Educational infrastructures and organisational memory: Observations from a Swedish perspective

Daniel Nordholm
Uppsala University, Sweden

Mette Liljenberg
University of Gothenburg, Sweden

Abstract
This article focuses on the interplay between the concepts of ‘educational infrastructure’ and ‘organisational memory’. Using data from collaboration between a Swedish university and a local municipality, the article draws attention to the interplay between three nation-wide improvement programmes and their educational infrastructures, and the knowledge developed and stored in the local schools. The data analysis is supported by the theoretical concept of organisational memory built up by ‘soft’ and ‘hard’ forms of knowledge. The findings show that primarily soft types of knowledge were developed and stored in organisational memory in the local schools. The programmes, therefore, became highly dependent on leaders’ and teachers’ personal knowledge and commitment, in-job training, imitation and socialisation. Regarding hard types of knowledge, for example, clear guidelines, organisational routines, processes and roles for improvement work, the programmes and their infrastructures were, generally, less supportive. These findings illuminate the importance of an organisational learning perspective in successful school system improvement.

Keywords
Decentralisation, educational infrastructure, leadership, organisational memory, school system improvement

Introduction
The concept of ‘educational infrastructure’ has recently been addressed in school improvement literature. Hopkins and Woulfin (2015) detailed that, at best, an educational infrastructure can bolster capacity-building efforts and support teaching and leadership practices. In addition, they highlighted the dynamic relationship between educational infrastructures and local practice. They
pointed out ‘that any examination of educational infrastructure requires attention to both (1) the structures and tools that policymakers use to implement largescale reforms’ and (2) ‘how these structures and tools are taken up and reshaped by leaders and teachers in their particular contexts’ (p. 372). This point of departure considers the ongoing discussions of top-down and bottom-up approaches to educational reform and school improvement. Hopkins and Woulfin explained that educational infrastructure and educational reform require standardisation and continuity, but at the same time, designs and programmes must permit flexibility and local responsiveness. In line with Anderson, Mascall, Stiegelbauer and Park (2012), Local Education Authorities (LEAs) and other middle-tier intermediaries must balance centralised expectations, accountability and resource management with local school-level flexibility. Thus, previous research emphasise that teachers and leaders must be given opportunities to interact and learn from one another around a locally defined vision (Hopkins and Woulfin, 2015). Moreover, they must engage in the practices that allow them to make sense of the networks and tools (e.g. infrastructure) available, modifying them to their particular contexts and student populations. Such infrastructure, for instance, is fostered by ‘collective work practices’ (Umekubo, Chrispeeels, & Daly, 2015), a ‘supportive learning environment for teachers’ (Mehta & Fine, 2015) and ‘teacher reflection and instructional change’ (Camburn & Won Han, 2015).

Without overlooking the importance of previous works, this article diverges to enhance understanding of school improvement and educational infrastructure. It aims to employ a clearer theoretical standpoint to provide details on nation-wide improvement programmes from national level, through districts and LEAs, down to local school level. In doing so, the theoretical departure is based around the concepts of ‘organisational learning’ and ‘organisational memory’ (e.g. Cook & Yanow, 1996; Hanson, 2001; March, 1999; Mintzberg, 1975) (see below). Argyris and Schön (1996) explained that organisational knowledge, in schools, for instance, is to be understood as the product of social interaction between members of organisations – not as the sum of individual, cognitive learning processes. Hanson (2001) pointed out that this raises important questions about the concept of organisational memory and, more precisely, how individual school organisations develop, store and articulate different types of knowledge concerning their improvement work, that is, whether reform work takes a top-down or bottom-up approach. Such questions and perspectives have arguably received little attention. For instance, Hannay and Earl (2012) detected three school district triggers for reconstructing professional knowledge in local schools: focusing on improving student learning, emphasising and creating opportunities for educators to collectively engage in professional dialogue about their practice, and stressing that educators use evidence to assess whether their actions improve student results. However, less is said about how these dialogues, learning opportunities and analyses should be stored and made accessible for future improvement work.

As identified by Hopkins and Woulfin (2015), school systems across the globe face similar challenges in developing infrastructures that could support school leaders and teachers in improvement work. In Sweden, the current system of school governance is often portrayed as a striking example with regard to decentralisation, marketisation and de-regulation (Lundahl, 2002; Lundahl, Arreman Erixon, & Holm, 2013; Seashore Louis, 2013). In this system, local municipal actors have played a key role since the 1990s because they are obligated to plan for, perform and evaluate local school activities. These actors were, however, generally unprepared to handle the complexity of the decentralised system (Organisation for Economic Co-operation and Development (OECD), 2015; SOU 2014:5, 2014; Swedish National Audit Office, 2004, 2011). Accordingly, Sweden started to re-centralise its education system in the 1990s (Nihlfors, 2003; Rönnberg, 2012). As part of this development, there were a number of nation-wide improvement initiatives focusing on prioritised areas of education during the 2000s. This article draws attention to the interplay between three
initiatives and organisational learning rooted in the local organisations’ improvement history. It is important to note, however, that despite the recentralisation developments in recent years, the importance of local decision-making and leadership in education has been preserved from central points of view (Johansson et al., 2013). Moreover, the decentralised school system and the ‘free school model’ have also gained attention in other European countries, Great Britain, for instance (Allen, 2010; Rönnberg, 2015). This makes Sweden an important example, given that response to educational reforms must be analysed within particular localities.

Using data from a Swedish municipality, this article draws attention to three improvement initiatives developed during the 2000s to support LEAs, local school leaders and teachers in the local contexts. In the studied case, these initiatives were linked by LEAs to local needs and prioritisations, and finally translated by principals and teachers in the local schools. By analysing the improvement work performed in these programmes, the aim of the article is to explore how organisational knowledge is developed and stored in organisational memory in the local organisations. The following research questions directed the analytical work:

1. What types of knowledge are developed and stored in the local organisations’ improvement history in the nation-wide programmes?
2. What characterised organisational learning in the local school organisations, and what can be said about the interplay with the educational infrastructure provided?

The article has the following structure: First, the theoretical starting-points are detailed. Second, a background for three nation-wide improvement areas is discussed. Third, the focal case study and the analytical work are outlined. Fourth, the findings of the analysis are presented in three sections. The final sections provide a discussion and conclusion.

**Theoretical starting-points**

This article builds on organisation theory and the concepts of organisational learning and organisational memory, since it is significant to move beyond an individual and cognitive learning position which requires an organisational perspective on educational change (cf. Blossing & Ertesvåg, 2011; Stoll, 1999, 2009); It is thus important to note that organisations, not only the individuals within them, can learn, and lasting school improvement and educational change is not dependent on a few individuals when both principals and teachers tend to change jobs quite frequently. As March (1999) also pointed out, it is essential to then understand how organisations learn, since this could help us to design smarter organisations, save time and energy, and secure ongoing learning processes.

By integrating previous theoretical works (e.g. Argyris & Schön, 1996; Levitt & March, 1996), Hanson (2001) elaborates on the interplay between the concepts of organisational learning and organisational memory. One key point is that schools must possess shared learning processes and ‘a sound holding environment of past experiences’ – otherwise they tend to repeat previous mistakes. Such an environment, which Argyris and Schön (1996) termed organisational memory, consists of a series of structures, procedures, relationships, documents, artefacts and so on, as March (1999: 83) explained.

This article draws attention to different types of knowledge of organisational memory, stored in earlier improvement work and their interplay with organisational learning in the local organisations. On this topic, Huber (1996) centred the role of organisational memory in organisational learning, emphasising that what has been learned must be stored and existing knowledge must be made accessible to members of the organisation. More specifically, Hanson (2001) outlined a
broader dividing line between ‘soft’ and ‘hard’ knowledge of organisational memories. Soft knowledge exists, according to Hanson (2001), ‘principally in people and documents, can be formal or informal, and is transmitted and perpetuated through processes as in-service training, imitation, socialisation, and professionalization’ (p. 638). Hard knowledge, on the contrary, consists rather of knowledge stored in policies, school rules, formal processes, standard operating procedures and acknowledged roles. With reference to Mintzberg (1975), Hanson (2001) points out that hard knowledge has proven to be less vulnerable and, therefore, more persistent over time in operationalising educational change. It is finally emphasised that both soft and hard knowledge are essential for accomplishing lasting improvement and therefore improvement capacity increases if there is a balance of each.

That said, important questions can be raised regarding local school organisations’ capacity to translate and store knowledge of improvement programmes initiated by national agencies and the support offered by educational infrastructures. What do we actually know when it comes to access to and use of previous knowledge and experiences stored in organisational memory? What is the balance between hard and soft knowledge and what impact could this have on school system improvement? Such components will be possible to trace and analyse by using key theoretical starting-points.

**Background**

The Swedish National Agency for Education introduced a number of large areas designated for school improvement in the 2000s. In this section, the backgrounds to these initiatives are described and linked to this article.

The first initiative on which we focus in this article draws attention to ‘genus and gender equality’, which received increased attention in schools in the 2000s. Arguments have been raised that teachers generally need more knowledge on these issues to accomplish their pedagogic duties. Regarding compulsory schools, the Swedish National Agency for Education was given an assignment to implement a number of programmes between the years 2008–2010 with different types of in-job training and improvement programmes (SOU 2010:83, 2010). In these programmes, the local actors were able to apply for national funding on three occasions. In addition, the Swedish Association of Local Authorities and Regions (SKL) received money to undertake a programme for sustainable equity. This initiative actively supported municipalities, districts and regions to implement targeted, sustainable and knowledge-based work to integrate gender equality into their activities.

The second initiative related to the government’s efforts to develop ‘entrepreneurial learning in schools’ (e.g. The Swedish National Agency for Education, 2010). In May 2009, the Swedish government adopted a ‘Strategy for Entrepreneurship within the Field of Education’. The agency was appointed to encourage the improvement of entrepreneurship in Swedish schools and develop the students’ curiosity, creativity and ability to take initiative and manage a business. Such skills and abilities were also found in the current curricula (e.g. Curriculum of Lgr. 11, 2016). The Agency for Education had the task of identifying, analysing and disseminating the experiences of LEAs’ and schools’ work with entrepreneurship. It was emphasised that the concept of entrepreneurial learning could be understood from several starting-points (The Swedish National Agency for Education, 2015) from a perspective related to globalisation, international competition, increased growth, employment and regional development.

The third and final initiative draws attention to mathematics and efforts to improve pedagogics and didactics within this subject in compulsory schooling – an initiative termed ‘The Mathematics Lift’. Given the fact that students’ results in mathematics have declined in Sweden since the 1990s,
as shown in Trends in International Mathematics and Science Study (TIMSS) and Programme for International Student Assessment (PISA), the Government stressed the need for in-job training for mathematics teachers (Ministry for Education, 2012). The Swedish National Agency for Education cooperated with the National Centre for Mathematics Education (NCM) at the University of Gothenburg and offered in-job training of mathematics supervisors and principals. Furthermore, they developed a web-based platform to be used for in-service training at the local school level, providing relevant support materials and training to supervisors and teachers. Principals became responsible for appointing mathematics supervisors among their teachers and providing time for in-service training, and also completed the in-job training arranged by the Swedish National Agency for Education. The Mathematics Lift was implemented in the years 2012 and 2016.

The municipality discussed in this article participated in all these initiatives. The common structure for improvement work in the municipality has been that LEAs decide on the prioritised goals of the municipalities’ schools every year. These goals can target both government initiatives as well improvement areas identified in the local context. In the next step, it is principals and teachers in the local schools who are expected to interpret and implement the contents of the prioritised goals into their specific contexts.

**Introducing the empirical study**

This article is linked to a 3-year research project conducted in a Swedish municipality, starting in 2014. The project involved all public schools ($n=17$) and preschool units ($n=11$) within the municipality. In this project, an essential task for researchers was to analyse all schools and preschools in the municipality, and based on these analyses, write a report for each unit in which the ongoing improvement work was examined from various perspectives. Importantly, detailed questions were asked about previous improvement initiatives in every local school organisation. Questions were asked about the focus of previous improvement work, about how the local organisations decided to work with the initiatives and about the outcomes since.

This article is based on data from the 17 schools participating in the project. Interviews, individual or in pairs, were done with superintendents and principals. Teachers were interviewed in groups. Informants for the group interviews were selected based on years of employment, teaching subjects, grade levels and whether the informants had leadership duties in their organisation. The selection of informants also included informants from all teacher teams in the unit. In total, the analysis is based on audio-recorded interviews with 360 respondents: 2 superintendents, 27 principals and 331 teachers. Together, these provided material rich enough to detect overall trends and also to analyse certain details in each local organisation. Table 1 offers a detailed overview of the participants.

**Analysis**

Empirical data were analysed and interpreted with the assistance of software for qualitative analysis (NVivo 11.1). In the first step of the analysis, the written reports of the local school organisations were examined to identify improvement initiatives at a governmental level in which the local schools had taken part. Based on the reports from the 17 schools, the genus and gender equality, entrepreneurial learning and Mathematics Lift initiatives appeared to be most prominent. To achieve a deeper understanding, selected parts of the audio-recoded interviews were transcribed verbatim.

In the second step of the analytical work, each initiative was coded into two broad categories: hard knowledge and soft knowledge of organisational memory elaborated by Hanson (2001).
Linked to Hanson and colleagues’ work, the third step of the analysis applied the subcategories of ‘guidelines’, ‘routines’, ‘processes’ and ‘roles’ to trace storage of hard knowledge in the improvement histories. Regarding soft knowledge, the analysis applied the subcategories of ‘personal knowledge and commitment’, ‘in-job training’, ‘imitation and socialisation’ and ‘professional development’. In the next step of the analysis, the subcategories were complimented by data-driven categories to render contrasting themes visible. Coding and analysis can thus be characterised as both data-driven and concept-driven (Kvale & Brinkmann, 2009). The subcategories, as well as the differences between the three improvement initiatives and the outcomes in various schools, are detailed below.

### Results

**Genus and gender equality**

In this first example of nation-wide improvement, LEAs took on an influential role, initially to establish some forms of hard knowledge that could support processes in local school organisations. For instance, they created certain routines and roles intended to underpin improvement work. Development leaders were given the task and mandate to lead and operate development issues related to genus and gender equality. A superintendent clarified the forms and function of this collaboration:

> We educated gender pedagogues and made them responsible for the work with genus and gender equality in each school. They became responsible for initiating and getting the work running. To support them, the municipality started a network. We invited them regularly to inform them about new things that they

---

### Table 1. Interviews in the municipality.

<table>
<thead>
<tr>
<th>Schools</th>
<th>School form (school year)</th>
<th>Group interviews</th>
<th>Teachers</th>
<th>Superintendents/Principals</th>
</tr>
</thead>
<tbody>
<tr>
<td>School A</td>
<td>6-9</td>
<td>7</td>
<td>21</td>
<td>2</td>
</tr>
<tr>
<td>School B</td>
<td>F-5</td>
<td>6</td>
<td>19</td>
<td>2</td>
</tr>
<tr>
<td>School C</td>
<td>F-5</td>
<td>9</td>
<td>27</td>
<td>2</td>
</tr>
<tr>
<td>School D</td>
<td>F-5</td>
<td>4</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>School E</td>
<td>F-5</td>
<td>3</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>School F</td>
<td>F-5</td>
<td>4</td>
<td>16</td>
<td>1</td>
</tr>
<tr>
<td>School G</td>
<td>F-5</td>
<td>4</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>School H</td>
<td>F-5</td>
<td>7</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>School I</td>
<td>6-9</td>
<td>4</td>
<td>16</td>
<td>1</td>
</tr>
<tr>
<td>School J</td>
<td>F-9</td>
<td>6</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>School K</td>
<td>6-9</td>
<td>7</td>
<td>26</td>
<td>2</td>
</tr>
<tr>
<td>School L</td>
<td>F-9</td>
<td>7</td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>School M</td>
<td>F-9</td>
<td>7</td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>School N</td>
<td>F-5</td>
<td>4</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>School O</td>
<td>6-9</td>
<td>6</td>
<td>23</td>
<td>2</td>
</tr>
<tr>
<td>School P</td>
<td>F-5</td>
<td>3</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>School Q</td>
<td>F-5</td>
<td>4</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>92</strong></td>
<td><strong>331</strong></td>
<td><strong>29</strong></td>
</tr>
</tbody>
</table>
needed to know. But also to support them in their work so that they could be a driving force in the work with genus and gender equality in their local school.

However, some forms of hard knowledge were less visible in the analysis. Most clearly, participating teachers received no clear goals for the improvement work or guidelines clarifying what LEAs included in ‘being a driving force in the work’. Principals also did not formulate such guidelines locally. Hence, despite the fact that genus and gender equality was a prioritised goal of the municipality, few examples were detected in which goals and visions of the local schools were impacted.

Regarding soft knowledge, the analytical work disclosed the notion that these forms of knowledge had a clear connection to personal knowledge interests and commitments. Thus, the LEA provided the opportunity for interested teachers to participate in certain training programmes and networks. By networking in the municipality, ‘gender pedagogues’ had the opportunity to further develop their knowledge and reflections from these programmes with the other participants. In social interaction, they had the opportunity to learn from each other and the content of the improvement initiative. A former gender pedagogue in School B explained,

In the network, we had discussions based on movies and literature and made reflections in relation to our own school and experiences. We received a lot of input and it was very fulfilling. If we wanted to take an additional step in our work we had the opportunity to accept help from the network leader. The network meant a lot to us. You really felt that genus and gender equality were priorities during these years.

However, when this nation-wide initiative was completed, it became relevant to ask what kind of knowledge was established and stored as organisational memory in the local schools. In time, LEAs dismantled the municipality-wide organisation, which had previously served as a framework and catalyst for hard knowledge. For instance, the role of gender pedagogues was eliminated as well as the network that gave gender pedagogues the possibility to be brokers between the central organisation and the local school organisations. It is important to note, however, that principals still had the option to preserve roles and arrangements to build on and further develop these types of hard knowledge. Equally important to emphasise is that gender pedagogues’ work had not been linked to the local organisation and their guidelines, goals and visions. Consequently, when the hard forms of knowledge were removed, this also reduced the capacity for storing soft knowledge. Ongoing processes were then made highly dependent on individual teachers’ leadership. As teachers in School H described, this slowed down the improvement work and, in time, the lack of focus became clear, although many teachers still saw the importance of working with these issues:

Teacher 1: We have two teachers who are trained in gender pedagogy. However, our work with gender pedagogy has faded-out.
Teacher 2: I can agree with that. Previously it was a standing item on all meetings, but no longer. Although it is an important subject.

In summary, this first section, the analysis, showed that both soft and hard knowledge were developed within this initiative as long as the Agency for Education supported LEAs and the local schools. However, when the national initiative ended, the local organisations did not preserve or further develop hard forms of knowledge by in organisational memory. Moreover, improvement work became too dependent on individual commitment and personal interests, that is, softer forms of knowledge. These conditions also caused the local school organisations to have problems taking advantage of prior knowledge.
**Entrepreneurial learning**

Regarding the second nation-wide improvement initiative addressing entrepreneurial learning (EL) in schools, this was prioritised as an improvement area in the studied municipality. Overall, the analysis revealed that some schools were, and still are, clearly impacted by this nation-wide initiative because they have translated the content and leading ideas into the local organisations. However, in the other schools, EL has had a modest impact on the organisation and pedagogic work. It is thus essential to further investigate organisational memory and the relationship between hard and soft knowledge.

The municipality invested a great deal of time (and money) in this improvement initiative. Concerning hard knowledge, the LEA strived to impact the local schools in regard to vision, improvement goals, and teaching and learning activities. In some cases, in which such types of knowledge were not considered, the analysis showed that the local school organisations had difficulty capitalising on and translating the (soft) knowledge generated in the municipality-wide collaboration. In some cases, school leaders and teachers lacked awareness of the importance of creating hard knowledge for successful improvement work. In particular, the lack of appointing certain structures in the local organisations became obvious over time, as described by teachers in School M:

Teacher 1: Ten training days for all teachers in the municipality. That is a huge investment.
Interviewer: What were the results? What did you take with you?
Teacher 1: It went badly I would say.
Teacher 2: It’s terrible to say because it is probably the most expensive initiative ever.
Interviewer: Can you think about some reasons for this?
Teacher 1: The structure for collegial learning. When we worked with EL we had no such strategies [. . .] There were no supportive structures in the school to pick up the things we learned in the training days.

In other cases, there was an argument which held that the content of EL was nothing new for the local organisation and, therefore, there was also no need for developing new forms for hard knowledge.

Regarding soft knowledge, a majority of the municipality’s teachers participated in in-service training and local schools arranged several learning days on this theme. A partnership was also started with an education company that supported the municipality, for instance, through coaching and in-service training. The analysis showed that, in some cases, the in-service training and the socialisation activities among teachers generated personal engagement and a professionalisation process which impacted the everyday work, here described by a teacher in School I:

Interviewer: What is it that distinguishes the work you do now from earlier?
Teacher 1: We have become confident with the content that we received in the first step of the initiative and know we can focus on what EL should be in work with the students.

In some cases, the analysis revealed that teachers had difficulties establishing softer forms of knowledge. Interviewees clarified that the concept and content of EL was rather vague, often rather ‘visionary’, leading to confusion or to very diverse interpretations. Thus, they expressed the challenge of establishing common ground based on the in-service training that could stimulate
imitation, socialisation and professional development – that is, developing soft knowledge, as teachers from School P explained:

Interviewer: Why didn’t the initiative give any results?
Teacher 1: We were afraid of losing control.
Teacher 2: Yes, because it was so fuzzy and unclear. That’s why it was so difficult. I must say, it did not matter how much I read about it. It was still unclear to me.

The analysis was able to detect a few examples in which both hard and soft knowledge were developed and stored in the organisational memory of the local organisation. In these schools, EL became a key concept which was clearly visible in the visions and goals of the units. For instance, the pedagogic focus of these schools has a somewhat different way of looking at knowledge, emphasising that students should be able to apply and use their skills, manage facts and put them in context. Moreover, the notion of ‘self-knowledge’ stresses that teaching is based on the individual’s own commitment. In newly built schools in one area of the municipality with an explicit focus on EL, classrooms and other facilities also had a certain, rather non-traditional design to match the pedagogic ideas. Principals in these schools developed routines to support the improvement initiative and also assigned lead teachers and team leaders the task of leading and further developing the ideas on EL. To coach them, external consultants were hired. The principal in School L described their work with EL as follows:

We have a lead teacher to help us develop the work with EL. We also have an evaluation system developed on the basis of EL that the teachers use to evaluate and analyse their work with a focus on our development of EL. We have an analysis sheet with thirteen questions that they should use in the teacher team. My principal colleague and I collect them and give responses to the teacher teams after reading them. We also give responses to the entire school in school meetings. We do this because we want to see development. We also give the teachers’ team leaders supervision. We work with two consultants, and they come to us once a month to work with the teacher team leaders and give them supervision in relation to EL.

Thus, by considering hard types of knowledge, these organisations had better prospects to benefit from teachers’ individual commitment and personal interests attained in socialisation activities further developing their professionalisation. Worth underlining is, however, that EL remained a challenging improvement initiative even in these units.

To summarise, in this improvement initiative, different types of soft knowledge were established in schools. In contrast to genus and gender equality, the analysis disclosed that the concept of EL had a much more complex nature, sometimes leading to confusion or very diverse interpretations. Hence, the need for hard knowledge that could translate, systematise and legitimise the knowledge in organisational memory became evident. With a few exceptions, the need for such hard knowledge was seldom recognised in the local schools and therefore EL only had a minor impact.

The Mathematics Lift

In this third and final example of nation-wide improvement, the Swedish National Agency for Education had a design characterised by more detail regarding content and objectives compared with the two previous initiatives. As noted above, there was also a rather clear structure for collaboration between different levels of the school system. As also indicated above, a significant need to improve this teaching subject had become evident, and the desire to attain support from a national level was generally pronounced.
Starting with the foundation of hard knowledge, the analysis showed that the Swedish National Agency for Education communicated which improvement processes should be completed and what roles the initiative encompassed. The LEA and the local schools followed these guidelines and directives, and the content of the initiative was often linked to goals and visions in the local organisations. They also made use of the supportive structures arranged by the agency; for instance, the didactic material provided on the website and modules. As principals devoted time to the initiative, the mathematics teachers could follow the prearranged structure throughout the initiative and thus become confident with the working method. In some cases, the hard knowledge developed was also incorporated into organisational memory in the local organisations. A teacher in School M explained,

The structure for collegial learning that we used in the Mathematics Lift and that we embraced and transferred to ‘Assessment for learning’. We read texts and had input into our work, we saw some short movies, reflected and returned to the classrooms and tried some new things. We went back, discussed our results and shared them with each other, as we still do. After that new input. The Mathematics Lift was very well structured.

In School F, a mathematics teacher described how they had continued to the improvement initiative themselves after the supervisor had left them:

We continued the Mathematics Lift on our own when the year with the supervisor was over. During the in-service training, we met regularly every week and had homework to do between the meetings. The year after we worked on our own. ‘The After Lift’ we called it. We continued with other modules and it was very rewarding. I work quite a lot with the lessons that we jointly developed.

Similarly, the comprehensive initiative also developed different types of soft knowledge. The analyses showed that mathematics teachers valued the fact that they finally had the time and resources to further develop this subject. The freer forms of training and the platforms that were created for socialisation and cooperation during the initiative were also considered to have contributed to increased professionalisation. Teachers in School I explained,

Teacher 2: The initiative was really good. We were a great team with teachers from three schools [. . .] We had productive discussions. How do you work with this area? What did you see in your classroom when you tried this? It was fantastic.

Interviewer: How can this be seen in your work today?
Teacher 3: It has affected my way of working with mathematics. I go back to the work we did and the reflections we made. My way of thinking about how to teach mathematics has changed. I think that I have become a better mathematics teacher.

That said, the clear directives from the Swedish National Agency for Education on how processes should be operated combined with the clarifications on roles, assignments, routines and expected outcomes impacted the establishment and storage of hard knowledge. School leaders’ involvement in the improvement work also seemed essential because they could communicate with and, if needed, support their teachers in the improvement work. However, in some schools, the hard knowledge was not integrated into organisational memory. Thus, in these organisations, responsibly rested on individual teachers. If these teachers left the school, the commitment and also the knowledge generated in the initiative was lost. In these schools, it turned out to be a true challenge to maintain the new ways of working with mathematics when the Mathematics Lift finished, here exemplified by teachers in School H:
Teacher 3: The mathematics workshop, we put a lot of energy into building it up. When we changed rooms in the school this spring we packed it into moving boxes. And it is still in the moving boxes. Although it is useful teaching material.

Teacher 4: But it was one teacher who applied for money to build it up.
Teacher 3: It was connected to an enthusiastic individual. That is my explanation. Sometimes you have the passion for something and sometimes it is somebody else. But when that person loses interest or leaves, everything dissolves.

In summary, in this third and final initiative, the analysis showed that both hard and soft forms of organisational learning were integrated into organisational memory in several organisations. These organisations had the capacity to preserve and also further develop the combination of hard and soft knowledge in other improvement initiatives, even after the Swedish National Agency for Education had completed their nation-wide collaboration initiative. In schools that were not able to preserve the results of the organisational learning, clear similarities to the two former examples were evident.

Discussion

The above analysis detected that, generally, there was an emphasis on soft types of knowledge during the improvement programmes studied that was developed and stored in organisational memory, with the exception of the Mathematics Lift. Thus, the nation-wide programmes became highly dependent on participating teachers and leaders’ personal knowledge and commitment, their in-job training, imitation and socialisation, and their individual professional development. In the Mathematics Lift, the subcategories of guidelines, routines, processes and roles, for example, indicators for developing and storing hard knowledge in the improvement histories, became more evident in the analysis. As shown, hard knowledge was important for the outcome of the programmes and for long-term improvement, not least after the government’s and LEAs’ involvement but also for organisational learning – that is, contributing to future improvement work.

Concerning the interplay between improvement work performed by local actors and the educational infrastructure provided by government agencies translated by LEAs, the lack of a clear infrastructure in the programmes of genus and gender equality and EL reduced the possibility of establishing both hard and soft types of knowledge. In contrast, the Mathematics Lift comprised an infrastructure for collegial learning that made all mathematics teachers part of the ongoing discussions and the programme. Equally important to note is the fact that the mathematics supervisors and online models helping teachers to collaborate in their daily work. Regarding organisational learning and organisational memory, it became evident that the knowledge established in the Mathematics Lift was also stored and transferred to other improvement work. However, it would be wise to note that a rather short time has passed since the programme was formally ended. Nevertheless, the prospects seem to be good for lasting school improvement. In addition, it must be stressed that some schools actually recognised the need to establish ‘hard knowledge’ at the local school level, for instance, the principals of School L creating routines for classroom observations.

Regarding the Swedish case more broadly, it is important to emphasise some of the challenges that a decentralised and deregulated school system holds for LEAs as regards to translating and linking national improvement programmes. As underlined by Anderson et al. (2012), LEAs and other middle-tier intermediaries must balance centralised expectations, accountability and resource management with local school flexibility. The findings of this article indicate that this is far from a
straight-forward process in a decentralised system, especially if there is only loose infrastructure provided and if programmes are open-ended, expecting local professionals to make their own interpretations built on a knowledge-base founded in the local context. Considering the results of Hopkins and Woulfin (2015), local actors must make sense of the current educational infrastructure, modifying networks and tools to narrow down the ‘gap’ between the national and local levels. In the case of gender equality and EL, the infrastructure and the overall objectives were, however, too ambiguous, not least for principals and teachers in the local schools. As a consequence, both hard and soft types of knowledge were difficult to establish.

Based on these results, there are two main options to consider for system-wide improvement in a decentralised school system, recalling the previous bottom-up and top-down approach discussion. Thus, one alternative is to design national improvement programmes that always take into account an infrastructure that accommodates both hard and soft types of knowledge to structure and support local school improvement work. Another option is to foster improvement work in the local settings so that LEAs, school leaders and teachers recognise the importance of organisational learning in schools. As shown above, there are schools and principals, if few, which created a locally based infrastructure, and in some programmes, for instance, gender and gender equality, a proper design does not necessarily provide specific details on how to accomplish a local process and the goals for such work. A middle path is, as recognised in the introduction, to find ways to combine the two approaches. Nonetheless, these suggestions are important for all stakeholders to consider in designing and implementing nation-wide improvement programmes.

**Conclusion**

This article focused on the concept of educational infrastructure and how organisational knowledge is developed and stored in organisational memory by using a Swedish case, centred on three nation-wide improvement programmes. It analysed what characterised organisational learning in local school organisations and the interplay with the educational infrastructure provided by national agencies. The findings demonstrate the need for an organisational learning perspective to understand why some schools are more successful in capitalising on improvement work than others. Without denying the importance of collective work practices, a supportive learning environment for teachers and teacher reflection to accomplish mental shifts in how teachers and leaders construct their ideas about teaching and learning, this article argues that such processes must be stored and made available to members of organisations in up-coming improvement work. As pointed out by Hannay and Earl (2012), the shift to a knowledge-based society requires a shift in educational practices and in educational work to meet the needs of a knowledge-intensive labour market. However, we argue that this also demands a deepened understanding of schools as learning organisations and learning as more than the sum of individual learners. Today, both teachers and school leaders can change jobs several times during their careers, which mean dependence on individual teachers and leaders can be a risky prospect without an organisation that systematises and stores established knowledge. Thus, an educational infrastructure must support the development of hard and soft knowledge and organisational learning in the local school organisations.

**References**


