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Building coherence and impact: differences in Finnish school level curriculum making

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Abstract

The study aims to gain a better understanding on how curriculum making regulated by reform's implementation strategy contributes to teachers' and teacher communities perceived curriculum coherence, and further to the impact that reform has on school development. The two-level path modelling was utilised for analysing clustered data including the 75 schools and 1556 individual teachers from these schools during the most recent Finnish core curriculum reform. The results showed that the participatory strategy, including balancing the steering and transformative dialogue, seemed to be crucial both for promoting the individual teacher's and professional communities' shared capacity to process the big ideas of the new core curriculum document at the school level. Moreover, it promoted perceived curriculum coherence and further impact on school development. Participatory curriculum making strategy, balancing the steering and transformative dialogue in the curriculum making, seemed to be crucial both for supporting the individual teacher's and professional communities' in processing the ideas of the new core curriculum. Change management and knowledge sharing promoted perceived curriculum coherence and further reform's perceived impact on school development for both individual teacher and teacher communities.

Keywords Curriculum making · Change management · Knowledge sharing · Curriculum coherence

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Introduction

Engaging teachers as active agents and learners in curriculum making, both as individuals and teacher communities, is shown to contribute to pupils' learning outcomes, study well-being and their ability to meet the challenges of a complex school environment (Leana & Pil, 2006; Sellström & Bremberg, 2006; Silins et al., 2002). Furthermore, the ways in which the curriculum reform is carried out is likely to have impacts on how teachers and professional communities are able to use new curriculum as a resource for further professional learning and school development (Biesta & Tedder, 2007; Priestley, 2011). To have agency as curriculum makers, teachers need to experience curriculum as coherent and meaningful and consider it as having clear impacts on their daily work.

The implementation strategies of curriculum reform may enable teachers to strengthen, alter and create new functional pedagogical practices that allow and promote teacher learning (Coburn, 2005; Nordholm, 2016; Porter et al., 2015; Spillane, 2004). However, there is extensive evidence that teachers' meaningful involvement and teacher learning are

not always optimally facilitated in the implementation strategies of large-scale reforms; hence, the intended changes collapse due to lack of experienced ownership and curriculum coherence (e.g. Al-Daami & Wallace, 2007; Cheung & Wong, 2011). School level curriculum making that balances clear management and opportunities to build new understanding by sharing knowledge seem to contribute to more coherent understanding of the curriculum among teachers (e.g. Coburn, 2003; Honig & Hatch, 2004; Reezigt & Creemers, 2005; Spillane et al., 2002), which further increases the impact of the reform at schools when teachers are able to connect new ideas into their everyday pedagogical practices (Priestley et al., 2014; Spillane et al., 2002). Yet, our understanding of how differences in curriculum making contribute to perceived coherence and school impact of teacher communities, as well as individual teachers, is less than sufficient.

This study aims to gain a better understanding of curriculum making at the school level focusing on its relation to teachers' perceptions of curriculum coherence and reform impact on school development. Accordingly, two-level path modelling was utilised for analysing clustered data including the 75 schools and 1556 individual teachers from these schools. The data was collected during the recent Finnish core curriculum reform (Finnish National Agency for Education, 2014).

Importance of implementation strategy

The extent to which the new ideas and principles of a curriculum reform are adapted into the pedagogical practices of the classrooms is greatly dependent on the way the goals of the reform are transformed and interpreted at schools (Alvunger, 2015; Desimone, 2002; Fullan, 2007; Petko et al., 2015). It is suggested that in order for the reform to take a root, the curriculum making should employ a participatory implementation strategy; context-sensitive orchestration of meaningful learning promoting stakeholder participation and ownership (Pietarinen et al., 2017; Soini et al., 2021; Thoonen et al., 2012). Participatory strategy allows collective creation of new ideas, and hence provides opportunities for the teacher community to utilise teachers' understanding in building shared knowledge (Borko, 2004; Schechter, 2008). In return, teacher learning is enhanced by the shared knowledge-building that increases collective resources provided by the professional learning community. Hence, both group and individual learning are promoted (Stoll et al., 2006).

Previous research implies that participatory implementation strategy involves a balance between steering and dialogue (Boone, 2014; Pietarinen et al., 2017). While efficient change management provides sufficient frames and guiding for development work (e.g. Leithwood et al., 2002; Ng, 2009; Thoonen et al., 2012), processes of knowledge

sharing promote dialogue, negotiation and agency among teachers (Alkahtani, 2017; Guhn, 2009; Hargreaves, 2007). Especially in complex, large-scale educational reforms, such as core curriculum reform in Finland, school level change management is necessary since it points the direction and provides clear instruction, decreases confusion and unnecessary dwelling in the teacher community (Leithwood & Jantzi, 2006). At the same time, knowledge sharing is crucial, since it enables individual and joint meaning making and creating new knowledge from prior understanding, experiences, values and beliefs through dialogue and negotiation (Coburn, 2001, 2005; Evans, 2007; März & Kelchtermans, 2013; Spillane & Anderson, 2014; Weick et al., 2005).

Accordingly, providing opportunities for reflective professional inquiry among teachers who ultimately transform and implement the reform goals in their everyday work is central to sustainable curriculum making (Gawlik, 2015; Ramberg, 2014; Thoonen et al., 2012). There is tentative evidence from the Finnish context that such a strategy can promote a perceived curriculum coherence among the stakeholders within a large-scale curriculum reform (Pietarinen et al., 2017).

Curriculum coherence that fosters school impact

In most cases, school curriculum reforms aim at having meaningful impacts on a school's everyday life and especially on teachers' pedagogical practices. This requires that teachers perceive reform goals as comprehensible and relevant for school development. Previous studies have shown that the coherence of the reform's goals has a great influence on how the reform is understood by the teachers (see Coburn, 2004; Fullan, 2007; Könings et al., 2007; Leithwood et al., 2002; Ng, 2009; Russell & Bray, 2013). Accordingly, the more coherent the goals are, the more likely they enhance teachers' understandings of the curriculum, and through this promote school development and perceived curriculum coherence in practice (see Allen & Penuel, 2015; Newmann et al., 2001; Russell & Bray, 2013). Hence, achieving school level impact requires curriculum coherence, especially for those in charge of developing and implementing the curriculum at school (see Fullan, 2007; Honig & Hatch, 2004; Sahlberg, 2015). This requires individual and shared coherence making during the reform, involving teachers' and professional communities' constructing of the understanding of goals and meanings of the curriculum.

Teachers' prior knowledge and experiences with reforms shape how they understand and interpret (Coburn, 2004; Spillane et al., 2002), and hence embrace curriculum reform goals. The experiences also result in individual variation between the teachers both in the way they craft the coherence (Russell & Bray, 2013) and how they perceive it (Sullanmaa et al., 2019). In addition to individual differences,

the community influence how teachers interpret the curriculum and how they perceive it to fit with the reality and practices of their school (Cobb et al., 2003; Penuel et al., 2007).

Prior research has emphasised curriculum coherence in terms of connectedness, integration and continuity as a sustainable grounding for curriculum development (Beane, 1995; Geraedts et al., 2006). It has mainly focused on the alignment and sequencing of objectives or standards, content, instructional activities and assessment (e.g. Fortus et al., 2015; Schmidt et al., 2005). This implies that alignment characterised by continuity and connectivity within the curriculum is a crucial precondition for curriculum coherence that may reduce experienced fragmentation by teachers. Connectedness between the objectives, content, instruction and assessment (Squires, 2009) may enhance teachers' understanding of the curriculum, although thus far teachers' perceptions of curriculum alignment have been studied less. However, alignment alone is not sufficient to guarantee coherent perceptions of the curriculum. Teachers' perceptions of coherence are also dependent on the curriculum aims and the fit with the school level resources and goals (see Sullanmaa et al., 2019; Penuel et al., 2009).

Coherence also incorporates the quality of the aligned elements, including the extent to which the curriculum supports and clarifies the work of teachers and schools. Teachers also evaluate curriculum coherence regarding the intended direction of development, whether they perceive the intended changes and the new curriculum to be understandable and leading schools' and teachers' work in the right direction (Sullanmaa et al., 2019). This is especially important in the more decentralised school systems, such as in Finland, where the core curriculum provides the general aims and framework for autonomous local school development. Teachers' judgements of coherence include clarity of curriculum goals and the way in which they fit with the local conditions and teachers' beliefs and knowledge (Allen & Penuel, 2015; Penuel et al., 2009).

The curriculum's ability to support teachers in terms of developing their teaching, for example relevant content that allow more holistic and integrated teaching or teaching methods and assessment that supports learning, can be seen as yet another aspect of curriculum coherence. It entails harmonising teaching and encouraging teachers to use activating teaching methods and assessment that supports learning (Sullanmaa et al., 2019). As an element of curriculum coherence, an integrative approach to teaching and learning is related to a holistic approach to teaching, connecting and applying learning to a larger purpose (see Beane, 1995; Coburn, 2003; Geraedts et al., 2006). For example, facilitating active and engaging learning, which is a major goal in the Finnish core curriculum, requires new strategies and collaboration between teachers (Drake & Miller, 2001; Geraedts et al., 2006).

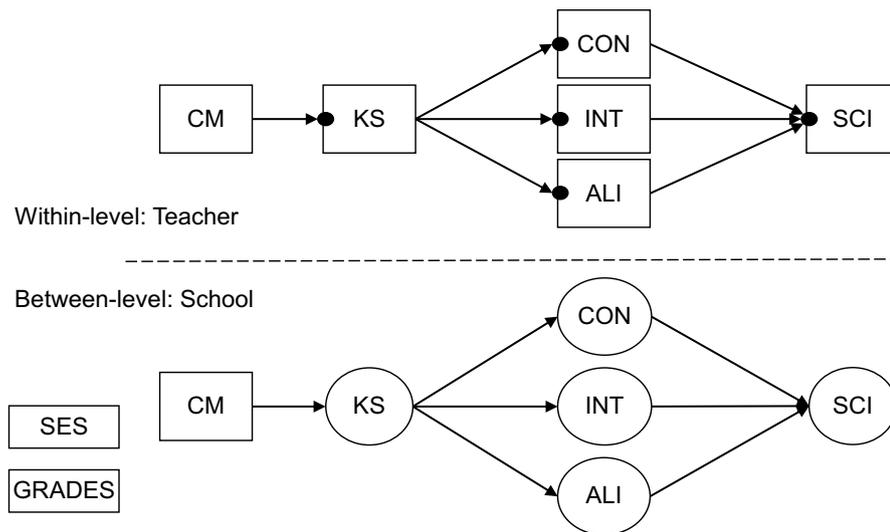
The perceived curriculum coherence in terms of the consistency of the intended direction, approach to teaching and learning and the alignment between the objectives, content and assessments is shown to be connected to the perceptions of a reform's potential impact on school development (Sullanmaa et al., 2019). Furthermore, coherent understanding of the curriculum and positive beliefs about the reform's impact on school development may facilitate more functional reform implementation (Allen & Penuel, 2015; März & Kelchtermans, 2013). Therefore, building curriculum coherence requires considering teachers' experiences of curriculum alignment but also beliefs about the purpose and goals of their work as well as functional pedagogical practices. All of these elements should be supported both individually and collectively in curriculum reforms.

The Finnish context

The core curriculum for basic education, including primary and lower secondary education (age 6 to 15) in Finland, is renewed approximately in every 10 years. The reform defines the objectives and core contents of each subject and the objectives for the learning environment, as well as principles for guidance, support, differentiation and assessment, providing the foundation for district and school level curriculum development work. In the latest curriculum reform, active involvement of pupils, joy of learning and interaction were in focus. There was a strong emphasis on integration and dialogue between subjects through multidisciplinary modules, as well as on developing school culture and school as a community (Finnish National Board of Education, 2014). Hundreds of stakeholders—for example, representatives from universities, schools and associations, such as the Finnish Parents' League—were invited by the Finnish National Agency for Education (at that time called the Finnish National Board of Education) to participate in the core curriculum reform working groups and seminars. There were also many opportunities for public comment. Therefore, Finnish curriculum reforms, particularly the latest reform process of core curriculum in basic education (2012–2016), could be described as participatory (Pietarinen et al., 2017; Sahlberg, 2010).

In Finland, coherence-building in curriculum making can be considered particularly important since the Finnish schools, teacher communities and individual teachers have extensive pedagogical autonomy to develop new pedagogical practices based on the goals, purpose, content, and assessment tools that are provided in the national core curriculum document (Kumpulainen & Lankinen, 2016; Vitikka et al., 2012). For example, the new core curriculum included principles, such as subject integration and the so-called transversal competencies, that have potentially major impacts on teachers' pedagogical practices. However, there was a lot of

Fig. 1 The hypothesised two-level path model of the individual teachers' and professional communities' capacity to regulate their school level curriculum process. SES and grades were tested as covariates of each latent variable at the school level



room for interpretation and varying ways of implementing the ideas in local curriculum and in schools and teachers have autonomy to form their final interpretations of the curriculum document and make creative pedagogical choices within the curricular framework (Pietarinen et al., 2017). The local coordinators of curriculum work, as well as teachers, find some of the goals of the new core curriculum to be challenging when aiming toward building coherence in teaching. For example, the emphasis on both strong subjects and transversal competences were experienced as demanding in terms of evaluation (Salonen-Hakomäki et al., 2016; Saarinen et al., 2021).

All Finnish comprehensive school teachers have a master's degree in either educational science or another subject, such as mathematics or biology, with compulsory additional studies in educational science. While lower grades are typically taught mainly by class teachers who have an MA in education, upper grades are often taught by subject teachers who have an MA in a major subject (e.g. math and physics). Consequently, moving from lower grades to upper grades, the teacher community becomes professionally more diverse in terms of teachers' educational backgrounds. The extent of multi-professionalism in the teacher community may impact teachers' capacity to orchestrate the curriculum process and construct shared knowledge and coherence in terms of the curriculum's big ideas (Lakkala & Thuneberg, 2018).

Also, the neighbourhood in which the school is located from a socio-economic status (SES) perspective may provide an indication of pupils' backgrounds, which may affect curriculum making, how teachers perceive curriculum coherence and hence the impact of the reform. Among low-SES neighbourhood schools, frequency of disciplinary problems among pupils is higher (Geving, 2007; Klusmann et al., 2008), school engagement and learning outcomes are shown to be lower, while the need for supportive practices is

higher than in high-SES neighbourhood schools (see review by Berkowitz et al., 2017; Kurdi et al., 2018; Lindfors et al., 2018). This might challenge curriculum making due to high teacher workload. This further implies that the teacher communities may vary in terms of curriculum making, perceived curriculum coherence and expectations of the reform's impact as a function of neighbourhood SES.

Aim of the study

This study aims to gain a better understanding of how school level curriculum making contributes to teachers' and teacher communities perceived curriculum coherence and further to schools' impacts. The interrelation between *change management* and *knowledge sharing*, perceived *coherence of written curriculum* and *school impact* was explored via multilevel path analysis. The invariance of the independent determinants and variation among the individual teachers and between the professional communities (i.e. schools) in terms of orchestrating the school level curriculum work was also examined. The following hypotheses were tested (see Fig. 1):

H1: Maintaining the balance between the steering and dialogue calls for participative leadership that emphasises extensive teacher participation throughout the curriculum work in the professional community. Accordingly, *change management* (CM) contributes positively to *knowledge sharing* (KS) both at the individual teacher (within-level) and the school level (between-level) (Coburn, 2003; Honig & Hatch, 2004; Newmann et al., 2001; Reezigt & Creemers, 2005; Spillane et al., 2002).

H2: The *knowledge sharing* (KS) that enables individual and joint meaning making and creating new knowledge from prior knowledge contribute positively to the perceived written curriculum coherence, including *the con-*

sistency of the intended direction (CON), *an integrative approach to teaching and learning* (INT) and *the alignment between the objectives, content and assessments* (ALI), both at the individual teacher (within-level) and the school level (between-level) (Beane, 1995; Geraedts et al., 2006; Fortus et al., 2015; Schmidt et al., 2005; Sullanmaa et al., 2019).

H3: The perceived *curriculum coherence* (CON, INT and ALI) contributes positively to perceived *school impact* (SCI), including the reform work's relevance and potential for school development, both at the individual teacher (within-level) and the school level (between-level) (Allen & Penuel, 2015; März & Kelchtermans, 2013).

H4: The academic level of the school, i.e. the grades that were taught in the school (GRADES), and the socio-economic status of the school district (SES) are related to change management, knowledge sharing, perceived curriculum coherence and perceived school impact. The more multi-professional the teacher community is, and the lower the school district's SES is, the more challenging the curriculum making becomes (between-level covariates) (Berkowitz et al., 2017; Lakkala & Thuneberg, 2018).

Methods

Research design and participants

In this study, the clustered nature of school communities (i.e. teachers nested within the school unit) was captured in the two-level research design. The clustered design was used in order to explore whether the professional communities (i.e. schools) differ from each other in terms of the adopted capacity to enable individual and joint meaning making and creating new knowledge, the perceived curriculum coherence and the school level impact in curriculum work.

The selection of the schools proceeded in three nested phases. Firstly, six school districts presenting variation in terms of geographical location (both urban/rural) and the network in which the curriculum reform work was carried out were selected for the sample (see also Pyhältö et al., 2018). Secondly, on the basis of the national SES indicator data from the Statistics Finland bureau (see also Statistics Finland, 2013), all schools in the districts ($N=303$) were profiled in terms of the SES of the living area. We formed a school's SES index based on six different socio-economic indicators: *the proportion of adults with a higher education degree, the proportion of adults with a pure basic education (i.e. only a compulsory comprehensive school was completed), the median income of the residents, the median income of the households, the unemployed–employed ratio and the unemployment percent* in the living area surrounding each school.

Thirdly, based on the combination of these six SES indicators, the general SES index was calculated for each school. Based on this, three-quarters of the schools (> 50 students) posited in the upper and lower quarters in terms of the SES index were included in the final sample ($n=122$). On the basis of district- and city-level permissions, those schools in the area were contacted and invited to participate in the study. Accordingly, 101 out of 122 schools responded to the initial invitation. All in all, 75 out of 122 schools accepted the invitation and participated in the study (i.e. school level response rate was 61%). The schools in the sample represented the demographic variation of the schools in Finland and the study sample comprised 1556 in-service teachers nested in these 75 schools (school's academic level: 49 primary, 9 lower secondary and 17 combined primary and lower secondary schools). Average size of the teacher community was 20.7 teachers per school (range 3–58 teachers).

The data were collected during the field work by the researchers in autumn 2016. Teachers were informed about the study before data collection, and they were given a choice to opt out of the study or to fill in the survey anonymously. The response rates in schools varied between 50 and 100%, with an average of 81%. All respondents had master's degrees, and they were at various stages of their careers (working experience: mean 15.5 years, $SD=9.6$, range 0–46 years). A majority of the respondents were women ($n=1103$, 76%) and the minority men ($n=342$, 24%). The gender distribution corresponds to the Finnish national statistics of teachers in basic education: females 77% and males 23% (National Board of Education, 2017).

Measures

The data were collected with the *Curriculum Reform Inventory* developed by the research group (Pietarinen et al., 2017; Sullanmaa et al., 2019). The *top-down–bottom-up implementation strategy* scale (13 items) comprising *change management* (3 items, e.g., 'A clear division of work has been performed') and *knowledge sharing* (10 items, e.g., 'The feedback received has influenced the content of the curriculum') was designed to measure an interactive and dynamic process of collective sense-making through which individuals and schools (i.e. professional communities) construct the new knowledge and meaning of the curriculum reform (Sullanmaa et al., 2019).

The *curriculum coherence* scale (including 3 factors, 17 items) was designed to measure the perceived core curriculum coherence in terms of the core curriculum's goals, purpose, content and the development of teaching and learning at the individual and school levels (Pietarinen et al., 2017). The scale includes three dimensions (Sullanmaa et al., 2019): (1) the *consistency of the intended direction* (CON, 6 items, e.g., curriculum 'successfully sums up

the most important goals for the operation of the school') entails clarifying and supporting the roles and duties of the teacher and school, and successfully summing up the most important goals; (2) the *integrative approach to teaching and learning* (INT, 4 items, e.g., 'encourages teachers to use activating and engaging teaching methods') entailing pedagogical practices; (3) the *alignment between objectives, content and assessment* (ALI, 7 items, e.g., 'the goals are in line with the assessment criteria') comprising continuity within subjects, acknowledging pupils' age range, as well as the alignment between goals, subjects, content, teaching methods and assessment.

The *school impact* scale (SCI, 6 items) measures the perceived impact of the curriculum reform process, i.e. how the reform work was perceived to engage teachers in working on developing the school and to maintain active development work on the school level (e.g. item curriculum 'Commits teachers to working on developing the school') (Pietarinen et al., 2017; Sullanmaa et al., 2019). All items were rated on a 7-point Likert-type scale from 1 = *completely disagree* to 7 = *completely agree*. Revised and shortened versions of the previously published scales were used in this study (see Appendix Table 2 for scales and items).

Moreover, two school level variables were constructed on the basis of the background information of the schools. The *Grades* variable was formed for indicating the school type and academic level of the school, i.e. the grades that were taught in that school: 1 = primary school (grades 0/1–6; $n = 49$), 2 = lower secondary school (grades 7–9, $n = 9$), 3 = combined primary and lower secondary school ($n = 17$). Moreover, the school's *SES* variable that was calculated from the national statistics (Statistics Finland, 2013) was used for indicating the socio-economic status of the living area surrounding each school: 0 = low ($n = 36$), 1 = high ($n = 39$).

Statistical analysis

Due to the two-level research design and consequently nested structure of the data, the *intra-class correlation coefficient* (ICC) that describes the proportion of variance at the between-level (i.e. school level) was initially tested (see e.g. Snijders & Bosker, 2012, p. 17 ICC, p. 23 design effect). Along with ICC, the *design effect* (Deff) that approximates the effect of clustered design and between-group variance and is weighted with the average cluster size was further analysed.

Based on the ICC (range 5–14%) and design effect (range 2.0–3.7) statistics, multilevel SEM analysis was applied to account for the clustered structure of the data. Analyses were conducted using *IBM SPSS Statistics* software (version 25; missing values analyses) and *Mplus* (version 8.2; Muthén & Muthén, 1998–2017). SEM modelling with Mplus is based on the total sample covariance matrix. The statistical assumptions include multivariate normality and

homoscedasticity of variances of the between-level units. The data were fairly normally distributed with slight skewness (max. –0.43) and kurtosis (max. 0.65). Accordingly, the robust maximum likelihood (MLR) estimator that provides robust standard errors and chi-square statistics was used (Muthén & Muthén, 1998–2017).

Altogether, 1511 teachers had answered all the scales of the *Curriculum Reform Inventory* (97% of total sample size 1556). The proportion of missing values was small, 0.1–2.6% univariately. Little's MCAR test showed that the data are missing completely at random ($\chi^2(44) = 54.56$, $p = 0.13$). The incomplete data were handled with full-information maximum likelihood (FIML; default in Mplus).

Model evaluation

The hypothesised two-level path model (see Fig. 1) was initially estimated by testing the within-level covariance structures between the observed variables, and by forming random intercepts on the basis of the within-level observed variables and similar covariance structures at the between-level.¹ The between-level predictors CM, KS, CON, INT and ALI were grandmean centred.

The model fit was evaluated by several model fit indices and against the following criteria: a non-significant Chi-squared test value, CFI, TLI and NFI above 0.95, RMSEA below 0.05 and SRMR below 0.05 would indicate a good model fit (Bentler & Bonett, 1980; Hu & Bentler, 1999).

Results

The results showed that the balanced implication strategy has been adopted, to a significant extent, in school level curriculum making (see Table 1). Accordingly, teachers perceived that the *change management* was adequately realised (mean = 4.12). They also perceived that the *knowledge sharing* including enhancing participation and transformative dialogue was sufficiently enabled (mean = 3.98) in the curriculum making. However, the intra-class correlations ($n = 75$; $ICC^{(\min-\max)} = 0.11-0.14$; $Deff^{(\min-\max)} = 3.07-3.71$) indicated that the schools differed from each other in terms of their capacity to maintain the balance between the steering and dialogue in the curriculum work.

The results showed that there was statistically significant variation between the schools in the extent to which teachers experienced that curriculum making was carried out by utilising *change management* and *knowledge sharing*, including

¹ The need for including random slopes into the model was checked for each regression path individually but there was no significant between-school variation in the slopes. These analyses were conducted with R statistical software using the nlme package (version 3.1–137; Pinheiro, Bates, DebRoy, & Sarkar, & R Core Team, 2018).

Table 1 Descriptive statistics of the curriculum reform inventory scales, and correlations on within-school and between-school levels

Scale	<i>N</i>	1. CM	2. KS	3. CON	4. INT	5. ALI	6. SCI
1. Change management	1516		.747	.442	.380	.444	.477
2. Knowledge sharing	1523	.922		.500	.454	.501	.596
3. Consistency	1548	.379	.392		.622	.717	.637
4. Integration	1550	.451	.428	.731		.673	.615
5. Alignment	1554	.470	.440	.905	.871		.598
6. School impact	1546	.729	.711	.725	.754	.801	
No of items		3	10	6	4	7	6
Min–max		1.00–7.00	1.00–6.80	1.00–7.00	1.00–7.00	1.33–7.00	1.00–7.00
Mean		4.12	3.98	3.88	4.97	4.42	4.43
SD		1.23	1.04	1.00	0.89	0.81	0.98
Alpha		0.81	0.91	0.87	0.75	0.83	0.90
ICC		0.14	0.11	0.08	0.05	0.06	0.05
Design effect		3.71	3.07	2.49	2.06	2.14	2.04

Correlations at the within-level (individual teachers) are above diagonal, correlations at the between-level (schools) are under diagonal. *Alpha*, Cronbach's alpha coefficient for scale reliability; *ICC*, intra-class correlation coefficient. All the ICCs are significant at the $p < .01$ level

exercising participative leadership and promoting teacher participation (see Table 1). All the bivariate scale correlations among sub-scales were statistically significant in the expected directions both at the individual and school level.

As shown in Table 1, the shared and coherent understanding of the curriculum's goals and meaning of the renewed curriculum, i.e. *curriculum coherence*, was also partly achieved among teachers. The national core curriculum document was evaluated as more coherent in terms of contributing an integrative approach to teaching and learning (mean = 4.97) and the alignment between the objectives, content and assessments (mean = 4.42), than structuring the consistency of the intended direction in the new core curriculum era (mean = 3.88). Moreover, the intra-class correlations between the schools ($n = 75$; $ICC^{(min-max)} = 0.05-0.08$; $Deff^{(min-max)} = 2.06-2.49$) indicated that the perceived *curriculum coherence* varied mostly between the teachers, but also slightly between the professional communities.

Teachers also evaluated the *school impact*, including the relevance and potential of the curriculum reform work for school development, to be relatively high (mean = 4.43). Similarly, the intra-class correlation between the schools ($n = 75$; $ICC = 0.05$; $Deff = 2.04$) indicated that there were not major differences between the professional communities in terms of school impact (see Table 1). Overall, the results showed that the schools differed from each other most significantly in the curriculum making in terms of *change management* and *knowledge sharing*.

The two-level approach to the crucial determinants of the school level curriculum work

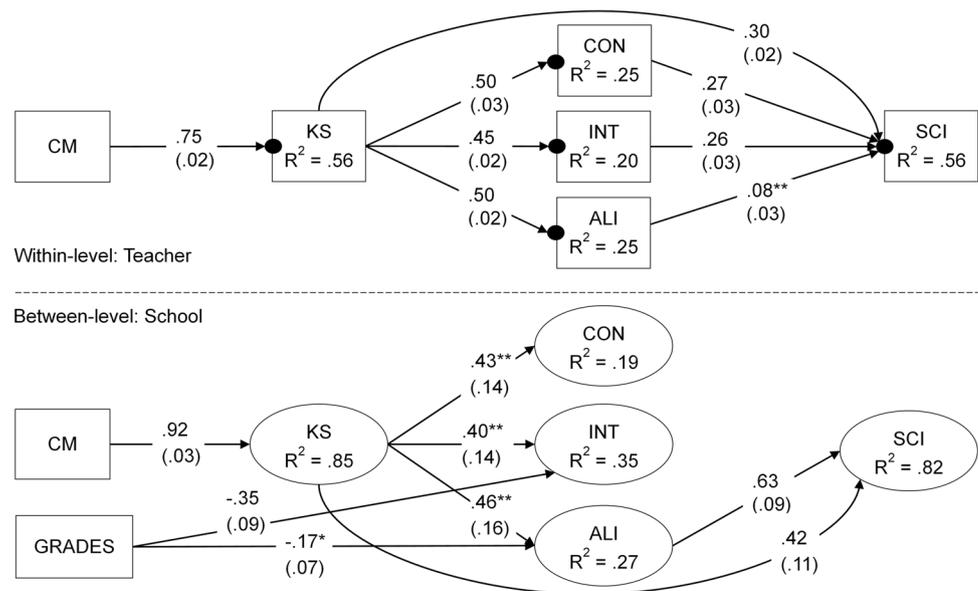
The final model fitted the data well: $\chi^2(13) = 32.21$, $p = 0.002$; $CFI = 0.996$; $TLI = .989$; $RMSEA = .031$; $SRMR_W = .025$;

$SRMR_B = .044$; $NFI = .99$ (see also Appendix 2). The statistically significant chi-squared value did not give support to the model fit. However, all other goodness of fit indices showed that the model fitted the data. The final sample size for the two-level path model was 1516. The results confirmed that the perceived *change management* contributed positively to the perceived *knowledge sharing* practices at the individual teacher level ($\hat{\beta}_W = .75$). However, a small amount of variance was better explained at the school level, and hence, the collectively perceived change management explained the knowledge sharing adopted in the professional communities ($\hat{\beta}_B = .92$). Accordingly, *change management* seemed to be crucial both for promoting the individual teacher's perceived ownership over curriculum reform and facilitating the shared capacity to process the big ideas of the curriculum in the professional community, i.e. *knowledge sharing* (H1).

The results also showed that even though a small amount of variance was better explained at the school level, the *knowledge sharing* practices contributed positively to the perceived written curriculum coherence of the national core curriculum (H2), comprising *the consistency of the intended direction* ($\hat{\beta}_W = .50$; $\hat{\beta}_B = .43$), *an integrative approach to teaching and learning* ($\hat{\beta}_W = 0.45$; $\hat{\beta}_B = .40$) and *the alignment between the objectives, content and assessments* ($\hat{\beta}_W = .50$; $\hat{\beta}_B = .46$), both at individual teacher and the school level.

Further investigation showed that not only the perceived curriculum coherence but also the curriculum making in term of *knowledge sharing*, contributed positively to the perceived *school impact* at both levels. The *knowledge sharing*, such as utilising the competence of various actors in an optimal manner in the professional community, also explained directly the perceived *school impact* of the curriculum work both at the school level ($\hat{\beta}_B = .42$) and at the level of the individual teacher ($\hat{\beta}_W = .30$). This was not assumed in the

Fig. 2 The two-level path model of the perceived school level curriculum process in the Finnish schools ($k=75$ schools; $n=1516$ teachers). The model fit: $\chi^2(13)=32.21$, $p=.002$; CFI=.996; TLI=.989; RMSEA=.031; SRMR_W=.025; SRMR_B=.044; NFI=.99. Standardized estimates (standard errors in parenthesis) are significant at the $p<.001$ level if not indicated otherwise. ** $p<.01$, * $p<.05$



H3. Moreover, the curriculum coherence in terms of *consistency of the intended direction* ($\hat{\beta}_W = .27$; $\hat{\beta}_B = \text{ns.}$) and *an integrative approach to teaching and learning* ($\hat{\beta}_W = .26$; $\hat{\beta}_B = \text{ns.}$) predicted the *school impact* at the individual teacher level but not at the school level. In turn, the curriculum coherence in terms of *the alignment between the objectives, content and assessments* ($\hat{\beta}_W = .08$; $\hat{\beta}_B = .63$) was a strong predictor of the perceived relevance and potential of the curriculum reform for the school development (i.e. school impact) at the school level (H3). Accordingly, hypothesis 3 was partly confirmed (see Fig. 2).

The school's SES was not a statistically significant predictor for change management, knowledge sharing, perceived curriculum coherence or school impact. In other words, the SES of the living area surrounding the school did not seem to regulate or challenge the process of integrating the big ideas of the curriculum into everyday school practices (H4). However, the grades that were taught in the school, negatively explained *curriculum coherence* in terms of *the integrative approach to teaching and learning* ($\hat{\beta}_B = -.35$) and *the alignment between the objectives, content and assessments* ($\hat{\beta}_B = -.17$). Hence, hypothesis 4 was partly confirmed.

Discussion

Methodological reflections

The validity and reliability of the scales (alphas .75–.91) used in this study, and the tested two-level path model were acceptable (Bollen, 1989; Hu & Bentler, 1999). Accordingly, this study showed that the developed scales can be used for identifying not only the teacher level but also the school level

differences, especially in terms of phrasing and steering the curriculum making, promoting sense-making through sharing and building knowledge together and constructing coherent understanding on the curriculum and its goals within the professional community. However, the scales have not so far been validated in other school systems aiming to identify possible school level variance in the curriculum renewal. Moreover, the cross-sectional two-level approach does not allow making causal assumptions and does not reveal the school level trajectories. This requires longitudinal two-level research designs carried out in different educational systems.

In this study, the self-reported printed paper survey was used. For reducing self-report biases and decreasing the risk of receiving unfinished questionnaires (i.e. proportion of missing values), the teacher communities were informed about the purpose of the research project, data collection, using 7-point Likert-scales, and research ethics issues. Furthermore, the study's response rate was adequate and the representativeness of the sample was acceptable. However, the results cannot be generalised to other educational contexts. Finally, despite the study's limitations, the scales it described and its novel results have the potential to contribute to future research in this field.

Findings in the light of prior research

The results showed that the participatory curriculum making strategy including balancing the steering and transformative dialogue in the process, seemed to be crucial both for supporting the individual teachers' and professional communities' learning. Processing the ideas of the new Finnish core curriculum was not easy for teachers. Even though Finnish teachers are used to developing their teaching and adopting new pedagogical ideas, the new core curriculum

suggested some major changes that challenged some existing pedagogical practices (e.g. transversal competences, subject integration, strong emphasis on self-regulated learning), and therefore experiencing curriculum coherence was not self-evident (Saarinen et al., 2021). However, change management and knowledge sharing promoted perceived curriculum coherence and further the reform's perceived impact on school development especially for individual teachers and, more moderately, also for teacher communities.

Results indicated that the implementation strategy needs to have strong change management that makes knowledge sharing possible. This means creating spaces for co-creative pedagogical development work, collaborative learning and supporting teachers for building shared understanding. Interestingly, the knowledge sharing seemed to play a dual function in this. It promoted perceiving curriculum as coherent and having impacts on school development through that—but it also had a positive direct effect on perceived school impact. Accordingly, we detected more complex interrelations between the determinants (see H3) contributing to the reform's perceived impact on school development than expected or previously detected (e.g. Allen & Penuel, 2015; Penuel et al., 2009).

Further investigation showed that the extent to which the teacher community was multi-professional, including teachers with various types of expertise (teachers of different subjects), did not determine how the implementation strategy was experienced. Teachers in all grades believed that the participatory curriculum making has succeeded relatively well, which may reflect more general appreciation for the autonomy of teachers and the strong culture of teacher involvement in curriculum making in Finland (Soini et al., 2021). However, there were differences in the perceived curriculum coherence. Multi-professional teacher communities experienced more difficulty in achieving shared meanings about the integrative approach to teaching and learning or the alignment between the objectives, content and assessments. This indicates that in the multi-professional communities building coherent understanding of the curriculum is a more challenging task. In turn, the SES of the living area surrounding the school did not seem to regulate or challenge the process of integrating the big ideas of the curriculum into everyday school practices. This may be due to a still somewhat minor segregation between schools in terms of SES in Finland. On the other hand, it might imply that schools are still successful in buffering SES-initiated differences in their pedagogical practices.

In general, the curriculum making strategies played a similar role both at the individual teacher and the school level. However, also minor, but interesting differences were detected. To the individual teacher, knowledge sharing contributed holistic perceptions about the curriculum coherence and significantly mediated experienced school impact. However, at the school level only perceived alignment between

the objectives, content and assessments mediated the effect of knowledge sharing on school impact. The alignment of the parts of the curriculum (e.g. if the assessment criteria is in line with objectives) may be understood as a more normative and managerial perspective on curriculum and teachers perceive that shared understanding in terms of what is needed to achieve impact. In contrast, in an individual teacher's pedagogical work the different perspectives of coherence form an integrated whole and the experiences of the alignment between a teacher's own beliefs about good education and pedagogical practices, and the direction of the reform is also important.

Variation in a schools' capacity to utilise the curriculum reform initiatives in their school development work was detected. In other words, there was variability in the extent to which the professional communities succeeded in change management and knowledge sharing as a route for enhancing coherence in terms of curriculum. Hence, the school communities also get the concrete benefits of large-scale educational reform. Prior research implies that schools that already have a high capacity for school improvement develop more efficiently into rich learning environments for teachers and reforms are more easily integrated into their practices (Slavin, 1998; Thoonen et al., 2012). Consequently, they and their pupils benefit more from reform and curriculum making than others. Achieving such capacity for school improvement seems to call for teacher subjectivity and holistic orientation towards reform (Pyhältö et al., 2012). Based on our results, it seems that this capacity can be facilitated by employing curriculum making strategies that balance change management and knowledge sharing.

The intentional planning of phases of change management and knowledge sharing could be fruitful. For example, considering the phases and issues of reform that restrict participation could result in more profound sense-making. Also, knowledge sharing practices are worthy of careful consideration and planning. For example, there can be significant differences in teachers' abilities and means (e.g. use of communication technology) of sharing expertise in the teacher community. Thus, knowledge sharing needs to be based on equal opportunities for participation. In contexts where teachers' educational levels are not high and/or their agency is not very strong, there may be a need for supporting teachers' involvement more intensively. One example of this would be helping teachers to identify pedagogical expertise development in work and finding multiple ways of making it visible and sharing it with colleagues. Moreover, strategies need to be transparent and justified for teachers. Such strategies can be intentionally learned and utilised for the benefit of the professional community. This may further contribute to a teacher's competence to design and experiment with new teaching practices for the benefit of their students, in line with the goals of the new core curriculum.

Appendix 1

Table 2 The scales and items of the Curriculum Reform Inventory (translated from Finnish)

Scales and items*
Top-down–bottom-up implementation strategy
Change management (CM) (3 items)
CM01 Management has been a success
CM02 The dissemination of information has been sufficient
CM03 A clear division of work has been performed
Knowledge sharing (KS) (10 items)
KS01 I have been able to influence definitions and contents
KS02 My competence has been utilised broadly
KS03 Decisions are based on joint negotiations
KS04 The feedback received has influenced the content of the curriculum
KS07 Even radical ideas are welcome, and they are discussed jointly
KS08 Work on the reform has been carried out jointly, not as a process dictated from above
KS09 The competence of various actors has been utilised in an optimal manner
KS10 Construction of an interactive atmosphere has been successful
KS12 Working together is assessed on a regular basis
KS13 The perspectives of the various teacher groups have been taken into account in an equal manner
School impact (SCI) (6 items)
SCI01 Maintains active development work at schools
SCI04 Commits teachers to working on developing the school
SCI05 Helps the school community identify the core tasks
SCI06 Directs development work to resolve problems observed in the daily life of the school
SCI07 Helps people develop solutions that work at the local level for organising teaching
SCI10 Promotes the resolution of many problems related to basic education at the local level
Curriculum coherence
Consistency of the intended direction (CON) (6 items)
CON11 Clarifies the entity of a teacher's job
CON13 Supports the teaching of the essential material in various subjects
CON15 Delimits the duty of the school in a sensible manner
CON16 Is clear and well organised
CON17 Successfully sums up the most important goals for the operation of the school
CON18 Constitutes an aligned foundation for the local curricular work
Integrative approach to teaching and learning (INT) (4 items)
INT21 Encourages teachers to use activating and engaging teaching methods
INT24 Encourages teachers to use assessment methods that support learning
INT25 Supports the harmonisation of teaching
INT27 The general section creates something new
Alignment between objectives, content and assessments (ALI) (7 items)
ALI31 The goals are in line with the assessment criteria
ALI32 A subject constitutes an integral continuum
ALI33 The goals are in line with contents
ALI34 Takes a pupil's age range into consideration
ALI35 Descriptions of teaching methods in various subjects are in harmony with the general goals
ALI36 Constitutes an integral whole
ALI37 The goals of the general section are also well in evidence in the subject section

*The item scale: *completely disagree*—1 2 3 4 5 6 7—*completely agree*

Appendix 2. The two-level path model evaluation

An initial two-level path model was specified in order to test the hypotheses in the clustered data (Fig. 1). However, fitting results of the estimated model were not very good: $\chi^2(10) = 365.73$, $p = .000$, CFI = .923, TLI = .770, RMSEA = .153, SRMRW = .068, SRMRB = .032. By adding the direct paths from the knowledge sharing (KS) to the school impact (SCI), both at within and between levels, a good model fit was obtained ($\chi^2(8) = 27.74$, $p = .0005$, CFI = .996, TLI = .984, RMSEA = .040, SRMRW = .025, SRMRB = .025). In the next phase, the two school level covariates, GRADES and SES, were added to the modified model. The school level covariates were tested as predictors of between-level latent components that represent the school level variance in each variable. The model fit sustained in the same level ($\chi^2(8) = 27.46$, $p = .0006$, CFI = .996, TLI = .979, RMSEA = .040, SRMRW = .024, SRMRB = .017). The final model ($N = 1516$) was specified by removing all non-significant ($p > .05$) paths one by one (see Fig. 2)

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Declarations

Conflict of interest The authors declare no competing interests.

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