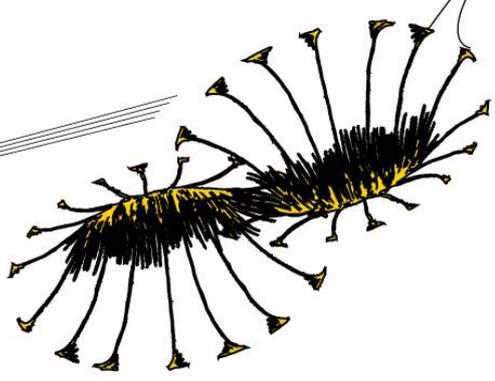




KNOWLEDGE SHARING IN SCHOOLS WITH DATA TEAMS



Mariska Sinke, S1090216
University of Twente, Enschede



Master Thesis
Educational Science and Technology

Graduation Committee:
First supervisor: M.D. Hubers, MSc
Second supervisor: Dr. K. Schildkamp

Table of contents

Summary	3
1. Introduction	4
2. Conceptual framework	6
2.1 Data teams	6
2.2 Creating and sharing knowledge	8
2.2.1 SECI-model of Knowledge Creation.....	9
2.2.2 Theory of Knowledge Building.....	9
2.2.3 Activity Theory	10
2.3 Factors promoting and hindering knowledge sharing	10
2.3.1 Organisational factors.....	11
2.3.2 Individual factors.....	13
3. Method	15
3.1 Respondents.....	15
3.2 Data collection.....	16
3.3 Data analysis.....	16
3.4 Reliability and validity	17
4. Results	18
4.1 School A.....	18
4.1.1 What and how knowledge is shared at School A	18
4.1.2 Factors promoting and hindering knowledge sharing at School A.....	20
4.2 School B	21
4.2.1 What and how knowledge is shared at School B.....	21
4.2.2 Factors promoting and hindering knowledge sharing at School B.....	24
4.3 School C	24
4.3.1 What and how knowledge is shared at School C.....	24
4.3.2 Factors promoting and hindering knowledge sharing at School C.....	26
4.4 School D.....	26
4.4.1 What and how knowledge is shared at School D	27
4.4.2 Factors promoting and hindering knowledge sharing at School D.....	28
4.5 Cross-case analysis.....	29
4.5.1 What and how knowledge is shared	29
4.5.2 Factors promoting and hindering knowledge sharing	33
5. Conclusion and discussion	36
5.1 Conclusion.....	36
5.1.1 What knowledge is shared between data team members and non-data team members?.....	36
5.1.2 How is knowledge shared between data team members and non-data team members?.....	36
5.1.3 What factors promote and hinder knowledge sharing between data team members and non-data team members?	37
5.2 Discussion	38
5.3 Implications for practice and future research	38
Reference list.....	40

Summary

Data-based decision making has become more and more important for schools. Schools are increasingly held responsible for the education they provide and their pupils' learning progress, and one way in which they can take this responsibility is by basing their decisions on data. This study focused on the data team procedure, which is one of the methods of data-based decision making. The data team procedure learns teachers to collect, interpret and analyse data and to develop improvement measures for the educational problems within the school (Schildkamp, Poortman, & Handelzalts, submitted). The group of teachers who use the data team procedure, the data team members, will not be able to solve the educational problem by themselves. The data team members need the cooperation of the non-data team members to implement the improvement measures in the school, because mostly these concern school wide problems. Therefore, knowledge sharing between the data team and the non-data team members is important. Data team members can share two types of knowledge: knowledge on the data team procedure and data use in general, and knowledge about the educational problem they are studying. This study focused on whether these two types are shared with the non-data team members, how this knowledge is shared, and what factors promote and hinder this knowledge sharing.

The results showed that data team members shared both knowledge about the data team procedure and about the educational problem, although more knowledge was shared about the educational problem. With regard to the way knowledge was shared, the results showed that knowledge was mostly shared verbally at the team level and during formal moments. Knowledge sharing could be promoted by a stimulating school culture and the presence of formal opportunities to share knowledge (e.g., team meetings). A factor that seemed to hinder knowledge sharing was the organisational structure of the school, when there is not much communication between the different locations and departments within the school.

This study may be a helpful overview of knowledge sharing in schools for school leaders. They could use the results to promote knowledge sharing in their schools, for example by creating a stimulating school culture and by facilitating the data team members with enough formal opportunities to share their knowledge. Future research about knowledge sharing in the context of data teams is needed in order to gain more insight in which factors have a promoting and a hindering influence on knowledge sharing within schools.

1. Introduction

1. Introduction

Over the past few years, schools are increasingly held responsible for the education they provide and the learning progress of their pupils (Ikemoto & Marsh, 2007; Schildkamp, Poortman, & Handelzalts, submitted). Schools can take this responsibility by trying to use data to gain insight in their education, and by basing their educational decisions on these data. One way in which schools can make data-based decisions is by working with the data team procedure (Schildkamp, Poortman, & Handelzalts, submitted). The data team procedure learns teachers to collect and analyse data and to develop improvement measures for educational problems the school encounters. Besides learning about data use, the teachers learn about the educational problem, how to solve this problem, and how to improve their education in general (Schildkamp, Poortman, & Handelzalts, submitted). However, making decisions based on data is not something teachers are very familiar with.

Schildkamp and Kuiper (2010) found several reasons why teachers do not use data to improve their education: they dissociate their own performance from the performances of the pupils, they think that using data is not a task for teachers but for the school leader, and they do not always have the required skills to collect and analyse data. Most teachers are not only quite unfamiliar with data use, sometimes they are also used to base their decisions on intuition. These intuitions may not always be correct and so a lot of time and money may be invested in ineffective improvement measures which are not adapted to the pupils' needs. Therefore, it is important that teachers in a data team learn how to make decisions based on data (Schildkamp & Kuiper, 2010). Furthermore, research showed that using data can lead to improved education and higher pupil achievement (Campbell & Levin, 2009; Earl & Timperley, 2009).

Using data to improve education and increase pupil achievement will only be effective when the data team members share their knowledge about data use and the educational problem, and their data use skills with the other teachers in the school (Achterberg & Vriens, 2002; Cabrera & Cabrera, 2002; Ipe, 2003). This way, the non-data team members also learn more about data use and the educational problems, and will be stimulated to work with data themselves and to implement the developed improvement measures in their own teaching. The educational problems the data team works on are often school wide problems, so it is important that all teachers in the school exactly know what the problem is and how to deal with it.

Over the past years, a lot of research has been conducted about knowledge sharing in general and knowledge sharing between teachers. Researchers have indicated several factors that could influence knowledge sharing, for example the motivation of a teacher to share, the abilities of a teacher to share, and the school's culture (Ipe, 2003; Riege, 2005). However, there is yet not much consensus about how knowledge is shared and what factors promote or hinder knowledge sharing between teachers. Furthermore, not much research is yet conducted about knowledge sharing in the context of data teams. Therefore, this study focused on which knowledge data team members and non-data team members share with each other, on how this knowledge is shared, and on the promoting and hindering factors of knowledge sharing. The results of this study will contribute to existing theories about knowledge sharing: it will provide more insight in what kind of knowledge is shared, how this knowledge is shared, and the factors that influence knowledge sharing. The outcomes of this study will also have a more practical relevance. It will help school leaders to gain more insight in how knowledge sharing could be promoted in order to make data use in schools more valuable. Besides that, it will help data team members and non-data team members to gain more insight in how they can share their knowledge with each other in a school context.

This study focused on three research questions:

1. What knowledge is shared between data team members and non-data team members?
2. How is knowledge shared between data team members and non-data team members?
3. What factors promote and hinder knowledge sharing between data team members and non-data team members?

1. Introduction

In the next chapter (Chapter 2) the theoretical framework used for this study will be described. An overview will be given about the concept of data teams and the data team procedure, existing theories about the creation and sharing of knowledge, and an overview of the most mentioned influential factors on knowledge sharing in the literature. In Chapter 3, an explanation will be given about the respondents who participated in this study, the way data were collected and the way data were analysed. In Chapter 4, the results of the within-case analyses and the cross-case analysis will be described. The conclusion, discussion and implications for practice and future research can be found in Chapter 5.

2. Conceptual framework

2. Conceptual framework

In the conceptual framework, an explanation will be given about data teams and the data team procedure. Thereafter, an overview will be given of existing theories about knowledge creation and sharing, and an overview of the most mentioned influential factors on knowledge sharing in the literature.

2.1 Data teams

A data team consists of four to six teachers and one or two school leaders (Schildkamp, Poortman, & Handelzalts, submitted). This team collects data, interprets them, and develops a plan of action to solve a school's educational problem. A data team can collect quantitative and qualitative data about any school aspect. The team can collect input data (e.g., pupils' demographics), process data (e.g., information on the quality of instruction), outcome data (e.g., pupils' grades), and satisfaction data (e.g., opinions of teachers, pupils, and parents) (Ikemoto & Marsh, 2007; Schildkamp, Lai, & Earl, 2013).

A data team works according to a cyclic and iterative procedure consisting of eight steps, see Figure 1. In each step, the data team members have to take different actions and use different skills in order to reach their goal. In Figure 2 all steps are described.

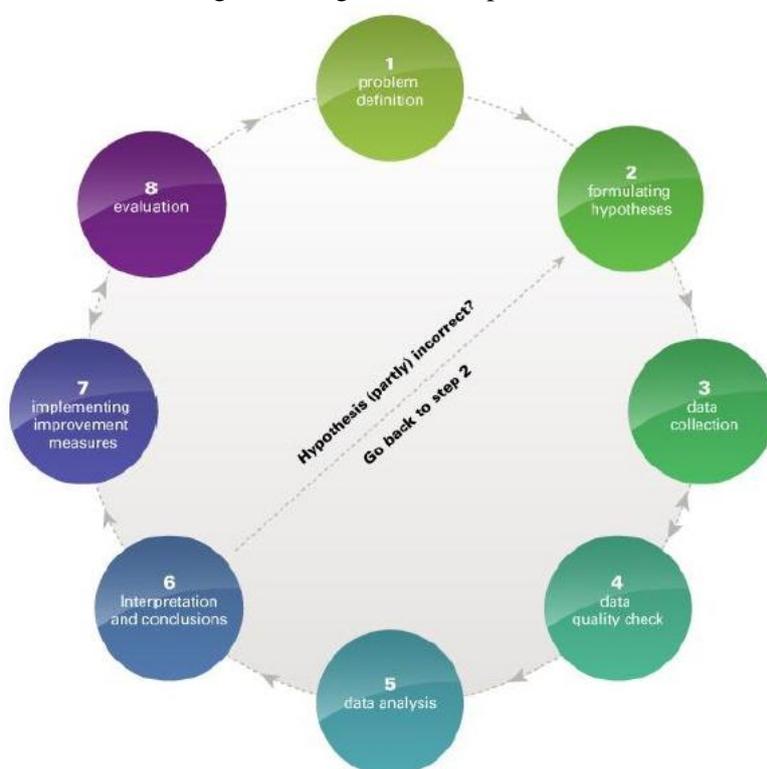


Figure 2.1. The data team procedure (Schildkamp, Lai, & Earl, 2013, p. 56).

2. Conceptual framework

The Eight steps of the data team procedure

1. **Problem definition:** the team decides on which educational problem and goals they want to focus their efforts. For example, if the data team decides to focus on grade retention, the first thing the team has to do in this step is collect data on grade retention (e.g. how many grade repeaters does the school have in each grade).
2. **Formulating hypotheses:** the team develops hypotheses (for example on what causes grade retention).
3. **Data collection:** the team collects data to either confirm or reject the hypotheses. Several types of data can be collected (e.g. assessment data, inspection reports, and examination results).
4. **Data quality check.** Are the collected data valid and reliable?
5. **Data analysis** (e.g. summarizing, calculating, comparing). This can involve simple data analyses (e.g. descriptive analyses, summarizing interview data) as well as more sophisticated analyses (e.g. correlational and regression analyses). For example, a data team in one of our studies (Schildkamp & Handelzalts, 2011) had the hypothesis that the policy of the school to still promote students with five insufficient marks on their report card to the next grade caused grade retention in the following grade. The data team collected report card data and retention data and found out that students who were promoted with five insufficient marks on their report card did not have to repeat the following grade. The hypotheses turned out to be false.
6. **Interpretation and conclusion:** If hypotheses turn out to be false, new hypotheses need to be investigated. The data team needs to collect additional data (back to step 2). If hypotheses are correct, the team draws conclusions based on the collected data.
7. **Implementing improvement measures.** The team describes the measures needed to solve the problem, and the goals that go with these measures. The team makes team members responsible for implementing the actions, and determines which resources are available for implementing the actions. The team also thinks of ways to monitor the implementation of the actions, sets deadlines, and determines which data is needed to establish the effectiveness of the implemented actions.
8. **Evaluation.** Are the actions effective? Are the goals met? Are the problems solved and is the team satisfied? To evaluate the actions, new data needs to be collected. This process continues until the priorities are met and the goals are reached. Then the team can go back to step 1 to work on a new problem and goals.

Figure 2.2. The eight steps of the data team procedure (Schildkamp, Lai, & Earl, 2013, p. 57).

In the first step, a data team formulates a problem definition, for example: ‘the number of grade repeaters in the second grade of the pre-university track (vwo) is higher than the national average, and this should be lower than 2% within three years’. A data team formulates a hypothesis in the second step: ‘the number of grade repeaters in the second grade of the pre-university track (vwo) is above national average, because the first graders of the senior general education track (havo) are wrongly promoted to the second grade of the pre-university track (vwo) by the school’s policy’. In the third step, the data team can collect assessment data and pupils’ demographics to study this hypothesis. In step four, the validity and reliability of the data will be checked by the data team members. When the data are valid and reliable, the data will be analysed in step five by, for example summarising and comparing the collected data. In step six, the data team comes to conclusions based on the analysis. When the hypothesis turns out to be incorrect the data team has to go back to step two. The data team develops and implements improvement measures in step seven, for example, changing the school’s policy. In step eight, the data team evaluates the implemented improvement measures by collecting new data about, for example the number of grade repeaters in the second grade of the pre-university track (vwo) a year after the implementation of the improvement measures.

2. Conceptual framework

Working with the data team procedure gives the data team members the opportunity to acquire the skills for data use, for example formulating hypotheses and analysing data. The data team members can acquire these skills by continuously practicing the different steps and skills with problems the school encounters. The use of data will be more concrete when the skills are trained with these problems and will be more understandable for the data team members. Besides that, the developed improvement measures can immediately be applied in school's practice, which emphasises the usefulness of the data team procedure.

2.2 Creating and sharing knowledge

Data teams are expected to create a lot of knowledge when working with the data team procedure. However, according to Davenport and Prusak (2000) it is important to understand that there is a difference between data and knowledge, and that these concepts are both connected to the concept of information. Data can be defined as objective facts, which means that data have no meaning by itself. An example of data a data team could use is the number of grade repeaters in the school. In contrast to data, information has meaning. Information can be defined as a set of data organised to a certain purpose. This organising could, for example be done by contextualising, categorising, and correcting data. An example of information the data team members could have is a categorisation of the number of grade repeaters into the different school tracks. Like data could be transformed into information, information could be transformed into knowledge. Davenport and Prusak (2000) define knowledge as "a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information (p.5)". This transforming could be done by, for example comparing or connecting information. So in case of the number of grade repeaters, data team members could compare the number of grade repeaters in their school with the national average to know if there are significant differences between them.

Data team members can create two types of knowledge: knowledge about data use in general and the data team procedure (e.g., how to formulate hypotheses, how to collect data), and knowledge about the educational problem the team is trying to solve (e.g., the improvement measures) (Schildkamp & Handelzalts, 2011). It is important to share these two types of knowledge with the non-data team members. Sharing knowledge on the educational problem will help the non-data team members to gain more insight in the educational problem and will help the data team members to implement the improvement measures they developed (Huffman & Kalnin, 2003). This way all teachers are involved with the data team and so the data team may become more easily a part of the school's culture and habits. Making data use a part of the school's culture is important, because this may contribute to the sustainability of the data team (Cijvat, Dijk, Förrer, Hortensius, & De With, 2010). Besides that, sharing knowledge on the data team procedure and data use in general will help non-data team members to develop their own skills of data use, and to contribute to their professional development as a teacher.

Knowledge sharing is a process of both sending and receiving, and these are two separate activities. The process starts with the sending of knowledge, this can be done in different forms, for example by speech or writing (Hendriks, 1999). Successful knowledge sharing ends with the receiving of knowledge. This is a process of perceiving, interpreting, and evaluating the shared knowledge by the receiver (Achterbergh & Vriens, 2002; Hendriks, 1999). Thus the receiving of knowledge is an active process, in which the received knowledge should be made valuable by the receiver. The receiver could, for example use the received knowledge to change his or her behaviour or to come up with new ideas about his or her behaviour (Davenport & Prusak, 2000). Because of the duality of the process, this study focused both on the senders of knowledge and the receivers of knowledge. In most cases the senders of knowledge will be the data team members and the receivers will be the non-data team members. However, knowledge sharing cannot be seen as a strictly unidirectional process. This means that in some cases the non-data team members will be the senders, while the data team members will be the receivers.

2. Conceptual framework

2.2.1 Theories of knowledge creation and sharing

Before discussing the influential factors on knowledge sharing, more background information will be given about the different perspectives on knowledge creation and sharing that can be found in the literature. It is hard to define exactly what knowledge is. Over the past few years, several theories have been developed to explain what knowledge is (Paavola & Hakkarainen, 2005). In this paragraph three knowledge theories will be discussed to explore what knowledge is and how it can be created and shared: the SECI-model of Knowledge Creation (Nonaka & Takeuchi, 1995), the Theory of Knowledge Building (Bereiter, 1985), and the Activity Theory (Engeström, 1987). Insight in these three theories may help to understand the process of knowledge sharing in an organisational context.

2.2.1 SECI-model of Knowledge Creation

In the SECI-model of Knowledge Creation, knowledge is defined as “justified true belief” (Nonaka & Takeuchi, 1995, p. 58), which means that it depends on personal beliefs what is seen and justified as the truth and as true knowledge. The model is based on the idea that new knowledge is created through the interaction of existing tacit and explicit knowledge (Gourlay, 2006; Nonaka, 1991). Tacit knowledge is ‘know-how’ knowledge, knowledge that is attained through individual experiences and is hard to articulate (Nonaka, 1991). An example of tacit knowledge of a data team member is knowing how to read the collected graphs and tables with data. Explicit knowledge is ‘know-what’ knowledge, knowledge that is captured in words and is therefore much easier to share (Ipe, 2003; Nonaka, 1991; Nonaka & Takeuchi, 1995; Paavola, Lipponen, & Hakkarainen, 2002; Ragab & Arisha, 2013). An example of explicit knowledge of a data team member is knowing what activities he or she should undertake to pass through the eight steps of the data team procedure. In the SECI-model tacit and explicit knowledge interact with each other in a ‘spiral of knowledge’, consisting of four modes that all contribute to the creation of knowledge (Nonaka, 1991).

The first mode is called socialization, in which the tacit knowledge of one person is acquired by another person, for example via observations. In case of a data team, a data team member could learn how to read graphs by observing another data team member who knows how to read graphs. In the second mode, externalization, the tacit knowledge of a person is translated into explicit knowledge. This translation can be done by articulating one’s own tacit knowledge in words and mind maps. A data team member could, for example presents his or her tacit knowledge to other data team members. This way, his or her tacit knowledge becomes visible and usable for others. The third mode, combination, facilitates the combining of different sources of explicit knowledge, for example by writing documents or putting the knowledge in a knowledge management system (Nonaka & Takeuchi, 1995). The data team members could summarise all knowledge they acquired while using the data team procedure and use this to develop improvement measures or to write a plan of action. The fourth mode is internalization. In this mode the external knowledge will be transferred into tacit knowledge. This happens when people who receive the explicit knowledge will reflect upon, and use the acquired knowledge (Gourlay, 2006; Nonaka, 1991). In case of a data team, data team members and non-data team members could learn how to apply the developed improvement measures in their daily practice.

2.2.2 Theory of Knowledge Building

In the Theory of Knowledge Building no clear definition of knowledge is given, although it can be said that knowledge is represented in conceptual artefacts. Conceptual artefacts are, for example theories, models, and ideas (Paavola, Lipponen, & Hakkarainen, 2002).

In the Theory of Knowledge Building, two modes of dealing with knowledge are distinguished. The first mode is the belief mode, in which people see knowledge as fixed facts which they could agree or disagree on. The second mode is the design mode, in which people are concerned with the usefulness of knowledge and improve knowledge to shift the boundaries of the existing knowledge base (Bereiter & Scardamalia, 2003). Because knowledge creation becomes more and more important in today’s society, it is necessary that people learn to deal with knowledge in the design mode and learn how to build knowledge (Bereiter & Scardamalia, 2003). The focus thus should

2. Conceptual framework

not be on the learning of already existing knowledge, but on the development of new knowledge (Paavola, Lipponen, & Hakkarainen, 2002). The main idea behind the Knowledge Building Theory is that this development of knowledge should occur within a community, because a community as a whole is greater than the sum of all the individuals in that community. In the community, knowledge should continuously be built by all the members of the community to improve ideas and expand the knowledge base of the community. Activities in which the community members could engage to build knowledge are, for example commenting on each others' ideas, strengthen one's own ideas with the help of empirical theories, and linking of each others' ideas (Scardamalia & Bereiter, 2003).

A data team could be seen as a community in which teachers continuously build knowledge together, for example knowledge about the data team procedure and knowledge about the educational problem they are working on. This collaboration helps the data team members to develop new theories about the educational problem and to broaden the existing knowledge base by testing these theories with data analyses.

2.2.3 Activity Theory

The Activity Theory is based on the cultural historical activity theory and the theory of expansive learning (Engeström, 1987). The emphasis of the Activity Theory is on the existence of activity systems. An activity system is an entity of people, tasks, tools, and rules in a community (Engeström, 1999). Knowledge is seen as something unstable that cannot be defined easily. It is a new activity that never existed before and that people have to learn when a transformation in the activity system takes place (Engeström, 2000). Knowledge development can only take place in the long term and this is why knowledge development is only reserved for collective learning in activity systems (Engeström, 1999).

Collective learning occurs in seven steps, which do not follow one another in a fixed order (Paavola, Lipponen, & Hakkarainen, 2002). In the first step, the community notices that the required knowledge and skills for solving a specific problem are lacking within the community. In the case of data teams, the data team members could notice that they do not have enough knowledge and skills to solve the school's problems of the high rate of grade repeaters and that they therefore have to increase their skills and knowledge. In the second step, the community members analyse which knowledge and skills they need for the problem. Data team members could, for example learn which data about grade repeaters they have to collect or how to interpret this data. The degree to which the members can increase their knowledge and skills is determined by the 'zone of proximal development'. The zone of proximal development sets the boundaries of possible goals the members could set and the actions they could take. However, these boundaries are flexible and can be shifted continuously when intermediate goals of the members are reached (Engeström, 1999). In the third, fourth and fifth step, the community members create, examine and implement a solution for the analysed shortcomings. The data team members may implement a new policy regarding grade promotion in order to prevent grade retention. In the sixth step of the model, the members reflect upon the newly implemented solution and consolidate this in step seven (Engeström, 1999). The data team members could, for example collect and analyse data about grade retention two years after the implementation of the new policy to see if the number of grade repeaters has been reduced and the new policy has been a success.

As can be seen in the three theories, there are different perspectives on how knowledge is created and how it is shared within organisations. Regardless of the differences between the knowledge sharing theories, they also have one thing in common: every theory acknowledges that knowledge sharing in organisations is influenced by several factors. These influential factors will be discussed in the next paragraph.

2.3 Factors promoting and hindering knowledge sharing

Although data team members are expected to have a lot of knowledge that can be shared, actually sharing this knowledge does not happen naturally (Hendriks, 1999; Ipe, 2003). Several factors can be distinguished that influence knowledge sharing. These factors can be divided into organisational factors and individual factors. In the next paragraphs these factors will be further explained. It is acknowledged that these are not the only influential factors, and other factors could be found in the

2. Conceptual framework

literature. The discussed factors are also not mutually exclusive, which means that the factors could also influence each other and that two factors could partly measure the same phenomenon. However, these factors were the most mentioned factors in the literature study conducted.

2.3.1 Organisational factors

The first group of influential factors are organisational factors. An organisation can be described as an entity consisting of people who all have their own tasks and responsibilities serving the organisation's goal. In the most ideal situation, the people working in an organisation all pursue the same goal, for example providing high quality education to the pupils (Plowman, 1998). Several organisational factors can be distinguished as influencing factors on knowledge sharing: school's culture, organisational structure, use of technology, school leader support, and opportunities to share.

2.3.1.1 School's culture

According to Ipe (2003) the school's culture is increasingly being recognised as the most influential factor on knowledge sharing. A school can be seen as an autonomous whole with an own culture to which all other possible influencing factors are linked and dependent. These other influencing factors will not be strong enough to actually create a knowledge sharing network by themselves, because all these factors are influenced by the cultural entity of the school (Damodaran & Olphers, 2000; Gold, Malhotra, & Segars, 2001; Ipe, 2003; McDermott & O'Dell, 2001).

A school's culture consists of beliefs, policies, norms, and traditions which could influence the behaviour of the teachers, school leaders, pupils, and other people involved in the school (Short & Greer, 1997). These beliefs, policies, norms and traditions could also influence knowledge sharing. They determine the assumptions about which knowledge is considered to be important, about which knowledge should be at which organisational level in the school, and about how knowledge should be shared between the teachers (De Long & Fahey, 2000; Gold, Malhotra, & Segars, 2001; Staples & Jarvenpaa, 2001). To support knowledge sharing in the school, it is thus important that the school's culture consists of beliefs, policies, norms and traditions that encourage knowledge sharing between the teachers, and that these are communicated throughout the school. Data team members and teachers should feel encouraged to collaborate with each other and to learn from each other (Gold, Malhotra, & Segars, 2001). According to Chen and Huang (2007), teachers will be more motivated to share knowledge in a collaborative school culture. So, when the beliefs, policies, norms and traditions of a school's culture emphasise the benefits of teacher collaboration, teachers are more willing to share their knowledge and skills with each other, and are more willing to establish interpersonal contacts with each other.

2.3.1.2 Organisational structure

Traditionally, most schools consist of a structure with multiple parties. In the case of data teams for example, three parties are involved: the school leader, the data team (consisting of the school leader and some teachers), and the teachers outside the data team. All these parties have their own responsibilities and procedures, and this may promote that teachers only share knowledge in their own party. Therefore, an traditional, hierarchical structure in the school makes it more difficult to share knowledge from one party to another one. An organisational structure in which the boundaries between the different parties and departments have been reduced, will make it more easy to spread knowledge within the whole school (Al-Alawi, Al-Marzooqi, & Mohammed, 2007).

Furthermore, sharing knowledge in a school can also be difficult because teachers most of the time do not work in the same room. All teachers have their own classes and do not see each other often, and particularly, do not often collaborate with each other (Gold, Malhotra, & Segars, 2001). To make knowledge sharing possible in the organisational structure of a school, it is necessary that teachers are supported to collaborate with each other more frequently. The study of Willem and Buelens (2009), for example, revealed that when teachers are literally put together, for example during a team meeting, they are automatically encouraged to collaborate as a team and to share knowledge.

2. Conceptual framework

2.3.1.3 Use of technology

To make knowledge sharing within the school possible, a school leader could adopt a knowledge management system. This system contains a knowledge database, to which every teacher could add knowledge, and from which every teacher could acquire knowledge (Damodaran & Olphert, 2000). The presence of a knowledge management system can promote knowledge sharing, because it provides the opportunity to store important knowledge and to make it available to all teachers in the school as required (Damodaran & Olphert, 2000).

Carroll et al. (2003) describe in their article three essential characteristics an effective knowledge management system should have. The first characteristic is that the system should be easy to use and should look attractive to use, so that teachers are not hindered by any low technological skills when they want to use the system. The second characteristic is that the system should provide tools with which the teachers can add their knowledge to the system. The third characteristic is that the knowledge should be ordered, so that it is easy to find when teachers are looking for knowledge about a certain topic.

Damodaran and Olphert (2000) warn that a knowledge management system is not a solution for the problem of sharing knowledge by itself. A management system should only be seen as a mean to make knowledge sharing easier. To make the knowledge management system really workable, the school leader should ensure that also the other stimulating organisational factors are achieved.

2.3.1.4 School leader support

According to Riege (2005), it is a challenge for the school leader to create a school culture in which sharing one's own knowledge with other teachers and using the knowledge of other teachers is supported. To make sure that knowledge is shared within the school, the school leader first has to set clear guidelines for this and set knowledge sharing as one of the school's organisational goals (Coburn & Turner, 2011; Ives, Torrey, & Gordon, 2000; Schildkamp & Poortman, in press). A school leader could, for example facilitate teachers with enough time to share knowledge in team meetings.

Second, most of the teachers, also the teachers in the data team, are not used to share knowledge, and therefore, sharing knowledge can be seen as a new behaviour they have to learn (Schildkamp & Kuiper, 2010). A school leader could provide all teachers with a training or ongoing support with which the teachers learn this new behaviour (Coburn & Turner, 2011; Ives, Torrey, & Gordon, 2000). The school leader could also emphasise that non-data team members could ask a data team member for help when he or she wants to acquire new data use skills.

Third, a school leader should make sure that data team members and teachers have enough opportunities and time to meet each other, to share knowledge, and to discuss this knowledge (Coburn & Turner, 2011; Riege, 2005).

2.3.1.5 Opportunities to share

Data team members should have many opportunities during the school year to meet non-data team members in order to make knowledge sharing possible. This way, the data team members will be able to present the non-data team members all aspects of their research and to involve their colleagues with the data team research. The opportunities data team members have to share their knowledge can be divided into formal and informal opportunities. Formal opportunities (e.g., a training or a teacher meeting) are an effective way of sharing explicit knowledge, because these opportunities are especially designed to share knowledge. Formal opportunities are mostly well structured and provide data team members and other teachers the tools for knowledge sharing with a large number of people. This means that the spread of knowledge could be fast and widespread (Ipe, 2003).

In contrast with formal opportunities, informal opportunities involve individuals or small groups of teachers and knowledge is shared at a slow pace. During informal opportunities (e.g., a short conversation in the hall way), knowledge is shared through individual face-to-face contact. A data team member should have sufficient personal, informal contacts with other teachers in the school to be able to spread his or her knowledge and skills. These personal contacts are particularly important

2. Conceptual framework

because most knowledge within a school seems to be shared via these personal and informal contacts rather than via formal contacts (Ipe, 2003; Riege, 2005).

2.3.2 Individual factors

The second group of influential factors are the individual factors. An school organisation consists of individual teachers who all have to be involved in knowledge sharing in the school to make data use successful. According to Schneider, Goldstein, and Smith (1995) those individual teachers are the most important component of an organisation. They argue in their article that people make the organisation, not the organisational culture or structure.

Three individual factors have been identified as influencing factors on knowledge sharing: motivation to share, abilities to share, and mutual trust.

2.3.2.1 Motivation to share

Data team members and non-data team members will only share their knowledge with each other when they are strongly motivated to do so (Stenmark, 2001). Both internal and external motivational factors can be distinguished (Akhavan, Rahimi, & Mehralian, 2013).

People are intrinsic motivated when they perform a task just for their own pleasure or for the satisfaction of the task itself (Akhavan, Rahimi, & Mehralian, 2013). An example of an internal motivational factor is the reciprocity for sharing knowledge. Data team members are motivated to share their knowledge when they have the feeling that they will receive something in return eventually (Ipe, 2003). In the context of data teams a possible return could be more support from the teachers when implementing improvement measures. Some researchers also indicated that once a reciprocal relation is created within the school, new reciprocal relations will be stimulated and a network of knowledge sharing will grow (Schultz, 2001).

People are extrinsic motivated when they perform a task only in order to receive rewards from factors outside the person (Akhavan, Rahimi, & Mehralian, 2013). Examples of external motivational factors are financial rewards, like bonuses, and non-financial rewards, like recognition (Bock, Zmud, Kim, & Lee, 2005; Ipe, 2003). Bock, Zmud, Kim, and Lee (2005) and Holste and Fields (2011) state in their article that the intrinsic motivation of people will contribute more to knowledge sharing than extrinsic motivation, because a motivation to share knowledge cannot be forced. Besides that, extrinsic motivation, in the form of reward systems, will mostly lead to a negative attitude towards knowledge sharing. People tend to see those systems as punishment systems and as a mean of the school leader to create a competition between the teachers, in which everyone tries to win more rewards than the other ones. Furthermore, teachers who are already intrinsic motivated to share their knowledge, can get a negative attitude towards reward systems, because they do not understand why they should be extra rewarded for one of their normal work activities and they feel too much controlled (Bock & Kim, 2002).

2.3.2.2 Abilities to share

Besides the motivation and the opportunities to share knowledge, data team members also need certain communication skills to share knowledge effectively. When someone is not able to explain his or her work to others in a clear way, it is most likely that other people will not understand his or her explanation, will not be able to use or internalise the shared knowledge and so the process of knowledge sharing will not be completed successfully. So, data team members need communication skills to promote knowledge sharing, both verbal and written (Riege, 2005).

2.3.2.3 Mutual trust

Having personal contacts as a data team member to share knowledge is not enough. There should also be a certain amount of trust between the data team members and the non-data team members (Al-Alawi, Marzooqi, & Mohammed, 2007; Chun & Mei, 2009; Holste & Fields, 2011; James & Seokwoo, 2011; McAllister, 1995). The data team members will be stimulated to share knowledge when they have trust in the non-data team members, because it means that they think the non-data

2. Conceptual framework

team members have the skills to understand the shared knowledge and to change their behaviour accordingly. The non-data team members will also be stimulated to share knowledge when they have trust in the data team members, because it means that they think the data team members are skilled enough to use the data team procedure to conduct their research and that their knowledge is valuable. Mutual trust is based on reciprocal care and perceived reliability. Reciprocal care means that colleagues take care of and are concerned about each other. Perceived reliability is the degree to which someone is seen as trustworthy (Holste & Fields, 2010). When teachers meet each other frequently their mutual trust may be increased; they will know what the knowledge and skills of the other teachers are and what they could expect from them. Especially during meetings where teachers are dependent on each other and where teachers have the opportunity to show the other teachers their competencies, the mutual trust of the teachers will increase (McAllister, 1995). The mutual trust between data team members and non-data team members could, for example increase during a team meeting where the data team members present their research and show their research skills.

3. Method

3. Method

In the method section an explanation will be given about the conducted study. First, the respondents who participated in the study will be described. Second, an explanation will be given about the instruments used in the study. Third, the way in which the data are analysed will be explained and thereafter the reliability and validity of the study will be justified.

The study made use of a qualitative multiple case study design to answer the three research questions. This design provided the opportunity to analyse the data in depth and to explore potential factors that could influence knowledge sharing in schools (Yin, 2009). Multiple cases, each consisting of several data team members and non-data team members of one school, were studied to get a wider overview of knowledge sharing within a school and to be able to compare the different cases.

3.1 Respondents

Four schools from the data team project of the University of Twente, were selected to participate in the study¹. The schools were selected because of their interesting school characteristics. Interesting characteristics were the amount of trust the school had in the data team and the starting level of the data teams. It was expected that a high amount of trust and a high starting level would contribute to the amount of knowledge the data team members would share.

School A had one location with approximately 1200 pupils. The school provided a pre-vocational track (vmbo), a senior general secondary education track (havo), and a pre-university track (vwo). School B had four locations divided over three cities. Two locations participated in the study. One location had approximately 550 pupils and the other location had approximately 450 pupils. Both locations only provided a pre-vocational track (vmbo).

School C had three locations divided over two cities, of which one location participated in the study. This location provided a senior general secondary education track (havo) and a pre-university track (vwo), and had approximately 1200 pupils. School D had four locations divided over four cities. All four locations participated in the study. The first location had approximately 1400 pupils, the second location approximately 500 pupils, the third location approximately 250 pupils, and the fourth location had approximately 200 pupils. The school provided a pre-vocational track (vmbo), a senior general secondary education track (havo), and a pre-university track (vwo).

In each school all data team members were selected (n=23). The non-data team members of each school were selected based on voluntary participation (n=13). In each school, an e-mail was sent to the non-data team members who were part of the school division (e.g. school division of the lower classes or school division of the upper classes) where the educational problem of the data team was, to ask them if they were willing to participate.

These non-data team members were selected, because it was expected that they received more knowledge about the data team compared to other non-data team members in the school. Both data team members and non-data team members were selected as respondents to be able to study both the sending and receiving of the knowledge sharing process.

Table 3.1

Number of respondents

	Data team members	Non-data team members	Total
School A	6	4	10
School B	6	3	9
School C	6	3	9
School D	5	3	8
Total	23	13	36

¹. For more information about the selection procedure, please contact the supervisors of the data team project at the University of Twente.

3. Method

3.2 Data collection

The data were collected at the end of the second year of the data team project. The data were collected in two different ways. First, the data team members and non-data team members were interviewed. And second, artefacts of the data teams were collected. In the following paragraphs it will be explained which instruments and procedures were used to collect data.

3.2.1 Interviews

Both the data team members and the non-data team members were interviewed using a semi-structured interview scheme, consisting of open general questions. The interview scheme for the data team members was focused on knowledge the data team members acquired when working with the data team procedure, consequences of their participation in the data team for themselves and the school, what and how knowledge is shared by the data team members, and what factors promote or hinder knowledge sharing. The interviews with the data team members took approximately 45 minutes.

The interview scheme for the non-data team members was focused on their experiences with data-based decision making, what and how knowledge is shared by the data team members and what factors promote or hinder knowledge sharing. The interviews with the non-data team members took approximately 20 minutes. All interviews were recorded and during the interviews notes were made.

3.2.2 Artefacts

The data team members were asked to provide all digital artefacts (e.g., presentations, newsletters) they had created and shared with the non-data team members over the past two years. The interviewed non-data team members were asked to provide all digital artefacts they had received from the data team members.

3.3 Data analysis

The two different data sources were coded in three categories: what type of knowledge was shared (e.g., knowledge on the data team procedure, knowledge on the educational problem), how knowledge was shared (e.g., at the individual, team, or school level, during a formal or informal moment, verbally or in writing), and the factors which influence knowledge sharing (e.g., organisational factors, individual factors). Thereafter, the data were analysed according to a fixed protocol of three steps. First, the data of each data source was written down in conceptual matrices. Per school and per data source a conceptual matrix was made to get a clear overview of the data. In these matrices the data were ordered per respondent and per code. Tables 4.1 – 4.3 are examples of these matrices. Second, a within-case analysis was conducted with the help of the conceptual matrices to get an insight in how in one particular school knowledge was shared. This was done by summarising the results per data source and by triangulating these results. Third, a cross-case analysis was conducted in which the results of all four schools were compared to each other with regard to what knowledge was shared, how this knowledge was shared and the recalled influential factors.

3.3.1 Interviews

The interview data were analysed in three steps (Miles & Huberman, 1994). First, the interview data were transcribed in verbatim. Second, the data were coded per interviewee in Atlas.ti. For the coding an a priori coding scheme was used. Examples of codes that were used in the category promoting and hindering factors are school leader support, mutual trust, and motivation to share. After all interview data were coded, a summary of all quotes of the teachers were written down in conceptual matrices and the fixed analysis protocol was followed.

3.3.2 Artefacts

The artefacts were coded by using an a priori checklist. The checklist focused on what knowledge was shared and on how this knowledge was shared. Examples of items on the checklist in the category how knowledge was shared are presentation, newsletter, and minutes of team meeting. After coding, the

3. Method

findings of each school were written down in a conceptual matrix and the fixed analysis protocol was followed.

3.4 Reliability and validity

The reliability and validity of the study was increased in several ways. First, the construct validity was increased by using multiple sources of evidence: a triangulation of instruments (interviews and artefacts) and two groups of respondents (data team members and non-data team members) (Yin, 2009). The triangulation provided the measurement of knowledge sharing in schools with two different instruments. Using two groups of respondents provided the opportunity to look from both the perspective of the sender and the receiver at knowledge sharing.

Second, the internal validity was increased by conducting within-case analyses (Miles & Huberman, 1994) and the external validity was increased by conducting a cross-case analysis (Yin, 2009). Third, the external validity and reliability was increased by following a fixed protocol for data collection and analysis to make sure all data were studied the same way. To increase the reliability further, a pilot test of the interview instrument for data team members was done. This small-scale pilot took place on one of the schools who participated in the data team project of the University of Twente. After the pilot test the instrument was slightly adapted to better fit the goal of the instrument. Furthermore, the reliability of the study was increased by coding 10% of the collected data of each data source by two researchers to be able to calculate Cohen's Kappa (Cohen, 1960). Cohen's Kappa for the interviews was 0.70 and Cohen's Kappa for the artefacts was 0.75, which can be classified as a substantial agreement for both instruments.

4. Results

4. Results

The result section consists of two parts: a within-case analysis of all four cases, and a cross-case analysis. The description of the within-case analyses will start with an explanation of the educational problem the data team was studying. After that, it will be described what knowledge is shared, how knowledge is shared, and which promoting and hindering factors were found using interviews and artefacts.

4.1 School A

The data team in school A analysed the educational problem of grade promotion and grade retention of the upper classes at the senior general education track (havo).

4.1.1 What and how knowledge is shared at School A

4.1.1.1 Interviews data team members

The data team members of School A remembered knowledge was shared about the educational problem. The data team members Charlotte, Eva, and Anna told that they published a report last year about the quantitative research they conducted and that they wanted to publish a second report at the end of the current school year. This report would be shared with the other teachers and with the management team. In this report it would be explained what the data team members have done over the last two years, which factors played a role in the studied educational problem, and what the conclusions of the data team were. One of the conclusions the data team members came to is that the way of testing and determination within the senior general education track (havo) should be improved, because continuing learning-teaching trajectories are partly missing. Anna mentioned that she would share the content of this report also with a presentation during a team meeting: *“Next Monday I will also verbally announce that the report is coming and what the content is. So they hear it at least once and can respond”*. Rob mentioned that the data team members also wrote an article for the staff magazine, to explain what the data team members were doing and what the results were, and to refer to the report. Eva explained that sharing knowledge about the educational problem was important, because it would make it more easy to implement the improvement measures effectively in the school when the non-data team members were involved with the research results and measures.

Knowledge about the educational problem was also shared verbally. Emma told that she shared the results of the data team both during formal and informal moments when it was discussed by colleagues: *“Where and whenever I can. I really bring it in every time, in the coffee room, during the report meetings and during the smoke break”*. She believed that colleagues became more aware of the results when it was shared verbally, because people paid more attention to it when it was shared in person rather than when it was shared via reports and newsletters. Data team members Charlotte and Rob also shared their knowledge verbally during informal moments, for example during a coffee break or in the hallway when they met interested colleagues. However, it did not become clear what knowledge was shared during these moments.

When asked about which knowledge the data team members should share, a difference could be seen between the answers and what was shared in reality. The data team members mentioned they should share more knowledge on the data team procedure, because the members thought of the procedure as very valuable. They thought that this procedure could become the standard procedure to handle the problems at school. Knowledge should also be shared about the measures the data team members wanted to take. Rob explained that they wanted the non-data team members to cooperate when the measures would be implemented and so it would be necessary to share these measures before the implementation. Charlotte, Eva, Aaron and Rob said more knowledge should also be shared about the conclusions of the data team to refute the gut feelings some colleagues might have. The most mentioned way in which this knowledge should be shared was via a workshop with a small group of people. In this workshop the non-data team members could, for example experience to work with the data team procedure for themselves and to come to their own conclusions.

4. Results

4.1.1.2 Interviews non-data team members

All non-data team members remembered knowledge was shared about the data team procedure and data use in general, specifically about the fact that the data team members collected and analysed data. Harry described the goal of a data team as: “*Well at least to collect data, to collect results of pupils, departments and teachers, and to analyse those data. So to estimate and to indicate that maybe there is something not quite right*”. The non-data team members gained knowledge about the data team procedure and data use in general during formal and informal moments, where knowledge was shared verbally. An example of an informal moment was given by Alice. Alice explained that she had been working with one of the data team members in Magister to do research about the grade promotion and grade retention of pupils and to look at the grades of different colleagues. Because of this collaboration she sometimes heard from the data team member what educational problem the data team was studying and how much time it took to be a data team member. Another example was given by Oliver, he recalled that the results of the data team were sometimes discussed at the coffee table. With regard to the composition of the data team, none of the non-data team members was able to recall all data team members. However, every member was able to name at least three data team members correctly.

Oliver, Jack, and Harry were able to tell which educational problem the data team was studying. They told the data team members once presented in a team meeting they were looking at the problem of grade promotion and grade retention, and how to solve this problem. Oliver and Jack remembered also some results of the data team were shared, although they both acknowledged that this did not happen frequently. Jack described it as: “*Things like that are mentioned, attention is paid to it and then we proceed to the order of the day*”. Oliver remembered some more details about the shared results: “*Sometimes during the joint meetings it is said that the data team members are working on it and that it appears that the problem is not in the third grade for example, but already in the second*”. Oliver was the only non-data team member who mentioned knowledge was also frequently shared in writing. However, he acknowledged that he did not pay much attention to this written form of knowledge sharing:

They also regularly send all kind of things, but you know how it works. You get so many of those e-mails and so many of those things and if it is not really necessary than you do not do anything with it.

All four non-data team members said the data team members should share their knowledge with them. They were curious about the results and conclusions of the data team and the factors that seemed to play a role with regard to grade promotion and grade retention. Jack said he was especially interested in those results he could use in his own daily practice. The reason why data team members should share this knowledge was, according to the non-data team members, to increase pupil’s learning results. Oliver and Alice preferred knowledge sharing during team meetings and via e-mail. Jack and Harry thought the knowledge of the data team should be shared via a think tank in the school.

4.1.1.3 Artefacts

The data team members provided one artefact, a report, which was shared with the management team. In this report it was presented how the data team members used the data team procedure to analyse the problem of grade promotion and grade retention of the senior general education track (havo). The hypothesis that was formulated by the data team members was: ‘What are, according to the pupils, reasons for their grade retention in the upper classes of the senior general education track (havo)?’ The data were collected by interviewing seven pupils, using a semi-structured interview scheme. This scheme was based on four subthemes which were seen as possible causes for grade retention: school, the pupil himself/herself, home situation, and leisure time. After the explanation of the data quality check and analyses, the interpretations and conclusions were presented. Examples of the reasons for grade retention the data team members found were: wrong expectations of the pupils about the upper classes, lack of structure in the lessons, and insufficient help of the mentor. The data team members also presented some measures they wanted to implement (e.g., evaluating the job description of the

4. Results

mentor) in response to the conclusions, and how they wanted to evaluate these measures. At the end of the report the data team members explained that the data team was part of the project facilitated by the University of Twente and that it was not yet clear how the data team would continue next school year.

Non-data team members Oliver and Harry were able to provide three artefacts they received from the data team. The first artefact was a newsletter, which was sent to the whole school. In this newsletter the data team members presented a summary of the progress they had made in the first year working with the data team procedure. They explained which educational problem the data team had studied, which hypotheses they had formulated (e.g., Do pupils more often have to repeat a class when they have an insufficient grade for one of the core subjects in the third grade?), and that they had collected and analysed data.

The second artefact was an overview of the pupils' grades and promotion over the past few years in the department of biology. The data team sent this overview to the teachers of the department to give them more insight into data the team had collected and analysed, and to help the teachers with data-based decision making in their own classroom. The artefact originally consisted of several overviews of each department which provided a central exam to the pupils. The non-data team members only received an overview of their own department.

The third artefact was a year activity plan for the departments, which was also sent to the whole school. In this plan, it was told that the data team can be seen as part of the data-based decision making in the school. Furthermore, it was told that the data team collected data to base their decisions on, and that the team eventually would evaluate the measures taken. It was suggested that the non-data team members could use this same approach of using data in their own daily practice.

4.1.2 Factors promoting and hindering knowledge sharing at School A

4.1.2.1 Interviews data team members

In the category organisational factors three promoting and two hindering factors were mentioned by the data team members. Anna called the school's culture as a promoting factor for knowledge sharing because more and more people felt the urgency for change: *“Well I think the urgency is gradually felt by everyone. Everybody knows: it is just needed, and we have been trying it for a few years and it does not work”*. The use of technology in the school was also called a promoting factor by Charlotte, Emma, and Anna. They explained that the pupil monitoring system Magister was frequently used by the data team members to register and collect pupils' grades, and to share knowledge with the non-data team members. Anna explained:

You do notice that it has more impact when you go to people with well supported information. People do not want to change because of changing so to speak. But if you say these are the facts and figures of the report in Magister, then you do see a kind of awakening like: oh yes, I do not really want that.

Opportunities to share knowledge with the non-data team members was another organisational factor that was both seen as promoting and hindering by the data team members. Emma and Rob said that it was a promoting factor, because data team members and non-data team members had a lot of formal opportunities to e-mail each other and this was done frequently, and because of the presence of team meetings. However, all six data team members also mentioned a lack of time to meet the non-data team members and the few number of team meetings during the school year. Eva and Anna explained that they, due to the lack of opportunities to meet each other, had chosen to publish a report and a newsletter so people can at least read it. *“But you know that reading has less impact than real exchange and telling about it and talking about it”*. Emma and Eva saw a lack of informal opportunities to share knowledge as a hindering factor. Eva explained that she was not a teacher, like the other data team members, and therefore had less contact with the teachers outside the data team. This hindered her to share her knowledge outside the formal meetings.

The individual factor verbal abilities to share knowledge was seen as a promoting and as a hindering factor. Anna felt like she could base her arguments more easily on data now. However,

4. Results

Charlotte and Eva thought it would be difficult to explain the concept of a data team and the data team procedure, because they had just started to work with the procedure themselves. And data team member Rob thought it would be difficult to present the content clearly, because of the complexity and the nuance of it.

4.1.2.2 Interviews non-data team members

With regard to the organisational factors, the use of technology was seen as a hindering factor by one of the non-data team members. Harry explained that he wanted to get more insight into the data and wanted to be able to conduct his own analyses, for example by learning how to use the pupil monitoring system in the school. He did not know how to collect the data within the system and how to put them in an overview to analyse them. Formal opportunities to share were seen as a hindering factor by Harry and Alice, because of a lack of time and a few number of team meetings during a school year. In contrast, informal opportunities to share were seen as a promoting factor by Oliver, Harry, and Alice. The data team members were called very accessible and they all had good relationships with the data team members.

Mutual trust was seen as a promoting factor for knowledge sharing by all four non-data team members. They all thought the data team members had enough expertise to collect and analyse data correctly, and to make things clear. But all non-data team members did not think the data team would be able to solve the educational problem by itself, and therefore would need the non-data team members. Oliver explained: *“Well I do not know if they can solve the problem. That is something the school board and we should do, but they can indicate the frames”*.

4.2 School B

The data team in school B analysed the educational problem of grade promotion and grade retention of their lower classes.

4.2.1 What and how knowledge is shared at School B

4.2.1.1 Interviews data team members

Data team members Thomas, Jacob, Lucy and Lilly told they shared, with regard to the data team procedure and data use in general, knowledge about data collection and the hypotheses. Thomas, for example explained that he and the other data team members had presented during a team meeting which hypotheses they had rejected and which one they had accepted, and that they conducted interviews with the pupils to collect data. He told that they only presented some of the interview questions and did not go into detail, because that would be too much information and therefore too complicated for the non-data team members. Lucy mentioned that the non-data team members were also informed about the interview procedure before the actual data collection, in order to ask the non-data team members for their cooperation. In an e-mail it was explained that the data team members wanted to interview some of the pupils and what the reason behind the interviews was. This resulted in some questions of the non-data team members, of which the most frequently asked question was on which basis pupils were selected as respondents for the interviews.

The data team members also shared knowledge about the educational problem, for example the results of the interviews with the pupils they conducted. It turned out that the pupils indicated the atmosphere in the class as a cause for their reduced motivation, while the data team members had expected the pupils to indicate their home situation as a cause. Thomas called the presentation of these results an eye opener for the colleagues, because of these unexpected outcomes. Besides sharing the results, the data team members also shared possible measures they could take in response to the interview results. Examples of these measures are letting pupils fill out a questionnaire about the atmosphere in the class, stimulating teachers to frequently discuss grades with the pupils to motivate them, and providing the pupils with a study skills training.

Data team member Oscar did not specify whether he shared knowledge about the data team procedure or the educational problem, but he was the only one who mentioned an informal way of knowledge sharing of the data team. He told that he and the other data team members always sat in the

4. Results

staff room for an hour after their data team meeting and then answered questions from the non-data team members if they showed interest in the data team. It did not become clear what the exact content of these informal conversations was.

Knowledge sharing about the data team procedure and the educational problem was seen as important by all six data team members, in particular about the results, the measures and about what the data team had been doing. Jacob explained the educational problem they were studying was a school wide problem and it would therefore be necessary that the whole school is informed and involved with the implementation of the solutions. The need of a critical attitude in the school, and the need for professionalization of the non-data team members were also reasons for knowledge sharing, mentioned by Lucy, Sacha and Jacob. A third reason the data team members mentioned was giving the non-data team members the room and space for their input to create more support for the measures. All data team members thought that their knowledge should be shared verbally during team meetings, because it would be more easy to create interaction in small groups, and to give the non-data team members the opportunity to respond and think along with the data team members.

4.2.1.2 Interviews non-data team members

With regard to the data team procedure, Ethan remembered the data team members started their research by formulating hypotheses, which they could reject or accept. Ethan and Evie mentioned the data team members had collected and analysed data, for example by using pupil and parent surveys. Knowledge sharing about the data team procedure was always done verbally during formal team meetings. None of the three non-data team members was able to name all data team members when asked, but everyone named at least one data team member correctly.

Ethan and Grace were able to recall the educational problem the data team was working on: grade promotion and retention in the lower classes. Ethan and Evie also mentioned the data team shared the research results with them. They shared, for example the collected data about the examination grades and the results of the pupil and parent surveys. Evie remembered a formal meeting organised by the data team, where she received data from her own department:

Well things like that were all discussed and explained, and then we dispersed in groups with our section and we looked at how we do it as a section. And the intention actually was that we, consequently, started to write a plan how we are going to handle this, how we are going to improve.

Ethan could not remember exactly what the content of the meeting with the data team members was. He only remembered that it was a long story in which the data team members told they had to reject their hypothesis and that they had to start all over again with a new subject.

Grace never participated in a team meeting because of other commitments, but knew from the team meeting minutes the data team presented something about the data team:

It is briefly described who explained something about the data teams and that is it. Well I have not been present, so I miss that part. And I think that piece is currently not important enough for me to say: well what has happened, how should I deal with it?

All three non-data team members thought it was important for the data team members to share their knowledge. Although Ethan emphasised that he thought the data team procedure was unproductive and so he only wanted to hear the results of the data team when they were relevant, innovative and usable. Grace and Evie were especially interested in what the data team was doing during the school year and what the goal of the data team was. Grace said:

I think the goal is very important, but also what the purpose of the school with it is for us as ordinary teachers at this school. I think that is important. Why are we doing that and why is

4. Results

money and time invested? That is for the benefit of you and the pupil. That objective should be clear and that should be communicated.

According to the non-data team members, the data team members should share their knowledge via team meetings or e-mail. Grace explained that a short presentation during a team meeting at the beginning of the school year should be enough, so everyone would know what is going on in the school. However, Evie thought that the data team members should share their knowledge several times during the school year. This way, room and space could be facilitated in which the non-data team members could learn in collaboration with the data team members and could give their input to the data team. This way it would also be more easy to implement improvement measures halfway through the school year when necessary.

4.2.1.3 Artefacts

The data team members provided two artefacts. The first artefact was a presentation about the progress the data team members made so far. This presentation was given at the start of the school year during a formal team meeting. The presentation started with the problem statement about the many grade repeaters at the third grade, and the formulated hypothesis about this problem: 'Grade repeaters come more often from certain elementary schools'. The data team members had analysed this hypothesis with quantitative research, but wanted to collect more data with qualitative research. Therefore, several pupils would be interviewed about the reasons of their grade retention to get more insight into these reasons. The presentation ended with an explanation of the interview scheme. This scheme consisted of two parts. First, the pupils would be asked to recall several reasons for their grade retention and to categorise these into one of the three categories (e.g., school, home, yourself). Second, the pupils would be asked to describe in more details their reasons behind the retention.

The second artefact was also a presentation about the progress the data team made so far. The presentation was given in the second semester of the school year during a formal team meeting. In the presentation, it was again explained that the data team worked according to a cyclic procedure. The team presented the hypothesis they had formulated, and how and when they had collected data. They presented, among others, that they had collected qualitative data by conducting interviews, and which pupils they had interviewed. Thereafter, the presentation showed which themes and subthemes the data team had used to code the collected data (e.g., the pupil itself, school, and home situation), and how the data were analysed by using conceptual matrices. The data team also presented how they had interpreted the data analysis and what their conclusions were. They told, for example that pupils saw the teacher, their lower level of motivation, and their lack of study skills as a reason for their grade retention. At the end of the presentation, the non-data team members was told which possible measures the data team suggested to improve the problem of grade retention.

Non-data team member Grace was able to provide two artefacts she received from the data team. The first artefact was the minutes of a team meeting during the second semester of the school year. In the meeting, a presentation was given by the data team members. This presentation was provided as an artefact by the data team. According to the minutes of the team meeting, the presentation was about the coding scheme the data team members had made to code and analyse the interview data they collected. Besides that, it was presented that pupils tend to see the teacher and their lower level of motivation as a reason for their grade retention. Finally, the non-data team members were told that the data team would focus on possible measures. The minutes were sent to a teacher team. The second artefact Grace could provide was an e-mail, which was sent to the whole school. In this e-mail, the data team members were introduced and it was told that a data team focuses on data-based decision making. The data team procedure was also presented. Furthermore, it was explained that the data team in the school consisted of teachers from two locations of the school and the data team therefore had chosen an educational problem which was interesting for both locations. To involve the non-data team members in the data team procedure, the data team members asked them to help formulating hypotheses for the problem. It was told that the non-data team members could write

4. Results

down possible causes of the problem at a flap-over in the staff room, and that all these hypotheses would be verified by the data team.

4.2.2 Factors promoting and hindering knowledge sharing at School B

4.2.2.1 Interviews data team members

The school's culture was one of the two promoting organisational factor that was recalled by the data team members. Lucy explained it was particularly important for the data team to inform a team leader about the data team. And that this team leader could help the data team to spread their knowledge in the school by presenting this knowledge enthusiastically to his or her own team. The organisational factor formal opportunities to share was also seen as a promoting factor and as a hindering factor. Oscar, Lucy en Sacha called it promoting, because they thought of the team meetings as an effective way to share knowledge. However, Thomas mentioned a lack of time in the team meetings to let the non-data team members really experience working with the data team procedure.

Verbal abilities to share knowledge was seen as an influential factor by Lilly and Lucy. Lilly said she felt skilled enough to present the data team knowledge, because she was enthusiastic, honest and spontaneous. On the other hand, Lucy thought it would be very difficult to explain something completely new and something that was still quit unfamiliar to herself to colleagues. Mutual trust was also seen as a promoting and hindering factor by the data team members. Jacob and Lucy saw mutual trust as a promoting factor and believed the non-data team members had the skills to handle the information of the data team. Jacob explained: *"What I notice on the location here is that they really are of good will and that they are also open to it"*. Oscar, Thomas and Lucy thought of it as a hindering factor, because they expected that there would always be a little bit of resistance and that the non-data team members would not be familiar enough with the data team procedure.

4.2.2.2 Interviews non-data team members

The formal opportunities to share was only by Evie seen as a promoting and hindering factor. It was seen as a promoting factor because the communication lines within the school were very short. All teachers saw each other on a daily basis and had a lot of contact via e-mail. But it was seen as a hindering factor when it comes to really meet a data team member face to face. According to Evie, a lot of people worked part time, and therefore scheduling a meeting could be quite difficult sometimes.

With regard to the individual factors, all three non-data team members had trust in the skills and expertise of the data team members. Evie said: *"I think there are people in it, if I look at the names, who understand it well and are able to get to work seriously"*. And Ethan said that the data team members were capable of working with data and coming to conclusions according to the data team procedure.

4.3 School C

The data team in school C analysed the educational problem of the promotion in the fourth grade of the pre-university track (vwo).

4.3.1 What and how knowledge is shared at School C

4.3.1.1 Interviews data team members

With regard to knowledge on the educational problem and the results of their research, only Leonard, James, Chloe and Rosalynn recalled this type of knowledge was shared. This knowledge was shared during team meetings, or during department meetings when the results were only related to a specific department. They shared which tests they took, what the results of those tests were and which aspects of improvement they had found, for example the text analysis skills of the pupils. Jessica mentioned that besides presentations during team meetings, knowledge was also shared by publishing an article in the school's news letter. In this news letter the data team members presented they were working on the problem of delayed grade promotion in the fourth grade of the pre-university track (vwo), and that they were analysing the grades of promoted and not-promoted pupils. Furthermore, it was presented which three hypotheses the data team members had been studying and which one were accepted or

4. Results

rejected. One of the rejected hypotheses was, for example: ‘Not-promoted pupils in the fourth grade have a significant lower score on their CITO test than promoted pupils in the fifth grade’. Only Noah could remember he had shared knowledge during an informal moment, a coffee break, when the subject is discussed:

If the subject comes up about the poor attitude in the fourth grade of the pre-university track, or something similar. Sometimes I tell that we have been working on it and that you have to be careful coming to conclusions.

When asked about which knowledge the data team members should share, all data team members said they should share the results and implications the data team came up with. This knowledge should be shared to create an open relationship in which non-data team members felt motivated to ask questions and to think along, and in which data team members were able to explain clearly the work of the data team. This explaining was, according to Chloe, especially important because some non-data team members felt threatened by the data team members looking at their grades. Furthermore, sharing was called important because every teacher contributed to the success of the pupils and therefore should be aware of the results of the data team. The best way in which knowledge could be shared was, according to all data team members, via a presentation during unit meetings and department meetings where non-data team members could ask questions and give their input. Leonard and Noah also thought knowledge should be shared with the non-data team members via the management team, so it would become clear that the management team supported their improvement measures.

4.3.1.2 Interviews non-data team members

The non-data team members could recall knowledge was shared both about the data team procedure and the educational problem. All three members heard during team meetings the data team members collected data about problems that occurred in the school. William and George also knew from team meetings that data were analysed to discover links between data and to come to conclusions. Joshua said he had heard from one of the data team members what to do with data during a small meeting he had as being a remedial teacher. None of the members was able to recall all data team members, but they all named at least two members correctly.

Joshua and George could remember knowledge was shared about which educational problem the data team was studying. Joshua told this was done by putting a flap-over in the staffroom to invite non-data team members to write down possible causes of the educational problem. William and George also mentioned results of the data team were shared, such as overviews about pupils’ grade promotion and grade retention.

All three non-data team members said that knowledge of the data team members should be shared to make the non-data team members more aware of the results the data team found. William and Joshua said they thought more communication was needed about the data team and their results, for example via unit meetings and e-mail. William said: “*When you show more often what are we doing and what are the benefits. That is something you miss sometimes*”. George emphasised that not only successes should be shared, but also non-successes when the data team members were not able to come to conclusions:

If they say we have studied something and we do not see a connection, that is often underestimated, but that is also very important information. So not saying: we have a success, and then share that. Even if they say: despite our hard work we did not come to conclusions, that is still an important result to share with the group.

4.3.1.3 Artefacts

The data team members provided one artefact they shared with the non-data team members. This artefact was an article published in the school’s newsletter, which was sent to the whole school. The article provided information about the educational problem of the data team, and the three hypotheses

4. Results

the data team had formulated (e.g., ‘Grade repeaters in the fourth grade have significant lower scores on the core subjects in the third grade than non-repeaters’). The article also presented the conclusions the data team members came to for each of the three hypotheses. For example, it turned out that grade repeaters in the fourth grade do have significant lower scores on the core subjects in the third grade than non-repeaters. Furthermore, it was presented that the data team wanted to collect more data, with the help of questionnaires for pupils, to get more insight into the possible causes of the educational problem. The non-data team members did not provide any artefact.

4.3.2 Factors promoting and hindering knowledge sharing at School C

4.3.2.1 Interviews data team members

Of all organisational factors, only the school’s culture was seen as a hindering factor for knowledge sharing, by data team member Noah. He expected it would be difficult to change some aspects of the school’s culture, because people are used to it:

I am afraid it will not be widely accepted in the school eventually. Because everyone is used to do his own things and everyone thinks that he is doing well. And when you have to change things because others say so, that is where it comes down to, it is difficult to get everyone in.

Chloe called mutual trust a hindering factor with regard to knowledge sharing. She told she knew from experience that there would always be people who would disagree and who would not abide the agreements. So she did expect that this would also happen when the data team members wanted to implement their measures. Formal opportunities to share knowledge was seen as a promoting factor by James and as a hindering factor by Leonard. It was seen as promoting, because the unit was a very close and involved team. And it was seen as hindering, because the meetings took too much time and were not to the point. Leonard felt it was difficult to bring in knowledge from the data team in such meetings. Noah and Rosalynn called informal opportunities to share a promoting factor. According to them, there was a good collegial atmosphere within the school without a strict hierarchy, and the people were open for the idea of improvement with the help of data.

Verbal skills to share knowledge were seen as both promoting and hindering. Jessica felt skilled enough to articulate and present knowledge and, because of her participation in the data team, felt knowledgeable enough to share knowledge. However, Noah explained that he did not like to present, and Chloe expected it could be difficult to share knowledge because of the possible sensitivity of the knowledge.

4.3.2.2 Interviews non-data team members

The organisational factor formal opportunities to share were seen as a promoting and as a hindering factor by Joshua. He often had meetings with one or more data team members as being a remedial teacher, which made it more easy to share knowledge about data and the data team. However, Joshua also mentioned a lack of time and urgency in the school to share knowledge, which can be seen as a hindrance.

Having mutual trust was by all three non-data team members seen as a promoting factor. All three members said they did not doubt the expertise and skills of the data team members, because they were seen as capable of arguing and working with data. William described the sphere as open and accessible enough to share knowledge, even sensitive knowledge. He also said it was convenient to have data team members with authority in the school, to make the implementation of improvement measures more easy.

4.4 School D

The data team in school D first analysed the educational problem of the promotion in the third grade of all tracks. After one year the data team members decided to concentrate on the grade promotion in the

4. Results

third grade of the senior general education track (havo) at the biggest location of the school, because the first hypothesis turned out to be too extensive.

4.4.1 What and how knowledge is shared at School D

4.4.1.1 Interviews data team members

Although most data team members had shared some knowledge with non-data team members, data team member Alvin was the only one who could recall what type of knowledge they had shared. He mentioned that the data team shared the conclusions with the non-data team members about the research they had conducted during the past year, for example that it turned out that boys more often than girls have to repeat the third grade.

However, Leo, Emily, and Max could tell how they shared their knowledge with people outside the data team. Leo and Emily did this on an individual level, for example in conversations with the team leader of the senior general education track (havo), a supervisor, and a colleague. About those conversations with colleagues Leo said: *“But also informal, just as I said during the coffee breaks I say: I have experienced it and that has that effect on us”*. Knowledge was also shared at the team level by Leo and Max. For example, when something was discussed during a team meeting that had common ground with the data team research, Max shared the knowledge he gained in the data team. Leo explained that knowledge on a team level was shared in different ways at the four locations of the school: directly during a team meeting with a little group of mentors and a team leader, or via a report which was discussed in a team meeting. On the school level, Leo, Emily, and Olivia mentioned the data team always published the report on intranet, which was available for all non-data team members. However, Olivia explained that she did not expect much effect of that publication because the non-data team members were too unfamiliar with the data team. In this report it was presented that the data team worked on the problem of grade retention in the third grade of all three tracks. One of the two studied hypotheses was: ‘Boys have to repeat the third grade more often than girls’. It was presented that both hypotheses were accepted for some of the departments in the school. It was also explained that the current results were not clear and usable enough for the data team members and so it was decided to continue with the data team procedure.

When asked about which knowledge the data team members should share, differences could be seen between the answers of the data team members. Alvin, Olivia and Max said knowledge should be shared about the problem statement and the hypotheses, so the non-data team members would have the opportunity to give input and think along about these two aspects of the data team research. Olivia explained she wanted to share her knowledge to involve the non-data team members by finding the cause of the educational problem:

When there is a problem somewhere, you really need the people who have to deal with it, that is the intention. They should have a big input into the brainstorming and in stating what they think about possible causes of the problem. The data team should not be a little group on his own calculating everything without a connection with the people who are really involved.

On the other hand, Leo and Emily said knowledge should be shared about the research results, in order to make colleagues becoming aware of their behaviour. A reason for knowledge sharing almost all data team members mentioned, was to create support among the non-data team members for the improvement measures that would be implemented. Leo and Emily thought knowledge should be shared in writing with a research report or an article in the staff magazine or on intranet, because these written sources would be accessible for everyone in the school. The other data team members thought that a team meeting was the best way to share knowledge, because a meeting would provide the opportunity for interaction.

4.4.1.2 Interviews non-data team members

Lucas and Sophia only could recall knowledge was shared about the data team procedure and data use in general. Both members showed some uncertainty when they said they had once heard in a team

4. Results

meeting the data team members collected data, for example via pupil and parent surveys. With regard to data analysis, they only heard data would be analysed. So, no knowledge was shared about how the data would be analysed. Non-data team member Daniel only remembered something about the data team was presented during the team meeting, but did not have any clue about the exact content. Sophia was the only one who could remember knowledge sharing at an individual level. This was a meeting in which she participated together with a data team member and the school psychologist. During this meeting knowledge was shared about the grades of CITO VO (a pupil monitoring system), but Sophia was not sure whether this had anything to do with the data team. None of the non-data team members were able to recall any of the data team members correctly.

When the non-data team members were asked which knowledge the data team members should share, all three non-data team members answered the research results. Daniel and Sophia said they were especially interested in results with regard to their own work or their own functioning. The non-data team members differed in their preferences with regard to the way in which this knowledge should be shared. Lucas preferred team meetings, Daniel preferred news letters on paper, and Sophia thought knowledge should be shared both via team meetings and e-mail. All three non-data team members said that the reason for knowledge sharing should be to become a better organisation with better learning results. Lucas explained: *“I think it is good to know how parents, pupils, and colleagues think about the school, to come to a better organisation with each other”*.

4.4.1.3 Artefacts

The data team members provided one artefact, which was a news article in the staff magazine. This magazine was sent to the whole school. The article provided information about the composition of the data team, the educational problem, and the two hypotheses the data team had formulated. These hypotheses were: ‘Boys more often than girls have to repeat the third grade’, and ‘Grade repeaters in the third grade have a lower score on their CITO test than non-repeaters’. The data team members also mentioned some bottlenecks during their research (e.g., doing research on all tracks within the school, which meant too much work for the data team). At the end of the news article, attention was paid to the results of the data team. It was presented that the two hypotheses were rejected for most departments in the school. It was also stated that this conclusion did not provide the data team members with enough information to take effective measures, and so the data team members decided to continue their research to get more insight into possible causes of the educational problem. None of the non-data team members provided an artefact.

4.4.2 Factors promoting and hindering knowledge sharing at School D

4.4.2.1 Interviews data team members

Formal opportunities to share knowledge was both seen as a promoting and as a hindering factor by Emily and Alvin. Emily thought of formal opportunities as promoting, because of the presence of location meetings where people could discuss the results of the data team and the presence of intranet. On the other hand, Alvin mentioned a lack of time to meet each other. Informal opportunities were seen as promoting by Emily because of the many contacts within the school.

Verbal abilities to share knowledge was seen as a hindering factor by Leo. He explained that it could be very difficult to articulate the core message well because of the sensitivity of the message. Mutual trust was seen as a promoting factor by Olivia. She expected that, once the goal of the data team was made clear to the non-data team members, they would be motivated to solve the problem together with the data team.

4.4.2.2 Interviews non-data team members

The organisational structure was one of the two influential organisational factor mentioned. Lucas thought the organisational structure was hindering, because little was shared between the different locations of the school about what was happening at all locations. Sophia saw the structure of the organisation as hindering because of a lack of time and the distance between the management and the teachers:

4. Results

Well I notice, and that has also to do with time again. I just notice that so many things ask our attention and I think that therefore the distance between the management and the people at the workplace is increasing. They already experience a lot of pressure so to say, that they sometimes ignore information sharing with us. And brainstorming with us about where we want to go.

The second organisational factor that was mentioned, was opportunities to share knowledge. Formal opportunities to share knowledge was seen as a promoting and as a hindering factor. Lucas and Sophia called it promoting, because of the presence of internet and intranet. Sophia also mentioned that formal opportunities could be seen as a hindering factor, because of a lack of time for the non-data team members to obtain information and for the data team members to share information. Daniel thought of the informal opportunities to share knowledge as a promoting factor. According to him, the relationships within the school were very open.

Sophia showed trust in the skills of the data team members. She described the data team members as people with a clear helicopter view on how things run within the school, as having a vision and being intelligent enough. The other non-data team members did not have an opinion about their trust in the skills of the data team members.

4.5 Cross-case analysis

In the second part of the result section, the results of the cross-case analysis will be described. First, a description will be given about what knowledge was shared across the four schools and how this knowledge was shared. Overviews of these descriptions are shown in Table 4.1 and Table 4.2. Second, a description of the promoting and hindering factors on knowledge sharing will be given. An overview of the influential factors is shown in Table 4.3.

4.5.1 What and how knowledge is shared

Knowledge on the data team procedure and data use in general was shared in Schools B, C and D. Striking is that only the data team members of School B, where knowledge was shared the most, could recall they shared this type of knowledge. By analysing the artefacts the data team members provided, it became clear that the data team members of Schools C and D had also shared this type of knowledge. Although this was done much less frequently than in School B. The data team members had mostly shared knowledge about the formulated hypotheses. However, only the non-data team members of School B were able to recall they heard which hypotheses were rejected and accepted by the data team members. The data team members of Schools B and C also recalled they had shared knowledge about the way data were collected by the data teams. They had presented, for example what data they had collected with pupil surveys and interviews. This knowledge sharing was recalled by the non-data team members of all schools, also those from Schools A en D, of which the data team members did not recall they shared this aspect of knowledge. Knowledge about the data quality check and the evaluation of the implemented improvement measures was recalled the least by the data team members, only in School B. A reason for the little sharing on the evaluation could be that all four data teams were still working on the implementation of improvement measures and not yet had reached the evaluation step of the data team procedure. A lot of differences could be seen between the non-data team members with regard to knowledge about the composition of the data team. While the members of School A could at least recall three data team members correctly, the members of School D could not recall any data team member correctly.

Knowledge about the educational problem was shared in all four schools. All four data teams mentioned they had shared which educational problem they were studying: the grade promotion and grade retention in one of the grades or educational tracks. The data team members also shared their (tentative) results, for example the factors that seemed to influence the educational problem, the causes of the reduced motivation of pupils and the results of the pupil and parent surveys. Sharing knowledge about the educational problem and the results was also recalled by all non-data team members, except for the non-data team members of School D. Knowledge about possible improvement measures to

4. Results

implement was only recalled by the data team members of Schools B and C, maybe because the data teams were still working on these improvement measures and had not yet implemented them. An example of those possible improvement measures was to provide pupils with a study skills training in order to increase their motivation.

The data team members recalled that the two types of knowledge were shared on the individual level, team level and school level. When it was shared on the individual level, this was done verbally during small formal meetings or during informal conversations in the hallway and the staff room. Examples given by the non-data team members were small formal meetings with one of the data team members in Schools A, C and D, and informal conversations in the staff room or the hallway in Schools A and B. At Schools A, B and C knowledge was mostly shared verbally on the team level via presentations in formal team meetings, according to both data team members and non-data team members. Notable is that at School D none of the data team members recalled knowledge sharing with presentations during team meetings, while this was the most common way of knowledge sharing at the other three schools. The lack of these presentations could be an explanation why, overall, knowledge seemed to be shared the least at School D. On the school level knowledge was mostly shared in writing, for example by publishing research reports on intranet, sending several e-mails, publishing articles in the school's newsletter, or a flap-over in the staff room. In School B, where knowledge was shared the most, also the most moments of knowledge sharing were recalled. School B was the only school in which an extra verbal way of knowledge sharing at the school level was mentioned by the data team members and non-data team members: a presentation during a general school wide meeting. During this meeting the data team members presented their results and let the non-data team members analyse their own results.

4. Results

Table 4.1
What knowledge is shared

	School A		School B		School C		School D	
	Data team members	Non-data team members	Data team members	Non-data team members	Data team members	Non-data team members	Data team members	Non-data team members
Data team procedure and data use in general		Hypotheses	Accepted and rejected hypotheses	Accepted and rejected hypotheses	Hypotheses		Hypotheses	
		Data collection	Conducting interviews with pupils to collect data	Data collection with pupil and parents surveys	Data collection	Data collection		Data collection
		Data quality check	Data quality check	Data quality check				
		Data analysis	Data analysis	Analysis of test results		Data analysis		Data analysis
		Evaluation	Evaluation	Evaluation				
		Composition: at least three members correct	Composition of data team	Composition: at least one member correct		Composition: at least two members correct	Composition of data team	Composition: no data team member correct
Educational problem	Educational problem	Educational problem	Educational problem	Educational problem	Educational problem	Educational problem	Educational problem	Educational problem
			Possible measures		Possible aspects of improvements			
	Factors influencing educational problem	Data about grade promotion and retention	Unexpected results of interviews	Results of pupil and parents surveys, and analysis of examination grades	Research results	Results about grade promotion and retention	Results	
	Conclusions	Research conclusions						

4. Results

Table 4.2
How knowledge is shared

	School A		School B		School C		School D	
	Data team members	Non-data team members	Data team members	Non-data team members	Data team members	Non-data team members	Data team members	Non-data team members
Individual level	Conversations in the coffee room and during smoke breaks	Small formal meetings with one of the data team members Conversations at the coffee table Conversations at the hallway	Conversations in the coffee room	Conversations in the staff room	Conversations during coffee breaks	Small formal meetings with one of the data team members	Small formal meetings with a team leader and a supervisor	Small formal meetings with one of the data team members
Team level	Verbally during team meetings	Verbally during team meetings	Presentations during team meetings	Presentations during team meetings Minutes of team meetings via e-mail	Presentation during a meeting twice a year Verbally during team meetings	Presentations during team meetings	Small meetings with a team leader and some teachers	Verbally sharing during team meetings
School level	Publishing a research report about the past two years Publishing articles in the week bulleting	Several e-mails during the school year Newsletter Overview of pupils' grades in department Year plan for departments	Presentations during general meetings Sending an e-mail to inform colleagues about the interviews with pupils	Each school year one meeting organised by the data team to present results and to let non-data team members analyse their own results	Publishing an article in the school's news letter	Flap-over in the staffroom	Publishing research report on intranet and in the staff magazine	

4. Results

4.5.2 Factors promoting and hindering knowledge sharing

4.5.2.1 Organisational factors

With regard to the organisational factors analysed in this study, differences could be seen between the data team members and non-data team members of the four schools, and between the perspectives on each organisational factor. The school's culture for example, was both seen as a promoting and as a hindering factor by some data team members. The data team members of School A mentioned that the urgency to change was more and more felt by everyone in the school, and the data team members of School B said that they had the opportunity to inform the non-data team members via an enthusiastic team leader. In contrast, the data team members of School C said that the data team was not yet widely accepted in the school and so could not be seen as part of the school's culture at the moment.

The organisational structure was only recalled by the non-data team members of School D, and it was seen as a hindrance. The non-data team members said that there was not much communication between the different locations of the school and that there was a distance between the management and the teachers. Striking is that a hindering organisational structure, in which there was not much communication between the different locations of the school, was only recalled at the school where knowledge was shared the least. It could be that the organisational structure had an influence on the amount of knowledge that could be shared by the data team members across the four locations of the school. The use of technology was an organisational factor that was only recalled in School A, as a promoting factor. It was seen as promoting, because the data team members used their pupil monitoring system a lot to analyse data and to share knowledge.

With regard to the opportunities to share knowledge, formal opportunities were more often called than informal opportunities. Both data-team members and non-data team members mentioned a frequent use of e-mail, the presence of team meetings, short communication lines between colleagues, and the presence of internet and intranet as promoting formal opportunities to share knowledge. In contrast, the data team members and non-data team members also mentioned a lack of time to meet each other, a few number of team meetings during the school year and a lack of priority, which can be seen as a hindrance for formal knowledge sharing. Although the most moments of knowledge sharing were recalled at School B, it could not be seen that formal opportunities to share were also called more often as a promoting factor at this school. Informal opportunities to share knowledge was seen as promoting at Schools A, C and D, because of the good relationships between the colleagues and the accessibility of the data team members.

4.5.2.2 Individual factors

Also with regard to the individual factors analysed in this study, differences could be seen between the four schools, and between the perspectives on each factor. The verbal skills to share knowledge was only recalled by some of the data team members and by none of the non-data team members. In all data teams the verbal skills to share were seen as a hindering factor. The data team members said it was difficult to present their knowledge, because the data team procedure was still quite unfamiliar to themselves and because it was difficult to present things clearly to the non-data team members. In contrast, the data team members of School A and B called their verbal skills also promoting, because they felt skilled and knowledgeable enough to share their knowledge.

Mutual trust was seen as a promoting factor by the non-data team members of all four schools. The non-data team members said they had trust in the skills and expertise of the data team members. They were, for example expected to be able to make things clear, to collect and analyse data and to have a helicopter view. The data team members saw mutual trust both as a promoting and as a hindering factor. The data team members of School B and D had trust in the non-data team members because they thought of them as willing to change. However, the data team members of Schools B and C called mutual trust also a hindering factor. According to them, the non-data team members were not familiar enough with the subject, were too critical and not always abided to the agreements.

4. Results

Table 4.3
Promoting and hindering factors on knowledge sharing

Organisational factors	School A	School B	School C	School D
Promoting	<p>Promoting school culture: urgency is felt by everyone</p> <p>Promoting use of technology: using Magister to organise and share grades</p> <p>Promoting formal opportunities: frequent use of e-mail, presence of team meetings</p> <p>Promoting informal opportunities: data team members are accessible, good relationships between colleagues</p>	<p>Promoting school culture: informing the team leader about the results so he can share these with his team</p> <p>Promoting formal opportunities: presence of team meetings and short communication lines between colleagues</p>	<p>Promoting formal opportunities: unit is a close team and there are many contacts between the data team and the non-data team members</p> <p>Promoting informal opportunities: good collegial atmosphere and not strictly hierarchic</p>	<p>Promoting formal opportunities: publishing information in the staff magazine or on intranet</p> <p>Promoting informal opportunities: open relationships between colleagues</p>
Hindering	<p>Hindering formal opportunities: lack of time and few opportunities to meet each other</p>	<p>Hindering formal opportunities: a lack of time to meet each other</p>	<p>Hindering school culture: data team not widely accepted in the school</p> <p>Hindering formal opportunities: unstructured meetings, a lack of time and priority for the data team</p>	<p>Hindering organisational structure: little communication between different locations and little communication between management and personnel</p> <p>Hindering formal opportunities: lack of time and opportunities to meet each other</p>

4. Results

Table 4.3 Continued

Individual factors	School A	School B	School C	School D
Promoting	<p>Promoting verbal skills: feeling supported because of the use of data in conversations with non-data team members</p> <p>Promoting mutual trust: data team members are skilled enough to indicate problems and to analyse data</p>	<p>Promoting verbal skills: able to present enthusiastic and spontaneous</p> <p>Promoting mutual trust: particularly young non-data team members are open for change, data team members have enough knowledge and skills to work with data and have good relationships with colleagues</p>	<p>Promoting mutual trust: accessibility between colleagues, data team members have enough skills and authority</p>	<p>Promoting mutual trust: non-data team members are willing to change when the goal is made clear, data team members are skilled enough to be in a data team</p>
Hindering	<p>Hindering verbal skills: difficult to present things clearly, because of the complexity of the content</p>	<p>Hindering verbal skills: difficult to explain something which is quite unfamiliar to yourself</p> <p>Hindering mutual trust: non-data team members being critical and not familiar enough to understand the results</p>	<p>Hindering mutual trust: not everyone abides to the agreements</p> <p>Hindering verbal skills: do not like to present and difficult to share sensitive knowledge</p>	<p>Hindering verbal skills: difficult to articulate the core message well</p>

5. Conclusion and discussion

5. Conclusion and discussion

In this section, a conclusion will be given about the three research questions which were central to this study. After that, the limitations of this study will be discussed and implications for practice and future research will be given.

5.1 Conclusion

5.1.1 What knowledge is shared between data team members and non-data team members?

Data team members could share two types of knowledge: knowledge on the data team procedure and data use in general, and knowledge about the educational problem. However, in the conceptual framework it is explained that it is important to make a distinction between data, information, and knowledge. With this distinction in mind, one could say that the data teams shared more information than knowledge with the non-data team members. To transform information into knowledge the data team members had to connect the information or use the information to come to conclusions about further consequences. A reason why information rather than knowledge was shared could be that none of the data teams have not yet completed the eight steps of the data team procedure. When they would do so, they would connect the information to develop improvement measures and converse about these measures with the non-data team members. This way the information of the data team will be transformed into knowledge. The data teams of School B and School C were the only data teams who shared some knowledge, in the form of possible improvement measures.

With regard to the knowledge on the data team procedure and data use in general, information about the formulated hypotheses (e.g., which hypotheses were accepted and rejected by the data team) and data collection (e.g., what instruments were used, who the respondents were) was shared the most by the data team members. Only the data teams of School A and School B also shared information about the data quality check and the evaluation of the improvement measures, by telling the non-data team members that these activities were part of the data team procedure. A reason for the minimal communication about the data quality check could be that the data team members deliberately had chosen not to share this information, because of its complexity for non-data team members. Most non-data team members probably did not know, for example what a chi square test is. The data teams of School B and School D were the only data teams that presented the non-data team members the composition of the data team.

Aspects of the educational problem that were shared, were the educational problem itself (e.g., which problem the data team was studying) and the (tentative) results (e.g., overview of collected interview data, conclusions about the formulated hypotheses). Only the data teams of School B and School C also shared knowledge about possible measures the data team members wanted to implement (e.g., provide pupils with a study skills training because data revealed that most pupils lack these skills). It could be that this knowledge was not shared in Schools A and D because the data team members were still working on the improvement measures and had not yet implemented them.

Almost all data team members and non-data team members mentioned they found it important to share knowledge with each other. Data team members found it important because sharing would help them, among other things, to implement the improvement measures, to involve the non-data team members more with the data team, and to show the value of a data team for the school. The non-data team members especially mentioned the importance of sharing the research results and other knowledge that has an influence on their own work and functioning.

5.1.2 How is knowledge shared between data team members and non-data team members?

Data team members could share their information and knowledge on the individual, team and school levels, during formal and informal moments and verbally or in writing. All these aspects were observed in this study, although differences could be seen between the aspects.

In all four schools information was mostly shared verbally, for example during formal moments at the team level (e.g., a team meeting). Information was also verbally shared at the individual level in all four schools, for example during coffee breaks or conversations in the hallway. In contrast to sharing at the individual level and team level, sharing at the school level was almost

5. Conclusion and discussion

always done in writing. The data team members and non-data team members recalled information was shared at this level via publications of research reports, sending e-mails and the publication of articles in the school's newsletter. Only in School B, where the most moments of sharing were recalled, also verbal sharing at the school level was mentioned (e.g., an annual school wide meeting organised by the data team members).

According to the respondents information was shared both during formal and informal moments, although they recalled formal moments more often. This was remarkable, because in the literature it was found that most knowledge seems to be shared via informal contacts within schools (Ipe, 2003; Riege, 2005). It was not clear whether information was actually shared more via formal contacts or that the respondents just did not recall more informal moments during the interviews, for example because these moments were more fleeting and unexpected than formal moments.

5.1.3 What factors promote and hinder knowledge sharing between data team members and non-data team members?

In this study, two groups of factors were analysed: organisational factors and individual factors. It appeared that most factors could both have a positive and a negative influence on the process of knowledge sharing, either by being present or absent. For example, the presence of formal opportunities to share knowledge had a positive influence on the process, while a lack of these formal opportunities hindered knowledge sharing. Two factors could be indicated as positive influences on the process of knowledge sharing: a stimulating school culture and the presence of formal moments to share knowledge. Only one factor could be indicated as a negative influence on knowledge sharing: the organisational structure.

The finding that the school's culture affected knowledge sharing corresponded to the conceptual framework of this study, in which it was explained that the school's culture was increasingly being recognised as the most influential factor on knowledge sharing (Ipe, 2003). The presence of a stimulating school culture was called a positive influence on knowledge sharing at Schools A and B. At School A it was mentioned that the urgency to change was more and more felt in the school and that everyone in the school knew that change was needed. At School B it was mentioned that the data team could share their knowledge with the non-data team members via an enthusiastic team leader. In contrast, at School C it was mentioned that the absence of a stimulating school culture was a hindrance for knowledge sharing, because it meant that the data team would not be widely accepted in the school.

The presence of formal opportunities to share was another factor that had a positive influence on knowledge sharing. Overall, the respondents said that more knowledge was shared during formal (e.g., team meetings) rather than informal moments (e.g., conversations during the coffee break). The formal opportunities to share were recalled at all four schools. Notable is that at School D, where knowledge was shared the least, only the opportunity to publish articles on intranet was mentioned as a formal opportunity to share. This is inconsistent with the other three schools, where team meetings were called most often as a formal opportunity to share knowledge. Another notable result is that at School B, where knowledge was shared the most, also more formal opportunities were recalled. School B was the only school where the data team members had organised an extra school wide meeting to share their knowledge with the non-data team members. In contrast, the respondents of all four schools also indicated that some hindrances with regard to formal opportunities, such as a lack of time to meet each other and a few number of team meetings during the school year, had a negative influence on knowledge sharing. So, it could be concluded that the amount of shared knowledge increased when there were more formal opportunities for the data team members to share.

The organisational structure of the school was the only factor that could be indicated as a hindrance for knowledge sharing. This factor was only mentioned at School D, the school where knowledge was shared the least. At this school the organisational structure was described as a structure in which there was little communication between the different locations of the school, and a distance between the management and the teachers. This finding corresponded to the conceptual framework, in

5. Conclusion and discussion

which it was said that a traditional structure, consisting of different parties, would make it more difficult to share knowledge within the organisation (Al-Alawi, Al-Marzooqi, & Mohammed, 2007).

Three analysed influential factors were not recalled by any of the respondents: support of the school leader, motivation to share, and written skills to share knowledge. A reason for this could be that the respondents just did not think of these influential factors during the interview, but it could also be that these factors did not have an influence on knowledge sharing in any of the studied schools.

5.2 Discussion

This study had several limitations with regard to the respondents and instruments. First, the interviewed non-data team members were selected via several selection procedures. This meant that only the non-data team members who were part of the school division were the educational problem were selected as respondents. These selected non-data team members were asked to participate in the study on a voluntary basis, which could have had the consequence that only the more enthusiastic non-data team members participated. However, it was deliberately chosen to only approach these non-data team members. It was expected that these colleagues had the most contact with the data team members and therefore could provide the most data.

A second limitation was that the data were collected at the end of the second year of the data team project. This may mean that mainly data about this second year were collected, because the respondents could recall knowledge sharing during this year more easily than sharing during the first year. So when interpreting the results, it should be kept in mind that the results of this study might not be representative for the first year of the data team project.

A third limitation was that it was unclear during the study what knowledge every data team member had shared, and whether this knowledge matched the actual research results of the data team. It could be, for example that a data team member presented his or her own opinion about a certain topic as a research conclusion of the data team, while this did not match the actual conclusions. However, this study focused on how data team members and non-data team members might see knowledge sharing in their school rather than on the precise content of the knowledge shared.

A fourth limitation was that the influential factors analysed in this study, could influence each other and could partly measure the same phenomenon. For example, the organisational factors school's culture and school leader support may have some overlap, because a school leader could have much influence on the school's culture and vice versa. This means that when a school's culture was seen as a promoting factor, it could be that this was mainly caused by a promoting attitude of the school leader. And thus the school leader support should be seen as promoting rather than the school's culture.

Despite these limitations, the study gave a valuable insight into the process of knowledge sharing between data team members and non-data team members. The analysis of two different sources of information, interviews and artefacts, provided the opportunity to study in depth what knowledge was shared and how this knowledge was shared. Besides that, the whole process of knowledge sharing could be studied by interviewing both the senders (e.g., data team members) and the receivers (e.g., non-data team members) within this process.

5.3 Implications for practice and future research

This study gave an insight in knowledge sharing between data team members and non-data team members. It provided results about what kind of knowledge was shared, how this knowledge was shared and possible influential factors on knowledge sharing. School leaders could use these results to promote knowledge sharing between the data team and the non-data team members in their schools. When we look at School B, where the process of knowledge sharing was most successful, we could indicate two factors that promote knowledge sharing and turn these factors into an advice for school leaders. First, school leaders should create a school culture consisting of beliefs, policies, norms and traditions which encourage knowledge sharing and which show the importance of a data team. At School B for example, the data team members could share their knowledge with the non-data team members via an enthusiastic team leader. This demonstrated that the team leader supported the work

5. Conclusion and discussion

of the data team, which could contribute to the perceived value of the data team by the non-data team members. Second, school leaders should facilitate the data team members with enough room and space to share their knowledge. A school leader could, for example give the data team the opportunity to present their results during a team meeting or to organise a special data team meeting. The data team members of School B had, for example organised an annual school wide meeting where they presented their results and let the non-data team members experience how to work with the data team procedure. This special meeting stimulated interaction between the data team members and the non-data team members, and stimulated the non-data team members to study the work of the data team members.

Although this study gave an insight in knowledge sharing in schools, more research is needed. Especially knowledge sharing in the context of data teams in schools has not much been studied yet, and so a lot of new insights could be gained in this research area. Future research may focus on how knowledge could be shared about the implementation and evaluation of improvement measures, when the data team members have completed all eight steps of the data team procedure. Or could focus on knowledge sharing with non-data team members outside the school department where the educational problem is to involve the whole school with the improvement measures. Furthermore, no consensus has been reached yet about which influential factors on knowledge sharing can be seen as promoting and as hindering. It is important though to be able to define these factors, in order to make knowledge sharing more effective. The results of this study showed, for example that the process of knowledge sharing was not always completed: the knowledge sent by the data team members was not always received by the non-data team members. Future research focused on the influential factors on the process of knowledge sharing could provide more insight into the success and failure of this process. It is also important to keep in mind that the influential factors may not only influence the process of knowledge sharing itself, but also the sender and the receiver. In future research, a distinction could be made between the factors that influence the sender of knowledge, the process of sharing itself, and the receiver of knowledge.

Knowledge sharing can be seen as an important aspect of data teams. Knowledge sharing by the data team members can promote the professionalization of non-data team members, the use of data in general in schools, and the implementation of the improvement measures of the data team. This study revealed that knowledge can be shared between data team members and non-data team members in several ways. The four schools differed sometimes in what knowledge was shared and how this knowledge was shared. The data team members and non-data team members also mentioned different factors that could have a positive or negative influence on knowledge sharing. Because of the importance of knowledge sharing, more research is needed into these different ways of knowledge sharing by the data team members and the different influences on this process.

Reference list

Reference list

- Achterbergh, J. & Vriens, D. (2002). Managing viable knowledge. *Systems Research and Behavioral Science*, 19, 223-241. doi: 10.1002/sres.440
- Akhavan, P., Rahimi, A., & Mehralian, G. (2013). Developing a model for knowledge sharing in research centers. *Vine*, 43(3), 357-393. doi: 10.1108/VINE-06-2012-0020
- Al-Alawi, A., Al-Marzooqi, N. & Mohammed, Y. (2007). Organizational culture knowledge sharing: Critical success factors. *Journal of Knowledge Management*, 11(2), 22-42. doi: 10.1108/13673270710738898
- Bereiter, C. (1985) Towards a Solution of the Learning Paradox. *Review of Educational Research*, 55(2), 201-226.
- Bereiter, C. & Scardamalia, M. (2003). Learning to work creatively with knowledge. In E. De Corte, L. Verschaffel, N. Entwistle, & J. van Merriënboer (Eds.), *Unravelling basic components and dimensions of powerful learning environments*. EARLI Advances in Learning and Instruction Series.
- Bock, G. W. & Kim, Y. G. (2002). Breaking the myths of rewards: An exploratory study of attitudes about knowledge sharing. *Information Resources Management Journal*, 15(2), 14-21.
- Bock, G. W., Zmud, R. W., Kim, Y. G., & Lee, L. N. (2005). Behavioral intention formation in knowledge sharing: examining the roles of extrinsic motivators, social-psychological forces, and organizational climate. *MIS Quarterly*, 29(1), 87-111.
- Cabrera, A. & Cabrera, E. F. (2002). Knowledge-sharing dilemmas. *Organization Studies*, 23, 687-710. doi: 10.1177/0170840602235001
- Campbell, C. & Levin, B. (2009). Using data to support educational improvement. *Educational Assessment, Evaluation and Accountability*, 21(1), 47-65. doi: 10.1007/s11092-008-9063-x
- Carroll, J. M., Choo, C. W., Dunlap, D. R., Isenhour, P. L. Kerr, S. T., MacLean, A., & Rosson, M. B. (2003). Knowledge management support for teachers. *Educational Technology Research and Development*, 51(4), 42-64.
- Chen, C. J. & Huang, J. (2007). How organizational climate and structure affect knowledge management: The social interaction perspective. *International Journal of Information Management*, 27(2), 104-118. doi: 10.1016/j.ijinfomgt.2006.11.001
- Chun, A. L. & Mei, C. H. (2009). Factors affecting teachers' knowledge sharing behaviours and motivation: System functions that work. *Information and Management*, 47(4), 226-236.
- Cijvat, I., Dijk, M., Förrer, M., Hortensius, L., & De With, T. (2010). *Bouwen en vasthouden*. Retrieved from CPS Onderwijsontwikkeling en advies website: <http://www.cps.nl/publicaties-uitgeverij/1401/alle-publicaties/2203/bouwen-en-vasthouden>
- Coburn, C. E. & Turner, E. O. (2011). Research on data use: A framework and analysis. *Measurement: Interdisciplinary Research & Perspective*, 9(4), 173-206. doi: 10.1080/15366367.2011.626729
- Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement*, 20(1), 37-46.
- Damodaran, L. & Olphert, W. (2000). Barriers and facilitators to the use of knowledge management systems. *Behaviour & Information Technology*, 19(6), 405-413. doi: 10.1080/014492900750052660
- Davenport, T. H. & Prusak, L. (2000). *Working knowledge: How organizations manage what they know*. Boston, MA: Harvard Business School Press.
- De Long, D. W. & Fahey, L. (2000). Diagnosing cultural barriers to knowledge management. *The Academy of Management Executive*, 14(4), 113-127. doi: 10.5465/AME.2000.3979820
- Earl, L. M. & Timperley, H. (Eds.) (2009). *Professional learning conversations: Challenges in using evidence for improvement*. Dordrecht: Springer.
- Engeström, Y. (1987). *Learning by expanding: An activity-theoretical approach to developmental research*. Helsinki: Orienta-Konsultit.
- Engeström, Y. (1999). Expansive visibilization of work: An activity-theoretical perspective. *Computer Supported Cooperative Work*, 8, 63-93.

Reference list

- Engeström, Y. (2000). Activity theory as a framework for analyzing and redesigning work. *Ergonomics*, 43(7), 960-974. doi: 10.1080/001401300409143
- Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge management: An organizational capabilities perspective. *Journal of Management Information Systems*, 18(1), 185-214.
- Gourlay, S. (2006). Conceptualizing knowledge creation: A critique of Nonaka's theory. *Journal of Management Studies*, 43(7), 1415-1436. doi: 10.1111/j.1467.6486.2006.00637.x
- Hendriks, P. (1999). Why share knowledge; The influence of ICT on the motivation for knowledge sharing. *Knowledge and Process Management*, 6(2), 91-100.
- Holste, J. S. & Fields, D. (2010). Trust and tacit knowledge sharing and use. *Journal of Knowledge Management*, 14(1), 128-140. doi: 10.1108/13673271011015615
- Huffman, D. & Kalnin, J. (2003). Collaborative inquiry to make data-based decisions in schools. *Teaching and Teacher Education*, 19(6), 569-580. doi: 10.1016/S0742-051X(03)00054-4
- Ikemoto, G. S. & Marsh, J. A. (2007). Cutting through the "data driven" mantra: Different conceptions of data-driven decision making. In P.A. Moss (Ed.), *Evidence and decision making* (National Society for the Study of Education Yearbook, Vol. 106, Issue 1, pp. 105-131). Chicago: National Society for the Study of Education.
- Ipe, M. (2003). Knowledge sharing in organizations: A conceptual framework. *Human Resource Development Review*, 2, 337-359. doi: 10.1177/1534484303257985
- Ives, W., Torrey, B., & Gordon, C. (2000). "Knowledge sharing is a human behaviour", in D. Morey, M. T. Maybury, & M. Bhavani (Eds.), *Knowledge Management*, MIT Press, Cambridge, MA.
- James, T. C. & Seokwoo, S. (2011). An exploratory examination of KS behaviors: Voluntary and solicited. *Journal of Knowledge Management*, 15(1), 104-117. doi: 10.1108/13673271111108729
- McAllister, D. J. (1995). Affect- and cognition-based trust as foundations for interpersonal cooperation in organizations. *Academy of Management Journal*, 38(1), 24-59.
- McDermot, R. & O'Dell, C. (2001). Overcoming cultural barriers to sharing knowledge. *Journal of Knowledge Management*, 5(1), 76-85.
- Miles, M. B. & Huberman, A. M. (1994). *An expanded sourcebook: qualitative data analysis*. Thousand Oaks: SAGE Publications Inc.
- Nonaka, I. (1991). The knowledge creating company. *Harvard Business Review*, 69(6), 96-104.
- Nonaka, I. & Takeuchi, H. (1995). *The knowledge-creating company*. New York, Oxford: Oxford University Press.
- Paavola, S. & Hakkarainen, K. (2005). The knowledge creation metaphor – An emergent epistemological approach to learning. *Science & Education*, 14, 535-557. doi: 10.1007/s111i1-004-5157-0
- Paavola, S., Lipponen, L. & Hakkarainen, K. (2002). Epistemological foundations for CSCL: A comparison of three models of innovative knowledge communities. In G. Stahl (Ed.), *CSCL* (pp. 24-32). International Society of the Learning Sciences.
- Plowman, T. S. (1998). The story of closely and loosely coupled organisations. *Journal of Higher Education Policy and Management*, 20(1), 13-18. doi: 10.1080/1360080980200102
- Ragab, M. A. F. & Arisha, A. (2013). Knowledge management and measurement: A critical review. *Journal of Knowledge Management*, 17(6), 873-901. doi: 10.1108/JKM-12-2012-0381
- Riege, A. (2005). Three-dozen knowledge-sharing barriers managers must consider. *Journal of Knowledge Management*, 9(3), 18-35. doi: 10.1108/13673270510602746
- Scardamalia, M. & Bereiter, C. (2003). *Knowledge building*. Encyclopedia of Education. New York: Macmillan Reference.
- Schildlamp, K. & Handelzalts, A. (2011, January). *Collaborative data teams for school improvement*. Paper presented at the International Congress for School Effectiveness and Improvement, Cyprus. Abstract retrieved from <http://devisa-hb.se/Varberg2011/CollaborativeDataTeams.pdf>

Reference list

- Schildkamp, K. & Kuiper, W. (2010). Data informed curriculum reform: Which data, what purposes, and promoting and hindering factors. *Teaching and Teacher Education*, 26, 482–496. doi: 10.1016/j.tate.2009.06.007
- Schildkamp, K., Lai, M. K., & Earl, L. (2012). *Data-based decision making in education: challenges and opportunities*. Dordrecht: Springer. doi: 10.1107/978-94-007-4816-3
- Schildkamp, K. & Poortman, C. (in press). Factors influencing the functioning of data teams. *Teachers College Record*.
- Schildkamp, K., Poortman, C., & Handelzalts, A. (submitted). Data teams for school improvement. *Teaching and Teacher Education*.
- Schneider, B., Goldstein, H. W., & Smith, D. B. (1995). The ASA framework: An update. *Personnel Psychology*, 48, 747-762.
- Schultz, M. (2001). The uncertain relevance of newness: Organizational learning and knowledge flows. *Academy of Management Journal*, 44(4), 661-681.
- Short, P. M. & Greer, J. T. (1997). *Leadership in empowered schools: Themes from innovative efforts*. Upper Saddle River, NJ: Prentice-Hall, Inc.
- Staples, S. D. & Jarvenpaa, S. L. (2001). Exploring perceptions of organizational ownership of information and expertise. *Journal of Management Information Systems*, 18(1), 151-183.
- Stenmark, D. (2001). Leveraging tacit organizational knowledge. *Journal of Management Information Systems*, 17(3), 9-24.
- Willem, A. & Buelens, M. (2009). Knowledge sharing in inter-unit cooperative episodes: The impact of organizational structure dimensions. *International Journal of Information Management*, 29(2), 151-160. doi: 10.1016/j.ijinfomgt.2008.06.004
- Yin, R. K. (2009). *Case study research: Design and methods*. Thousand Oaks, CA: Sage Publications.