

Data-informed curriculum reform: Which data, what purposes, and promoting and hindering factors

Kim Schildkamp^{a,*}, Wilmad Kuiper^{b,c}

^a University of Twente, Faculty of Behavioral Science, Department of C&O, P.O. Box 217, 7500 AE Enschede, The Netherlands

^b University of Utrecht, Freudenthal Institute for Science and Mathematics Education, Princetonplein 5, 3584 CC Utrecht, The Netherlands

^c Netherlands Institute for Curriculum Development, Piet Heinstraat 12, 7511 JE Enschede, The Netherlands

ARTICLE INFO

Article history:

Received 1 September 2008

Received in revised form

25 March 2009

Accepted 9 June 2009

Keywords:

Data use

Decision making

Curriculum development

School improvement

ABSTRACT

Schools face a lot of data on the functioning of their school which they can use to make improvements in teaching, learning and the organization. For data use to lead to improvement, it is important to further research the concept data-driven decision making. The results of this explorative study in the Netherlands show that teachers mainly use classroom level data for making instructional decisions at classroom level, and school leaders mainly use school level data for policy development decisions. This article ends with suggestions with regard to enhancing the effectiveness of data-driven decision making, for example by stressing the importance of developing teachers' competence in the use of data.

© 2009 Elsevier Ltd. All rights reserved.

1. Introduction and research questions

Education is usually depicted as a field in which teachers make decisions based on intuition and instinct (Slavin, 2002, 2003). Current research stresses the importance of using data, such as assessment results and student surveys, to base decisions on (see for example Wayman, Cho, & Johnston, 2007; Wohlstetter, Datnow, & Park, 2008). Policymakers argue that the only way to increase student achievement levels is that school staff bases their decisions on data. Data can help remove politics and ideology from decisions, and focus on teaching and learning. The demands of policymakers for school staff to use data raises several questions, especially concerning which forms of data school staff use, for which purposes they use data, and the conditions that may support or hinder data use (Honig & Coburn, 2008).

Different people in the school may have different information needs at different curriculum levels. Teachers may need, for example, information on learning strengths and weaknesses of individual students. School leaders usually require information about the progress of learning for each class in the school or a relative measure of performance focused on the performance level of the school in comparison to other schools that are similar (Coburn & Talbert, 2006).

* Corresponding author. Tel.: +31 53 489 4203; fax: +31 53 489 3759.

E-mail addresses: k.schildkamp@utwente.nl (K. Schildkamp), w.kuiper@slo.nl (W. Kuiper).

An important distinction in the literature about data-driven or data-based decision making is the distinction between data and information. Davenport and Prusak (1998) define data as “a set of discrete, objective facts about events” (p. 2). Data provides no judgment or interpretation, and no sustainable basis of action. Cousins and Leithwood (1993) state that data is rarely used in the form in which it is presented. Usually interpretation of the data takes place and it is the interpretation of this data that is used. Data in this study refers to data on the functioning of the school (including data on learning and achievement of students). When data is interpreted, it may be called information. Unlike data, information has meaning, relevance, and purpose. Data can be transferred into information by for example contextualizing, categorizing, calculating, connecting, and by summarizing the data (Davenport & Prusak, 1998). In order for data to be used, the data should be transferred into information by interpreting the data. Next, that information should be used as a basis for decision making.

Data use or data-driven decision making in this study is defined as systematically analyzing existing data sources within the school, applying outcomes of analyses to innovate teaching, curricula, and school performance, and, implementing (e.g. genuine improvement actions) and evaluating these innovations. Data use in this study thus concerns the purposeful use of data. Using data means that the data is being interpreted and thus transferred into information (e.g. information concerning the functioning of the school).

Data can help teachers to monitor their constantly changing environment, their functioning and to what extent curriculum aims

are met, and react timely and in an evidence-based manner when problems need to be solved. From research in a minority of best-practice schools we know that teachers can use data to innovate their teaching, innovate existing (ineffective) programs in their schools, and improve the functioning of the school in terms of increased student achievement (Feldman & Tung, 2001; Walsh, 2003; Young, 2006). For example, a teacher who is not satisfied with certain assessment results may decide to analyse the test results more critically. Based on these data he may come to the conclusion that he should focus his instruction on certain topics, and that he should make changes in his teaching. As a result, he may start using different instructional strategies (teacher improvement), and may focus on these specific topics (curriculum improvement). Data on the next test results can tell him whether or not his changes were successful in terms of that they led to higher student achievement results (school improvement) (Boudett & Steele, 2007).

However, we know that most teachers do not use data properly, or do not use data at all (see for example: Schildkamp & Teddlie, 2008; Schildkamp, Visscher, & Luyten, 2009; Wohlstetter et al., 2008). A majority of decisions by teachers are taken based on intuition and on limited observations (Ingram, Louis, & Schroeder, 2004). Valuable time and resources are lost with the implementation of new curricula, which for example do not coincide with the needs of the students (Earl & Katz, 2006).

The field of data-driven decision making is relatively new, and findings are predominantly based on studies conducted in the United States. Also, most studies focus on assessment data, excluding other types of relevant data such as inspection data, school self-evaluation data, and student and parent survey data. When analyzing data to improve the school's curriculum, it is important not only to use assessment data, but also take into account information from sources other than measures of student achievement. As stated by Baker, Linn, Herman and Koretz (2002 in Chen, Heritage, & Lee, 2005) in order to improve student achievement, understanding the context of student achievement can be just as important as knowing the parameters of test performance.

The time has come, as also suggested by others in the field (Kerr, Marsh, Ikemoto, Darilek, & Barney, 2006; Wayman & Stringfield, 2006a, 2006b), to take the current body of knowledge on data use (or rather non use) further by focusing not only on the use of data within schools, but also on how to support school staff in the use of data. Therefore, an explorative study into the possibilities and restrictions of data-driven decision making was conducted in the Netherlands. Based on the results of this study, future studies can focus on supporting schools in the use of data. The underlying research questions of this article are:

1. For which purposes are different types of data being used by school leaders and teachers in secondary education in the Netherlands?
2. Which variables promote or hinder data use by teachers and school leaders?

In the next section, first some background information on the Dutch educational context is provided (Section 1.1). Next, a theoretical framework with regard to what purposes school staff may use data (Section 1.2), and variables which may promote or hinder data use (Section 1.3) is presented. The section thereafter presents the method used in this study (Section 2), followed by the results of the study (Section 3) and conclusions (Section 4).

1.1. The Dutch context

Most studies on data-driven decision making are situated in the United States, where data-driven decision making is receiving

increased attention, due to increased attention for accountability, especially with the passing of the No Child Left Behind (NCLB) Act of 2001. The context of the Netherlands is rather different though. Dutch schools traditionally have considerable autonomy. They have always been free to choose the religious, ideological and pedagogical principles on which they base their education, as well as how they choose to organize their teaching activities (Ministerie van Onderwijs, Cultuur & Wetenschappen, 1999). This freedom has led to a situation where both public and private schools are funded equally by the Government. Since the 1980s the process of further decentralizing competencies from the national level to the level of schools and municipalities has been initiated, schools have received more autonomy regarding their administration and finances; some other tasks have been decentralized to the municipalities (Hendriks, Doolaard, & Bosker, 2002).

The Netherlands do have an inspectorate, which holds schools accountable for their education. The decentralizations process in the Netherlands is rapidly proceeding towards governance in education (i.e., adjusting inspection evaluation to the principles of increased school autonomy), and schools are held accountable for their functioning in three different manners. Firstly, like in the United States, a vertical hierarchical external accountability function exists, in which an external organization (e.g. the Dutch Inspection) holds schools accountable for their functioning. Next, horizontal accountability is present, in which schools are expected to provide their community and stakeholders with insight into their processes, choices and results. Thirdly, internal vertical accountability exists, in which schools are supposed to provide their boards of supervision with insight into the adequacy of their management, policy and steering (Janssens, 2005, 2007).

The inspectorate plays an important role in the vertical hierarchical external accountability function. The main goal of the inspectorate is to assess and improve the quality of Dutch schools. Improvement is defined here in terms of added value: the extent to which schools add more value to their students' school entry performance levels (and how that compares with the average value added by schools with similar student populations, in terms of school entry level, or students' socio-economic status). The Dutch inspection supervision framework for assessing school performance includes the school's quality care system, assessment, classroom teaching (quality of teaching), pupil care and support, school climate, school results, lesson content, and teaching time. Dutch school inspectors assess the quality of schools using the school supervision framework. Based on their assessment inspectors provide data to schools on their strengths and weaknesses including suggestions on how to improve. Schools assessed by inspectors as 'weak schools' are visited more intensively and more frequently than other schools, and inspectors draw up written agreements with these schools about the improvements required ("schools under special measures"). Schools may also be requested to describe how they will implement the school improvement action plan. These plans are monitored thereafter by the school inspector (Ehren & Visscher, 2008).

An important aspect of the Dutch Inspectorate is the so-called 'principle of proportionality'. This means that the inspection of schools starts from the results of schools' quality assurance and school self-evaluation activities (Inspectie van het Onderwijs, 2002; Ministerie van Onderwijs, Cultuur & Wetenschappen, 2000–2002; Renkema, 2002), which implies that schools have to collect data on their own functioning. This method is expected to encourage schools to develop adequate quality assurance measures and as a result, based on data identify and correct their own weaknesses.

Unlike in the United States, in the Netherlands it is difficult to sanction weaker schools. Freedom of education is highly valued in the Netherlands and implies that schools are free to determine how they will organize their education. As long as they comply with legal

requirements, they cannot be sanctioned or be obliged to change (Ehren, Leeuw, & Scheerens, 2005), although a follow up visit by the inspection to weaker schools is sometimes seen as a sanction.

Summarizing, on the one hand there are explicit expectations of schools using data to monitor and improve their quality, as school inspections are based on quality assurance and school self-evaluation data. On the other hand, the use of, for example school self-evaluation data, is usually perceived by school staff as a task of school management. Teachers feel that their primary task is teaching, and this does not include the use of (self-evaluation) data (Schildkamp, 2007). Moreover, since it is difficult to sanction schools, school staff may feel less pressured to use data to improve. This context may influence how data are being used in the Netherlands.

In the Netherlands, several data sources are available within schools, including:

- School inspection data: the inspection generally judges the school on the educational processes based on the supervision framework discussed above. Schools are also judged on the basis of their output, including the percentage of grade repeaters in lower and higher levels of secondary education, as well as the average grade for the final exams of each track.
- School self-evaluation data: school self-evaluation can be defined as a procedure involving systematic information gathering initiated by the school with the intention to assess the functioning of the school for supporting decision making, organizational learning, and for fostering school improvement (Schildkamp, 2007). In the Netherlands, more than 70 different instruments for school self-evaluation are available (The Standing International Conference of Central and General Inspectorates of Education, 2003). Schools use different types of school self-evaluation instruments, but most school self-evaluations include management and teacher questionnaires on the functioning of the school. Sometimes, school self-evaluation instruments also include student and parent questionnaires.
- Data on intake, transfer and school leavers: schools keep records on the intake of students, transfer (e.g. grade repeaters), and school leavers (with or without a diploma).
- Final examination results: at the end of secondary education, students have to pass a final examination. Dutch upper secondary education (which is the context of this study) encompasses two school types: HAVO (general secondary education) and VWO (university preparatory education). Both are for pupils from the age of 12 years and up. VWO diplomas qualify pupils to enter university or higher professional education. The HAVO diploma provides entry to higher professional education, but also to the fifth year of VWO or to upper secondary vocational education. The curriculum is organized around four subject profiles (nature and technology, nature and health, economics and society and culture and society). Pupils complete the requirements for at least one profile. This involves instruction in an average of 15 subjects, some of which are examined internally by the school, some of which are examined both internally and during a final national exam. Final examination results thus include the results of internal and external assessments.
- Assessment results: students in the Netherlands are assessed on a regular basis. Assessments include both oral and written assessments, and are usually administered by teachers.
- Student questionnaire data and focus groups: some schools administer student questionnaires, to gather information on the students' perception on the functioning of teachers, school leaders and the school in general. Some schools also use student focus groups for these purposes.
- Parent questionnaire data and focus groups: some schools administer parent questionnaires, to determine the needs of

their stakeholders, to gather information on the parents perception on the functioning the school. Some schools also use parent focus groups for these purposes.

1.2. Purposes of data use

From a literature study (see for example Brunner et al., 2005; Coburn & Talbert, 2006; Kennedy, 1984; Kerr et al., 2006; Wayman & Stringfield, 2006a, 2006b; Young, 2006) it appears that data may be used for several purposes. In a study conducted by Young (2006), for example, teachers used assessment data for instructional purposes, to move students between groups mid-year, and to create and review intervention strategies for individuals. Data may also be used to support conversations with parents, students, (fellow) teachers, and (fellow) administrators (Breiter & Light, 2006; Brunner et al., 2005) or to shape professional development (Brunner et al., 2005; Breiter & Light, 2006). In several studies, teachers indicated that they used the assessment results to reflect on their own teaching practice. School leaders indicated that they used data to shape professional development activities for teachers, including helping teachers to create differentiated instructional activities or learning about school or district wide standards and goals (Breiter & Light, 2006; Brunner et al., 2005).

Data may also be used for encouraging self-directed learning by giving the data to students. Teachers reported disseminating the data to their students as a way to encourage them to take ownership of their own learning (e.g. providing feedback to students) (Breiter & Light, 2006; Brunner et al., 2005; Young, 2006).

Identifying areas of needs and targeting resources (policy development and planning) is another possible purpose of data use. School leaders reported that the data helped them to identify grade, class, and school-wide strengths and weaknesses, which then could be used to make decisions about planning, shaping professional development activities, and determining student performance and demographics. School leaders, in some studies, for example, reported that they used the data to plan for setting school and district priorities and goals, to plan test-preparation activities, and to make yearlong pacing calendars (Breiter & Light, 2006; Brunner et al., 2005; Coburn & Talbert, 2006).

Moreover, data may be used for meeting accountability demands or complying with regulations (Coburn & Talbert, 2006; Kennedy, 1984) and for legitimizing existing or enacted programs and policy decisions. Data (in a high stakes accountability system) can serve as a threat, as a way for school leaders to push teachers to change their practices, and do the bidding of the school leader (Coburn & Talbert, 2006; Diamond & Spillane, 2004).

Furthermore, data can be used for motivating students and staff, by for example celebrating achievement and improvement (Diamond & Spillane, 2004; Kerr et al., 2006). In a study conducted by Diamond and Spillane (2004), high performing schools used data to praise school staff for past performance and to stress the need for constant improvement, and to motivate teachers. School performance was praised in team meetings, and student outcomes were proudly displayed within the school, and communicated to parents.

Finally, decisions related to personnel (e.g. evaluating team performance and determining and refining topics for professional development) can be based on data (Kerr et al., 2006; Wayman & Stringfield, 2006a, 2006b).

However, data may also lead to unintended responses. Unintended responses occur if schools use data in undesirable ways. Schools use data in undesirable ways when they for example select only easy to use data to change, and ignore data that involve more complicated long term improvement trajectories. This type of unintended response can be called 'strategic use'. They are considered to

be unintended as schools ignore opportunities to improve. Another unintended response includes misuse of data. This may occur when schools interpret data incorrectly and, as a result, focus on improving aspects of their education that are not in need of improvement. Again, opportunities to improve are ignored.

School staff can also abuse data or use data for educational triage practices (Gilborn & Youdell, 2000 cited in Booher-Jennings, 2005) or the focus on so-called bubble kids (Booher-Jennings, 2005). The findings of the study conducted by Booher-Jennings indicate that teachers, tried to improve test scores by using a collection of “educational triage” practices. Teachers divided their students into three groups: safe cases, suitable cases for treatment, and hopeless cases, and they focused their teaching solely on bubble kids (those on the threshold of passing the test), targeted resources to the accountables (those included in the school’s accountability rating), and decreased the size of the accountability subset by referring students for special education (since the school focused on data-driven decision making within the new accountability system the number of referrals doubled). This practice was also found by Diamond and Spillane (2004), but only in probation schools. Higher performing schools in their study used data to enhance the performance of all students.

1.3. Variables promoting and hindering data use

Since a generally accepted framework for the variables promoting data use by school staff is not available, the factors that are supposed to promote data use have been identified by conducting an extensive literature review on data and information use and related fields (see for example: the special issue of the American Journal of Education, 2006, 112(4); Schildkamp, 2007; Schildkamp & Teddlie, 2008 Visscher, 2002; Wayman, 2005; Wohlstetter et al., 2008). The following factors are hypothesized to influence data use: data characteristics, data user characteristics, and school organizational characteristics (see Fig. 1).

Data characteristics may play an important role in the use of data. From literature it becomes clear that investing in an information management system and technology (Breiter & Light, 2006; Chen et al., 2005; Datnow, Park, & Wohlstetter, 2007; Kerr et al., 2006; Sharkey & Murnane, 2006; Wayman, 2005; Wayman & Stringfield, 2006a, 2006b; Wayman et al., 2007; Wohlstetter et al., 2008) may be crucial for effective data use. Data use in many schools is hindered by ineffective data systems, which make it hard to gather and analyze the data needed. A study conducted by Chen et al. (2005) shows, for example, that technology tools, which facilitate the analyses and reporting of data, can lead to timely identification of at-risk students and interventions to meet their needs, resulting in improved performance. These tools thus should lead to easy data access (Kerr et al., 2006; Mingchu, 2008; Wayman & Stringfield, 2006a, 2006b), access to accurate and timely data (Kerr et al., 2006; Kimball, 2002; Sharkey & Murnane, 2006; Wayman & Stringfield, 2006b), reliable and valid data (Schildkamp, 2007; Kerr et al., 2006; Mingchu, 2008; Teddlie, Kochan, & Taylor, 2002; Visscher, 2002), relevant data (Schildkamp, 2007; Teddlie et al., 2002; Visscher, 2002), and data, which coincide with the needs of the user (Schildkamp, 2007; Visscher, 2002).

The review of educational innovation literature, feedback literature, information management literature, and data literature provides general observations on how school organizational characteristics may influence the use of data. Different responses to the use of data may, at least partially, result from differences in the organizational contexts of schools. Firstly, distributed leadership and support for data use (Earl, 2005; Feldman & Tung, 2001; Kerr et al., 2006; King, 2002; Sutherland, 2004; Wayman & Stringfield, 2006b; Wohlstetter et al., 2008; Young, 2006) may promote the use of data. The school leader has to encourage and support data use, be enthusiastic about it and convey this enthusiasm to staff (Sutherland, 2004). According to Young (2006), school leaders should model data use, and plan and scaffold teachers’ learning about using data. Park and Datnow (2008) state that it is important that

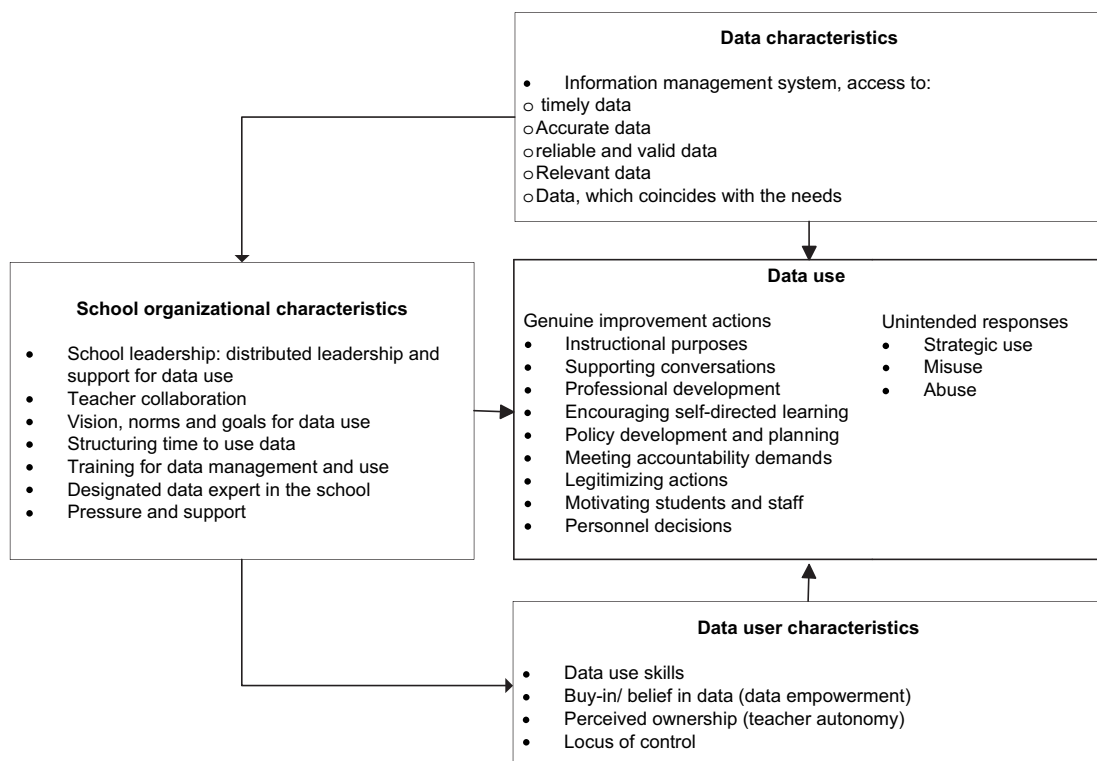


Fig. 1. Factors hypothesized to influence data use.

decision making authority is spread over several levels and groups to enable people to act on data.

Data use may further increase if teachers have time for teacher collaboration (e.g. devote frequent and substantial time to reviewing data and planning accordingly) (Burbank & Kauchak, 2003; Park & Datnow, 2008; Wayman, 2005; Wohlstetter et al., 2008; Young, 2006). Schmoker (2003) states that using data should be a team effort. Based on data a team should identify a school's strengths and weaknesses. Lessons and strategies targeted to improve student learning should be shared, produced, tested and refined. Huffman and Kalnin (2003) state that collaboration is essential for reducing the isolation of the profession, for enhancing individual teacher's professional growth, and it can have a positive impact on schools and students. It can increase teachers' knowledge on teaching, improve their teaching, and increase connections with other educators. Moreover, it can help teachers to get outside their own classroom and participate in discussion on school-wide issues.

Vision, norms, and goals for data use are also important (Datnow et al., 2007; Earl & Katz, 2006; Feldman & Tung, 2001; Kerr et al., 2006; King, 2002; Park & Datnow, 2008; Sharkey & Murnane, 2006; Wayman & Stringfield, 2006b; Wayman et al., 2007; Wohlstetter et al., 2008; Young, 2006). The school leader should create a climate, a shared vision and norms for data use with a focus on continuous inquiry, learning and improvement based on data rather than a focus on using data to blame (e.g. data should be discussed openly without the fear of repercussions). In several schools studied by Sutherland (2004), data use had become a part of the school's culture, "the way we do things around here". Teachers did not think about data as "something that is done to the school" but as something that "is done by and for the school". Related to creating a clear vision and developing norms for data use, it is important to establish specific, measurable goals at the system, school, classroom, and individual student level (for example, 80% of the students will be proficient in math). Also, schools should develop goals not only pertaining to student progress, but also to school staffs' own professional responsibilities and learning (for example, attend a writing seminar).

Furthermore, the school leader has to structure time to use data (Earl, 2005; Feldman & Tung, 2001; King, 2002; Park & Datnow, 2008; Sutherland, 2004; Wayman & Stringfield, 2006b; Wohlstetter et al., 2008; Young, 2006). Not only to collect, analyze, and interpret data, but also meeting time for teachers to discuss the data and to learn from each other (Choppin, 2002; Datnow et al., 2007; Feldman & Tung, 2001; King, 2002; Park & Datnow, 2008; Wayman, 2005; Wayman et al., 2007; Young, 2006).

Training for data management and data use (Breiter & Light, 2006; Kerr et al., 2006; Wayman & Stringfield, 2006b; Wohlstetter et al., 2008) may also lead to an increase in data use. Coddington, Skowron, and Pace (2005), for example, developed a training to teach teachers how to interpret certain types of assessment data (curriculum-based measurement), and translate these data into objective, measurable, and technically adequate objectives for students. The training focused on writing observable and measurable individualized educational program objectives, interpreting data to identify students' instructional levels, and calculating annual goals and benchmarks based on data. The individual training included modelling, practice, and performance feedback. The results of the study showed that after the training teachers were successfully using data to formulate students' instructional goals and objectives based on the data. However, it was not studied if the training impacted teachers' implementation of these objectives.

As data collection and data analysis is often rather difficult for teachers and even school leaders other types of support may also be necessary. A type of support to schools may include a designated data expert within the school who facilitates data use (Kerr et al., 2006; Wohlstetter et al., 2008; Young, 2006).

Finally, a combination of pressure and support may promote data use. Results from a study conducted by Diamond and Spillane (2004) show that in a high stake accountability system, the extensive pressure on probation schools (in combination with too little support) led in these schools to a narrow focus on complying with policy demands and focusing on improving student achievement of only certain students. Higher performing schools benefitted more from accountability policy, because they had the support and resources needed to use data to improve achievement scores of all students. Pressure from the Dutch inspectorate to use data to improve, in combination with support from within schools (from for example a designated data expert) and outside schools (from for example school inspectors) may also promote data use in Dutch schools.

Kluger and DeNisi (1996) conclude in their review of the impact of feedback interventions on performance that feedback effects also depend on *user characteristics*, and as feedback can be seen as a form of data, these characteristics may also influence the use of data. Moreover, according to Taylor's model of information use (1986, 1991 in Mingchu, 2008), data-driven decision making is influenced by the shared assumptions and attitudes by a set of people in the same occupation or profession, in other words user characteristics.

Firstly, school staff has to possess data analysis and use skills (Choppin, 2002; Datnow et al., 2007; Earl, 2005; Earl & Katz, 2006; Feldman & Tung, 2001; Kerr et al., 2006; Mingchu, 2008; Sharkey & Murnane, 2006; Wohlstetter et al., 2008; Young, 2006). Schools have many formal and informal data available. School staff has to decide which data are appropriate and useful for their purposes, ensuring the quality of the data, and conducting the correct analyses and interpretations. The data has to be transformed in information the school can use. In the study conducted by Datnow et al. (2007), for example, teachers indicated that collecting data was not as difficult as reading and using data is more difficult. Data can highlight strengths and weaknesses, but it does not improve student learning in itself.

Moreover, it is important that Buy-in/belief in data exists (data empowerment) (Datnow et al., 2007; Feldman & Tung, 2001; Kerr et al., 2006; Mingchu, 2008; Sutherland, 2004; Wohlstetter et al., 2008). One of the barriers to implementing data-driven decision making is the lack of buy-in to the process. School staff is sometimes resistant to change their practice and they do not see the need to look critically at data and reflect on their own functioning (Feldman & Tung, 2001). There should be interest to engage in data-driven decision making and commitment to change.

Ownership or teacher autonomy is identified as an important influencing factor (Datnow et al., 2007; Feldman & Tung, 2001; Huffman & Kalnin, 2003; Kerr et al., 2006; Sutherland, 2004; Wayman & Stringfield, 2006b; Wohlstetter et al., 2008; Young, 2006). Huffman and Kalnin (2003), for example, found that an important influencing factor was the fact that participants were able to take ownership of the issues, because they collected their own data, rather than only looking at data collected by someone else (e.g. researchers). Although the process of inquiry was sometimes frustrating and time consuming, data helped teachers break the cycle of isolation, helped teachers to critically inquire about their teaching, helped focus on evidence-based decision, and made teachers realize they could influence outcomes through their own.

Finally, Tokar, Fischer, and Mezydlo Subich (1998) found that people with a higher internal locus of control (attributing success or failure to themselves) fare better in change related processes. This may imply that schools with a majority of school staff with a high internal locus of control do better in educational change and thus are more inclined to use the data, to make changes to improve the quality of education than schools with an external locus of control.

2. Method

To explore how school leaders and teachers in the Netherlands use data, a qualitative research methodology was used. The use of data was studied in six best-practice Dutch schools for upper secondary education. Although data from such a small sample of schools do not permit extensive generalizations of the findings, they may offer valuable new insights into the role of the use of data within Dutch schools. Based on these results, future research can focus, for example, on supporting schools in the use of data.

2.1. Respondents

The six schools were identified as best-practice schools based on inspection reports (2005 and 2006). Schools that were judged by the Dutch Inspectorate as having a good quality care system were included in the sample. Furthermore, these schools were identified as best-practice schools by educational researchers, who had previously worked with these schools. We choose these best-practice schools, because we believe that if data can lead to genuine improvement actions, it should become visible here.

The first school (AL) is a school with six locations in three cities. The location that participated in this study is a school with a pre-university educational track (VVO) and a senior general education track (HAVO). The school has approximately 1600 students.

The second school (BC) is part of a school cluster (group of schools providing secondary education in a particular geographical area). The school has seven locations. The location participating in this study is a school with approximately 800 students, a pre-university educational track and a senior general education track.

Schools three and four (CC) are part of a school cluster with 5 schools. Two locations participated in this study. Location three (CCT) (approximately 1300 students) has a pre-university educational track and a senior general education track. Location four (CCL) (approximately 1450 students) also has a pre-university educational track and a senior general education track.

School five (WS) is a school with a pre-university educational track and a senior general education track. The school has approximately 1750 students.

School six (KS) is a school with two pre-university education tracks (one bilingual and one Dutch track), a senior general secondary education track, and a junior general secondary education track. The school is one of the four publicly-run schools in the city with approximately 1650 students.

2.2. Interviews

Interviews in all schools were conducted to determine for which purposes school leaders and teachers use data, and which variables promote and hinder the use of data. Table 1 shows an overview of all the respondents interviewed. In total, 21 (assistant) school

Table 1
Respondents interviewed.

Function	(Assistant) school leaders		Teachers	
School	School heads and site managers	Deputy heads and assistant site managers	Teachers/department heads/track coordinators	Total
AL	1	1	2	4
BC	2	1	2	5
CCT	2	2	0	4
CCL	2	2	2	6
WS	1	1	3	5
KS	1	5	2	8
Total	9	12	11	32

leaders (which will be referred to as school leaders in the remaining sections of this article) and 11 teachers/coordinators in the department of science (in the Netherlands, science education is undergoing some major changes, and data use may support teachers in implementing these changes) were interviewed. All interviews were conducted in the months May and June 2007. All interviews lasted approximately 1 h.

In order to answer the research questions, interviews were held based on an interview schedule. The interviews started with an open question with regard to current school-wide school improvement initiatives, and whether or not data played a role in these activities, and, if yes, how. Secondly, respondents were asked whether or not they used several data sources, such as final examination results, assessment data, and inspection reports. The interview schedule was first tested with a critical teacher-friend. After some minor adjustments, it was used in the six best-practice schools. Interviews were converted into transcripts and analyzed by using the qualitative data analyses program Atlas/ti, which allows for coding all interview fragments, relating the coded fragments to each other, and comparing the codes of different schools and respondents. The results were summarized in a report and sent to all participants with the question to reply if they did not agree with the content of the report (member check). All respondents agreed with the report. Respondents confirmed the description of data-driven decision making in their school. The interview data were coded based on the theoretical framework developed. The coded data were then used to develop detailed report cases for each school according to a common outline (see Table 3). This facilitated a cross-site analysis. Differences between schools in the use of data as well as differences between school leaders and teachers were analyzed.

2.3. Documents analysis

From each school the following documents were collected (Table 2):

- The most recent full inspection report (before the interviews were held) to determine the school's results (both with respect to educational processes and output such as the percentage of grade repeaters in lower and higher levels of secondary education, as well as the average grade for the final exams of each track) from the inspection, and possible school organizational characteristics.
- The school plan and school prospectus to determine if data use results were visible in these documents, and also to determine school organizational characteristics, which may influence data use. The school plan is an integral policy document as well as an accountability document for the Inspectorate. The school prospectus gives information on a school's objectives, its educational activities, and the results achieved. The school prospectus is a public record for parents and teachers (Hendriks et al., 2002).

2.4. Reliability and validity

In this study reliability was fostered by using a systematized approach to data collection that is consistent with the research questions (Riege, 2003). We used a protocol, which described the research questions, data collection method and instruments, and analysis planned. Internal validity was enhanced by highlighting major patterns of similarities and differences between respondents' experiences and beliefs in one table. Moreover, misrepresentation and interpretation of respondents' statements were avoided by member-checking (Onwuegbuzie & Leech, 2007). All the

Table 2
Data collection to answer the research questions: interviews and documents.

	Data use	Data characteristics	School organizational characteristics	Data user characteristics
AL	Interviews 2007 School plan 2008 School prospectus 2008	Interviews	Interviews Full inspection 2006 School plan 2008 School prospectus 2008 School prospectus 2008	Interviews
BC	Interviews 2007 School prospectus 2008	Interviews	Interviews Full inspection 2006 School prospectus 2008	Interviews
CCT	Interviews 2007 School plan 2008 School prospectus 2008	Interviews	Interviews Full inspection 2004 School plan 2008 School prospectus 2008	Interviews
CCL	Interviews 2007 School prospectus 2008	Interviews	Interviews Full inspection 2004 School prospectus 2008	Interviews
WB	Interviews 2007 School prospectus 2008	Interviews	Interviews Full inspection 2004 School prospectus 2008	Interviews
KS	Interviews 2007 School prospectus 2008	Interviews	Interviews No inspection reports available School prospectus 2008	Interviews

respondents agreed with the results. For enhancing construct validity, multiple sources of evidence or triangulation (i.e., interviews and different types of documents) (see also Table 2) and member checks were used. External validity was realized by providing case-specific and cross-case thick descriptions (also including citations of respondents), and describing the congruence with the theoretical framework.

3. Results

This section will start with summarizing the use of data in each of the six schools (Section 3.1) (see also Table 3). Next, the results will be used to answer the research questions with regard to the purposes of data use by school leaders (Section 3.2) and by teachers (Section 3.3), and the factors hindering and promoting data use (Section 3.4).

3.1. Data use in Dutch schools

Data use by school leaders was limited in school 1 (AL). Several types of data were collected and analyzed, mainly to determine progress of students' learning and the functioning of the school, for policy development, and to evaluate the functioning of teachers. However, the outcomes were not systematically applied to innovate teaching, school-wide curricula and/or school performance. School leaders used, for example, final examination results to evaluate teachers' performance in general, but the results were not used for improvement-oriented actions, such as professional development.

The use of data by teachers was also limited. Teachers mainly used assessment and examination results to monitor progress, and to some extent to address the needs of the learners. One teacher, for example started working with study guides in his classroom, based on final examination results. The results showed that the examination results had decreased compared with last year. The teacher had read somewhere that working with study guides can promote student learning, and he decided to try this in his classroom. Possible explanations for a lack of data use include a (perceived) lack of: access to relevant data, which coincides with the needs of the users; time; school leader support in the use of data; teacher

collaboration; data analysis and use skills; and autonomy to take decisions based on the data.

The use of data by school leaders of school 2 (BC) was also limited. Again, data such as examination results, data on intake, transfer and school leavers, were mainly used to monitor progress of students' learning and for policy development, and rarely resulted in concrete measures to improve teaching, the curriculum or school performance. However, we did find one example of data use, in terms of using data for genuine improvement actions. Based on poor final examination results, the school decided to implement practice sessions for the final exam.

Only one out of the two teachers interviewed indicated that he used data to base decisions on and to reflect on his own performance, such as to determine class priorities (e.g. which topics need immediate attention). The other teacher interviewed did not believe in the use of data (a lack of buy-in or belief in data use). This teacher also displayed an external locus of control: "The results are different each year depending on whether you have a year of good students or not so good students". As it seems, these two factors may be important explanations for a lack of data use at this school. Other factors that may have hindered the use of data in this school are a (perceived) lack of: access to relevant data, which coincides with the needs of the users; time; teacher collaboration; training in the use of data; and a clear vision, norms, and goals for data use.

School leaders of school 3 (CCT) expressed a clear vision, norms and goals for data use (also visible in the school plan and school prospectus). All school staff was expected to use data to inform their decisions, as is stated in several school documents, and was also stressed in team meetings according to the school leaders. School leaders applied outcomes of data analyses to innovate the curriculum and school performance. Based on a combination of school self-evaluation results, data on intake, transfer and school leavers, final examination results, and recommendations of the inspectorate, in cooperation with teachers, they developed and implemented an entire new school-wide curriculum, with a focus on independent learning, activating teaching methods, attention for language development in all subjects of the curriculum, remedial teaching for weaker students, and a new special care system. This new curriculum came about after analyzing the different data

Table 3

Results: factors influencing data use and data use by school leaders and teachers.

School	Data characteristics	School organizational characteristics	Data user characteristics	Data use by school leaders: purposes	Data use by teachers: purposes
1 (AL)	<ul style="list-style-type: none"> Lack of access to reliable, valid, accurate and timely data, which coincides with the needs of the users (SL1, SL2, T1, T2) No sanctions or pressure by the inspectorate (school inspection report) 	<ul style="list-style-type: none"> Not enough time (SL2, T1, T2) Too little support by the school leader (T1, T2) Little teacher collaboration (T2) 	<ul style="list-style-type: none"> Buy-in/belief in data: data use is important in education (SL1, SL2, T1, T2) Data use skills: some types of data, such as school self-evaluation results, are difficult to analyze and comprehend (SL2) Not enough autonomy to use data (T1) 	<ul style="list-style-type: none"> Monitoring progress and identifying areas of need: assessment and final examination results and data on intake transfer and school leavers (SL1, SL2), student and parent surveys and focus groups (SL1) Policy development/planning: school self-evaluation results and school inspection data (e.g. increasing teaching time and start documenting of plans for special needs students) (SL1, SL2, school plan and prospectus) Evaluating teacher performance: final examination results (SL1, SL2) Public Relation (PR) purposes: school inspection data (SL1, SL2) 	<ul style="list-style-type: none"> Instructional changes: assessment results (T1), final examination results and school self-evaluation results (e.g. to improve education by, for example, strengthening the counseling system, and making students work with study guides) (T2) Monitoring progress and identifying areas of need: assessment results (T2), final examination results, and data on intake, transfer and school leavers (T1, T2)
2 (BC)	<ul style="list-style-type: none"> Lack of access to reliable, valid, accurate and timely data, which coincides with the needs of the user (e.g. SL1: "we need a good information management system", T1: "a lot of irrelevant data, data is not suitable for our pupil population") (SL1, SL2, SL3, T1) No sanctions or pressure by the inspectorate (school inspection report) 	<ul style="list-style-type: none"> Designated data expert: support of a good quality assurance manager (SL1, SL2, SL3) Not enough time (SL2, T1, T2, SL3) Need for training in how to use the data in own specific context (T1) Little teacher collaboration (e.g. T2: "I would like to work with other teachers with data") (T1) No clear vision, norms and goals for data use (SL2, SL3, T2) 	<ul style="list-style-type: none"> Buy-in/belief in data: data use is important in education (SL1, T1, T2) Perceived ability to improve without the use of data (SL2, SL3, T2) External locus of control ("the results are different each year depending on whether you have a year of good students or not so good students") (T2) 	<ul style="list-style-type: none"> Supporting conversations with teachers: student surveys and focus groups (SL1) Monitoring progress and identifying areas of need: assessment results (SL3), final examination results and data on intake, transfer and school leavers (SL1), school inspection data (SL1, SL2, SL3, school prospectus), student and parent surveys and focus groups (SL1, SL2) Policy development: final examination results and data on intake, transfer and school leavers (e.g. implementation of practice sessions for the final exam, strengthening the counseling system) (SL1, SL2), school inspection data (e.g. teachers should focus more on independent learning and use more activating teaching methods) (SL1, SL2, SL3, school prospectus), Evaluating teacher performance: assessment results (SL2), final examination results (SL1, SL2, SL3) 	<ul style="list-style-type: none"> Instructional changes: assessment results and final examination results (e.g. to determine the quality of the assessment and improve the assessment if necessary, to determine on which topics to spend more time, implementation of practice sessions for the final exam, strengthening the counseling system) (T1) Evaluating teacher performance: assessment results (T1)
3 (CCT)	<ul style="list-style-type: none"> Lack of access to reliable, valid, accurate and timely data, which coincides with the needs of the user (e.g. SL1: "it is sometimes difficult to locate the information you need" and SL3: "Access to assessment results and data on student characteristics is problematic (partly due to software problems)" (SL1, SL3, SL4) No sanctions or follow up by the inspectorate (school inspection report) 	<ul style="list-style-type: none"> Vision, norms and goals for data use (inspection report, school prospectus, school plan, SL1, SL2) Designated data expert: support of a good quality assurance manager (SL1, SL2) Need support in regulating data: when to use which data (SL2) 	<ul style="list-style-type: none"> Buy-in/belief in data: data use is important in education (e.g. data such as inspection data are in line with our own conclusions) (SL1, SL2, SL3, SL4) 	<ul style="list-style-type: none"> Monitoring progress and identifying areas of need: assessment results (SL3, SL4), final examination results (SL1, SL2, SL4), data on intake, transfer and school leavers (SL1, SL3, SL4), parent and student surveys and focus groups (SL1, SL4) Policy development/planning: school self-evaluation results and inspection data (e.g. develop a new vision and translate it in a new curriculum: more independent learning, more optional subjects and time, new school building, implementation of activating teaching methods, exam training, remedial teaching for weaker students, development of a new special care system, more Dutch language training in other subjects) (SL1, SL2, SL3, SL4, school plan, school prospectus), student surveys and focus groups (e.g. increase the focus on independent learning) (SL2), final examination results and data on intake, transfer and school leavers (e.g. implementation of exam training, remedial teaching for weaker students, more attention in all subjects for reading skills) (SL2, SL3) Meeting accountability demands: school self-evaluation results (SL1) Evaluating teacher performance: final examination results (SL2) 	<ul style="list-style-type: none"> No teacher data available

(continued on next page)

Table 3 (continued)

School	Data characteristics	School organizational characteristics	Data user characteristics	Data use by school leaders: purposes	Data use by teachers: purposes
4 (CCL)	<ul style="list-style-type: none"> Lack of access to reliable, valid, accurate, usable and timely data, which coincides with the needs of the users (e.g. a lot of irrelevant data and according to SL1: "it is sometimes difficult to locate the information you need") (SL1, SL2, SL4, T1, T2) Lack of alignment of different types of data (SL3, SL4) No sanctions or pressure by the inspectorate (school inspection report) 	<ul style="list-style-type: none"> Teacher collaboration and involvement (inspection report, T1) Vision, norms and goals for data use (SL1, SL2, inspection report, school prospectus, school plan) Designated data expert: support of a quality assurance manager (SL1, SL2, SL3, SL4) Not enough time (SL2: "I am not used to turn to data for support, due to the pressure of every days work") (SL2). Need for training in how to support teachers in using data to make improvements (SL2) 	<ul style="list-style-type: none"> Buy-in/belief in data: data use is important in education (SL1, SL2, SL3, SL4, T1, T2) 	<ul style="list-style-type: none"> Monitoring progress and identifying areas of need: final examination results, data on intake, transfer and school leavers, and student and parent surveys and focus groups (SL1, SL2, SL3, SL4) Policy development/planning: final examination results and data on intake, transfer and school leavers (e.g. alignment of the curriculum of the different locations, more attention for language skills in lower stage of secondary education, making transitional arrangements more strict, implementation of exam training) (SL2, SL3, SL4), school self-evaluation results (SL1, SL3, SL4), school inspection data (e.g. implementation of hours available for independent work) (SL1, SL3, SL4, school prospectus, school plan), student survey and focus groups (SL2), student surveys and focus groups: (e.g. improve the transition between the first (location 1) and second stage (location 2) of secondary education by providing student with more information and by offering additional support for the subjects for which the alignment is not satisfactory, improving the hours available for independent learning by offering students subjects and topics from which they can choose, scheduling the test weeks differently, in such a way that there is no weekend in between) (SL2) Meeting accountability demands: school self-evaluation results (SL1) Evaluating teacher performance: assessment results (SL3, SL4), final examination results (SL1, SL2, SL3, SL4) Public Relation (PR) purposes: inspection data (SL3, SL4) 	<ul style="list-style-type: none"> Instructional changes: student surveys and focus groups: (e.g. improve the transition between the first (location 1) and second stage (location 2) of secondary education by providing student with more information and by offering additional support for the subjects for which the alignment is not satisfactory, improving the hours available for independent learning by offering students subjects and topics from which they can choose, scheduling the test weeks differently, in such a way that there is no weekend in between) (T2) Supporting conversations with parents: assessment results (T2) Monitoring progress and identifying areas of need: assessment results (T1), final examination results (T1), data on intake, transfer and school leavers (T1), student and parent surveys and focus groups (T2) Evaluating teacher performance: final examination results (T1)
5 (WB)	<ul style="list-style-type: none"> Lack of access to reliable, valid, accurate, usable and timely data, which coincide with the needs of the users (e.g. lot of irrelevant data) (SL1, SL2, T3) No sanctions or pressure by the inspectorate (school inspection report) 	<ul style="list-style-type: none"> Need for a designated data expert (SL1: e.g. "someone who can locate the data you need and present it in a usable way") (SL1) Not enough time (SL1, SL2, T3) Need for training in finding, analyzing and using data (SL1, SL2, T1) Lack of support: one teachers starts improving based on data (focus on independent learning, and working with individual student plans), but is not supported and stops his actions (T3) Lack of teacher collaboration (T2) 	<ul style="list-style-type: none"> Buy-in/belief in data: data use is important in education (SL2, T2) "If you have a good functioning curriculum you do not need data" (T1) These data (mostly external data) do not apply to my teaching or functioning (T1, T3, SL2) Data use skills: need for guidelines where to find which data and how to use it (SL2) 	<ul style="list-style-type: none"> Supporting conversations with teachers: data on intake, transfer and school leavers (SL1) Monitoring progress and identifying areas of need: final examination results, data on intake, transfer and school leavers, parent and student surveys and focus groups (SL1, SL2) Policy development/planning: school self-evaluation results (SL1, SL2), inspection data (SL1, SL2, school prospectus) Meeting accountability demands; school self-evaluation results (SL1) Legitimizing actions: inspection data (SL1) Evaluating teacher performance: final examination results (SL1, SL2) Public Relation (PR) purposes: inspection data (SL1, SL2, school prospectus) 	<ul style="list-style-type: none"> Instructional changes: assessment and final examination results (e.g. use different teaching strategies or change the assessment, more assessments in between instead of one or two large assessments at the end of the school year for the school exam, based on bad exam results we made the school exams for pre-university education easier, the school exams for senior general secondary education were made more difficult, because the results shows the assessments were too easy) (T1, T2, T3), student surveys and focus groups (e.g. changes in instructional strategies) (T3) To monitor progress: final examination results (T1, T2)

<p>6 (KS)</p> <ul style="list-style-type: none"> • Lack of access to reliable, valid, accurate, usable and timely data, which coincide with the needs of the users (e.g. T2: "data not always accessible, partly because there are too much data available" (SL2, SL5, SL6, T1, T2) • Inspection report is not published (yet) as a result of objections of the school • Need for guidelines where to find which data and how to use it? (SL1, SL2) 	<ul style="list-style-type: none"> • Not enough time (SL1, SL2, T1, T2, SL5) • Need for more teacher collaboration (T1) • Need for training in using data to make improvements (SL3, SL4) • No clear vision, norms and goals for data use (T1, T2) 	<ul style="list-style-type: none"> • Buy-in/belief in data: data use is important in education (SL1, SL2, SL3, SL4, SL5, SL6) • According to one of the school leaders (SL1), teachers do not perceive the use of data as important, but rather as a task of the school leader: "quality care if a hobby of the school leader or an obligation of the inspectorate". • No need for data to improve education, as years of experience are perceived as enough (T1, T2) • External locus of control: explaining poor output as a result of unmotivated students (T1, T2) 	<ul style="list-style-type: none"> • Monitoring progress and identifying areas of need: final examination results (SL2), data on intake, transfer and school leavers (SL1, SL2, SL5), student and parent surveys and focus groups (SL3, SL2, SL3, SL4, SL5, SL6) • Policy development/planning: assessment results (e.g. changes in the assessment schedule and/or use of activating teaching strategies, focus on independent learning, free periods are hours available for independent work, dense time tables) (school prospectus, SL3), final examination results (e.g. changes in the assessment schedule and/or using activating teaching strategies, focus on independent learning, free periods are hours available for independent work, dense time tables) (school prospectus), data on intake, transfer and school leavers (e.g. use of activating teaching strategies, focus on independent learning, free periods are hours available for independent work, dense time tables) (school prospectus, SL2, SL3, SL6), inspection data (e.g. use of activating teaching strategies, focus on independent learning, free periods are hours available for independent work, dense time tables) (school prospectus, SL3, SL5), • Evaluating teacher performance: assessment and final examination results (SL2, SL5, SL6) 	<ul style="list-style-type: none"> • Instructional changes: assessment results (e.g. changes in the assessment schedule and/or use of activating teaching strategies, focus on independent learning, free periods are hours available for independent work, dense time tables) (T1, school prospectus), final examination results (e.g. changes in the assessment schedule and/or using activating teaching strategies, focus on independent learning, free periods are hours available for independent work, dense time table (T1, T2, school prospectus) • Monitoring progress and identifying areas of need: assessment results (T2), final examination results (T2), data on intake, transfer and school leavers (T2)
--	--	--	---	---

Between brackets the data sources from which the evidence was derived can be found: evidence from school leader interviews (SL), teacher interviews (T), school plans, school prospectuses, and inspection reports.

sources mentioned above in combination with experiences of teachers and school leaders, and discussions (in several work groups consisting of teachers, school leaders, parents, students and school board members) of all aspects of education that needed to be included in the new curriculum. Important promoting factors of data use in this school may have been having a clear vision, norms and goals for data use and having a designated data expert available in the school (the quality assurance manager).

The degree of data use in school 4 (CCL) is comparable to school 3. School leaders of this school also took measures, based on data, such as examination results, data on intake, transfer and school leavers, and inspection data, to improve the curriculum and school performance. The alignment of the curriculum across the various locations was improved (as a results of students complaints in student questionnaires), attention for language development increased (as a results of low final examination results in the language subjects), stricter transitional arrangements were implemented (as a results of problems indicated by the transfer results), and exam training was implemented (as a result of low examination results).

The focus of teachers of this school was mainly on how to meet the needs of the learners. An example of a measure taken by teachers, based on student survey results, included improvement of the hours available for independent work by offering students more options in assignments during these hours. Although several factors, such as lack of access to relevant data, which coincided with the needs of the users, lack of time, and a need for training, may have hindered more effective data use, respondents of this school were able to use data to some extent. Factors that may have caused this success include teacher collaboration and involvement, a clear vision, norms and goals for data use, and having a data expert within the school.

The use of data by school leaders in school 5 (WB) was limited to the use of data for policy development, meeting accountability demands, evaluating teacher performance, supporting conversations with teachers, and monitoring progress. Data did not lead to any concrete measures to improve the curriculum, teacher performance or school performance.

The use of data by teachers was also limited. Data was used by teachers to make some changes in instructional strategies, but was mostly used to make changes in assessments (more difficult or easier assessments) and assessment schedules. This lack of data use may be explained by a (perceived) lack of: access to relevant data, which coincides with the needs of the users; a data expert; time; data analyzing and use skills; support; and teacher collaboration. An important factor may also have been a lack of buy-in or belief in data use, as two teachers and one school leader did not perceive the use of data as necessary within the school as "most data do not apply to their functioning" and "if you have a good functioning curriculum you do not need data".

Data in school 6 (KS) was again mostly used by school leaders to monitor progress, for policy development, and to evaluate teachers' performance. To improve assessment results and final examination results, school leaders wanted teachers, for example, to focus more on independent learning and on the use of more activating teaching strategies. Teachers indicated, that based on these data, they were trying to implement independent learning and more activating teaching strategies in their classroom. However, it appears (from for example, the inspection report) that the implementation was not very successful. This was probably caused by the fact that teachers did not perceive a need for using data to improve education as "years of experience are enough". They were of the opinion that poor assessment and final examination results were the result of unmotivated students and not a result of their teaching (e.g. external locus of control). The school also lacked a clear vision, norms and goals for data use, and there seemed to be problems

with the access to relevant and timely data, which coincides with the needs of the users.

Overall, the results of the analyses show that the use of data is limited within Dutch schools. Exact results of each school can be found in Table 3. The results are further discussed in Section 3.2.

3.2. Purposes of data use: school leaders

School leaders and teachers described using different types of data. However, the results of this study show that the use of data by school leaders was limited to using school level data, and often the use was restricted to policy development. In most schools, data use by school leaders did not lead to genuine improvement actions. Data were used for the following purposes:

3.2.1. Monitoring progress and identifying areas of need

All school leaders used final examination results, data on intake, transfer and school leavers, and sometimes parent and student surveys and focus groups to monitor progress of students and the functioning of the school. For example, differences between the results of the students of the school and national results were analyzed, as well as differences between the school exam and the national exam. School leaders compared the examination results of the school with the goals of the school. Results were discussed with the different departments, focusing on low passing rates, differences between the school exam and the national exam, and low marks. However, none of the school leaders could name examples of concrete measures to improve the curriculum, teachers' functioning, or the school's performance, as a result of the monitoring. As one of the school leaders stated: "What happens after that, we don't know. This is a bit embarrassing, but we don't follow up". School leaders identify areas of need and often passed this one to teachers, but they do not check if teachers actually used this information to implement measures to improve student achievement.

3.2.2. Policy development and planning

Nineteen school leaders of six schools used data, such as inspection data and school self-evaluation results for policy development and planning. School leaders reported that they used these data to plan for school priorities and goals. The school leaders of school 1, for example, increased teaching time by scheduling more lessons and started documenting plans for special needs students, based on the recommendations in the inspection report.

From analyses of examination results and school self-evaluation results, school leaders of schools 2 and 3 came to the conclusion that the low grades were partly caused by a lack of text and reading comprehension, and partly due to students' motivational problems. They took several measures to improve examination results, including implementing exam training, remedial teaching for weaker students, and implementing more reading and text assignments and lessons in the first stage of secondary education. In school 3, all teachers were instructed by the school leaders to pay more attention to reading skills in all subjects.

In school 4 data on intake, transfer and school leavers showed that students experienced problems when transferring from one location of the school to another (to higher levels of secondary education). The school administered student surveys to exactly find out what the main problems were. The results showed that students experienced language problems and a lack of information on the transfer. School leaders responded to these problems (together with teachers) by trying to align the curriculum of the different locations, offering additional support to students for the subjects for which the alignment was not satisfactory (yet) (mainly the language subjects), and by providing students with more information on the curriculum of both locations.

Especially, school self-evaluation results and inspection data formed a valuable input for policy development, according to school leaders. In all schools, school self-evaluation results highlighted certain problems, some familiar, some new. Some of the problems that were mentioned (some of them also visible in other data) included transfer from the first stage of secondary education to the second stage of secondary education, a lack of basic reading and writing skills, too little alternation in teaching methods, and one school did not have a clear vision. Based on the results all school leaders indicated that the school took certain measures. Teachers were told that they had to apply more differing teaching methods, and students had to start working with study guides in the first stage of secondary education. The school that lacked a clear vision engaged in communication with different stakeholders (teachers, parents, students) on how to shape its vision and how to translate this new vision into a new curriculum.

Problems highlighted by the inspectorate included problems with the school's quality assurance policy (focusing on parents and students, but missing a focus on examination results), a lack of students' basic skills, the number of hours of education the school provided (not enough), and a lack of focus on active and independent learning. Based on the Inspection data, schools took several measures, partly only to comply with regulation, and partly because the school was already planning these measures, based on other data such as school self-evaluation data and data on intake, transfer and output. According to the school leaders and policy documents, the recommendation of the inspectorate for schools 2 and 6 led to an increased focus on independent learning and activating teaching strategies. However, no evidence was found that this was also a focus of teachers. So it appears that this new policy was not implemented in the classrooms. Examples of other measures setting new goals, starting lessons earlier, organizing staff meetings after school hours, reducing test weeks, and using remedial teaching to enhance students' basic skills.

3.2.3. Evaluating teacher performance and supporting conversations with teachers

Fifteen school leaders of six schools stated that they used assessment results and final examination results to evaluate teachers' performance. In the case of poor assessment or final examination results school leaders addressed this to teachers. However, in none of the schools this led to any concrete improvement actions. No evidence was found that school leaders, for example, used the results for selecting topics for professional development. In two of the schools, reoccurring poor student assessment results could in theory lead to obliged professional development activities for teachers. Assessment results were also used as input for the yearly formative teacher assessments. However, in general, using assessment data was considered to be a teacher task. One school leader indicated that he found it difficult to judge teachers based on student assessment results: "If all students from one teacher have poor assessment results just before our Christmas break I will go and talk to that teacher. But it is difficult. They are trying. They usually have good reasons for bad results. Sometimes they will tell you that they are working hard, but their students are not, or they will tell you that their students did not learn anything from their previous teacher".

3.2.4. Public relations, meeting accountability demands and legitimizing actions

Six school leaders from three schools used the inspection report, if the results were good, for Public Relation purposes. They, for example, published the results on their website or send out a newsletter to the community. Three school leaders of three schools stated that the school self-evaluation results were given to the

Inspectorate to use as a basis for inspection (e.g. meeting accountability demands). Finally, one school leader stated that the inspection results finally provided him with the argument he needed towards his staff to make some changes (e.g. legitimizing actions).

3.3. Purposes of data use: teachers

Data use by teachers was limited. Several data sources were not used by teachers. They rarely used school self-evaluation results to base decisions on. School leaders also indicated that teachers usually are not interested in school self-evaluation data or quality assurance; they are mainly interested in their classrooms. One school leader states in this light: “Teachers focus on their classroom. They are busy with getting students to learn what they have to learn. They consider quality assurance to be either a hobby of the school leader or an obligation of the Inspectorate”.

None of the teachers used inspection data either. In general, teachers were not interested in these data, although some teachers said they sometimes studied the results to see how their subject was rated. Using school inspection data is considered to be a task of school leaders, as becomes clear from the following statement: “Our administration deals with the inspectorate and they do not tell us about it. I could ask for the reports, but it is more a school leader task.” Another teacher stated: “Several years ago motivating students was a problem. The administration, based on the inspection report, made this an issue in the school. A problem is that this is too general, it is not personal enough. The inspectorate talked to several people, but they did not talk to me. I am able to motivate my students. Teachers will often state that it does not concern their classroom”.

Teachers used mainly assessment results, final examination results, data on intake, transfer and school leavers, and student surveys and focus groups, for the following purposes:

3.3.1. Monitoring progress, identifying areas of need, and making instructional changes

Assessment results, final examination results, data on intake, transfer and school leavers, and student surveys and focus groups were used to monitor progress and identify areas of need. Two teachers did not follow up on the results with actions, but all the other teachers used this as a basis for making instructional changes.

Ten teachers of five schools used assessment results, final examination results, data on intake, transfer and school leavers, and student survey and focus groups, to meet the need of diverse learners. Teachers analyzed results, focusing on what did not go well. They analyzed the reasons for students’ failing certain assessments: didn’t they comprehend the subject, were there problems with the content of the assessment, or didn’t they prepare for the assessment? Some teachers also made changes in their instructional strategies (for example, changes in the ways they explained certain topics to students). In school 1, for example, poor assessment results and final examination results were for one teacher reason to look for ways to improve his education. He started working with study guides to meet the needs of the learners. Sometimes the data also led to changes in the assessment (e.g. making the assessment easier or harder).

Teachers of school 4 confirmed the policy changes mentioned by the school leader as a result of student surveys. This school made changes in its curriculum to align the curriculum of the different locations, and offered additional support for the subjects for which the alignment was not satisfactory.

Teachers indicated that examination results were an important form of data. Differences between the results of their students and national results were analyzed, but teachers’ analyses mainly focused on the questions students passed and failed. Based on the examination results, some teachers took action in order to improve

examination results. Three teachers indicated that they spent more time in the lessons on subjects that did not go well in the examination. Some teachers indicated that they changed instructional strategies (e.g. more time independent learning during lessons) and some teachers made changes in the yearlong pacing calendar.

Five teachers indicated that student surveys and/or focus groups were used within the schools. In those surveys, students could assess the functioning of the teacher, and/or the functioning of the school in general. Analyses of the results of these surveys showed several areas of improvement, including that in the hours available for independent working, most students just did their homework. Measures taken based on this data source included offering specific skill training and subjects on the hours available for independent work.

3.3.2. Evaluating teacher performance and supporting conversations with parents

Two teachers of two schools indicated that final examination results and assessment results were used by school leaders to evaluate their functioning. However, this didn’t have any consequences yet. According to these teachers, the results were, for example, not used to select topics for professional development. One teacher used assessment results as a basis for conversations with parents at the annual parent-teacher meetings.

3.4. Factors promoting and hindering data use

The results show that only schools 3 and 4 were able to use data effectively to some extent. Although several factors, such as a lack of access to relevant data, which coincided with the needs of the users, a lack of time, and a need for training, may have hindered more effective data use, respondents of these schools were able to use data. Factors that may have caused this success include teacher collaboration and involvement, a clear vision, norms and goals for data use, and having a designated data expert within the school. The absence of these factors in schools 1, 2, 5 and 6 may have hindered the use of data in these schools.

Furthermore, school staff of schools 1 and 5 stated that they did not receive any support by the school leader in the use of data. Teachers seem to be more effective data users when they receive support and encouragement from the school management to use data, and when school leaders encourage teachers to use data to reflect on their own functioning. However, school leaders find this rather difficult, as teachers sometimes dissociate the performance of their students with their own performance.

Teachers also indicated that they found it difficult to analyze data and to determine exactly what the causes of poor results are: “Are the student lazy?” and “Didn’t they spend enough time on certain subjects?” are examples of questions teachers had after studying examination results. As one of the teachers put it: “Our examination results are really poor, I am not afraid to admit it. Mine are to. When your results are that poor, you first try to make adjustments in your assessments, and you try to motivate students to work harder. But it is just not concrete enough. It is still to abstract. If I knew what to change, I would have made those changes five years ago”.

Also, a lack of teacher collaboration in the use of data may have hindered the use of data in schools 1, 2 and 5. Teacher collaboration played an important role in school 4. Teachers were involved in collaboratively analyzing and discussing data, such as student survey results. Based on these results, they decided, together with the school leader, to focus on improving the transition between the first and second stage of secondary education. In three schools, teachers complained about a lack of teacher collaboration. Two physics teachers in the same school complained, for example, that they had to analyze the final examination results all by themselves, without the help of the other physics teacher in the school.

Buy-in or a belief in data use may also promote data use, as a lack of buy-in or belief in data use may have led to a lack of data use in schools 2, 4 and 6. Respondents of these schools believed that they don't need data to improve their education. Teachers of school 6, for example, stated that "years of experience are enough" or "we have sufficient knowledge in our heads to improve education". The lack of buy-in or belief in data appeared even greater when it concerned inspection data, as one of the teachers stated: "When the inspection comes to visit us, it is more like a private chat between the school leader and the inspectorate. I could ask for the inspection report, but using this type of data is more a school leader task." In the schools with higher levels of data use, buy-in existed, and data was combined with experiences and observations of teachers. In these schools, a lot of measures were still taken based on experiences. These experiences and the current state of affairs in the school were discussed in the team on a regular basis, which formed the basis for collecting data and using data on the topics discussed.

An external locus of control present in schools 2 and 6 may also have hindered effective data use. As one of the teachers in school 2 stated: "Assessment results are different each year, depending on whether you have good or not so good students". School leaders also indicate that this external locus of control is a problem. Teachers do not use data to reflect on their own functioning, they explain poor output simply as a result of unmotivated students. As one school leader stated: "Examination results do not always lead to improvement. Teachers will say that the exam was too difficult; it contained strange questions and so on. They will point to all kinds of causes, but often they do not use the results to take a closer look at their own functioning".

Another hindering factor, not included in our framework, which became visible in the results, is what we would like to call information overload or paralysis through analysis. Especially in schools 2 and 6 school staff stated that there is a lot of irrelevant data and that "data are not always accessible, partly because there are too much data available". One teacher compared it with e-mail. Sometimes you receive so much e-mail that it overloads your e-mail account, and you are not able to filter it anymore.

4. Conclusion and discussion

Before starting to discuss the results, it is important to emphasize the role of a few contextual and methodological factors. First of all, in this study (research) data were collected partly by interviewing teachers and school leaders. Teachers' and school leaders' self-perception is used to study their use of data. We checked the comments made by the respondents by asking for more details and by asking for examples. Still, the data may produce a slightly colored or biased picture of the actual use of data within schools.

Moreover, as stated for example by Breiter and Light (2006), data-driven decision making is a very complicated cognitive process and decision makers are not fully aware of all the data they incorporate in their decision making process, making it difficult to study the use of data. Data or new information is usually fitted into data users' pre-existing framework, which Kennedy (1982 in Honig & Coburn, 2008) calls 'working knowledge'. Data never directly informs decisions, but influence working knowledge, which in its turn may shape decision making. Individual and social processes of interpretation also play an important role, because data may be ambiguous regarding to what it means and whether and how it should be used (Honig & Coburn, 2008). This makes studying data-driven decision making a complex endeavor.

Furthermore, the use of data in this study was studied in only six schools. We re-emphasize that the goal of this study was not to make firm generalizations, but to gain more insights into the use of data in Dutch schools. This exploratory study is meant as a starting

point for larger (quantitative) follow-up studies on the use of data for curriculum renewal purposes at school level.

One of the main findings is that school heads and teachers use data differently. *School leaders* are interested in data at the school level. They have to make sure that the curriculum is in line with government guidelines and the school's own goals. Moreover, they want data (for example, school self-evaluation data) concerning how the curriculum is being implemented, and they have a need for data with regard to attainment (e.g. examination) results at school level. School leaders, in general, are interested in data that can help them to develop and implement school policy. However, they express their concerns when it comes to translating classroom level data in usable knowledge, as is a concern also mentioned by Earl and Fullan (2003). The school leaders interviewed mainly use data for the following purposes: (1) monitoring progress and identifying areas of need, (2) policy development and planning, (3) evaluating teachers' performance and supporting conversations with teachers, (4) public relation purposes, and (5) meeting accountability demands.

Not surprisingly, *teachers* seemed to be mostly interested in data at the classroom level (e.g. data based on their classroom and their students). Important data for teachers are data with regard to how students perceive their lessons and what the results of their lessons are in terms of, for example, student achievement. Teachers in this study used data-driven decision making mainly to inform their own classroom (e.g. to make instructional changes). They used data mainly for the following purposes: (1) monitoring progress and identifying areas of need, (2) instructional purposes, (3) evaluating teachers' performance (e.g. their own performance), and (4) supporting conversations with parents.

Different types of data, including assessment results, final examination results, school self-evaluation results, teacher- and student questionnaires, data on intake transfer and school leavers, and inspection or accountability data, can together form a comprehensive view of the school's functioning, and may serve as a basis to improve that functioning. Similar as in scientific research, triangulation is important for effective data-informed decision making. School staff should not rely on a single source of data or evidence to improve their functioning, but rather take into account different data sources to base their decisions on. For example, information from assessment can serve to locate the individual's attainment in relation to criteria for learning, but this location should also be informed by norm data on the progress of others working to the same curriculum (in Black & Wiliam, 1998a).

However, the results of this study show that school staff mostly does not use data to base their decisions on. Some teachers, for example, disassociate their performance from that of their students, which can cause them to overlook important data (Ingram et al., 2004). Also, several decisions made within schools are not based on data. Especially teachers stated that they made several decisions based on what they saw happening in their classroom and based on their experience as a teacher. Ingram et al. (2004) also found that not all decisions made by schools are data-informed decisions. Their analyses showed that approximately 40% of the descriptions of teachers of their decisions included a description of using systematic data for decision making, an equivalent proportion of the remarks reflected the use of anecdotal information, experience, or intuition to make decisions, and about 15% of the remarks described using a combination of some type of systematic data and some type of non-systematic data such as anecdotes.

Most school leaders and teacher in this study did neither systematically analyze existing data sources within the school, nor apply outcomes of analyses to innovate teaching, curricula, and school performance, and, nor implement and evaluate these innovations. Data were mostly used to monitor progress, but outcomes of this monitoring were usually not applied to improve

education. As concluded by others (e.g. Stecker, Fuchs, & Fuchs, 2005), schools have a lot of data available, but the mere availability of data is not sufficient to lead to improvement. The variables in our theoretical framework may partly explain this lack of data use.

Lack of access to relevant data was considered by several schools as a problem. Respondents mentioned a lack of access to reliable, valid, accurate and timely data, which coincides with their needs. Respondents of two schools indicated they needed a proper information management system. Some respondents expressed problems related to the access of data not as a lack of diffusion of data but on the contrary too much diffusion of data. There is a lot of irrelevant data out there and that “data are not always accessible, partly because there are too much data available” (e.g. information overload). District central office administrators in the study conducted by Honig and Coburn (2008) also indicated that data was sometimes “excessively available to degrees that exceed their ability to make sense of and incorporate it” (p. 595).

A supporting school leader seems to be an important factor. Schools that were more effectively using data had supportive and enthusiastic school leaders, who stressed the importance of data use. These school leaders also expressed a clear vision for data use, and established norms and goals for data use, which may have increased buy in or belief in the importance of data use in the school. Other research also shows, that teachers are more willing to participate in decision making if they perceive their relationship with the school leader as more open, collaborative, facilitative, and supportive (Smylie, 1992).

The results further show that teacher collaboration may also foster data use within schools. On the other hand, lack of teacher collaboration may be a hindering factor in the use of data. Black and Wiliam (1998b) found, for example, that assessment data are usually not shared between teachers within schools, nor are they critically reviewed in relation to what they actually assess. One promising way to increase teacher involvement and collaboration as well as enhancing the effectiveness of data-driven decision making may be, as stated by (Wayman, Midgley & Stringfield, 2005, 2006), setting up collaborative data teams within schools. These teams can consist of teachers and school leaders who analyze and use data to improve educational practice. Collaboration helps teachers to learn from each other how to use data, and allows for a fertile exchange of ideas and strategies (Park & Datnow, 2008; Wayman, 2005; Wohlstetter et al., 2008).

Next, limited implementation may be related to the complex skills successful implementation requires. It is naïve to assume that school staff simply masters data collecting, analyzing and using skills straightaway without providing profound professional development and external support. Especially using data for genuine improvement actions may be difficult as data is sometimes ambiguous and does not provide clear guidelines for action (Honig & Coburn, 2008), and this is even more so for the more complex problems. School staff has to become data literate, they need to have certain expertise to engage in effective data-driven decision making. The data have to be transformed in information the school can use. This also means that school leaders have to allocate time to the use of data (Choppin, 2002; Datnow et al., 2007; Earl, 2005; Earl & Katz, 2006; Feldman & Tung, 2001, Young, 2006). Important in this light is, as stated by Stecker et al. (2005) that teachers must learn how to use data to evaluate the curriculum and their own instructional effectiveness. When student growth lacks behind, teachers need to adjust the curriculum and their instructional strategies. When student growth exceeds expectations, teachers need to raise the goals they have for these students. Teacher colleges may have an essential role in making future teachers more “data wise”. Teacher colleges can include training of data analysis and data use skills in their curriculum.

In our view an important point of action for promoting the utilization of data within schools may be the deliberate training and support of intended users in collaborative data teams (e.g. teachers collaboratively using data for improvement). Such a professional development program should be based on the full recognition and analysis of the complexity of data in terms of the following:

- the availability of an information management system;
- school leader support for data use;
- establish a vision, norms and goals for data use;
- teacher collaboration for data use
- developing the skills to collect, analyze and interpret data;

If a careful approach is followed here (e.g. designing the professional development course and testing it to make sure the goals are met) then we may be able to fulfil important preconditions for a learning school organization which is capable of using the data in terms of reflecting on its performance, and improving it if necessary. However, in the current situation, despite the positive perceptions of the schools using data we cannot be confident that the way school leaders and teachers use data really benefits schools, because the use of data has not been studied rigorously yet. Therefore, conducting more and better (experimental) research into the use of data in order to produce a sounder evidence-base about the use and effectiveness of data is urgently needed. Moreover, if we can confirm the importance of the variables found to hinder or promote data use in this study (e.g. the type of use that leads to improvement-oriented action), we may use this knowledge to support data-driven decision making within schools.

References

- Black, P., & Wiliam, D. (1998a). Assessment and classroom learning. *Assessment in Education*, 5(1), 7–74.
- Black, P., & Wiliam, D. (1998b). Inside the black box: raising standards through classroom assessment. *Phi Delta Kappan*, 80(2), 139–148.
- Booher-Jennings, J. (2005). Below the bubble: “educational triage” and the Texas accountability system. *American Educational Research Journal*, 42(2), 231–268.
- Boudett, K. P., & Steele, J. L. (2007). *Data wise in action. Stories of schools using data to improve teaching and learning*. Cambridge: Harvard Education Press.
- Breiter, A., & Light, D. (2006). Data for school improvement: factors for designing effective information systems to support decision-making in schools. *Educational Technology & Society*, 9(3), 206–217.
- Brunner, C., Fasca, C., Heinze, J., Honey, M., Light, D., Mandinach, E., et al. (2005). Linking data and learning: the grow network study. *Journal of Education for Students Placed at Risk*, 10(3), 241–267.
- Burbank, M. D., & Kauchak, D. (2003). An alternative model for professional development: investigations into effective collaboration. *Teaching and Teacher Education*, 19(5), 499–514.
- Chen, E., Heritage, M., & Lee, J. (2005). Identifying and monitoring students’ learning needs with technology. *Journal of Education for Students Placed at Risk*, 10(3), 309–332.
- Choppin, J. (April 2, 2002). *Data use in practice: Examples from the school level*. Paper presented at the American educational research association, New Orleans.
- Coburn, C. E., & Talbert, J. E. (2006). Conceptions of evidence use in school districts: mapping the terrain. *American Journal of Education*, 112, 469–495.
- Codding, R. S., Skowron, J., & Pace, G. M. (2005). Back to basics: training teachers to interpret curriculum-based measurement data and create observable and measurable objectives. *Behavioral Interventions*, 20(3), 165–176.
- Cousins, B. J., & Leithwood, K. A. (1993). Enhancing knowledge utilization as a strategy for school improvement. *Knowledge: Creation, Diffusion, Utilization*, 14(3), 305–333.
- Datnow, A., Park, V., & Wohlstetter, P. (2007). *Achieving with data. How-high performing school systems use data to improve instruction for elementary students*. San Francisco: Center on Educational Governance University of California.
- Davenport, T. H., & Prusak, L. (1998). *Working knowledge. How organizations manage what they know*. Boston: Harvard Business School Press.
- Diamond, J. B., & Spillane, J. P. (2004). High-stakes accountability in urban elementary schools: challenging or reproducing inequality. *Teachers College Record*, 106(6), 1145–1176.
- Earl, L. M. (August 7–9, 2005). *From accounting to accountability: Harnessing data for school improvement*. Paper presented at the ACER research conference, Melbourne.
- Earl, L. M., & Fullan, M. (2003). Using data in leadership for learning. *Cambridge Journal of Education*, 33(3), 383–394.

- Earl, L. M., & Katz, S. (2006). *Leading schools in a data-rich world. Harnessing data for school improvement*. Thousand Oaks: Corwin Press.
- Ehren, M. C. M., Leeuw, F. L., & Scheerens, J. (2005). On the impact of the Dutch Educational Supervision Act: analyzing assumptions concerning the inspection of primary education. *American Journal of Evaluation*, 26(1), 60–76.
- Ehren, M. C. M., & Visscher, A. J. (2008). The relationships between school inspections, school characteristics and school improvement. *British Journal of Educational Studies*, 56(2), 205–227.
- Feldman, J., Tung, R. (April 10–14, 2001). *Whole school reform: How schools use the data-based inquiry and decision making process*. Paper presented at the American educational research association conference, Seattle.
- Hendriks, M., Doolaard, S., & Bosker, R. J. (2002). Using school effectiveness as a knowledge base for self-evaluation in Dutch schools: the ZEB0-project. In A. J. Visscher, & R. Coe (Eds.), *School improvement through performance feedback* (pp. 115–142). Lisse: Swets & Zeitlinger B.V..
- Honig, M. I., & Coburn, C. (2008). Evidence-based decision making in school district central offices: toward a policy and research agenda. *Educational Policy*, 22(4), 578–608.
- Huffman, D., & Kalnin, J. (2003). Collaborative inquiry to make data-based decisions in schools. *Teaching and Teacher Education*, 19(6), 569–580.
- Ingram, D., Louis, S. K., & Schroeder, R. G. (2004). Accountability policies and teacher decision making: barriers to the use of data to improve practice. *Teachers College Record*, 106(6), 1258–1287.
- Inspectie van het Onderwijs. (2002). *Onderwijsverslag over het jaar 2001*. [Education report for 2001]. Den Haag: SDU.
- Janssens, F. J. G. (2005). *Toezicht in discussie: Over onderwijstoezicht en educational governance*. [School inspections and educational governance]. Enschede: Universiteit Twente. (Inaugural Lecture).
- Janssens, F. J. G. (2007). Supervising the quality of education. In W. Böttcher, & H. G. Kotthoff (Eds.), *Schulinspektion: Evaluation, Rechenschaftslegung und Qualitätsentwicklung* [School inspection: Evaluation, accountability and quality development]. Münster: Waxman.
- Kennedy, M. M. (1984). How evidence alters understanding and decisions. *Educational Evaluation and Policy Analysis*, 6(3), 207–226.
- Kerr, K. A., Marsh, J. A., Ikemoto, G. S., Darilek, H., & Barney, H. (2006). Strategies to promote data use for instructional improvements: actions, outcomes, and lessons from three urban districts. *American Journal of Education*, 112, 496–520.
- Kimball, S. M. (2002). Analysis of feedback, enabling conditions and fairness perceptions of teachers in three school districts with new standards-based evaluation systems. *Journal of Personnel Evaluation in Education*, 16(4), 241–268.
- King, M. B. (2002). Professional development to promote schoolwide inquiry. *Teaching and Teacher Education*, 18(3), 243–257.
- Kluger, A. N., & DeNisi, A. (1996). The effects of feedback interventions on performance: a historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychological Bulletin*, 119(2), 254–284.
- Mingchu, L. (2008). Structural equation modeling for high school principals' data-driven decision making: an analysis of information use environments. *Educational Administration Quarterly*, 44(5), 603–634.
- Ministerie, van Onderwijs Cultuur & Wetenschappen (1999). *Variëteit en waarborg: Voorstellen voor de ontwikkeling van het toezicht op onderwijs* [Diversity and a guarantee: Proposals for the development of the supervision of education]. Zoetermeer: Ministerie van Onderwijs, Cultuur & Wetenschappen.
- Ministerie van Onderwijs, Cultuur & Wetenschappen; Ministerie van Landbouw, Natuur en Visserij. (2000–2002). *Wet op het onderwijstoezicht*. [Education supervision act]. Den Haag: SDU.
- Onwuegbuzie, A. J., & Leech, N. L. (2007). Validity and qualitative research: an oxymoron? *Quality and Quantity: International Journal of Methodology*, 41(2), 233–249.
- Park, V., & Datnow, A. (2008). *Co-constructing distributed leadership: District and school connections in data-driven decision making*. Paper presented at the American educational research association.
- Renkema, G. (2002). *Kwaliteitszorg, wat levert het op?* [Quality assurance – What are the gains?] In: *Basisschoolmanagement*, vol. 15(8) Alphen aan den Rijn: Samsom.
- Riege, A. M. (2003). Validity and reliability tests in case study research: a literature review with “hands-on” applications for each research phase. *Qualitative Market Research: An International Journal*, 6(2), 75–86.
- Schmoker, M. (2003). First things first: demystifying data analysis. *Educational Leadership*, 60(5), 22–24.
- Schildkamp, K. (2007). *The utilisation of a self-evaluation instrument for primary education*. Enschede: Universiteit Twente.
- Schildkamp, K., & Teddlie, C. (2008). School performance feedback systems in the USA and in the Netherlands: a comparison. *Educational Research and Evaluation*, 14(3), 255–282.
- Schildkamp, K., Visscher, A. J., & Luyten, H. (2009). The effects of the use of a school self-evaluation instrument. *School Effectiveness and School Improvement*, 20(1), 69–88.
- Sharkey, N. S., & Murnane, R. J. (2006). Tough choices in designing a formative assessment system. *American Journal of Education*, 112, 572–588.
- Slavin, R. E. (2002). Evidence-based education policies: transforming educational practice and research. *Educational Researcher*, 21(7), 15–21.
- Slavin, R. E. (2003). A reader's guide to scientifically based research. *Educational Leadership*, 60(5), 12–16.
- Smylie, M. A. (1992). Teacher participation in school decision making: assessing willingness to participate. *Educational Evaluation and Policy Analysis*, 14(1), 53–67.
- Stecker, P. M., Fuchs, L. S., & Fuchs, D. (2005). Using curriculum-based measurement to improve student achievement: review of research. *Psychology in the Schools*, 42(8), 795–819.
- Sutherland, S. (2004). Creating a culture of data use for continuous improvement: a case study of an Edison project school. *The American Journal of Evaluation*, 25(3), 277–293.
- Teddlie, C., Kochan, C., & Taylor, D. (2002). The ABC+ model for school diagnosis, feedback, and improvement. In A. J. Visscher, & R. Coe (Eds.), *School improvement through performance feedback* (pp. 75–114). Lisse: Swets & Zeitlinger B.V..
- The Standing International Conference of Central and General Inspectorates of Education. (2003). *Effective school self-evaluation*. County Down: SICI.
- Tokar, D. M., Fischer, A. R., & Mezydlo Subich, L. (1998). Personality and vocational behavior: a selective review of the literature, 1993–1997. *Journal of Vocational Behavior*, 53, 115–153.
- Visscher, A. J. (2002). A framework for studying school performance feedback systems. In A. J. Visscher, & R. Coe (Eds.), *School improvement through performance feedback* (pp. 41–72). Lisse: Swets & Zeitlinger B.V..
- Walsh, K. (2003). *After the test: How schools are using data to close the achievement gap*. San Francisco: Bay Area School Reform Collaborative.
- 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., Cho, V., & Johnston, M. T. (2007). *The data-informed district: A district-wide evaluation of data use in the Natrona County School District*. Austin: The University of Texas.
- Wayman, J. C., Midgley, S., Stringfield, S. (April 11–15, 2005). *Collaborative teams to support data-based decision making and instructional improvement*. Paper presented at the American educational research association conference, Montreal.
- Wayman, J. C., Midgley, S., & Stringfield, S. (2006). Leadership for data-based decision making: collaborative educator teams. In A. Danzig, K. Borman, B. Jones, & B. Wright (Eds.), *New models of professional development for learner centered leadership* (pp. 189–205). Erlbaum.
- Wayman, J. C., & Stringfield, S. (2006a). Data use for school improvement: school practices and research perspectives. *American Journal of Education*, 112, 463–468.
- Wayman, J. C., & Stringfield, S. (2006b). Technology-supported involvement of entire faculties in examination of student data for instructional improvement. *American Journal of Education*, 112(4), 549–571.
- Wohlstetter, P., Datnow, A., & Park, V. (2008). Creating a system for data-driven decision-making: applying the principal-agent framework. *School Effectiveness and School Improvement*, 19(3), 239–259.
- Young, V. M. (2006). Teachers' use of data: loose coupling, agenda setting, and team norms. *American Journal of Education*, 112, 521–548.