Sustainable evidence-driven school improvement: routines and data use in Estonian schools

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Educational systems worldwide seek sustainable school improvement by fostering collaborative organizational routines that support teachers' practises and students' learning outcomes. This study examines how five Estonian schools perceive evidence-driven school improvement in a 3-year school-university partnership program. In each school, the principal and teachers collaborated with an external mentor. Supported by university experts, the school improvement teams worked on projects aimed at enhancing student learning in their schools and fostering a collaborative, evidence-driven school culture. Data was collected through focus group interviews with the school teams and analyzed using thematic content analysis. The findings reveal that schools view data as connected to accountability and decision-making, with considerably less emphasis on instructional improvement. School organizational and teacher-related factors, together with data overload, hindered systematic data use. Notably, the school improvement program's effectiveness was most evident in the final year, with the sustainability of improvement largely dependent on collaborative routines.

KEYWORDS

evidence-driven school improvement, data use, routines, sustainable change, collaboration, Estonia

1 Introduction

Educational systems worldwide are seeking ways to improve their schools. School improvement typically focuses on enhancing teaching practices and building capacity to purposefully boost students' learning outcomes (Creemers and Kyriakides, 2015; Kyriakides et al., 2024). As a result, teachers are expected to persistently pursue professional development and improve their competencies (Cain, 2015; Republic of Estonia, 2019; Verhoef et al., 2020). Organizational routines are crucial for structuring activities that align with school goals and drive school improvement (Maag Merki et al., 2023). Furthermore, when new initiatives have become routine actions within the school, they help individuals in taking action and moving the school forward regardless of different hindering factors, such as lack of time, changes in leadership or periods of uncertainty (Conley and Enomoto, 2009). Yet, as previous studies indicate, the success of these routines often depends on effective collaboration between teachers, which can be difficult to achieve without adequate support (Goodyear and Casey, 2013; Coburn et al., 2013; van Schaik et al., 2019).

Earlier research has also highlighted a strong connection between efficient evidence-driven approaches and school improvement (Schildkamp et al., 2014, 2016; Schildkamp, 2019). However, implementing improvement programs can be complex due to constantly changing school contexts and external pressures to schools (Grützmacher et al., 2023; Kyriakides et al., 2024). Another issue is the short duration of improvement programs that might not be sufficient in reaching set goals or supporting new initiatives in becoming routine actions within the organization (Conley and Enomoto, 2009). To provide schools with enough time to initiate and sustain necessary activities to reach goals, schools in

Estonia are required by national policy to adopt evidence-driven approaches in their development plans (Eisenschmidt et al., 2023). These plans, designed for a minimum of 3 years, must outline how data will be used to monitor school's progress and to make informed decisions on possible improvement practices (Estonian Parliament, 2010). In addition to school-collected data, other data sources are provided by the government, including results from exams or school satisfaction surveys. Data use helps schools reach key goals, such as to enhance instruction, create strong learning communities and to potentially improve student outcomes (Levin, 2010). However, previous research has found that teachers often lack the skills and knowledge about how to use data effectively for school improvement (Schildkamp and Kuiper, 2010; Carroll and Carroll, 2015; Mandinach and Gummer, 2016b; Rääk et al., 2021). Another problem is that data use is not always unified or systematic (Vanlommel, 2018; Rääk et al., 2021; Siemann, 2021). Consequently, schools encounter difficulties in implementing and sustaining evidence-driven school improvement practices (OECD, 2020). Schildkamp et al. (2016) posit that challenges to data use stem from several factors: (1) teacher-related issues, such as negative attitudes to data and limited data literacy, (2) school context factors, like insufficient support or external pressures to use data, (3) the absence of a collaborative or supportive school culture to use data. As a lack of a collaborative or safe school culture. Drawing from this, a practical approach to achieve school improvement goals would be to foster a sustainable data-use culture where teachers are actively involved (Datnow and Hubbard, 2015; Mandinach and Gummer, 2016a).

To help support teachers' perceptions and skills regarding data use, collaboration has been proposed as the most efficient means (Levin, 2010; Admiraal et al., 2015; Schildkamp et al., 2017). Collaboration is shaped by the prevailing school culture and its effectiveness may therefore vary in different schools (Vangrieken et al., 2015; Pieters and Voogt, 2016). Building on this, a school-university joint School Improvement Program was designed to support Estonian schools in their paths toward creating and maintaining a more evidence-driven collaborative school culture as previous research indicated that tailored programs, similar to the one central to this study, that take each school's specifics into consideration, are needed to help schools pursue their objectives related to evidence-driven practices (Schildkamp et al., 2017; Eisenschmidt et al., 2024). This program involves selected schools engaging in a 3-year process centered on their specific objective, supported by university and mentors. Each school is represented in the program with a school improvement team and the local municipality was also involved to encourage changes at systems level.

Drawing from the identified gaps, this research aims to study how five school teams perceive the evidence-driven school improvement process in a 3-year school-university partnership program. The study is framed by three research questions:

1. How do schools understand evidence-driven school improvement?
2. What are the enabling and hindering factors of data use that schools face in improvement?
3. How do school improvement teams perceive the sustainability of evidence-driven school improvement routines?

The broader impact of this study lies in its contribution to the further development of similar programs for schools to ensure sustainability of evidence-driven school improvement processes.

2 Literature review

2.1 Evidence-driven school improvement

School improvement may sometimes seem superficial or target isolated elements of school culture. Focusing on just one aspect of the teaching and learning process without considering the necessary resources or providing support for teachers to implement new initiatives can lead to frustration and cause them to abandon these efforts. School improvement efforts driven by a single teacher, as is often the case, are usually unsustainable if the teacher happens to leave school (Creemers and Kyriakides, 2015; Meyer, 2022). Hopkins et al. (2014) emphasize that starting a school improvement process requires a thorough understanding of the organizational culture and its dynamics, including aspects such as leadership, teacher communities, and professional development. To facilitate school improvement, leadership has proven to be crucial for engaging more teachers in decision-making and for implementing distributed leadership as these practices have been shown to positively impact both school performance and student outcomes (Leithwood et al., 2019).

Today, school improvement is more and more linked to evidence-based practices as they can lead to more effective instruction, enhanced student learning, and overall organizational improvement in schools (Vanlommel et al., 2017; Schildkamp 2019; Vanari et al., 2020). Using data helps schools identify the areas that require improvement, determine potential interventions that could enhance the current situation, and evaluate the effectiveness of such interventions (Scott, 2013). Schools acquire evidence from data which is defined as "information that is systematically collected and organized to represent some aspect of schooling" (Kippers et al., 2018, p. 21). To make sense of data, you need data literacy skills, which are "the educator's ability to set a purpose, collect, analyse, and interpret data, and take instructional action" (Kippers et al., 2018, p. 21). Information, in turn, becomes evidence when you use it to test hypotheses or make informed decisions (Vanari et al., 2020).

Schools have access to different types of data-informed and research-based evidence that facilitate informed decision-making regarding school improvement. Vanari et al. (2020) distinguish between the nature of evidence (input) and its intended uses (output). The types of evidence available to schools include national surveys, school-specific data, assessment of result, and observational data. There is also research-based evidence that derives from literature reviews or research literature. Schools should implement both for output purposes, such as to improve instruction or to improve an aspect of the school. According to Vanari et al. (2020), schools should leverage both types of evidence for specific output purposes, such as enhancing instructional practices or improving certain aspects of the school culture. Notably, while school improvement seems to be affected mostly by data and school characteristics; instructional improvement tends to

be influenced more by user and school characteristics (Vanari et al., 2020).

Earlier studies have emphasized four aspects that affect evidence-driven school improvement: data-related, team or user-related, organizational and context-related factors (Schildkamp and Poortman, 2015; Schildkamp et al., 2017). Data-related factors are to do with its availability and quality as data needs to be viewed as relevant and valid (Schildkamp and Kuiper, 2010; Coburn and Turner, 2011). Team or user-related factors include working on a shared goal, the users' knowledge and skills in using data and also, whether the previous experience using data has been positive or negative (Schildkamp and Kuiper, 2010). Organizational factors that affect data use involve the leadership aspect regarding how data-use is encouraged and facilitated in the school; and also, whether extra time is allocated to work with data (Schildkamp et al., 2017). Context-related factors include three main stakeholders in the possible evidence-driven school improvement process and these are: the local municipalities who offer both pressure and support, mentors who guide and facilitate the school's development; and collaborative partnerships with other schools (Schildkamp et al., 2017).

There is a dearth of studies in Estonia that have been conducted to study teachers' data use and how meaningful it is for teachers in terms of its possible impact on instruction. However, in the study on Estonian teachers' perceptions of data use that support evidence-driven school improvement, the conditions for data use were divided into school and teacher level factors. The importance of collaboration in data-use practices was highlighted separately as it was regarded central to the success of data use (Rääk et al., 2021). Since then, as the Estonian School Improvement Program has been developed further, the current study expands from the earlier contextual framework and adds data-related and external factors that might affect data use practices (Figure 1). Collaboration is emphasized as a key component of evidence-driven school improvement initiatives, which are supported by the school principal and shaped by factors related to teachers. Collaboration aspect is especially evident in Estonian context as according to research, school leaders struggle with supporting effective collaboration for school improvement purposes (Eisenschmidt et al., 2021). Therefore, schools should be supported to create and maintain school improvement initiatives in the form of collaborative activities (Vanari et al., 2024). This aspect is further supported by research which states that professional learning through organized enquiry and collaboration is vital in enhancing evidence-driven school improvement (Harris et al., 2012). The importance of adding external factors to the framework lies in the fact that there has been an ongoing shift from individual school improvement efforts to system-wide transformation, and it could not be reached without including relevant stakeholders (Harris and Chrispeels, 2008).

2.2 Sustainability of evidence-driven school improvement

The most challenging aspect of any educational innovation is not initiating it, but making it sustainable within the organization (Hargreaves and Fink, 2012). Sustainability is "…the process of integrating and scaling the innovation's core aspects in organizational routines that are adaptive to ongoing work, with continuing improvement of results" (Tappel et al., 2022). It is also important to note that school improvement is a journey and its nature is to progress (Hopkins et al., 2014). Yet, the short nature of many school improvement programs means there is relatively limited research tracking school improvement activities over extended periods and examining their effective continuation (Tappel et al., 2022). Continuity, however, is one of the fundamental dimensions of sustainability as its aim is to make the initiative a routine part of the everyday work of the school. When schools work on the core aspects of the innovation, they reach the adaptiveness dimension of sustainability which means deciding together what works for each particular school and then adapting the initiative according to their unique needs (Tappel et al., 2022). This dimension is further substantiated by research on the importance of creating and developing needs-based programs that are customized to address the specific requirements of different schools; thereby, enabling teachers to find greater significance from their engagement (Grützmacher et al., 2023). In this context, the dimension of sustainability related to scaling up or increasing the number of participants involved in the process becomes pertinent (Tappel et al., 2022). Finally, in terms of reaching sustainability, it is also noteworthy that initiatives which nurture the existing "grammar of schooling" are generally more enduring than those which require more fundamental changes; therefore, taking small steps in introducing new initiatives is important (Wolthuis et al., 2021b).

2.3. Routines as bases for sustainability

For an initiative to become sustainable, organizations must often establish and uphold various routines as these are regarded as critical to achieving objectives (Feldman and Pentland, 2003). Such routines can be defined as "/repetitive, recognizable patterns of interdependent actions carried out by multiple actors" (Feldman and Pentland, 2003, p. 95). Routines are essential for organizational learning since they are viewed as stable sources of organizational knowledge and skills. Nevertheless, routines may also be subject to change due to external pressures or as a result of adjustments aligned with the organization's needs (Conley and Enomoto, 2009).

There are different routines that are implemented in schools, such as teacher evaluations, school improvement planning, and professional learning communities (Sherer and Spillane, 2011; Maag Merki et al., 2023). Regarding evidence-driven practices, Coburn and Turner (2011) found that initiatives that support the use of data have a number of benefits, such as to shape teachers' observations, altering interaction patterns in a way that impacts people's perceptions of and actions to change, and lastly, to influence the beliefs on individual as well as staff level. One of such initiatives that supports data use practices could be to compile a school improvement team (Newton and Burgess, 2016). Research indicates that while schools manage to establish such teams, they often face challenges with their development and sustainability (Mandinach and Gummer, 2016a; Tappel et al., 2022).

FIGURE 1
Conditions for data use.
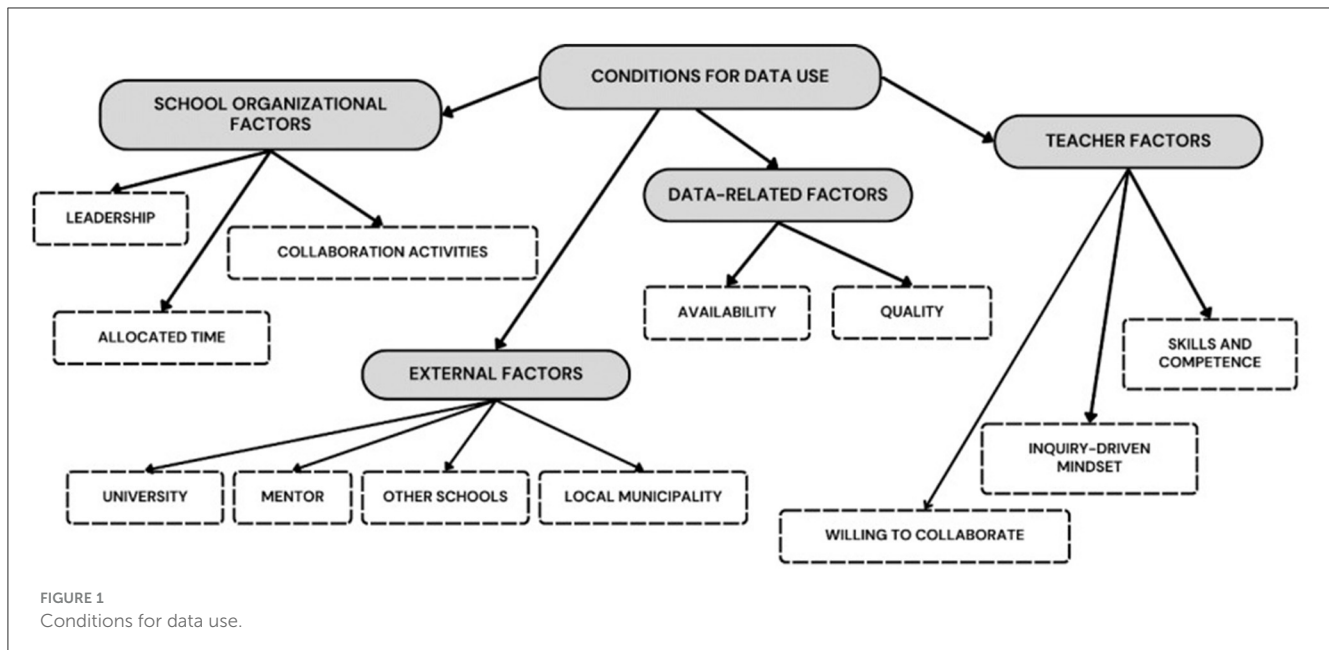
This may be attributed to the short duration of programs that have been designed to assist schools in developing and sustaining new evidence-driven improvement routines, as research indicates that changes in organizational routines typically require between 3 to 5 years to become impactful (Datnow, 2005; Sigurðardóttir et al., 2021; Eisenschmidt et al., 2024).

2.4. Collaboration as a foundation for sustainable routines

School development is a collaborative endeavor. Collaboration could be defined as "joint interaction in the group in all activities that are needed to perform a shared task" (Vangrieken et al., 2015). It is considered one of the most important aspects in efficient data use (Wayman and Jimerson, 2014). There are multiple terms available in literature that denote teacher collaboration, such as professional (learning) communities (P(L)Cs), communities of practice (CoP), teacher teams, teacher learning groups, or others, such as data teams (Mclaughlin and Talbert, 2006; Vangrieken et al., 2015). Creating a teacher learning community for school improvement purposes significantly enhances teachers' knowledge base, professionalism, and capacity to apply acquired knowledge while fostering moral support and mutual trust between teachers (Vangrieken et al., 2015). Similarly, research-practice partnerships unite teachers around particular content areas or skill sets. Additionally, teacher learning communities are valuable due to promoting enduring changes in daily teaching practices that are grounded in local contexts (Mclaughlin and Talbert, 2006).

However, there can be some possible hindering factors when it comes to performing collaboration activities. First and foremost, incompatibility of teachers manifests not only in their approaches to teaching and learning but also in their personal differences (Krammer et al., 2018). However, previous literature states that although self-selection proves to be more helpful in establishing

functioning teams, this kind of selection does not necessarily lead to more quality in collaboration (Krammer et al., 2018). Other characteristics that impact the effectiveness of collaboration are to do with the group (e.g. clear roles, atmosphere, communication), structure (e.g. time, frequency of interaction), process [e.g. approaches to task, (inter)dependency], organizational (e.g. general culture and atmosphere) and support (e.g. leadership, external help) (Vangrieken et al., 2015).

In conclusion, routines provide a useful lens through which it would be possible to examine how evidence-driven school improvement initiatives function. Their added benefit for schools is that routines can be sources of organizational learning as they promote standardization, reduce variability, and store organizational experiences (March, 1991). Based on this, the various evidence-based collaborative initiatives that were implemented by schools during the 3 years of the program, such as lesson observations, setting up school improvement teams and establishing a time for collaboration, are analyzed through the five dimensions of sustainability. This includes examining which improvement activities were sustained and their visibility within the school, how schools integrated routine activities into their everyday work, and how they adapted these activities to meet their specific needs. The dimension of involving other staff and helping to create meaning in the new initiatives is also included in the study.

In this study, the theoretical framework is grounded in evidence-driven school improvement, along with the core role of routines and collaboration in sustaining the improvement process and educational changes.

3 Materials and methods

3.1 Context of the current study

In Estonia, the organization that is responsible for enhancing the quality of learning and teaching and for supporting learners'

TABLE 1 School types and characteristics.

School code	School type and characteristics	Approximate number of students 2023/2024	Approximate number of teachers 2023/2024
S1	Primary and lower-secondary school (grades 1–9), small town	300	50
S2	Rural primary (grades 1–6)	15	30
S3	Rural primary and lower-secondary school (grades 1–9)	80	20
S4	Rural primary and lower-secondary school	90	20
S5	Rural primary and lower-secondary school (grades 1–9)	100	30

development is the Estonian Quality Agency for Education (n.d.). Although data about schools' performance is available to the public and schools have substantial autonomy in terms of professional development activities or when developing pedagogical aspects, it is the role of the central government to become involved when it sees a school deviating from the national standard (Eisenschmidt et al., 2023). In 2021, the quality agency used the national database, Education Eye, to select six Estonian schools with lower performance indicators to participate in the School Improvement Program. Five of them continued in the program for 3 years (Table 1). Based on the selection criteria, four of the chosen schools were small rural schools which combined primary and lower-secondary schools (see Table 1), one was a primary and lower-secondary school from a small town in Estonia.

Prior studies have highlighted the importance of external support that schools need for changes to take place (Levin, 2010; Grützmacher et al., 2023; Eisenschmidt et al., 2024). The School Improvement Program was created by Tallinn University experts to support the schools in their improvement processes and the program derived from the Future School methodologies (Eisenschmidt et al., 2020). This program aimed to enhance the whole school improvement by supporting a school team through three academic years to increase leadership capacity, teachers' co-creation of new practices and evidence-driven decision-making. Over the course of the 3-year program, school teams consistently engaged with an evidence-driven approach as a central theme. School teams learned how to effectively plan and integrate data into their school improvement processes. Teams also established systematic methods for analyzing and monitoring student learning. By using research-based tools and structured organizational routines, teams collaborated to interpret findings to make evidence-based decisions. University experts supported the improvement process by providing relevant educational research and helped to use reliable tools to monitor the improvement process.

Each school was assigned a mentor who has experience in school leadership and change management; their role was to be a "critical" friend who asks relevant questions and shares their professional experience to support the schools in their school improvement journey. During this period, the schools participated in university-led seminars, completed a number of assignments that helped them implement their development plan, and had regular meetings with their school improvement teams and their mentors. Representatives from local municipalities were also involved to

support broader systematic changes in support of these schools. Each school was required to select four to six members for its school improvement team, including the school principal, with the team leader role designated to a teacher to promote teacher leadership practices. The schools were working on the development plan depending on the needs of their school, but they were advised to keep in mind the three principles that help navigate successful change management, such as (1) to seek and maintain continuous dialogue with the involved parties (2) to ensure that the meaningfulness of the change is felt by the teachers and management, and (3) to ensure that the involved parties feel a sense of ownership of the change (Snoek et al., 2017).

To establish sustainability of evidence-driven school improvement processes and further develop university-schools partnership programs, this research seeks to study the perceptions of five school teams regarding their evidence-driven school improvement process. The study is guided by three research questions:

1. How do schools understand evidence-driven school improvement?
2. What are the enabling and hindering factors of data use that schools face in improvement?
3. How do school improvement teams perceive the sustainability of evidence-driven school improvement routines?

3.2 Participants

Altogether, 24 members from five different schools that participated in the School Improvement Program (2021-2024) were interviewed (Table 2). Each school team comprised four to six participants, including the principal and teachers actively involved in the improvement process. In one case, the deputy principal participated in the interview due to a leadership transition, as a new principal had not yet been appointed. The aforementioned schools were selected for their relative similarities which enabled the inclusion of topics in monthly seminars that would resonate with all school teams. Also, sharing experiences on participating in the program became more valuable and meaningful for schools that were somewhat more homogeneous as opposed to schools with diverse backgrounds and characteristics. No additional demographic or professional information about the participants

TABLE 2 The interviewees and their codes.

School teams and codes	Participants in focus group
School 1 (S1)	School principal
	Four teachers as team members
School 2 (S2)	School principal
	Four teachers as team members
School 3 (S3)	School principal
	Five teachers as team members
School 4 (S4)	School principal
	Four teachers as team members
School 5 (S5)	School deputy principal
	Three teachers as team members

was not collected as it was not within the scope of this study to draw parallels between the quality or characteristics of teachers and the program's success. Instead, this study focuses on teacher-related factors that might impact evidence-driven school improvement, such as willingness to collaborate and their data-literacy skills.

3.3 Data collection and analysis

Data was gathered with focus group interviews (Bryman, 2016). For the sake of this study, it was important to collect data pertaining to a collective view on the topic rather than the individual as the highly concentrated nature of focus groups interviews on studying specific issues might provide insights to the collective view that may not emerge from direct interviews (Cohen et al., 2018). The collective view also allows us to study the impact of evidence-driven practices on teachers' interaction patterns which influence the beliefs about data use on a staff level (Coburn and Turner, 2011). These focus group interviews drew from the concepts of the theoretical framework on how school teams perceive evidence-driven practices for school improvement purposes and which factors might impact their performance in doing so sustainably (Figure 1). The interviews that lasted from 23–45 min were conducted via Zoom in June 2024, and were transcribed verbatim with the use of a transcription system for Estonian speech (Alumäe et al., 2018). The transcripts were given codes S1–S5 for confidentiality. For the purposes of this study, the quotes from the interviews were translated into English.

A thematic content analysis was applied to examine the findings based on the theoretical framework (Schreier, 2012). Cross-verification was employed where two researchers analyzed the data independently and then compared their interpretations to ensure consistency and improve the reliability and transparency of data analysis (Cohen et al., 2018). The first author conducted an initial coding with the aim of developing the coding frame for main categories. In the next step, two authors tested the coding frame through multiple rounds of individual coding and collaborative review sessions. This process continued until inter-coder reliability reached an acceptable level and the final coding scheme was agreed upon by consensus. Through a discussion, the coders

modified themes and sub-themes. Next, peer debriefing sessions were conducted with a colleague with expertise in qualitative research and who was not involved in this study. These sessions focused on discussing emerging themes, questioning underlying assumptions and refining the interpretations to enhance the credibility of the findings. Finally, the main themes and sub-themes were finalized and aligned with the research questions through a consensus process (Table 3). For example, regarding sustainability of the evidence-driven improvement, visibility of change and becoming part of the everyday work were merged and routines for collaboration as an important factor for sustainability of the improvements was added as a sub-theme.

When planning and conducting this research, Tallinn University research ethics regulations and the Estonian Code of Conduct for Research Integrity were followed.

4 Findings

This study aimed to explore school improvement perceptions among teacher teams from five Estonian schools. First, it analyzes the teams' understanding of evidence-driven school improvement, followed by an examination of its enabling and hindering factors. Finally, the study examines how the teams perceive the sustainability of such evidence-driven school improvement routines.

4.1 Understanding evidence-driven school improvement

The results indicate that most schools use different data-informed evidence, such as national and school surveys, different feedback, and even some research-based evidence in the form of intervention results or systematic literature reviews. The latter was used when learning about what the schools wanted to achieve in the School Improvement Program, for example, studying different learning strategies. Regardless, the interviews showed that research-based evidence is not always viewed favorably by teachers in all participating schools due to the differences between teachers' beliefs and what data indicated. It was also a common practice among schools to present data to teachers at meetings without analyzing it together. This approach hindered the potential of data becoming more meaningful to teachers' work and helping them understand better how their classroom practices could influence overall school improvement through, for instance, enhanced student outcomes.

According to the interviews, two schools had not implemented systematic data use prior to the program. S5 did not participate in national surveys as the participation rate among teachers, students and parents, which stemmed from a lack of interest. Similarly, S1 initially did not recognize the value of evidence-driven school improvement as collecting data was deemed not meaningful within their context.

> *"The school had some data. But they could not use the data. /…/ Teachers did not believe in what data showed; and they worked how they felt best according to their gut feeling as if they knew better. Data was not reliable to them." (S1)*

TABLE 3 Main themes and sub-themes of categories for data analysis.

Research question	Themes and sub-themes
Meaning of evidence-driven school improvement (RQ1)	Nature of evidence: 1) Data-informed evidence; *e.g. surveys, assessment results, characteristics of teaching staff* 2) Research-based evidence *e.g. scientific literature, action research, university's studies*
	Purpose of using evidence: 1) for school organizational improvement; *e.g. arrangement of teachers' work, leadership structures* 2) for improvement of instruction; *e.g. choice of teaching methods, arrangement of learning process* 3) for accountability *e.g. communicating results for other teachers, parents, local community*
Enabling and hindering factors of using evidence (RQ2)	School-organizational factors: 1) leadership; 2) allocated time for collaboration; 3) collaboration activities
	Teacher-related factors: 1) willingness to collaborate; 2) inquiry-driven mindset; 3) skills/knowledge for data use
	Data-related factors: 1) availability of data; 2) quality of data
	External factors: 1) university; 2) mentor; 3) other schools; 4) local municipality
Sustainability of evidence-driven improvement routines (RQ3)	1) Continuation of activities; 2) Becoming part of everyday work; 3) Adaptiveness of activities; 4) Scaling-up changes; (involving others, creating meaning); 5) Routines for collaboration

A common pattern amongst schools was their recognition of the value of evidence for accountability purposes and they had adapted using freely available national survey data for mapping their performance and comparing it to other schools; and used their own surveys for informing school's policy-related decision-making and for communication with parents and other stakeholders.

> *"One big change that has happened is that when we have a meeting with parents or colleagues, our team always has something to say about the data we have about the topic, for example when we want to change the timetable or plan we always mention something about the evidence we have."* (S1)

The second aspect of using evidence that all schools started to value was its contribution to organizational improvement. Most school teams consistently highlighted the importance of basing decision of evidence rather than relying solely on intuition or gut feeling, especially when setting goals or compiling development plans.

> *"We have understood that we cannot only act based on our gut feeling or simply say that 'Yes, let's do that!' No, there has to be a 'Why? What is the reason! How do we know that?' I think that using evidence has thus far been rather far in the background in our everyday work and now it is starting to become more and more prominent."* (S2)

However, from the interviews it emerged that schools see the evidence used to improve instruction sparingly, for example,

observation data was mentioned, but observing colleagues' lessons as sources of evidence to improve instruction was not used by any participating schools at the onset of the program. Furthermore, most schools admitted that during the organization of lesson observations within the improvement program, teachers struggled to understand the relevance of this type of evidence to their work, leading to significant resistance. Another aspect in relation to this issue that emerged from the interview was that teachers struggled to recognize the connection between classroom improvement and school improvement.

To sum up, although schools examined their performance data and compared it to that of other schools, teachers, especially in S1, remained reluctant to make instructional changes based on this evidence possibly due to their lack of belief in the validity of the presented data.

4.2 Enabling and hindering factors of data use in school improvement

Regarding school-organizational characteristics, all schools identified two enabling factors that impact school improvement and establish a foundation for data use in improvement processes. The first aspect is leadership, which emphasizes the commitment of both school and improvement team leaders to the program and its activities, as well as their effectiveness in engaging staff. Here, the interviews highlighted that the leaders' willingness to learn and believe in evidence-driven activities throughout

the improvement process was a significant aspect in achieving their goals.

> "The team worked effectively and toward finding solutions thanks to our leader. We always had a set structure in our meetings, and even though sometimes we needed to let off steam, she gathered us quickly and said 'Wait, we need to talk about this as well!'" (S1)

The other enabling aspect to school improvement was the implementation of allocated time for collaboration in the timetable. The weekly teacher collaboration time was introduced as a new initiative for all participating schools beginning from the second year of the program; however, schools faced challenges in integrating this activity into their daily routines. S1 mentioned that despite the desire to use data more effectively during these meetings, they are too engaged with everyday organizational issues, and these time constraints prevented them from collecting new data.

> "When we previously had those collaboration times then we used to mostly share information. But now this is the time when we set shared goals and discuss thoroughly why we are doing something. This gives us an opportunity to argue things through and then we feel as if we are in the same boat and that we are moving forward in the right direction." (S4)

Regarding collaboration activities, several schools viewed certain initiatives as hindering school improvement processes. S1 and S5, in particular, faced staff retention and resistance, which impeded the improvement of the team's ability to start and sustain initiatives in the program. Lesson observation emerged as a collaborative activity that was seen as most problematic. All participating schools reported initial resistance from teachers, stemming from various fears, insecurities and negative past experiences. One practice that was then used to overcome resistance was to allow teachers to record their classes and then review the footage alone at first. The positive attitudes and support from teachers who had recently graduated from universities also contributed to the adoption of lesson observations. Additionally, as lesson observation had not been previously practiced in any of the schools, the novelty of the initiative required more time for it to become part of the everyday work of the schools. Notably, most schools were only able to conduct lesson observations a limited number of times, mostly toward the end of the school improvement program.

> "We basically did not even reach conducting lesson observations. We tried it once but we do not have any systematic or consistent plan in place. This is something that we might work on in the future though -perhaps next year or the year after that. It seems that the overall mindset and attitude to lesson observations is much better than it used to be. That is for sure." (S1)

In connection with teacher-related factors, the interviews revealed that an inquiry-driven mindset and willingness to collaborate are essential in supporting evidence-driven school improvement. However, all schools agreed that varying levels of skills and competencies among teachers in working with data represent major barriers to effective evidence-driven school improvement.

> "Well, I must say I didn't know much about evidence-driven school improvement and these things. /.../ To me it was very difficult for a long time to understand how I can analyze data that is not a number and how to analyze it qualitatively and put it into a table." (S2)

A supportive data-related factor for implementing evidence-driven school improvement practices was the availability of various high-quality data sources. Conversely, schools identified the abundance of data as a hindering factor, as they expressed difficulty in discerning what was relevant to their needs. Additionally, schools acknowledged that analyzing data, particularly qualitative data, could be too time-consuming, posing further challenges.

> "We actually had one interview form that we had to do as a home assignment. We did it and got some data from there, but we understood that it was too overwhelming for us. We have too few people at work to conduct interviews in an effective way. Don't get me wrong, it was a good form, but too time-consuming." (S3)

Evidence-driven school improvement is also affected by external factors. Here, the roles of the university and local municipality were viewed positively by schools in relation to their improvement efforts. Schools appreciated the local municipality's support and motivation for their initiatives, as well as its allocation of necessary funding. However, during the program, all participating schools experienced changes in the local municipality representatives, which complicated collaboration and undermined the sustainability of the school's initiatives. Regarding work with the mentors, there was one school who reported ineffective collaboration, highlighting a potential hindering to the school's improvement initiatives.

Collaboration with other schools was regarded as beneficial, particularly when these partnerships provided examples of successful and sustainable collaboration routines that supported school improvement.

> "In addition to changes in our improvement team members, there was another kind of a breakthrough in our thinking after the visit to our mentor's school. The people who visited the school could really see with their own eyes that it is possible to carry out changes and after that the thinking of those people changed. And possibly, some members of the team might have understood that they have to step aside as they do not have the necessary energy to achieve the goals successfully." (S1)

However, one school team found the visit to be a hindrance to their progress, as they struggled with demotivation and initial overwhelm after recognizing the significant differences between their own school, categorized by lower performance indicators, and the achievements of the school they visited.

Overall, several aspects were identified as positively influencing the use of data for school improvement. These included strong leadership, sufficient time allocated for collaborative data analysis, and teachers' willingness and ability to engage with data effectively. External support, such as guidance from a supportive mentor and fostering strong collaboration with local municipality representatives, were also highly valued. Despite the positive aspects, a few challenges could also be pointed out. Namely, school teams faced difficulties related to data overload, and the introduction of lesson observations as a new initiative presented additional challenges.

4.3 Sustainability of evidence-driven school improvement routines

All five participating schools implemented various collaboration routines for school improvement, including the establishment of a school improvement team, scheduling designated collaboration times, setting shared goals, involving other staff members in the improvement processes and monitoring their progress in achieving objectives. The interview results indicate that the continuation of these initiatives, as the first dimension of sustainability, was perceived as important by all schools, especially due to the support received from the university program and their mentor over 3 years.

On another note, the perceptions of school improvement initiatives differed depending on their context. For example, while all schools acknowledged the importance of sustaining the work of the improvement team post program, some teachers expressed the need for ongoing support from the university or their mentors to continue with the initiatives that were established. Additionally, teachers from two schools raised concerns about the potential impact of being engaged with the initiatives on their workload and wellbeing. Although scaling up or involving more people could mitigate these issues, all schools faced challenges in making collaboration routines for evidence-driven school improvement meaningful and visible to others. Success in this area was attributed to implementing new initiatives through a gradual, step-by-step approach. Here, smaller schools, such as S2, S3, and S4, were more successful in integrating new routines to their everyday work. Additionally, S3 has also added new initiatives to their development plan.

> "Before joining the program, we had this belief that when a change had to be implemented, it had to be implemented quickly. But now we have understood that if you change something quickly, it will also disappear quickly. It is important to explain and take time. The same goes for setting shared goals. You cannot do it quickly." (S4)

All schools acknowledged that allocating time for collaborative work positively impacted their improvement processes and enhanced both the efficiency of the improvement team as well as fostered collaboration among teachers outside the team.

> "We have reached this stage where teachers are more aware of what is going on in school. Teachers are calmer, much calmer. And the whole staff is included and we ourselves also feel that things are starting to go in the right direction." (S5)

All in all, schools also maintained that they appreciated the time allocated to discuss how to best implement evidence-driven practices, noting that the use of evidence has started to become more visible also in classrooms. Drawing from the interviews, teachers in all schools have begun to gradually unite around school improvement practices and recognize the value of their involvement in such activities; and all schools plan to proceed with the initiated routines by allocating extra time for collaboration to work on evidence-driven school improvement and by continuing the work of the school improvement team.

5 Discussion and further implications

This research aimed to investigate how teacher teams from five Estonian schools perceived evidence-driven school improvement during a 3-year school-university partnership program with an emphasis on the sustainability of the program's initiatives.

On the question of how teachers understand evidence-driven school improvement, this study found that all schools had started to view data as relevant through the School Improvement Program. While data use was initially identified as the weakest aspect, it therefore experienced the most significant changes. Notably, although data-driven decision-making was perceived as relevant, research evidence was also valued as useful sources for data collection. This shift could be attributed to the program's duration, as earlier research indicated that only a minority of Estonian teachers view research evidence as important to school improvement (Rääk et al., 2021).

Prior studies have also highlighted the importance of using different types of data (Schildkamp and Kuiper, 2010; Coburn and Turner, 2011; Schildkamp et al., 2017). The five participating schools primarily utilized data from national databases for mapping purposes, enabling effective comparisons with other institutions. One school experienced a significant change, as they had not previously engaged in national surveys before joining the program. Throughout the program, all schools began practicing the use of new data sources, including lesson observations and interviews, though these may present challenges for sustainability now that the program has concluded. However, observing the practices of other schools during visits had a positive impact on teachers' attitudes toward data use, particularly in regarding benchmarking. This shift may be attributed to teachers witnessing how various initiatives were implemented in other schools, making the use of evidence more meaningful for them. Overall, schools possess evidence that could enhance accountability and inform more meaningful organizational decisions. On the other hand, although Schildkamp and Poortman (2015) propose three purposes for which data could be used in school context, such as for accountability, school improvement and instruction, its primary focus should be on school improvement and instruction (O'Brien et al., 2019). In this study, the use of evidence for instructional improvement was found to be underutilized, largely due to the specific characteristics

of the schools and the program's duration, which required a focus on establishing effective school improvement teams and fostering teacher collaboration. The tendency to underuse evidence for instructional improvement also aligns with previous research which posits that teachers struggle with classroom data even though it could help them make more informed decisions about instruction with the aim to enhance student learning outcomes (Dunn et al., 2016, Hoogland et al., 2016; Gelderblom et al., 2016; Schildkamp et al., 2017).

The second research question of this study sought to determine the enabling and hindering factors that school improvement teams faced in implementing different evidence for school improvement. A significant finding revealed that all schools struggled with school-organizational and teacher-related factors in establishing data-use processes. Challenges such as staff retention, job position changes and resistance hindered collaboration both within and beyond the improvement teams regardless of the school leadership aspect which has been an indicator of the degree of success in teacher collaboration in previous research (Vangrieken et al., 2015). Moreover, this result also somewhat opposes earlier research conducted in Estonia which emphasizes that teachers feel more motivated when they can participate in school improvement activities where they can be involved in developing shared vision, choose roles and topics in which they would like to be engaged with (Slabina and Aava, 2019). However, a strong connection was observed between schools that did successfully create and maintain effective teams and their overall progress. This result was significant in that it suggests that schools, particularly those with lower performance indicators, struggle to plan an execute improvement activities sustainably due to collaboration issues; and that schools require external support to build their competence to carry out school improvement processes and more time for team dynamics to develop effectively (Schildkamp and Poortman, 2015). This result might also be indicative of schools focusing on day-to-day activities rather than setting goals, monitoring progress, and creating and retaining routines that enhance school improvement.

As outlined in the theoretical framework, effective data use can be achieved when teachers collaborate, as their beliefs about data use are shaped within professional learning communities (Datnow and Hubbard, 2015). Earlier studies demonstrate the importance of collaboration as a success factor in this aspect, especially when there are structures in place at the schools to facilitate collaboration (Jarl et al., 2021; Eisenschmidt et al., 2024). Common enabling factors which were identified across schools included the principal's support and provision of adequate time to engage with data. However, it became evident that data was primarily presented to teachers during meetings rather than being analyzed collaboratively. Research indicates that collaborating among teachers positively impacts the enhancement and standardization of knowledge regarding evidence use for school improvement, while simultaneously improving teachers' pedagogical expertise (Schildkamp and Poortman, 2015). Therefore, it is important to create opportunities for teacher leadership and collaboration activities. Also, evidence-driven school improvement requires external support to help enhance teachers' skills for data use as lack

of the right competencies and skills to work with data is seen as a significant hindering factor.

A relevant data-related hindrance that was identified was the overwhelming volume of available data that schools faced. One school team, which appeared to have a mostly strong grasp of data use, admitted that although they would like to employ certain data collection methods like interviews, they lack the time to analyze them. Similarly, another team expressed satisfaction with the data they had collected and noted that they were just about to recognize patterns; however, they did not intend to gather more data due to ongoing challenges with its analysis. The importance of the time factor may stem from the fact that schools, being relatively inexperienced in data handling, require considerable effort and support to effectively engage with it.

All schools, excepting one that struggled to establish a productive relationship with their mentor, recognized the value of collaborating with various stakeholders. One school faced challenges in establishing effective cooperation with their mentor due to two circumstances. First they were unable to meet as frequently as other school teams and mentors as their mentor was located farther away from the school than the other mentors in the program. This insufficient time to collaborate and discuss the processes of the program proved to be one key reason for failing to have a productive relationship. The second reason for this could be that there was misunderstanding between the participating school and its mentor about the program's objectives and the mentor's role in general which further hindered their collaboration. A notable and positive development was the increased involvement of local municipalities in the school improvement processes. However, retention issues within the local municipality also appeared to adversely affect these improvement activities.

Pertaining to the third research question about how school teams perceive the sustainability of evidence-driven school improvement routines, it was found that scaling-up of the initiatives posed significant challenges, particularly for larger schools, which struggled to engage other staff members meaningfully. Also, after 3 years of support from various stakeholders, some teachers expressed hesitance about the continuity of the initiative that was introduced as they were transitioning to greater independence in planning and maintaining improvement processes. Although this does not completely align with the previous conclusions drawn by Kyriakides et al. (2024) who identified the final year of their 3-year-long program as the most impactful and thus potentially ensuring greater sustainability. This outcome may be attributed to the fact that the participating schools had relatively lower performance indicators at the onset of the program, necessitating longer time frames for collaborative school improvement activities to be effectively established as routines. Another important aspect of sustainability that emerged from the study is that due to the external factors that supported the schools with lower performance indicators, the schools and improvement team leaders started to take ownership of their crucial role in carrying out school improvement activities. Here, all schools admitted to benefitting from creating separate collaboration time and from involving the whole school in the new initiatives.

As to the limitations, this research aimed to study certain participant schools in one program in Estonia. Therefore, the results might not be generalizable to other similar studies elsewhere. Additionally, the data collection process had some constraints: the university representatives from the School Improvement Program, the school mentors and the local municipalities were not included as the primary focus was on the work of the school improvement teams. Moreover, conducting focus groups interviews with both teachers and the school principals at the same time might complicate the differentiation of individual perspectives from collective views due to possible social dominance issues (Cohen et al., 2018). Studying routines also has its challenges as it might be difficult to define the starting point and end of a routine and to manage the involvement of multiple participants (Wolthuis et al., 2021a).

Despite these limitations, a notable strength of this study lies in its contribution to bridging the gap between theory and practice, illustrating effective research-practice collaboration in educational effectiveness, school improvement and policymakers (Kyriakides et al., 2024). This study also builds from previous research on the work of school improvement teams conducted in Estonia in relation to similar school improvement programs (Rääk et al., 2021) Furthermore, it adds to the limited research we have available of studying school improvement teams for a prolonged period of time with a focus on data use for school development and instructional improvement (Bolhuis et al., 2019).

Further research could explore the specific role that the school principal has within the School Improvement Program. Additionally, including the local municipality representatives would potentially enhance the understanding of how school improvement processes are perceived at a wider, system's level.

6 Conclusion

This study aimed to examine how teachers perceive the implementation of activities that support schools in sustainable evidence-driven improvement routines in five Estonian schools. By the conclusion of the 3-year program, it was evident that certain improvement activities exhibited considerable potential for long-term sustainability provided certain conditions were met. The findings provide a foundation for recommending further enhancements to similar school improvement programs. Rather than being organized according to the research questions, the following points are presented as practical suggestions for schools seeking to engage in improvement initiatives with an emphasis on the sustainability of the evidence-driven practices.

First, the efforts of the school improvement teams, aside from formal administration, positively influenced teachers' attitudes toward improvement initiatives and contributed to a more inquiry-driven school environment. However, retention and resistance issues that participating schools struggled with, indicate that school improvement programs should focus even more on the aspect of collaboration within the improvement team. School and team leaders should recognize their crucial role in implementing and sustaining school improvement routines as well as in shaping teachers' attitudes to using evidence.

Second, dedicated time for collaboration is essential. While two schools had previously practiced allocated time, it was used for information exchange instead. Drawing from this, the school improvement program should introduce diverse collaboration activities to help schools learn effective collaboration.

Third, for initiatives to become routine, they need time; and taking small gradual steps in school improvement practices is vital. Implementing too many initiatives simultaneously reduces the likelihood of their sustainability. Most school improvement activities, such as utilizing various data for decision-making, forming teacher learning communities, allocating time for collaboration, conducting lesson observations, visiting other schools for benchmarking, visualizing the steps and progress of the initiatives, were new to the schools that completed the program.

Fourth, a longer time period is crucial for sustainable school improvement programs. A minimum timeframe of three consecutive years is necessary to shape the schools' attitudes to and perceptions of the improvement initiatives. Some schools might need extra assistance with establishing effective teacher learning communities as organizational factors can hinder collaborative learning. Others may struggle with overwhelming planning. Even so, external assistance in organizing these communities in the form of school visits, for instance, should be approached cautiously, as one school had a negative experience that increased staff resistance.

Fifth, establishing data-use routines is imperative. Although schools reported collecting and using data for mapping and monitoring purposes, these practices were not yet systematic or integrated into the daily work of the schools. All schools acknowledged an increased awareness of data and began using it to inform school policy changes. They reported that the program helped them understand the distinction between relevant and irrelevant data more clearly and enhanced their confidence in analyzing existing data. This highlights the necessity of improving teacher's data literacy skills as a key component of such school improvement programs.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

KR: Conceptualization, Investigation, Methodology, Writing – original draft, Writing – review & editing. EE: Conceptualization, Methodology, Supervision, Writing – review & editing.

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The authors declare that the research was conducted without any commercial or financial ties that could be seen as a potential conflict of interest.

Generative AI statement

The author(s) declare that no generative AI was used in the creation of this manuscript.

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