative designing. *Design Studies*, 25, 351–371.
- Lee, W. O., & Tan, J. P.-L. (2018). The new roles for twenty-first-century teachers: Facilitator, knowledge broker, and pedagogical weaver. In H. Niemi, A. Toom, A. Kallioniemi, & J. Lavonen (Eds.), *The teacher's role in the changing globalizing world* (pp. 11–32). Leiden, The Netherlands: Brill Sense.
- Low, E.-L. (2018). The changing roles of teachers and teacher learning in the twenty-first century: The Singapore story. In H. Niemi, A. Toom, A. Kallioniemi, & J. Lavonen (Eds.), *The teacher's role in the changing globalizing world* (pp. 125–140). Leiden, The Netherlands: Brill Sense.
- Marcos, J. M., Sanchez, E., & Tillema, H. M. (2011). Promoting teacher reflectin: What is said to be done. *Journal of Education for Teaching*, 37(1), 21–36.
- Markauskaite, L., & Goodyear, P. (2016). *Epistemic fluency and professional education*. Dordrecht: Springer.
- Marzano, R. J., Waters, T., & McNulty, B. A. (2005). *School leadership that works: From research to results*. Alexandria, Va: Association for Supervision and Curriculum Development.
- Mavropalias, T. (2019). The Greek Co-teaching model. In O. Tayfur Ozturk, & W. Wu (Eds.), *Research highlights in education and science 2018* (pp. 5–16). IRES.
- McLaughlin, M. W., & Mitra, D. (2001). Theory-based change and change-based theory: Going deeper, going broader. *Journal of Educational Change*, 2, 301–323.
- Murata, R. (2002). What does team teaching mean? A case study of interdisciplinary teaming. *The Journal of Educational Research*, 96(2), 67–77.
- Murawski, W. W., & Dieker, L. A. (2004). Tips and strategies for Co-teaching at the secondary level. *Teaching Exceptional Children*, 36(5), 52–58.
- Napier, N. K., Hang, N. M., Mai, N. T. T., Thang, N. V., & Tuan, V. V. (2002). Bicultural team teaching. *Journal of Management Education*, 26(4), 429–448.
- NCCBE. (2014). *Perusopetuksen opetussuunnitelman perusteet 2014. [Finnish national core curriculum for basic education]*. The Finnish National Board of Education. Retrieved from https://www.oph.fi/sites/default/files/documents/perusopetuksen_opetussuunnitelman_perusteet_2014.pdf.
- Nevin, A. I., Thousand, J. S., & Villa, R. A. (2009). Collaborative teaching for teacher educators – what does the research say? *Teaching and Teacher Education*, 25, 569–574.
- Niemi, H., Toom, A., Kallioniemi, A., & Lavonen, J. (2018). The teaching profession amid changes in the educational ecosystem. In H. Niemi, A. Toom, A. Kallioniemi, & J. Lavonen (Eds.), *The teacher's role in the changing globalizing world* (pp. 141–150). Leiden, The Netherlands: Brill Sense.
- Office of Education. (1967). *Project for the inservice preparation of teachers for the desegregation of selected school faculties through the implementation of team teaching*. Technical Progress Report. Retrieved from <https://eric.ed.gov/?id=ED024737>.
- Opfer, D., & Pedder, V. D. (2011). Conceptualizing teacher professional learning. *Review of Educational Research*, 81(3), 376–407.
- Paavola, Sami, Lipponen, Lasse, & Hakkarainen, Kai (2004). Modeling innovative knowledge communities: A knowledge-creation approach to learning. *Review of Educational Research*, 74, 557–576.
- Pratt, S. (2014). Achieving symbiosis: Working through challenges found in co-teaching to achieve effective co-teaching relationships. *Teaching and Teacher Education*, 41, 1–12.
- Richard, B., & Treichel, C. J. (2013). Increasing secondary teachers' capacity to integrate the arts. *The Clearing House*, 86, 224–228.
- Riikonen, S., Seitamaa-Hakkarainen, P., & Hakkarainen, K. (2018). Bringing Practices of Co-Design and Making to Basic Education. In J. Kay, & R. Luckin (Eds.), *I. Rethinking learning in the digital age: Making the learning sciences count. Proceedings of the 13th international conference of the learning sciences* (pp. 248–255). London: ICLS.
- Rytivaara, A., & Kershner, R. (2012). Co-teaching as a context for teachers' professional learning and joint knowledge construction. *Teaching and Teacher Education*, 28, 999–1008.
- Rytivaara, A., Pulkkinen, J., & Bruin, C. L. de (2019). Committing, engaging and negotiating: Teachers' stories about creating shared spaces for co-teaching. *Teaching and Teacher Education*, 83, 225–235.
- Saavedra, A. R., & Opfer, V. D. (2012). *Teaching and learning 21st century skills. Paper presented at the joint AARE/APERA conference, sydney, 2012*. Retrieved from <https://www.semanticscholar.org/paper/Teaching-and-Learning-21st-Century-Skills-Saavedra-Opfer/5b8e7217fc64c9ad2da265c8e53917af273adc2a>.
- Sawyer, R. K. (Ed.). (2011). *Structure and improvisation in creative teaching*. Cambridge: Cambridge University Press.
- Scardamalia, M., Bransford, J., Kozma, R., & Quellmalz, E. (2011). New assessments and environments for knowledge building. In P. Griffin, B. McGaw, & E. Care (Eds.), *Assessment and teaching of 21st century skills* (pp. 231–300). New York, NY: Springer.
- Scruggs, T., Mastropieri, M. A., & McDuffie, K. A. (2007). Co-teaching in inclusive classrooms: A metasynthesis of qualitative research. *Exceptional Children*, 73(4), 392–416.
- Seitamaa-Hakkarainen, P., Viilo, M., & Hakkarainen, K. (2010). Learning by collaborative designing: Technology-enhanced knowledge practices. *International Journal of Technology and Design Education*, 20(2), 109–136.
- Stefanidis, A., King-Sears, M. E., & Brawand, A. (2019). Benefits for coteachers of students with disabilities: Do contextual factors matter? *Psychology in the Schools*, 56(4), 539–553.
- Strogilos, V., Stefanidis, A., & Tragoula, E. (2016). Co-teachers' attitudes towards planning and instructional activities for students with disabilities. *European Journal of Special Needs Education*, 31(3), 344–359.
- Syh-Jong, J. (2008). Innovations in science teacher education: Effects of integrating technology and team-teaching strategies. *Computers & Education*, 51, 646–659.
- Takala, M., & Uusitalo-Malmivaara, L. (2012). A one-year study of the development of co-teaching in four Finnish schools. *European Journal of Special Needs Education*, 27(3), 373–390.
- Tannock, M. T. (2009). Tangible and intangible elements of collaborative teaching.

- Intervention in School and Clinic*, 44(3), 173–178.
- Toft, P. (1990). The craft, design and technology support through change project. *International Journal of Technology and Design Education*, 1(2), 74–98.
- UNESCO. (1994). The Salamanca statement and framework for action on special needs education. In *World conference on special needs education. Salamanca, Spain 7-10. June*. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000098427>.
- Viilo, M., Seitamaa-Hakkarainen, P., & Hakkarainen, K. (2018). Long-Term Teacher Orchestration of Technology-mediated Collaborative Inquiry. *Scandinavian Journal of Educational Review*, 62(3), 407–431.
- Walther-Thomas, C., Bryant, M., & Land, S. (1996). Planning for effective Co-teaching: The key to successful inclusion. *Remedial and Special Education*, 17(4), 255–264.
- Zhang, J., Scardamalia, M., Reeve, R., & Messina, R. (2009). Designs for collective cognitive responsibility in knowledge-building communities. *The Journal of the Learning Sciences*, 18(1), 7–44.
- Zhang, Y., & Wildermuth, B. M. (2009). Qualitative analysis of content. In B. Wildermuth (Ed.), *Applications of social research methods to questions in information and library science* (pp. 308–319). Westport, CT: Libraries Unlimited.