

# Individual, co-operative and collaborative data use: A conceptual and empirical exploration

Roos Van Gasse\*, Kristin Vanlommel, Jan Vanhoof and  
Peter Van Petegem

*University of Antwerp, Belgium*

In recent decades, the belief has originated that data use contributes to more thought-out decisions in schools. The literature has suggested that fruitful data use is often the result of interactions among team members. However, up until now, most of the available research on data use has used ‘collaboration’ as an umbrella concept to describe very different types of interaction, without specifying the nature of collaboration or the degree of interdependency that takes place in interactions. Therefore, the current study investigates and describes Flemish teachers’ individual, co-operative and collaborative data use. In doing so, the level of interdependency of teachers’ interactive activities (storytelling, helping, sharing, joint work) is taken into account. The results of a qualitative study with semi-structured interviews show that teachers’ data use is predominantly of an individual nature and that felt interdependencies among teachers are few. The study enhances knowledge and opens the conceptual debate about teachers’ interactions in the context of data use.

**Keywords:** individual data use; collaboration; co-operation; storytelling; helping; sharing; joint work

## Introduction

In the past few decades, the belief has originated that data use contributes to more thought-out decisions in schools. Hence, the amount of research on data use has recently expanded. Significant differences have been found in how practitioners use data to inform their policy and practice and in the extent to which data use serves as an accelerant for educational reform and school improvement (Wayman, 2005; Wayman *et al.*, 2007; Schildkamp & Kuyper, 2010; Verhaeghe *et al.*, 2010).

The literature has suggested that fruitful data use is often the result of interactions among team members (Copland, 2003; Wayman *et al.*, 2006; Hubbard *et al.*, 2014). Interactions are assumed to shape fundamental conditions for data use. Although researchers expect that teachers’ individual data use might fail due to lack of knowledge and skills with regard to how to use data, capacity issues of data users can be overcome by interacting with colleagues (Mason, 2003; Wayman *et al.*, 2006; Hubbard *et al.*, 2014). Moreover, interactions can shape fundamental conditions for thorough data use, since interactions require teachers to be more involved in the process

\*Corresponding author: Institute for Educational and Informational Sciences, University of Antwerp, Gratiekapelstraat 10, 2000 Antwerp, Belgium. E-mail: Roos.VanGasse@uantwerpen.be; Twitter: @RoosVanGasse



and to persevere in implementing improvement actions (Verhaeghe *et al.*, 2010; Wayman *et al.*, 2012; Jimerson, 2014).

However, up until now, the body of literature that thoroughly investigates and describes interactions in the context of data use remains rather limited. Most available research on data use employs ‘collaboration’ as an umbrella concept. The concept is generally used to describe very different types of interaction, without specifying the nature of collaboration or the degree of interdependency that takes place in interactions (Bertrand & Marsh, 2015). A lot of the literature only gives surface attention to what exactly happens when teachers use data for school improvement. Hence, there is a growing need for studies that dig deep into teachers’ data use processes (Little, 2012). Given the crucial role of interactions in teachers’ data use, the literature would benefit from studies that examine how interactions among teachers are shaped in the context of data use.

Nuance is needed in the distinction that has been made between teachers’ individual and collaborative data use. Conceptually, data use can be distinguished between individual, co-operative and collaborative (Roschelle & Teasley, 1995; Hammick *et al.*, 2009). Individual data use can be referred to as data use that is initiated and completely undertaken by individuals, without any type of interaction taking place. Co-operation indicates a loose and spontaneous relationship between team members, wherein joint goal setting and a long-term engagement remain absent (e.g. asking a colleague for help while interpreting test results). Collaboration is used for interactions that result from a common goal and imply a long-term engagement (e.g. introducing a work team to improve the school’s test results on mathematics) (Hammick *et al.*, 2009). In the context of data use, both co-operation and collaboration incorporate essential features for overcoming individual struggles with data use for school improvement, such as support, knowledge sharing and shared decision making (Mason, 2003; Wayman *et al.*, 2006; Hubbard *et al.*, 2014). However, in terms of exploring the nature of data use interactions, the distinction between individual, co-operative and collaborative data use has not been well examined.

Individual, co-operative and collaborative data use imply differences depending on the degree of interdependency that is inherent in the data use process. Therefore, it is crucial to gain insight into the degree of interdependency of teachers’ interactive activities in the context of data use. Although researchers into data use have attempted to study various forms of interaction, such as team work or communities (Wayman *et al.*, 2006; Hubbard *et al.*, 2014; Bertrand & Marsh, 2015), limited evidence is available on what actually happens in these interactions. This type of in-depth insight is needed in order to generate a better comprehension of teachers’ data use in general and of the importance of teacher interactions for their data use in particular.

Teachers’ data use comprises processes that can vary over a spectrum of different interaction types, ranging between individual and collaborative (inter)actions. In order to address this complexity, we use the Little (1990) framework, which incorporates an individual as well as a social perspective of teachers’ interactions. The framework distinguishes interactions by their level of interdependency. We investigate four types of interaction in the context of data use: daily conversations on data (story-telling); asking for help or giving advice with regard to the use of data (helping);



sharing materials or strategies to use data (sharing); and making arrangements or creating work groups with regard to data use (joint work) (Little, 1990; Kwakman, 2003).

Given the above considerations, the aims of the present study are twofold. First of all, we examine the nature of teachers' data use. We therefore investigate whether data use occurs at an individual level or through co-operation or collaboration. Additionally, we focus on the degree of interdependency in teachers' co-operative and collaborative data use. Therefore, the present study addresses the following research questions:

1. What is the nature of teachers' data use (i.e. individual, co-operative, collaborative data use)?
2. What is the degree of interdependency of teachers' interactive activities in the context of data use (i.e. storytelling, helping, sharing, joint work)?

### Theoretical framework

The theoretical framework of this study has three main parts. Since data use is a broad concept, which might include several processes and a wide spectrum of types of data, we start by describing the concept of 'data use' and narrow down the concept of 'data'. Next, we provide an overview of the existing literature on the individual, co-operative and collaborative nature of data use. Lastly, we describe the Little (1990) framework, which will be used to describe the interdependency of teachers' interactions in the context of data use.

#### *Data use and data*

Data use is a way to manage processes within the school. The aim is to map school processes, to ensure that these processes are in line with school-wide goals and to use data to improve these processes (Schildkamp & Kuyper, 2010; Barrezele, 2012). Therefore, many types of qualitative and quantitative data can be used (Hulpia *et al.*, 2004; Schildkamp & Kuyper, 2010). In view of respecting the value of different data sources and in view of exploring the individual, co-operative and collaborative nature of various data use settings, we start this study from a broad interpretation of the concept of 'data' by using the CIPO framework (Scheerens, 1990; Kellaghan & Stufflebeam, 2003). The name of this framework is an acronym for 'context', 'input', 'process' and 'output'. 'Context' data includes contextual factors of the school, such as demographical data on the school environment. 'Input' data covers characteristics, capabilities and competences of people within the school, for instance pupils, teachers or parents. 'Process' data indicates the way in which results are achieved and might be, for instance, data on decision-making processes or pupils' learning processes. 'Output' data includes the school's results, such as pupil learning outcomes. We further define the concept of 'data' by only studying context, input, process and output data that can be related to core processes of teachers and (1) is (in)directly related to pupils' learning or (2) has the potential to contribute to internal quality control. Although this definition of data is broad, it provides an exclusion of those types of





data that we do not consider valuable for data use in schools—such as teachers' yearly number of parking tickets or a quick chat with parents about the next excursion.

### *Individual, co-operative and collaborative data use*

We distinguish between individual, co-operative and collaborative data use. Although an implicit dual distinction between individual and interactive forms of data use is often supposed, the literature shows that this dual distinction between individual and collaborative activities is difficult to make. The transition from individual to collaborative activities incorporates a wide spectrum in between (Roschelle & Teasley, 1995; Hammick *et al.*, 2009). Therefore, a conceptual clarification is needed.

Data use can be undertaken merely by individuals. Individual data use denotes data use processes that are initiated and completely undertaken by individuals, without any form of interaction taking place. For example, a teacher can analyse pupils' mistakes on certain exercises in order to gain insight into pupils' pitfalls that he or she needs to address.

Besides individual data use, more interactive forms of data use can take place in schools. Interactions between teachers can result in collaborative data use. In collaborative data use, a group of individuals initiates and undertakes data use. Specific to collaboration are the aims of problem solving or sharing expertise, and an active and ongoing partnership (Hammick *et al.*, 2009). This implies that collaborative data use is not a one-off. It is a continuous process in which joint goals are set and the responsibility for reaching these goals is shared (Stoll *et al.*, 2006; Seashore Louis *et al.*, 2010). For example, a school-wide goal might be to improve pupils' writing skills. To this end, data can be used to collaboratively investigate which aspects of writing need to be better addressed. Subsequently, arrangements can be made among teachers for strategies they will implement to improve their pupils' writing skills.

On a continuum from a small to a large interactive component within data use, co-operative data use can be situated in between individual data use and collaboration. Co-operation is less elaborate and less ambitious than collaboration, but it still incorporates an interactive component. The concept of co-operation is used to describe people who are open, willing and able to work with others, but who do not necessarily share common goals to work on (Hammick *et al.*, 2009). Co-operation is thus different from collaboration because of its 'loose' character. Whereas collaborating people have a long-term engagement with each other, co-operating people work together on an occasional basis. In co-operation, the pith of the matter lies with the individual, but this individual might interact with others in order to reach his/her own (data use) goals. For example, a teacher might analyse a pupil's maths exercises with the aim of improving this pupil's test scores. In doing so, the teacher may find that the pupil makes similar mistakes every time. Subsequently, the teacher might consult a colleague to discuss the appropriate remedy for this type of mistake.

### *Storytelling, helping, sharing and joint work*

In order to describe the level of interdependency of teachers' interactions in the context of data use, we use the Little (1990) framework. This framework addresses the



complexity in the nature of teachers' data use, which can range from individual to collaborative. By categorising types of interaction depending on their level of interdependency, Little (1990) embeds both an individual and a social perspective in her framework, which is particularly useful in the context of data use and is helpful in describing teachers' data use as a part of their daily practice. Little (1990) distinguishes between four types of interaction: storytelling, helping, sharing and joint work.

*Storytelling* is a type of interaction in which teachers are nearly completely independent of each other. Owing to daily conversations with colleagues, a quick exchange of information takes place. Subsequently, teachers are completely independent in their use of this information in practice (Little, 1990).

Storytelling provides a good illustration of the daily life in schools (Meirink *et al.*, 2009; Bakkenes *et al.*, 2010; Katz & Earl, 2010). Daily conversations occur also in the context of data use (Datnow *et al.*, 2013; Bolhuis *et al.*, 2016). These storytelling activities can range from general conversations about data use to conversations about a specific data use topic within the school.

*Helping* refers to giving or asking for help or advice and incorporates a high level of independence (Little, 1990; Kwakman, 2003). Helping activities derive from a question that is asked by an individual teacher, who—subsequently—decides independently to follow or ignore the help or advice that is offered (Little, 1990). Owing to the underlying purpose of help-seeking, this type of activity is less open-ended for the help-seeker than storytelling activities.

Helping activities are one of the main reasons why emphasis has been laid on interactions in the context of data use (Datnow *et al.*, 2013; Hubbard *et al.*, 2014). The presence of helping activities in data use settings can be crucial in order to tackle personal barriers with regard to data use, such as difficulties with analysing and interpreting data or setting improvement actions (Datnow *et al.*, 2013; Hubbard *et al.*, 2014; Jimerson, 2014).

A third type of interaction is *sharing*, which implies the distribution of data, materials and methods, or the open exchange of ideas and opinions (Little, 1990). The underlying goal of teachers is to make aspects of their work accessible and expose their ideas and intentions (Katz & Earl, 2010). Thus, teachers create a kind of 'open access environment' of materials, choices and rationales that have been made. Therefore, sharing is seen as a learning activity that incorporates a higher level of interdependence, compared with storytelling and helping (Little, 1990). Sharing activities do not imply that teachers are bound to shared strategies or materials with regard to how they shape their daily practice (Little, 1990).

Empirical evidence has validated sharing activities also in the context of data use. However, there is little insight into their frequency of use, since the extent to which sharing activities are reported differs across studies (Kwakman, 2003; Katz & Earl, 2010; Bolhuis *et al.*, 2016; Hubers *et al.*, 2016).

The last type of interaction in Little's (1990) framework is *joint work*, or 'encounters among teachers that rest on shared responsibility for the work of teaching'. This implies a high level of interdependency—collective purposes that result in truly collective action, such as work groups and agreements (Little, 1990). Felt interdependencies among teachers are few, which is why joint work is rarely found among teachers



(Kwakman, 2003; Katz & Earl, 2010). Within the context of data use, indications for joint work are found, but mainly in the context of intervention studies (Cosner, 2011; Schildkamp *et al.*, 2015; Hubers *et al.*, 2016).

For reasons of conceptual clarity, we have strictly distinguished between storytelling, helping, sharing and joint work in this conceptual framework. However, we assume that in real-life situations more than one type of interaction can appear at a time (e.g. situations in which storytelling as well as sharing materials appear).

The level of interdependency of teachers' interactions can be conceptually related to the nature of interactions (i.e. co-operative and collaborative data use). In storytelling, helping and sharing interactions, teachers do not set common goals or share responsibility for the outcomes of these interactions. Instead, teachers undertake these interactions out of personal goals and remain individually responsible for how these interactions change or do not change the outcomes of their individual data use. Therefore, we categorise storytelling, helping and sharing as co-operative data use and joint work as collaborative data use. This is visualised in Figure 1.

## Method

With the aim of generating in-depth insights into teachers' interactions in the context of data use, we used a qualitative research design including semi-structured in-depth interviews. This approach was conducted in order to gain rich knowledge of teachers' individual, co-operative and collaborative data use and of the level of interdependency that is inherent in teacher interactions in the context of data use.

### Context of the study

This study took place in Flanders, the Dutch-speaking region of Belgium. Flanders has a specific context in which to study data use. Compared with other countries appearing in the literature, the Flemish government tends to wield a perspective on

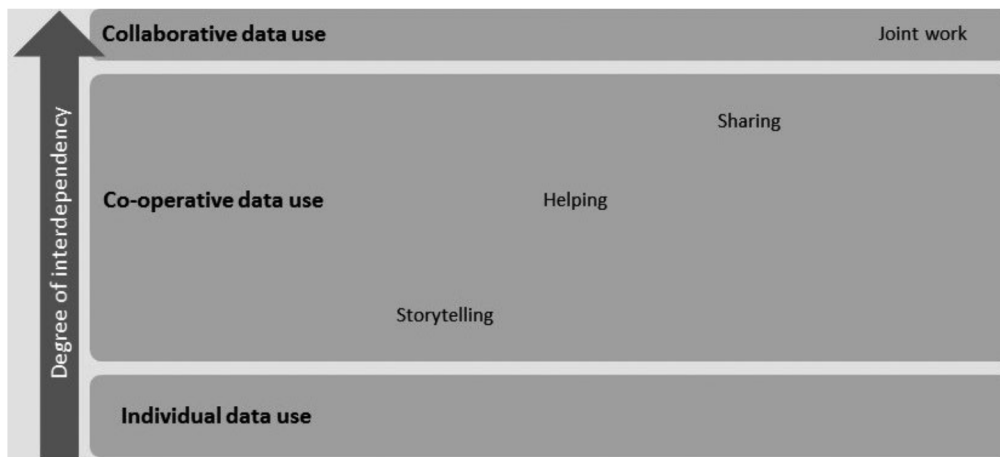


Figure 1. Level of interdependency for different types of interaction

data use that is oriented towards school improvement. Whereas attainment targets are set at the end of primary education and the second and sixth grades of secondary education, schools are autonomous in how these standards are reached (i.e. they have autonomy and control over the curriculum) (Penninckx *et al.*, 2011; De Volder, 2012). In addition, central exams are absent and no public databases or rankings of schools are available (De Volder, 2012; OECD, 2013). Schools themselves are responsible for investigating and assessing whether or not their pupils reach the Flemish standards at the end of primary and after the second and sixth grades of secondary education (De Volder, 2012). Thus, governmental expectations towards data use are implicit and the responsibility for using data and support for data use lies with individual schools and teachers.

### *Participants and interviews*

Interviews were performed with 12 teachers in 6 primary and 6 secondary Flemish schools, taking into account the point of saturation and sufficient heterogeneity among participants (Morrow, 2005; Guest *et al.*, 2006). All teachers participated voluntarily. The participants varied in gender (4 male; 8 female) and in teaching experience (ranging from 6 to 32 years). See Table 1.

For the interviews, a semi-structured guidance was used, based on the concepts of the theoretical framework. The in-depth interviews, with an average duration of one hour, were conducted by a single researcher and subsequently transcribed ad verbatim.

### *Coding and analysing procedure*

Starting from the theoretical framework, a mainly deductive coding process took place using Nvivo 10 software. A coding scheme was developed by the main researcher and a colleague researcher with expertise in the field of study. General codes, such as 'nature of data use', were extracted from the theoretical framework (headcodes) and specified through several subcodes, such as 'individual data use' or 'co-operative data use'. In order to ensure the validity of the study, agreements were

Table 1. Participant characteristics

School	Participant	Gender	Teaching experience	School type
1	Chrissy	F	20–25	Primary
2	Kelly	F	20–25	Primary
3	Martha	F	30+	Primary
4	Kristen	F	30+	Primary
5	Karen	F	5–10	Primary
6	Peter	M	5–10	Primary
7	Lizzy	F	30+	Secondary
8	John	M	30+	Secondary
9	Frank	M	10–15	Secondary
10	Kim	F	15–20	Secondary
11	Susan	F	10–15	Secondary
12	Joey	M	10–15	Secondary





made on when text fragments do (not) belong to the different codes in the coding scheme. Table 2 provides insight into the coding scheme of this study, the characteristics of codes and data exemplars.

To test the construct validity of the coding, a second researcher coded four interviews independently. The inter-rater reliability (Miles & Huberman, 1994)—the ratio of the total amount of agreement in the coding to the total amount of coded text excerpts—was 85.7%.

Additional to the researcher triangulation, the coding and analysing procedure was peer debriefed at several time points by two members of the research team who were not involved in the development of the coding scheme (Newman & Benz, 1998). Furthermore, an audit trail was left, including raw data, quantitative summaries of findings, reflexive journals and instrument development information.

In the analyses, we searched for similarities and differences from theory as well as from the input of participants in the interviews to deduce cross-case interview results (Miles & Huberman, 1994). Thereby, we followed the principles of framework analysis (Maso & Smaling, 1998).

Additionally, we 'binarised' the qualitative data at the level of subcodes for each participant. Score 1 was given to a participant if a subcode was present in the interview, score 0 if this was not the case. Binarisation is a robust technique to gain insight into the appearance of phenomena across or within participants (Onwuegbuzie, 2003). Since all conceptual topics were questioned in all semi-structured interviews, this technique was suitable for the present data set. The advantage of binarising relative to counting citations is that it purges personal differences of participants (e.g. talkative versus introverted participants).

The binarised data was used to generate insight into the occurrence of subcodes across participants via the calculation of the relative frequencies (Onwuegbuzie, 2003). For example, 'individual data use' occurred in 10 out of 12 interviews. This means that the relative frequency of 'individual data use' is 0.48 (10 of a total of 21 spread over individual data use, co-operative data use and collaborative data use). In theory, this relative frequency is a value between 0 and 1, ranging from not occurring (0) to being the only occurring code (1). Counting the relative frequencies of all learning activities together ends with a total of 1. Thus, the extent of occurrence of individual, co-operative and collaborative data use compared with each other is reflected by the values (Onwuegbuzie, 2003).

## Results

In line with the present research questions, we start with the results on individual data use, co-operative data use and collaborative data use (Table 3). The results regarding the second research question on the interdependency of teachers' data use interactions are posted within the sections on co-operative and collaborative data use.

### *Individual data use*

Two teachers, who both work in secondary education (i.e. Lizzy and Susan), do not report any type of data use. Within the transcriptions of their interviews, no





Table 2. Conceptual characteristics of axial codes

Headcode	Subcode	Conceptual characteristics and example data
Nature of data use	Individual data use	<ul style="list-style-type: none"> <li>- Individually initiated and completed data use processes.</li> <li>- No interaction.</li> </ul> <p>For example, in my course you have the grammar part. You have distributed a piece of paper with certain grammatical rules that you explained and so on. Next, if you finished these lessons, pupils make a test. Well, this test is relevant for me to question myself whether my pupils understand what I taught.</p>
	Co-operative data use	<ul style="list-style-type: none"> <li>- Individual purposes for data use.</li> <li>- Loose interactions.</li> <li>- Individual responsibility for data use.</li> </ul> <p>I give you an example. This year, I get a dossier of a pupil. This dossier tells me that there should be kept an eye on this boy. He bullied last year. But in my class, I see this boy as normal and well-behaved. So I went to his head teacher of last year to know which incidents happened. So I know this and for me, the case is closed.</p>
	Collaborative data use/ joint work	<ul style="list-style-type: none"> <li>- Joint purposes for data use.</li> <li>- Active and ongoing interactions.</li> <li>- Collective responsibility for data use.</li> <li>- High interdependency: joint work is reflected in individual practice.</li> </ul> <p>Together with the school leader, I followed a seminar on child interviews. And afterwards, we had a team meeting about it. And at this team meeting, we made agreements on whether we would start with child interviews in the class and how we would organise these interviews.</p>
Type of co-operative interaction (Little, 1990)	Storytelling	The moment I get some important information about a pupil, for example about a divorce, I go talk to the pupil's teacher to share this information.
	Helping	<ul style="list-style-type: none"> <li>- Advice related to data.</li> <li>- Individually driven: derives from a need/question.</li> <li>- Little interdependency: need of the advice-seeker.</li> </ul> <p>With the toddlers, we did a test on language proficiency. So I try to indicate which information my colleagues win with this test, how to interpret these scores and so on.</p>
	Sharing	<ul style="list-style-type: none"> <li>- Intentional distribution of materials, strategies, data.</li> <li>- Driven from a collective perspective: serving the school.</li> <li>- Little interdependency: individual responsibility of teachers.</li> </ul> <p>No examples available in the present data set.</p>

indications are found that context, input, process or output data are used in any way (individually, co-operatively or collaboratively) to monitor or improve their classroom practice.

Table 3. Binary results for the nature of teachers' data use

	Participant												Relative frequency	
	Chrissy	Kelly	Martha	Kristen	Karen	Peter	Lizzy	John	Frank	Kim	Susan	Joey		Total
Individual data use	1	1	1	1	1	1	0	1	1	1	0	1	10	0.46
Co-operative data use	1	1	1	1	1	0	0	1	1	1	0	0	8	0.36
Collaborative data use	0	1	0	0	1	1	0	0	0	1	0	0	4	0.18
													22	1



For all other teachers, who do report some kind of data use, we find that data use is to a great extent of individual nature. With 10 out of 12 interviewed teachers reporting individual data use, the interview data shows that data use generally is initiated and undertaken individually, which is reflected by a relative frequency of 0.46 within the present data set (Table 3).

The 10 teachers report data use activities that are similar regarding the absence of interaction in initiating and carrying out data use. Nevertheless, differences can be determined with regard to the extent of (individual) data use activities that are found in the interviews and the purposes that teachers report for (individual) data use. For example, regarding the extent of data use, a teacher in secondary education (i.e. Joey) indicates that he may undertake fewer activities than his colleagues because he teaches 20 pupils one hour of geography each week, 250 in total, and does not believe that he is able to improve his education for every pupil.

We find that, in most cases, pupils are the mainspring for teachers' data use. Many of the citations that show individual initiation and use of data are about the use of pupil dossiers, which involve, *inter alia*, test scores, information about learning disorders and classroom observations. The main purpose for teachers using pupil dossiers individually is to enhance their understanding of learning results, attitudes or learning progress of pupils. Additionally, four participants (i.e. Martha, Karen, Peter and Frank) indicate that they use data out of pupil dossiers individually with the purpose of initiating actions that can lead to improvement in their daily practice.

An illustration of how teachers' individual data use is shaped can be found in the interviews with Kristen and Peter. Kristen is a pupil care teacher in primary education who is responsible for the follow up of pupils with special needs and learning problems. How she says she uses LVS tests (a type of standardised test) is illustrative for how teachers generally use data out of pupil dossiers. The test scores are helpful for Kristen to obtain a better understanding of whether her practice is oriented at the right pupils. Therefore, Kristen's citation illustrates clearly the kind of individual data use that many teachers in the present data set report: using data to monitor and understand (the learning processes of) pupils. Peter, in contrast, is one of the teachers whose purpose in data use lies (also) in defining actions to improve his practice. Peter is also employed in primary education. In his interview, he confirms that LVS tests are helpful to understand pupils' learning, but also indicates that they are an information source that is helpful to initiate differentiation. In this way, the text fragment from Peter's interview provides a good illustration of what our interviews show about the same types of data being used individually for different purposes.

In February, the teachers give an LVS test, but only a part of it. The spelling test is given completely, but mathematics is limited to mental arithmetic. And I also get this information and then I monitor if the pupils that fall out, if these are the same pupils that are taken out of class for extra care. Now I know that this is not a perfect mirror, that these are all snapshots. But nevertheless I check whether or not there are some fluctuations. (Kristen, care teacher in primary education)

Here at school, we have the habit to give LVS tests two times a year. Those LVS tests are used . . . Well, this is always the discussion here at school . . . or the question, how we are going to use these results. Because those tests always happen during class time, two times



a year, two to three mornings. [thinks] Well, take two mornings that are necessary to give those tests. That is valuable class time that is lost. Well, lost, this time is not lost when you use the results in a meaningful way. And that is the discussion here at school how we can do this in the best way. And then mostly, in my experience, we use the results of those LVS tests primarily to get more insight into pupils' understanding of the curriculum and maybe to communicate this to parents in a certain situation if this is important for the child. The second thing is to differentiate in the class. If we notice that some children fall out for certain aspects we will look if it is possible to make smaller groups to remediate pupils. If for example [it] appears that some children have difficulties with mathematical questions, we will focus on this topic with those pupils. (Peter, teacher in primary education)

### Co-operative data use

Compared with individual data use, a smaller share of teachers report involvement in co-operation in the context of data use. Eight out of the 12 interviewed teachers report co-operative data use. This is reflected in a relative frequency of 0.36. Thus, a moderate number of teachers engage in loose relationships and are willing to work together in order to achieve personal data use goals (Table 3).

Table 4 shows the binary results for the interdependency in teachers' co-operative data use activities. We did not find evidence for sharing activities in the context of data use among teachers. The absence of sharing activities that fit into the conceptualisation in this study (cf. Table 2) was checked by the colleague researcher involved in developing the coding scheme. None of the teachers' activities for data use purposes involved the intentional distribution of materials, strategies or data from a school or team-oriented perspective.

*Storytelling.* All eight participants who use data co-operatively indicate that these co-operative activities involve storytelling. Therefore, daily conversations of teachers in the context of data use are by far the most common type of co-operation that is reported by teachers in the context of data use. This is reflected in a relative frequency of 0.73 (Table 4).

In line with teachers' individual data use, their interactions in the context of data use are generally pupil (learning) oriented. Seven teachers in the present data set (i.e. Chrissy, Kelly, Martha, Kristen, John, Frank and Kim) engage in storytelling activities that are related to pupil (learning) data. These teachers indicate that they find it

Table 4. Binary results for the level of interdependency of teachers' co-operative data use

	Participant												Total	Relative frequency
	1	2	3	4	5	6	7	8	9	10	11	12		
Storytelling	1	1	1	1	1	0	0	1	1	1	0	0	8	0.73
Helping	0	1	0	0	1	0	0	0	0	1	0	0	3	0.27
Sharing	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
													11	1



important to try to understand pupils' learning process. That is why data about pupils' achievements, learning motivation or learning behaviour is discussed among colleagues. Most of this data is bundled in pupil dossiers. Thus, the main purpose for teachers' storytelling activities in the context of data use is in line with what we know about teachers' individual data use. Teachers use data in order to enhance their understanding of their pupils' learning process. Additionally, some teachers (i.e. Kristen and Karen) aim to use data to improve their practice. To this end, these teachers indicate that data is discussed among colleagues in order to align visions on certain topics.

To illustrate how teachers engage in storytelling activities, we provide interview fragments with Chrissy and Karen. Chrissy teaches toddlers. Her most commonly used data comes from classroom observations. Chrissy's citation is highly illustrative for how storytelling activities among teachers within the current data set are initiated and carried out. As the text fragment makes clear, achieving a better understanding of what is going on with pupils is the main purpose for teachers. Storytelling activities create opportunities to get insight into whether what they notice from the data is prevailing for (their type of) pupils. And to do so, they lean on the experiences of colleague teachers. Additionally, the interview fragment with Karen shows how few teachers move beyond increasing their understanding via storytelling activities. Karen is a care teacher in primary education. Her interview indicates that storytelling in the context of data use can take the form of discussing and brainstorming about future improvement priorities. A footnote to this citation is that the level of interdependency increases by the end of the text fragment. With the team, they move from discussing the report to a more collaborative type of data use (i.e. prioritising improvement goals to work on).

This is a very large school so I have some colleagues working in the same age group. So you always have a colleague with whom you can discuss if certain things you observe in the class are normal development. But I think that when you start in a new age group without colleagues teaching the same age, you would just sometimes not know. (Chrissy, teacher in primary education)

That was also the first year I became a care teacher, so I did not know where to start. I had an amazing initial situation, because improvement opportunities were listed. The inspectors were positive, but they do say ... So I had an amazing initial situation and then I started working with the report. Because that is ... I don't know if you have ever seen it? That is soooo comprehensive, to distil the essence out of it. So with the team we discussed it. How do you interpret this? Ok, these are the five main improvement points, how are we going to work on them? And then, as a team, we chose: first this, then that. And so we tried to do this. (Karen, care teacher in primary education)

*Helping.* Three teachers who report co-operative data use provide evidence for helping activities. The relative frequency of 0.27 (Table 4) indicates that helping activities have a reasonable share in teachers' co-operative data use.

Two of the three teachers who report helping activities (i.e. Kelly and Karen) indicate that their school team is 'close', which indicates that they—according to them—generally interact a lot. Therefore, also in the context of data use, interactions are present. Similar in both teams is that they have invested in coping with a strongly

changing school population (i.e. increased percentage of foreign language speakers) through the years, which has resulted in working together intensively to rearrange the school in terms of structure and instruction.

The three interviews in which helping activities are coded indicate that helping activities are initiated to serve individual purposes. The purposes that are found are different across the teachers, but are mostly related to changes or improvements in teachers' classroom practice. An illustration of how helping situations usually occur is provided by Kim. Kim teaches general subjects in vocational secondary education. She indicates that the school had implemented attitude measurement as an addition to the cognitive results on pupils' monthly school reports. With the exams coming up, the teacher had summarised the attitude figures in a diagram but she did not feel confident in interpreting this type of data. Subsequently, she consulted a colleague in order to help her figure out conclusions that could be made on the basis of the diagram.

I think we are a nice, dynamic and young team. Because teachers in general subjects, there are a mathematic[s] teacher, a foreign language teacher, I studied Dutch, then history, economics, so a great variety. Yes, we are very complementary. [...] But I really ask for support from my maths colleague. I know how to derive a diagram out of those attitude measures, but it is thanks to her actually ... She tells me what they mean. (Kim, teacher in general subjects in vocational secondary education)

### *Collaborative data use*

Three participants report collaborative data use. The limited evidence for joint work activities is reflected in a relative frequency of 0.18 (Table 3). Two of the teachers who use data collaboratively also use data individually and co-operatively. Of the participants who indicate that they use data collaboratively, one teacher (i.e. Kelly) says that in her school team generally a lot of interaction takes place (cf. section on helping). The other teachers (i.e. Martha, Karen and Kim) indicate that their school leader stimulates and models data use at school.

From the interviews, we learn that joint work in the context of data use transcends teachers' individual purposes for data use. Generally, the collaborative situations reported by teachers are about creating alignment in data use goals and improvement actions at school level. Although almost all teachers who report collaborative data use also provide indications for co-operative data use, it is not necessarily so that all collaborating teachers are also co-operating with colleagues in the context of data use. The counterexample is Peter, a teacher in primary education. His interview indicates that he takes a sort of 'expert' role in data use within the school and does not feel the need to engage in storytelling, helping or sharing activities. Compared with his colleagues, he is well grounded in data use and also supports the school leader in her data use.

Collaboration in the context of data use is generally about making (school-wide) agreements, mainly in implementing changes or improvement actions on the basis of data. Illustrative in this is a fragment from the interview with Kelly. Kelly is a care teacher in primary education. During the interview with Kelly, it became clear that



within the school, the school leader and the teachers highly value consultation when it comes to implementing changes or thinking out improvement actions that affect teachers' daily practice. The citation below illustrates how information from a seminar attended by her and her school leader was deliberated within the school team. Subsequently, agreements were made on how the insights of the seminar would be implemented in the daily practice of teachers.

Together with the school leader, I followed a seminar on child interviews. And afterwards, we had a team meeting about it. We showed the videos that were used at the seminar to the teacher team. And then, we made agreements on whether we would start with child interviews in the class and how we would organise these interviews. (Kelly, care teacher in primary education)

## Conclusion and discussion

The aim of this study was to widen and deepen our knowledge on teacher interactions in the context of data use. Therefore, we investigated (1) the individual, co-operative and collaborative nature of teachers' data use and (2) the level of interdependency in teachers' interactions in the context of data use. In order to answer these research questions, a qualitative study was set up. Semi-structured interviews were performed with 12 teachers of primary and secondary education in Flanders.

In the practice of the teachers in this study, data was generally used individually. According to the majority of the teachers, they use data individually to some extent. In contrast, co-operative and collaborative data use is less apparent. Storytelling activities (co-operation) are reported by a moderate number of teachers in the present data set, but activities that involve a higher level of interdependency (i.e. co-operative activities such as helping and sharing; collaborative activities such as joint work) are almost absent. A possible explanation for the large proportion of individual data use among the participants might be that these teachers consider their teaching practice as an individual responsibility. Thus, the teachers consult colleagues in order to discuss the context of data use, but do not go beyond this (low) level of interdependency to improve their practice. Co-operative data use with higher levels of interdependency (helping and sharing) and collaborative data use (joint work) are not common practice among the participating teachers.

The finding of limited collaboration (i.e. joint work) is not uncommon in educational research (Little, 1990; Kwakman, 2003; Katz & Earl, 2010). Moreover, Flemish teachers in particular do not generally engage in activities that demand higher degrees of interdependency with their colleagues (OECD, 2013). Teachers do not tend to feel interdependent in terms of teaching and learning (Little, 1990). Therefore, teachers do not generally engage in activities that might affect their individual responsibility for their classroom practice, such as making arrangements or creating work groups. These findings are extended to the context of data use by means of this study.

Although the limited collaborative data use may not be surprising, in particular given the Flemish context of the study, the finding that several types of co-operative data use is also scarce is a new finding. Despite the research indicating that storytelling is a good illustration of the daily life in schools (Meirink *et al.*, 2009; Bakkenes





*et al.*, 2010; Katz & Earl, 2010), the activity was reported by a moderate but not considerable number of teachers in the context of data use. Moving further on the continuum of interdependency, helping activities are limited, which goes against the findings of Meirink *et al.* (2009) and Katz & Earl (2010), who did find these types of activity in schools. Furthermore, contrary to other research in the context of data use (Bolhuis *et al.*, 2016; Hubers *et al.*, 2016), we do not find evidence for sharing activities independent of the context of intervention studies.

The present study contributes to the data use literature in several ways. First, we enhanced conceptual clarity with regard to teacher interactions in the context of data use. In general, interactions in the context of data use are approached by using 'collaboration' as an umbrella concept that comprises different types of interaction without specifying them. This is addressed in the present study. Conceptually as well as empirically, we found a continuum from individual, to co-operative, to collaborative data use, depending on the level of interdependency of data use interactions. Furthermore, the framework of Little (1990), including interactions with various levels of interdependency (i.e. storytelling, helping, sharing, joint work) is explicitly validated in the present study. However, although indications for the validity of the framework are found in several studies, this study makes the first attempts at validation of the framework as invented. Additionally, the present study contributes to the theory by integrating two frameworks to describe and investigate data use processes. The way in which we integrated the Hammick *et al.* (2009) and Little (1990) frameworks on interactions resulted in a refinement of the prior set concepts. In particular, we found that the concept of co-operation can include different types of activity (i.e. storytelling, helping, sharing), depending on the level of interdependency in the interaction. Lastly, most of the studies in the data use field involve research conducted in an intervention setting. Studying data use collaboration by means of such interventions strongly affects the picture that is drawn of teacher interactions, because data use interventions are mostly shaped around teacher collaboration. Therefore, doubts can be raised with regard to the sustainability of teacher interactions when studying them via an intervention setting. This study addresses that problem by examining data use as a part of teachers' daily life. This is crucial in order to understand the potential of data use in general and the success and sustainability of data use interventions in various contexts.

Although the results of this study contribute to the data use literature, some limitations have to be taken into account. The methodological choices that were made allowed us to provide a description of individual, co-operative and collaborative data use to some extent. Therefore, a useful framework for studying data use was created. However, the methodology also had its limitations in widening and deepening the research results. Interviews with teachers from diverse teams provided an indication of teachers' individual interactions, but did not provide information about data use interactions in whole teacher teams or increased understanding regarding the relationships of the studied teachers with their colleagues. Future research could address these limitations by using alternative research methods and analysis techniques, such as social network analysis. Conceptually, there are some limitations in this study with regard to the broad conceptualisation of the concept of 'data'. Although the research field voices criticism with regard to a too-strict definition of the concept, future





research can benefit from taking a more specific type of data into account (e.g. pupil learning outcome data). This is helpful to increase the contextualisation and comprehension of the research results. It is recommended that future data use studies try to find a balance between a (too) broad and a (too) narrow conceptualisation of the concept of 'data'.

In light of the results on individual, co-operative and collaborative data use, questions arise on differences in 'quality' between these different types of data use. In other words: what kind of data use do we expect or hope to see in schools? Prior research related fruitful data use to interaction (Copland, 2003; Wayman *et al.*, 2006; Hubbard *et al.*, 2014). However, this study makes it clear that individual data use remains the most common form of data use among the Flemish participants. Therefore, questions arise about the level of interdependency that is recommended with regard to data use. That is why the link of individual, co-operative and collaborative data use with outcome variables (e.g. professional learning outcomes, quality of decisions) needs to be addressed. The challenge will be to determine which level of interdependency is appropriate within specific school contexts and with regard to specific data use goals.

Given that interactions are considered indispensable for fruitful data use (Hubbard *et al.*, 2014), this study draws a rather pessimistic state of the art. The results of this study imply that a supportive environment for data use, in which teachers co-operate and collaborate, cannot be taken for granted. Therefore, attempts need to be made to facilitate co-operation and collaboration in the context of data use. In particular, since teachers do not tend to feel interdependencies, they should be stimulated to create them. A common goal setting related to data use might be one of the keys to successful co-operation and collaboration in schools, as this is important for school-wide data use (Levin & Datnow, 2012; Schildkamp *et al.*, 2012). This might not be self-evident from a teacher's perspective. Therefore, it is important for practitioners to explicate and formulate problems from which a data use co-operation and collaboration can start (Schildkamp *et al.*, 2015). Discussing, analysing and working together to solve these problems by using data might result in growing interdependencies, which might lead to an enriching environment for teachers' data use.

The literature generally underlines the importance of interactions in the context of data use. This study is a useful first step to bring to the surface differences between co-operation and collaboration that were previously submerged in data use research. The results generate the need for more refined future approaches to interactions and collaboration in the context of data use. Only by enriching the (conceptual) debate on data use interactions can their potential added value come into its own in both research and practice.

## References

- Bakkenes, I., Vermunt, J. D. & Wubbels, T. (2010) Teacher learning in the context of educational innovation: Learning activities and learning outcomes of experienced teachers, *Learning and Instruction*, 20(6), 533–548.
- Barrezele, G. (2012) *Informatiemanagement. Een nieuw tijdperk, een nieuwe aanpak [Information management. A new era, a new approach]* (Leuven, Acco).



- Bertrand, M. & Marsh, J. A. (2015) Teachers' sensemaking of data and implications for equity, *American Educational Research Journal*, 52(5), 861–893.
- Bolhuis, E. D., Schildkamp, K. & Voogt, J. M. (2016) Improving teacher education in the Netherlands: Data team as learning team?, *European Journal of Teacher Education*, 39(3), 320–339.
- Copland, M. A. (2003) Leadership of inquiry: Building and sustaining capacity for school improvement, *Educational Evaluation and Policy Analysis*, 25(4), 375–395.
- Cosner, S. (2011) Supporting the initiation and early development of evidence-based grade-level collaboration in urban elementary schools: Key roles and strategies of principals and literacy coordinators, *Urban Education*, 46(4), 786–827.
- Datnow, A., Park, V. & Kennedy-Lewis, B. (2013) Affordances and constraints in the context of teacher collaboration for the purpose of data use, *Journal of Educational Administration*, 51(3), 341–362.
- De Volder, I. (2012) *Externe schoolevaluaties in Europa [External school evaluations in Europe]* (Antwerp, Garant).
- Guest, G., Bunce, A. & Johnson, L. (2006) How many interviews are enough? An experiment with data saturation and variability, *Field Methods*, 18(1), 59–82.
- Hammick, M., Freeth, D., Copperman, J. & Goodsmith, D. (2009) *Being interprofessional* (Cambridge, Polity Press).
- Hubbard, L., Datnow, A. & Pruyne, L. (2014) Multiple initiatives, multiple challenges: The promise and pitfalls of implementing data, *Studies in Educational Evaluation*, 42, 54–62.
- Hubers, M. D., Poortman, C. L., Schildkamp, K., Pieters, J. M. & Handelzalts, A. (2016) Opening the black box: Knowledge creation in data teams, *Journal of Professional Capital and Community*, 1(1), 41–68.
- Hulpia, H., Valcke, M. & Verhaeghe, J. P. (2004) The use of performance indicators in a school improvement policy. What do experts say about it?, paper presented at the *Annual Conference of the American Educational Research Association*, San Diego, CA, 12–16 April.
- Jimerson, J. B. (2014) Thinking about data: Exploring the development of mental models for 'data use' among teachers and school leaders, *Studies in Educational Evaluation*, 42, 5–14.
- Katz, S. & Earl, L. (2010) Learning about networked learning communities, *School Effectiveness and School Improvement*, 21(1), 27–51.
- Kellaghan, T. & Stufflebeam, D. (2003) *International handbook of educational evaluation* (Boston, MA, Kluwer Academic).
- Kwakman, K. (2003) Schools as places for teachers to learn?, paper presented at the *Annual Conference of the American Educational Research Association*, Chicago, IL, 21–25 April.
- Levin, J. A. & Datnow, A. (2012) The principal role in data-driven decision making: Using case-study data to develop multi-mediator models of educational reform, *School Effectiveness and School Improvement*, 23(2), 179–201.
- Little, J. W. (1990) The persistence of privacy: Autonomy and initiative in teachers' professional relations, *Teachers College Record*, 91(4), 509–536.
- Little, J. W. (2012) Understanding data use practice among teachers: The contribution of micro-process studies, *American Journal of Education*, 118(2), 143–166.
- Maso, I. & Smaling, A. (1998) *Kwalitatief onderzoek: Praktijk en theorie [Qualitative research: Practice and theory]* (Amsterdam, Boom).
- Mason, S. A. (2003) Learning from data: The role of professional learning communities, paper presented at the *Annual Conference of the American Educational Research Association*, Chicago, IL, 21–25 April.
- Meirink, J. A., Meijer, P. C., Verloop, N. & Bergen, T. C. M. (2009) How do teachers learn in the workplace? An examination of teacher learning activities, *European Journal of Teacher Education*, 32(3), 209–224.
- Miles, M. & Huberman, M. (1994) *Qualitative data analysis* (London, Sage).
- Morrow, S. L. (2005) Quality and trustworthiness in qualitative research in counseling psychology, *Journal of Counseling Psychology*, 52(2), 250–260.
- Newman, I. & Benz, C. R. (1998) *Qualitative-quantitative research methodology: Exploring the interactive continuum* (Carbondale, IL, Southern Illinois University Press).



- OECD (2013) *Synergies for better learning. An international perspective on evaluation and assessment* (Paris, OECD Publishing).
- Onwuegbuzie, A. J. (2003) Effect sizes in qualitative research: A prolegomenon, *Quality & Quantity*, 37, 393–403.
- Penninckx, M., Vanhoof, J. & Van Petegem, P. (2011) *Evaluatie in het Vlaamse onderwijs. Beleid en praktijk van leerling tot overheid [Evaluation in Flemish education. Policy and practice from student to government]* (Antwerp, Garant).
- Roschelle, J. & Teasley, S. D. (1995) The construction of shared knowledge in collaborative problem solving, *Computer Supported Learning*, 128(1995), 69–97.
- Scheerens, J. (1990) School effectiveness research and the development of process indicators of school functioning, *School Effectiveness and School Improvement*, 1(1), 61–80.
- Schildkamp, K., Ehren, M. & Lai, M. K. (2012) Editorial article for the special issue on data-based decision making around the world: From policy to practice, *School Effectiveness and School Improvement*, 23, 123–131.
- Schildkamp, K. & Kuiper, W. (2010) Data-informed curriculum reform: Which data, what purposes, and promoting and hindering factors, *Teaching and Teacher Education*, 26(3), 482–496.
- Schildkamp, K., Poortman, C. L. & Handelzalts, A. (2015) Data teams for school improvement, *School Effectiveness and School Improvement*, 27(2), 228–254.
- Seashore Louis, K., Dretzke, B. & Wahlstrom, K. (2010) How does leadership affect student achievement? Results from a national US survey, *School Effectiveness and School Improvement*, 21(3), 315–336.
- Stoll, L., Bolam, R., McMahon, A., Wallace, M. & Thomas, S. (2006) Professional learning communities: A review of the literature, *Journal of Educational Change*, 7(4), 221–258.
- Verhaeghe, G., Vanhoof, J., Valcke, M. & Van Petegem, P. (2010) Using school performance feedback: Perceptions of primary school principals, *School Effectiveness and School Improvement*, 21(2), 167–188.
- Wayman, J. C. (2005) Involving teachers in data-driven decision making: Using computer data systems to support teacher inquiry and reflection, *Journal of Education for Students Placed at Risk*, 10(3), 295–308.
- Wayman, J. C., Midgley, S. & Stringfield, S. (2006) Leadership for data-based decision-making: Collaborative educator teams, paper presented at the *Annual Conference of the American Educational Research Association*, San Francisco, CA, 7–11 April.
- Wayman, J. C., Midgley, S. & Stringfield, S. (2007) Leadership for data-based decision making: Collaborative educator teams, in: A. B. Danzig, K. M. Borman, B. A. W. Jones & W. F. Wright (Eds) *Learner-centered leadership: Research, policy and practice* (Hillsdale, NJ, Lawrence Erlbaum), 189–205.
- Wayman, J. C., Jimerson, J. B. & Cho, V. (2012) Organizational considerations in establishing the data-informed district, *School Effectiveness and School Improvement*, 23(2), 159–178.

