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Improving interprofessional collaboration in schools: A cluster-randomized study evaluating the effectiveness of the LOG model on collaboration practices

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ABSTRACT

Although interprofessional collaboration is emphasized as important in schools, little is known about how it should be organized. We analyzed the effects of an organizational model of interprofessional collaboration, the LOG model. The model aims to improve interprofessional collaboration by identifying and improving various meeting places for collaboration, involving municipal school leaders, principals, staff, and interprofessional collaborators, and by increasing feedback from meeting places in and around schools. In a cluster-randomized design including 35 Norwegian primary schools, 19 schools were randomized to the experimental group and implemented the LOG model, and 16 were randomized to a control group. A total of 142 interprofessional collaborators (e.g., school nurses, social workers, and principals) received a questionnaire prior to randomization, with one- and two-year follow-up. Using a validated scale to measure interprofessional team collaboration, we evaluated the effects of the model on collaborators' perceptions in four dimensions: (a) Reflection on process, (b) Professional flexibility, (c) Newly created professional activities, and (d) Role interdependence. During the first, but not the second year of follow-up, the results demonstrated positive and statistically significant effects of the LOG model on the dimensions Reflection on process ($p < .001$) and Newly created professional activities ($p = .016$). Our findings demonstrate the potential of interventions addressing interprofessional collaboration at the organizational level.

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Interprofessional; school; collaboration; cluster-randomized; intervention

Introduction

Interprofessional collaboration is defined as two or more professionals from different educational and professional backgrounds working together to ensure the best possible support and services for students (Dale et al., 2021). The different professionals complement each other's areas of expertise, and thereby support schools in their interventions for students, enabling teachers to concentrate on their core task of teaching. Traditionally, teachers have dominated the school setting, but now multiple interprofessional collaborators are involved, such as professionals from the health and social fields (Green & Johnson, 2015). An important goal of interprofessional collaboration in schools is to achieve inclusive education, where schools aim to include and teach all students in the same classroom. Inclusive education contributes to reducing the number of students in need of special education (Dahl, 2016). In Norway, the white paper on 'Early intervention and inclusive education in kindergartens, schools and out-of-school-hours care' (Kunnskapsdepartementet, 2019) advocated for improved interprofessional collaboration through better organization, strengthened regulations, and clarification of roles and responsibilities among professionals in and around the school.

Although, there is a common understanding that interprofessional collaboration is important in schools, the question of *how* interprofessional collaboration is to be conducted remains

unanswered (Griffiths et al., 2021; Hynek et al., 2020). Some models of interprofessional collaboration in schools have been developed, such as models to improve collaboration between school nurses and school counselors (Tuttle et al., 2018), but their effectiveness has rarely been evaluated (Hillier et al., 2010; Mellin et al., 2010). Furthermore, the research has mainly focused on collaboration between the school and *one* interprofessional collaborator (e.g., a school nurse or a social worker) but few researchers have focused on the effectiveness of models for interprofessional collaboration involving several professionals in and around the school (Allen-Meares et al., 2013; Borg & Drange, 2019). As part of a development and research project conducted from 2017 to 2020 financed by the Norwegian Directorate for Education and Training, a model for interprofessional collaboration, the LOG model (Norwegian acronym for leadership, organization, and implementation), has been developed and evaluated. This study analyzes the effectiveness of the LOG model on interprofessional team collaboration.

Research on interprofessional collaboration in schools

Interprofessional collaboration in schools is seen as beneficial for the health and well-being of students and, more generally, as a precondition for inclusive education (Reuterswärd &

Hylander, 2017). Interprofessional collaboration can, however, be demanding, and researchers have identified several factors in schools that can hamper the process, such as insufficient communication and unclear roles, organizational issues such as judicial obstacles, as well as insufficient time and resources for collaboration (Montero et al., 2016; Widmark et al., 2011). Ekornes (2015) identified a lack of contextual competence among collaborators, weak leadership at school, and teachers' insufficient knowledge of students' mental health challenges as additional factors hampering interprofessional collaboration. Contradictory agendas and goals between collaborators have also been pinpointed as challenges for interprofessional practices (Freeth, 2001).

In addition to contextual constraints, there is a lack of clarity about how interprofessional collaboration should be conducted. At a policy level, analyses of Norwegian policy documents by Hesjedal et al. (2015) demonstrated that green papers, white papers, and legislation all have failed to provide clear recommendations on how interprofessional collaboration should be conducted in schools. Consequently, schools may have difficulty committing to the goals of interprofessional practices. Based on their analyses of policy documents, Hesjedal et al. (2015) argued that unclear recommendations may hamper schools' and teachers' implementation of interprofessional collaboration.

Several researchers have reported that interprofessional collaboration is challenging in practice. For example, Mælan et al. (2020) showed that there are challenges related to interprofessional collaboration in schools, such as a lack of integrated practices between teachers and collaborating services. In their study, even with comprehensive organizational support from leaders, different cultural values and roles emerged between various professionals. The lack of communication between collaborators resulted in parallel processes for student support, rather than collaboration and integration. Furthermore, interprofessional meetings were more often used to discuss how collaborative practices ought to support the students, than how the teachers could support the students. Similarly, Hansen et al. (2020) stated that there are sub practices in a school setting, and that teachers and other professionals seem to be eager to protect their own practices, which further hampers interprofessional collaboration.

In a qualitative study Reuterswård and Hylander (2017) demonstrated similar challenges, in that school nurses reported a lack of clarity related to their tasks and roles within interprofessional school teams. The nurses experienced a discrepancy between their contribution to the teams, and what they perceived was expected of them by other members of the team. Other researchers have reported variability in the quantity and quality of interprofessional collaboration and have argued that it is difficult to achieve optimal collaboration in schools; concluding, however, that support from principals seems to be important for successful outcomes (Stone & Charles, 2018; Wiedebusch et al., 2020). Hjörne and Säljö (2014) reported that interprofessional collaborators did not acknowledge teachers' perspectives. Rather, children's problems were individualized, and were not contextualized within pedagogical practices, teachers' activities, or practices in the classroom. Further, these authors reported that discussions

within interprofessional teams were not very beneficial, as the person who presented the case also often suggested a solution. Hence, the need for this type of discussion between interprofessional collaborators was limited as they displayed a high degree of consensus and few suggestions for alternative actions (Hjörne & Säljö, 2014).

To deal with the various challenges related to interprofessional collaboration, some scholars, such as Tuttle et al. (2018), Baker et al. (2017), and Bronstein (2003), developed practice models to improve interprofessional collaboration. According to the systematic review by Hillier et al. (2010), the models for interprofessional collaboration, though often well described, have rarely been systematically evaluated, emphasizing a need to develop and efficiently evaluate collaborative models in schools.

Aim of the study and hypothesis

The aim of the study was to assess the effectiveness of the LOG model on perceptions of interprofessional team collaboration in schools. Our aim was to assess the model's effect on interprofessional collaborators' assessments of a) Reflection on process, b) Professional flexibility, c) Newly created professional activities, and d) Role interdependence. The hypothesis was that interprofessional collaborators in schools randomized to the experimental group that implemented the LOG model would demonstrate a higher level of interprofessional team collaboration in all dimensions of the scale, compared to their counterparts from schools randomized to the control group.

Methods

Research design

Thirty-five Norwegian primary schools participated in this cluster-randomized study. Of the participating schools, 19 were randomized to the experimental group and 16 to the control group. Schools randomized to the experimental group implemented the LOG model; schools randomized to the control group continued working on interprofessional collaboration as previously, including collaborative efforts with individual students but without an organizational model for collaboration. The participants filled out a baseline (T1) questionnaire in 2017 prior to randomization of the schools, with follow-up conducted one year (2018) and two years (2019) after the baseline questionnaire.

The Norwegian Center for Research Data granted ethical permission for the study (case No. 54470). Participation was voluntary; all interprofessional collaborators were informed about the research and invited to participate. They were able to withdraw from the study at any time and for any reason. The researchers are subject to professional confidentiality, and all data are stored on a secure server. The research design and the LOG model have been thoroughly described elsewhere in the study protocol (Saltkjel et al., 2018), and the study was preregistered in Clinicaltrials.org (identifier: NCT03248245). According to the trial registry, the primary outcomes of the LOG model are to increase interprofessional collaboration in

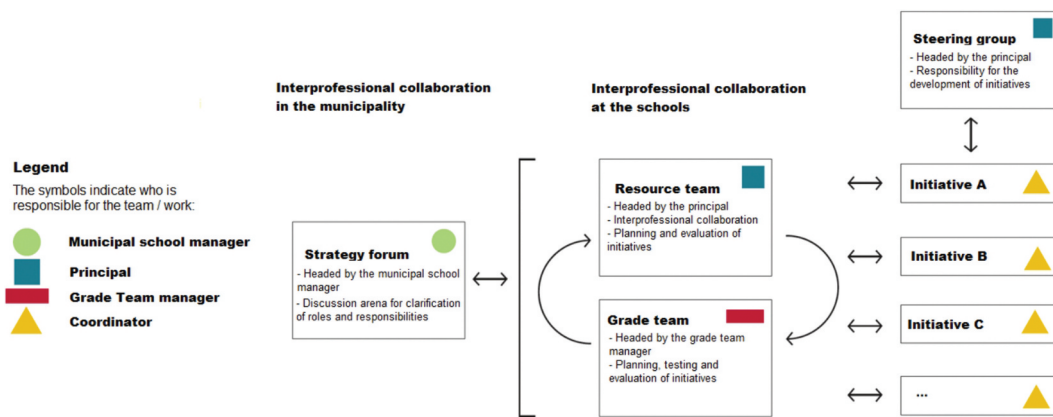


Figure 1. Meeting places in the LOG model, with communication and feedback loops at both the municipal and school levels.

schools and the municipality and to improve the interprofessional collaboration. The secondary outcomes are teacher self-efficacy and student learning outcomes and environments.

Population and participants

The population in this study were all interprofessional collaborators employed in the four municipalities and affiliated to the 35 participating schools. In 2017, the population was 142 interprofessional collaborators. Of the 108 collaborators who responded in 2017, 82 (76%) were women and 26 (24%) were men; 25 (23%) were school nurses, and 32 (30%) were principals. The remainder had various social and health-related positions, such as positions in child welfare or pedagogical-psychological support services. The interprofessional collaborators had varying educational levels: 71 (66%) had a master's degree or higher, 37 (34%) had a bachelor's degree or lower. The mean age of the interprofessional collaborators was 48, the youngest was 29 and the oldest was 66 years old. The interprofessional collaborators consisted of both school-internal and external collaborative actors. External collaborative actors included employees at the Educational Psychological Counseling Services, and actors from the Child Welfare Services and Child and Adolescent Psychiatry Services, as well as employees of various Public Health Services (e.g., school nurses, psychologists, physiotherapists, and occupational therapists). The internal collaborative actors included employees at the school, such as principals and inspectors.

Intervention

The LOG model was developed in collaboration among researchers, municipal school leaders, and principals from four municipalities. The aim of the model is to facilitate interprofessional collaboration in schools (e.g., collaboration between school nurses and teachers) and among interprofessional collaborators across organizations (e.g., collaboration between child welfare services, schools, and health-care providers), with a special focus on grade 5–7 students and their teachers. Central goals are to achieve a better use of pedagogical, health, and social resources in and around the school, enabling inclusive education and improved learning

environments for students, especially those with special needs (Saltkjel et al., 2018). We have previously analyzed the effects of the LOG model on teachers' perceptions of interprofessional collaboration. In a one-year follow-up, there were no significant effects on teachers' perceptions of interprofessional collaboration (Hynek et al., 2020).

The idea behind the model is that municipal school leaders and principals have a central role in facilitating interprofessional collaboration, however, they lack the tools and competencies required to include staff in development work. Another important idea behind the model is that several meeting places already exist for interprofessional collaboration in and around the school, but they are not used efficiently (Borg et al., 2015). Therefore, the LOG model entails new and more efficient use of the various meeting places at schools and in the municipalities. The meeting places included in the model are a steering group, a resource team, and a grade team at the school level, and a strategy forum at the municipal level. See, Figure 1 for the various meeting places. As leaders' involvement in development work is central, municipal school leaders and principals are responsible for carrying out the implementation of the LOG model.

The model emphasizes increased communication using feedback loops between the various meeting places and where key persons, such as grade team leaders, participate across meeting places. The various meeting places in the model also serve as a place to discuss development initiatives that are meant to improve students' learning environments. These development initiatives ought to be concrete and involve elements of interprofessional collaboration but can vary in nature depending on the needs of each individual school. An example of a development initiative that was implemented within the LOG model in one of the schools was weekly drop-in sessions where teachers or parents had the opportunity to consult interprofessional collaborators if they needed to (Malmberg-Heimonen et al., 2020).

A central aim of the model is further to include interprofessional collaborators in the schools' activities. To improve communication between staff and collaborators, the LOG model includes annual dialogue conferences at the schools and in the municipality. At these conferences, municipal school leaders, principals, and the various professionals in the municipality, as

well as teachers and other staff at the schools, identify and discuss challenges related to interprofessional collaboration. Municipal school leaders, principals, and leaders and professionals of various municipal agencies, such as Child Welfare Services, Public Health Services, and Educational Psychological Counseling Services. The implementation of the LOG model was supported by a manual and a team of trainers. More detailed information regarding the tasks and responsibilities of each meeting place can be found in the study protocol (Saltkjel et al., 2018).

Randomization

The randomization of schools to experimental and control groups was conducted October 6, 2017, using Stata version 14.2 (StataCorp, College Station, TX, USA) in a procedure tested and conducted by persons external to the study. Within the municipalities, half of the schools were randomized to the experimental group and half to the control group. If, however, municipalities had an odd number of schools, the additional school was randomized to the experimental group. Of 35 participating schools, 19 were randomized to the experimental group and 16 to the control group.

Data collected

The data collection was administered through online questionnaires to interprofessional collaborators and principals at baseline (T1), in the fall of 2017, prior to the randomization of schools, and with subsequent follow-up in the fall of 2018 and again in 2019, which was 12 and 24 months after the baseline questionnaire. Each interprofessional collaborator working in one or more of the 35 participating schools filled out the questionnaire at baseline in 2017, T2 (+12 months) in 2018, and T3 (+24 months) in 2019. The questionnaires included background information and assessments of interprofessional collaboration. We asked collaborators for some general information about how long they had worked in collaborative teams and their experience of it. The majority of these collaborators responded each year, but some staff turnover meant that a certain number of new collaborators were recruited to the study each year.

Measures

To study interprofessional team collaboration, we used the Index of Interprofessional Team Collaboration for Expanded School Mental Health (IITC-ESMH) scale developed by Mellin et al. (2010). The scale measures learning support and mental health strategies in schools from an interprofessional perspective, and consequently it is also relevant for the goals of the LOG model. We evaluated the IITC-ESMH scale as suitable for evaluating the effectiveness of the LOG model on interprofessional team collaboration. Table 1 shows how the four dimensions of the scale and the LOG model correspond.

In our analyzes we use the four-factor model of the scale to assess (1) Reflection on process; (2) Professional flexibility; (3) Newly created professional activities; and (4) Role interdependence. The response options were 1 = *never* to 5 = *always*. We used the Norwegian translation of the scale, by Borg and Pålshaugen (2019). Although there are some discrepancies between Mellin et al. (2010) and the Norwegian translation, we consider the original and the translation satisfactorily comparable. The discrepancies are that the dimension of 'Role Interdependence' has four items in the original scale, whereas it has two items in the Norwegian translation by Borg and Pålshaugen (2019). Also, the original scale uses 'youth' in the various items, the Norwegian translation uses 'students.'

Prior to randomization of the schools, collaborators filled out the baseline (T1) questionnaire. Table 2 presents the number of items in each dimension of the IITC-ESMH scale and their Cronbach alphas. At baseline (T1), Cronbach's alpha for the various dimensions was .778 for Reflection on process, .889 for Professional flexibility, .705 for Newly created professional activities, and .259 for Role interdependence. The low level for Role interdependence derives from that the dimension only has two items.

Sample size

Prior to the onset of the study, we conducted power calculations based on student outcomes, to estimate the number of schools we needed to recruit. The power calculations were conducted according to Donner et al. (1981), using the sample size calculator for cluster-randomized studies provided by the University of Aberdeen (1999), applying a conventional .05 significance level and 80% statistical power. For a sample of 3,965 students, power calculations suggested that the smallest

Table 1. Dimensions of the IITC-ESMH scale and elements of the LOG model.

Dimensions of the IITC-ESMH scale	The aims and key elements of the LOG model
<i>Reflection on process</i> measures the frequency of team reflection, evaluation of working relationships and incorporate feedback about process to support ongoing collaboration.	The LOG model emphasizes ongoing feedback between arenas and professionals to facilitate collaboration.
<i>Professional flexibility</i> measures how flexible teams function in relation to blurring roles and responsibilities, including behavior that support flexibility through communication, mutual respect and utilization of knowledge and skills from different professions as key features for well-functioning interprofessional teams.	The LOG model facilitates communication between collaborators and school staff, for a common understanding of how students best can be supported at school.
<i>Newly created professional activities</i> measures the extent of innovation associated with merging of multiple professional perspectives, that is new professional practices.	Through the development initiatives the LOG model facilitates innovation and new professional practices.
<i>Role Interdependence</i> measures the extent to which team members rely on interactions with other professionals.	The LOG model help to improve interaction between collaborators and clarify how the various collaborators best can use their competence to help students.

Table 2. Number of items in scales, and Cronbach’s alpha at baseline (T1).

Dimensions	Number of items in the scale	Cronbach’s alpha
Reflection on process	8	.778
Professional flexibility	9	.889
Newly created professional activities	5	.705
Role interdependence	2	.259

identifiable effect size was .182, when ICC was .03 (Saltkjel et al., 2018).

Analyses plan

We analyzed the effect of the random treatment, the LOG model, on the four dimensions of the IITC-ESMH, one and two years after implementation. To acknowledge the cluster-randomized structure of the data, we applied two-level linear models with observations nested within schools. The inter-professional collaborators were engaged in several schools and did not necessarily respond for the same schools in 2018 and 2019 as they did at baseline, implying that the number of observations in the two-level models are limited when we control for baseline. Hence, we ran all models both with and without controlling for baseline. Professionals providing services to the same school are not expected to be independent. In this

study we report the intraclass correlation (ICC), which is the proportion of variance in the outcome that lies between schools (Donner et al., 1981), and vital in estimating sample sizes for future cluster randomized trials (Kul et al., 2014). All analyses were conducted using the software Stata/SE 16.1 (xtmixed and estat ICC post-estimation commands); the syntax is available upon request.

Results

Participant flow and baseline data

In each of the four participating municipalities, municipal school leaders identified interprofessional collaborators. In 2017, municipal school leaders identified 143 collaborators in the four municipalities, in 2018 they identified 153 collaborators, and in 2019 municipal school leaders identified 147 collaborators. Of the identified collaborators, the response rates were 74% in 2017, 83% in 2018, and 60% in 2019. See, Figure 2 for a flow chart of the study, including all data collected; however, the present report is limited to the data on inter-professional collaborators.

It is important to note that some collaborators worked in more than one school, as it is common for external collaborators to be employed at several schools at a time. At all three data collection points, we asked collaborators to evaluate their

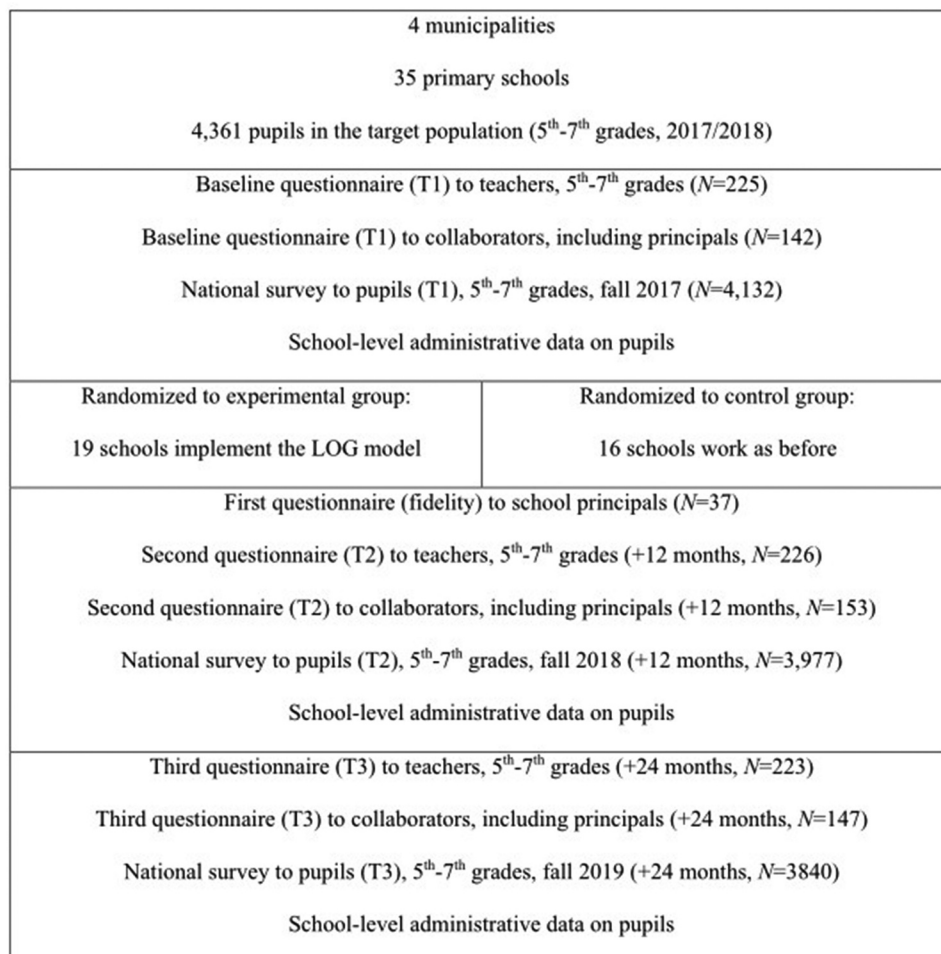


Figure 2. Flow chart of the study.

Table 3. Number of schools assessed by each collaborator. Percentages in brackets.

Number of schools assessed by collaborators:	2017 (T1)	2018 (T2)	2019 (T3)
0 schools (%)	7 (6.5)	22 (17.5)	7 (7.9)
1 school (%)	80 (74.1)	88 (70.0)	74 (83.1)
2 schools (%)	14 (13.0)	13 (10.3)	5 (5.6)
3 or more schools (%)	7 (6.5)	3 (2.4)	3 (3.4)
Total (%)	108 (100)	126 (100)	89 (100)

practices in three or more schools they worked in. Table 3 shows an overview of collaborators' responses each year and the number of schools they evaluated. As shown, most of the interprofessional collaborators assessed their collaboration at one school, only a few included more than one school in their assessments. There were also some collaborators who did not assess any school. A common reason for this was that these collaborators had leadership tasks at the assessed time point and were not involved in collaboration with participating schools.

Table 4 shows baseline measurements on the four dimensions of the IITC-ESMH scale. It is important to note that there were no differences between the experimental and control groups regarding any dimensions. Generally, the dimension of Professional flexibility received fairly high evaluations at baseline, whereas Newly created professional activities and Reflection on process received lower evaluations.

Effects of the LOG model on interprofessional team collaboration

Table 5 shows the LOG model effects on the four dimensions of the IITC-ESMH in 2018 and 2019, with control for baseline (T1) assessments. The results show a significant LOG model effect on Reflection on process and Newly created professional activities, with medium ESs in 2018 and small ESs in 2019.

Further, the results in Table 5 indicate a LOG model effect on Role interdependence in both 2018 and 2019. Although, the results on Role Interdependence are not statistically significant, the ESs were small in 2018 and medium in 2019. When we do the same analyzes without control for the baseline (T1) assessments, these results (not shown) reveal a significant effect of the LOG model on Reflection on process ($ES = 0.54$) and Newly created professional activities ($ES = .49$) in 2018, with medium ESs. Without control for baseline (T1), there were no significant effects of the LOG model on the other two measures. ESs are somewhat larger when controlling for baseline (T1) values, that is a comparison restricted to collaborators reviewing the same schools at baseline and follow-up. The ICC values are low in 2019, indicating that a very small proportion of the variance in the outcomes lies between schools.

Discussion

The main finding of this study is that in the one-year follow-up, the results showed positive and significant effects on two out of the four dimensions of interprofessional team collaboration. Moreover, the effect on Role interdependence at the two-year follow-up was positive, although not statistically significant, giving a medium ES in 2019 and when controlling for baseline measurements. As such, our hypothesis of positive LOG model effects on interprofessional team collaboration was partially supported. Improving interprofessional collaboration in and around the school is important to achieve goals of inclusive education, also for the benefit of students with special needs.

Reflection on process is a dimension that relates to how often a team evaluates its collaboration and how often it incorporates feedback to strengthen the collaborative processes. Both Hansen et al. (2020) and Mælan et al. (2020) demonstrated that feedback and reflection are important for the overall functioning and success of collaboration, whereas poor communication between team members is detrimental to

Table 4. Baseline (T1) measurements on the four dimensions of the IITC-ESMH scale for collaborators from experimental and control groups.

Dimensions	Experimental group		Control group	
	Mean (95% CI)	N	Mean (95% CI)	N
Reflection on process	3.00 (2.88–3.13)	73	2.95 (2.81–3.09)	57
Professional flexibility	3.99 (3.86–4.11)	74	4.01 (3.88–4.14)	57
Newly created professional activities	2.95 (2.82–3.07)	73	3.04 (2.91–3.17)	57
Role interdependence	3.44 (3.31–3.58)	72	3.33 (3.14–3.53)	57

Note: All dimensions have been standardized to correspond to the response options 1 = never to 5 = always. CI = confidence interval. N = Number of interprofessional collaborators in analyzes.

Table 5. Two-level regression models (individuals nested within 35 schools) estimating effects of the LOG model, with control for baseline.

Variable		Cohen's d (95% CI)	ICC	N	P- value
Reflection on process	2018	.61 (.28–.94)	.081	73	>.001
	2019	.33 (–.22–.88)	>.001	42	.244
Professional flexibility	2018	.18 (–.20–.57)	.198	73	.347
	2019	.16 (–.26–.59)	>.001	42	.455
Newly created professional activities	2018	.55 (0.10–0.99)	.116	73	.016
	2019	.30 (–.30–.90)	>.001	42	.328
Role interdependence	2018	.43 (–.05–.91)	.096	73	.076
	2019	.56 (–.07–1.19)	>.001	42	.080

CI = confidence interval; ICC = intraclass correlation coefficient. N = Number of interprofessional collaborators.

collaborative processes. Hence, the findings of this study indicate that the LOG model facilitates reflection and feedback by creating and improving existing meeting places that foster communication, discussion, reflection, and adjustments to the teams' own processes.

The dimension Newly created professional activities relate to innovation and changes in practices that may result from interprofessional collaboration. The positive effects on this dimension in the present study may not be surprising given that one of the main 'outputs' of the LOG model is the initiatives and new practices created through interprofessional collaboration. Other studies, such as the one by Borg and Pålshaugen (2019), also showed that the research and development project they evaluated promoted schools' innovative practices. More specifically, the study by Borg and Pålshaugen (2019) showed that dialogue conferences helped teachers and collaborative partners to define the challenges of interprofessional collaboration and develop practices to resolve these challenges. In the present study, the dialogue conferences at schools and municipalities were a central part of the LOG model; therefore, it is plausible that they contributed to the positive effects on the dimension of Newly created professional activities.

In accordance with the study by Griffiths et al. (2021) showing the importance of relationship building for interprofessional collaboration, the LOG model also includes relationship building as an essential element in supporting collaboration. Using qualitative data, we reported in a previous study that one of the key success factors of the LOG model was that it increased the legitimacy of the external collaborators at schools, and enabled them to gain acceptance as interprofessional collaborators within schools (Malmberg-Heimonen et al., 2020). This finding is important, as several studies such as those by Mælan et al. (2020) and Hansen et al. (2020) have shown that parallel practices and the lack of integration between school staff and interprofessional collaborators can be a major obstacle to successful collaboration.

There were no significant effects on Professional flexibility and Role interdependence. Furthermore, the effects on Reflection on process and Newly created professional activities were only short-term, thus showing that fidelity is a key aspect of program implementation. The schools implementing the LOG model identified turnover and sick leave among staff, competing projects, and lack of time and resources among staff and collaborators as obstacles to efficient implementation of the model (Malmberg-Heimonen et al., 2020).

Strengths and limitations

The strength of the study is the cluster-randomized design, enabling us to assess the effectiveness of the LOG model on interprofessional team collaboration, which gives new knowledge regarding intervention models that can improve interprofessional collaboration. However, several limitations need to be acknowledged when interpreting the findings. Firstly, some of the interprofessional collaborators evaluated several schools and some of them assessed schools in both the experimental and control groups; therefore, the results may be biased. Secondly, the interprofessional collaborators probably

knew which schools had been randomized to the experimental or control groups, which may have influenced their assessments of the interprofessional team collaboration in the schools. Thirdly, some of the elements of the LOG model were municipal-level elements, meaning that some of them may also have been implemented in schools randomized to the control group, thus reducing the contrast between experimental and control conditions. Fourthly, there was attrition from year to year due to staff turnover, but also due to a lower response rate in 2019; however, we have taken this into consideration in our analyses. Finally, we demonstrated some discrepancies between the Mellin et al. (2010) scale and the Norwegian translation used in this study. Although acknowledging these limitations, the findings of the study help us understand how interprofessional team collaboration can be developed in schools, a research area that is still underexplored (Mellin et al., 2010).

Conclusion

This study has shown that organizational models, such as the LOG model, can improve interprofessional team collaboration. The study demonstrates statistically significant effects of the LOG model, but only for the dimensions Reflection on process and Newly created professional activities. Furthermore, the results were only significant in the first year of follow-up; therefore, implementation fidelity needs to be emphasized throughout.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

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References

- Allen-Meares, P., Montgomery, K. L., & Kim, J. S. (2013). School-based social work interventions: A cross-national systematic review. *Journal of Social Work, 58*(3), 253–262. <https://doi.org/10.1093/sw/swt022>
- Baker, D., Anderson, L., & Johnson, J. (2017). Building student and family-centered care coordination through ongoing delivery system design: How school nurses can implement care coordination. *NASN School Nurse, 32*(1), 42–49. <https://doi.org/10.1177/1942602X16654171>
- Borg, E., Christensen, H., Fossetøl, K., & Pålshaugen, Ø. (2015). *Hva lærerne ikke kan! Et kunnskapsgrunnlag for satsning på bruk av flerfaglig kompetanse i skolen [A knowledge base for better use of interdisciplinary collaboration for teaching and learning]*. AFI-rapport, 6. <https://oda.oslomet.no/oda-xmlui/bitstream/handle/20.500.12199/6261/r2015-6.pdf?sequence=1&isAllowed=y>
- Borg, E., & Drange, I. (2019). Interprofessional collaboration in school: Effects on teaching and learning. *Improving Schools, 22*(3), 251–266. <https://doi.org/10.1177/1365480219864812>
- Borg, E., & Pålshaugen, Ø. (2019). Promoting students' mental health: A study of inter-professional team collaboration functioning in Norwegian schools. *School Mental Health, 11*(3), 476–488. <https://doi.org/10.1007/s12310-018-9289-9>
- Bronstein, L. R. (2003). A Model for interdisciplinary collaboration. *Social Work, 48*(3), 297–306. <https://doi.org/10.1093/sw/48.3.297>
- Dahl, T. (2016). *Om lærerrollen. Et kunnskapsgrunnlag [The teacher role: A basis of knowledge]*. Fagbokforlaget. <https://www.regjeringen.no/contentassets/17f6ce332c47437c8935d7ccc0a72769/rapport-om-laererrollen.pdf>
- Dale, B. A., Kruzliakova, N. A., McIntosh, C. E., & Kandiah, J. (2021). Interprofessional collaboration in school-based settings, Part 2: Team members and factors contributing to collaborative success. *NASN School Nurse, 36*(4), 211–216. <https://doi.org/10.1177/1942602X211000117>
- Donner, A., Birkett, N., & Buck, C. (1981). Randomization by cluster. Sample size requirements and analysis. *American Journal of Epidemiology, 114*(6), 906–914. <https://doi.org/10.1093/oxfordjournals.aje.a113261>
- Ekornes, S. (2015). Teacher perspectives on their role and the challenges of inter-professional collaboration in mental health promotion. *School Mental Health, 7*(3), 193–211. <https://doi.org/10.1007/s12310-015-9147-y>
- Freeth, D. (2001). Sustaining interprofessional collaboration. *Journal of Interprofessional Care, 15*(1), 37–46. <https://doi.org/10.1080/13561820020022864>
- Green, B. N., & Johnson, C. D. (2015). Interprofessional collaboration in research, education, and clinical practice: Working together for a better future. *Journal of Chiropractic Education, 29*(1), 1–10. <https://doi.org/10.7899/JCE-14-36>
- Griffiths, A.-J., Alsip, J., Hart, S. R., Round, R. L., & Brady, J. (2021). Together we can do so much: A systematic review and conceptual framework of collaboration in schools. *Canadian Journal of School Psychology, 36*(1), 59–85. <https://doi.org/10.1177/0829573520915368>
- Hansen, J. H., Carrington, S., Jensen, C. R., Molbæk, M., & Secher Schmidt, M. C. (2020). The collaborative practice of inclusion and exclusion. *Nordic Journal of Studies in Educational Policy, 6*(1), 47–57. <https://doi.org/10.1080/20020317.2020.1730112>
- Hesjedal, E., Hetland, H., Iversen, A. C., & Manger, T. (2015). Interprofessional collaboration as a means of including children at risk: An analysis of Norwegian educational policy documents. *International Journal of Inclusive Education, 19*(12), 1280–1293. <https://doi.org/10.1080/13603116.2015.1057241>
- Hillier, S. L., Civetta, L., & Pridham, L. (2010). A systematic review of collaborative models for health and education professionals working in school settings and implications for training. *Education for Health, 23*(3), 393. <https://pubmed.ncbi.nlm.nih.gov/21290358/>
- Hjørne, E., & Säljö, R. (2014). Analysing and preventing school failure: Exploring the role of multi-professionality in pupil health team meetings. *International Journal of Educational Research, 63*, 5–14. <https://doi.org/10.1016/j.ijer.2012.09.005>
- Hynek, K. A., Malmberg-Heimonen, I., & Tøge, A. G. (2020). Improving interprofessional collaboration in Norwegian primary schools: A cluster-randomized study evaluating effects of the LOG model on teachers' perceptions of interprofessional collaboration. *Journal of Interprofessional Care, 1–10*. <https://doi.org/10.1080/13561820.2019.1708281>
- Kul, S., Vanhaecht, K., & Panella, M. (2014). Intraclass correlation coefficients for cluster randomized trials in care pathways and usual care: Hospital treatment for heart failure. *BMC Health Services Review, 14*(48), 1–7. <https://doi.org/10.1186/1472-6963-14-84>
- Kunnskapsdepartementet. (2019). Tett på-tidlig innsats og inkluderende fellesskap i barnehage, skole og SFO [Early intervention and inclusive communities in child care, school and after school services]. *Meld. St, 6* (2019–2020). <https://www.regjeringen.no/no/dokumenter/meld.-st.-6-20192020/id2677025/?ch=1>
- Mælan, E. N., Tjomsland, H. E., Baklien, B., & Thurston, M. (2020). Helping teachers support pupils with mental health problems through inter-professional collaboration: A qualitative study of teachers and school principals. *Scandinavian Journal of Educational Research, 64*(3), 425–439. <https://doi.org/10.1080/00313831.2019.1570548>
- Malmberg-Heimonen, I., Tøge, A. G., Lyng, S. T., Borg, E., Pålshaugen, Ø., Bakkei, V., Wittrock, C., Christensen, H., Lund, T., Fossetøl, K., & Akhtar, S. (2020). *Et lag rundt eleven. En klynge-randomisert evaluering av LOG-modellen [The team around the student. A cluster-randomized study of the LOG model]*. OsloMet, AFI-rapport, 7.
- Mellin, E. A., Bronstein, L., Anderson-Butcher, D., Amorose, A. J., Ball, A., & Green, J. (2010). Measuring interprofessional team collaboration in expanded school mental health: Model refinement and scale development. *Journal of Interprofessional Care, 24*(5), 514–523. <https://doi.org/10.3109/13561821003624622>
- Montero, L. A., van Duijn, S., Zonneveld, N., Minkman, M., & Nies, H. (2016). *Integrated Social Services in Europe (978-0-9934556-2-9)*. <http://www.esn-eu.org/news/746/index.html>
- Reuterswård, M., & Hylander, I. (2017). Shared responsibility: School nurses' experience of collaborating in school-based interprofessional teams. *Scandinavian Journal of Caring Sciences, 31*(2), 253–262. <https://doi.org/10.1111/scs.12337>
- Saltkjel, T., Tøge, A. G., Malmberg-Heimonen, I., Borg, E., Lyng, S. T., Wittrock, C., Pålshaugen, Ø., Fossetøl, K., Christensen, H., & Lund, T. (2018). Research protocol: A cluster-randomised study evaluating the effects of a model for improving inter-professional collaboration in Norwegian primary schools. *International Journal of Educational Research, 91*, 41–48. <https://doi.org/10.1016/j.ijer.2018.07.001>
- Stone, S. I., & Charles, J. (2018). Conceptualizing the problems and possibilities of interprofessional collaboration in schools. *Children & Schools, 40*(3), 185–192. <https://doi.org/10.1093/cs/cdy011>
- Tuttle, M., Yordy, M., Appling, B., & Hanley, E. (2018). School counselor and school nurse collaboration: Partnering for K-12 student success. *Journal of School Counseling, 16*(4), 1–26.
- University of Aberdeen. (1999). Cluster sample size calculator. User manual. Retrieved from <https://www.abdn.ac.uk/hsrc/documents/calculationmanual.pdf>
- Widmark, C., Sandahl, C., Piuva, K., & Bergman, D. (2011). Barriers to collaboration between health care, social services and schools. *International Journal of Integrated Care, 11*(e124), 1–9. <https://doi.org/10.5334/ijic.653>
- Wiedebusch, S., Maykus, S., Gausmann, N., & Franek, M. (2020). Interprofessional collaboration and school support in inclusive primary schools in Germany. *European Journal of Special Needs Education, 7*(1), 118–130. <https://doi.org/10.1080/08856257.2020.1853971>