Eric Verbiest et al.[1]

Becoming a data-wise school leader: Developing leadership capacity for data-informed school improvement

Abstract: More schools are expected to use data because of accountability and development. School leaders play a pivotal role in collecting, interpreting and using these data, so the leaders must be sufficiently data-literate or data-wise. This article is based on the findings in the Developing Leadership Capacity for data-informed school improvement (DELECA)[2] project.[3] We examine the concept of school leaders' data literacy and describe school leaders' competencies according to different stages of evidence-informed practice. Because the problem-solving capacity of the organization and not the data per se plays a decisive role, we emphasize the supporting role of the school leader and the organizational learning process in terms of data use in formulating competencies. Although experience and knowledge development are significant aspects of the complex process of becoming a principal, these approaches work most powerfully in combination. In this article, we summarize the most important guidelines for developing a curriculum to train aspiring school leaders to become more data literate. We illustrate these guidelines with examples from a training course developed in the context of the DELECA project.

Keywords: School leaders, professional development, data literacy, competencies.

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[3] The general aim of this project is to develop the school leadership capacity for evidence-informed school improvement. The project's specific objectives are as follows: (1) develop a training programme curriculum for school leaders focused on data-informed school development; (2) develop a strategy to implement the above-mentioned programme into school leaders' training (see DELECA 2014). This project has been funded with support from the European Commission. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use that may be made of the information contained therein.

Introduction

More schools are expected to use data because of accountability and development. Therefore, school leaders are increasingly expected to be data literate or data wise. In this article, we underscore the necessity of data-wise school leaders. However, our main focus is on the development of school leaders who are competent in collecting, interpreting and using data. We will contribute to the professional development of data-wise school leaders by dealing with two topics: the "what", or the focus on school leaders' professional development to make them more data wise; and the "how", or the process of professional development. Therefore, we describe the concept of data literacy as competencies that are connected to stages of evidence-informed practice. Based on features of effective professional development programmes, we describe the most important guidelines for developing a curriculum (content and didactical approach) to train aspiring school leaders to become more data literate.

The necessity of developing data-wise school leaders

Many countries have moved towards results orientation and the decentralization and accountability of public services. Schools are becoming more autonomous but are expected to achieve high results. The growing demand for schools' accountability implies that schools are increasingly expected to inform their external environment about many aspects of their operation, particularly learners' results. Underlying this policy direction is the assumption that greater attention to formal student test results and systematically collected evidence of related organizational conditions will lead to more effective practices in classrooms and schools, with a considerable payoff in the form of greater student learning (McDonnell 2005).

The emphasis on results and accountability is subject to criticism. Among others, Bottery (2004), Vandenberghe (2004) and Ravitch (2010) noted the weak or negative outcomes of strong accountability programmes, such as narrowed curricula, de-professionalization, teaching to the test and fraud. Consequently,

we see efforts to combine an external accountability perspective and an internal development perspective (Elmore 2008; Hopkins 2007). Barber (2002) saw the 2000s as an era of informed professional judgement, with control over education in the hands of educators but with the explicit requirement that they should be informed professionals. Self-evaluation is an important way to manoeuvre beyond prescribed accountability programmes and earn autonomy (Geysel et al. 2010). Earl and Katz (2006) noted the consequence of this informed professional judgement: the use of evidence and research to justify and support educational decisions.

Both the external perspective (with a focus on accountability) and the internal perspective (with a focus on development) require the use of data—text, words, numbers, observations and meanings—as information that educators collect and organize in a systematic way and that can be used to make instructional or organizational decisions.[4] Therefore, data are more than a quantitative phenomenon and include qualitative knowledge. Such knowledge can sometimes be tacit, e.g. the perceptions of relationships between school leaders and teachers.

School leaders play a pivotal role in efforts towards accountability and development. In general, school leaders are expected to become data literate or data wise (Earl and Katz 2006; Earl and Timperley 2009). Hamilton et al. (2009) define data literacy as "…the ability to ask and answer questions about collecting, analysing, and making sense of data" (ibid., p. 47). In their view, widespread data literacy among teachers, education leaders and students is a salient characteristic of a data-driven school culture. The terms "data literate" and "data wise" are interchangeable in our work.

Some evidence has shown that school effectiveness is strongly associated with the effective use of data at the classroom and school levels (Anderson et al. 2010; Calman 2010). The role of the principal is paramount. When principals do not make data use a priority, mobilize expertise to support data use or create working conditions to facilitate data use in instructional decision-making contexts, teachers usually do not undertake these activities on their own (Anderson et al. 2010). Louis et al. (2010) investigated how principals and teachers use data, how districts influence principals' data-informed decision-making and how student achievement is related to data use at the school level. They found that principals play a key role in establishing the purpose for—and expectations surrounding—data use and provide planned opportunities and time to work with data, including professional learning, opportunities to work in collegial groups and access to expert knowledge. In addition, making tacit knowledge more explicit is an important role of school leaders so that cultural aspects of school life are understood.

This raises questions about aspiring school leaders' professional development. In this article, we will contribute to the professional development of data-wise school leaders by dealing with two topics. The first topic concerns the "what" or the

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[4] Distinctions between data, information, knowledge and other concepts can be made (Ackoff 1989; Schildkamp et al. 2012; Vanhoof et al. 2009). Data are symbolic representations of figures and quantities. Information contains data that are processed to be useful and provide answers to "who", "what", "where" and "when". Knowledge concerns the application of data and information and gives answers to "how" questions.

focus on school leaders' professional development to make them more data wise, including what data-wise school leaders do, the important competencies of data--wise school leaders and which practices and competencies we should focus on so school leaders become more data literate. The second topic concerns the "how" or the process of professional development, including how we can help school leaders become more competent at using data in school and which learning strategies support school leaders as they strive to become data wise. We will illustrate our elaborations with some examples adopted from the programme developed in the context of the DELECA project (see note 1).

These questions are relevant both from scientific and practical points of view. Existing research on school leaders' professional development is rather scarce (Darling-Hammond et al. 2007; Davis et al. 2005; Dempster et al. 2011; Pont et al. 2008; Smylie and Bennet 2005). In elaborating how to develop data--wise school leaders, we bring together recent empirically supported insights about school leaders' development. The need to train school leaders to become data wise is evident. Data-informed leadership is still underdeveloped in school leaders' training programmes. In most cases, a lack of focus exists on generating data and using them in the context of accountability and school development (Vanhoof and Mahieu 2011; Verbiest 2010). Furthermore, developing data-wise school leadership fits (inter)national policy priorities. An OECD study emphasizes the value of accountability systems but warns that those systems only lead to improvement if data-wise leadership is present (Pont et al. 2008).

A closer look at data literacy

Of course, data literacy is not the only capacity we expect from school leaders (see e.g. Leithwood 2012). However, in the context of this contribution, we must restrict ourselves to those competencies that are directly connected to collecting, analysing and making sense of data and using them to plan actions. Likewise, we should not pay attention to conditions for data-wise leadership, such as mastering modern technologies.

Vanhoof et al. (2014) perceived data literacy as a competency. First, this competency encompasses the strategies, skills and knowledge needed to define information needs and to locate, evaluate, synthesize, organize, present and/or communicate information as needed. Second, the concept of data literacy competencies also requires explicit attention to data use attitudes because users' attitudes towards data use largely determine the extent to which they are prepared to invest time and effort into using the information.

Given the presupposition that data use in schools stands or falls based on whether the principal uses data effectively and promotes and supports data use, it is important to understand differences in data use among principals. An important conclusion in this regard is that data use requires more than simply acquiring a series of data skills. Vanhoof et al. (2013) found that principals are not inclined to engage in data use when they are not enthusiastic about it or when they do

not feel comfortable working with data, even if they believe data use is helpful. In many cases, principals ignore their knowledge concerning data use and instead allow their behaviour to be guided by their affective attitudes. This finding is directly relevant to the design of training curricula for school leaders. Effective professional development programmes need to create a safe environment based on professionalism and respect, in which the enthusiasm that encourages principals to want to use data and the confidence in using data can grow.

Using data is often described as a process with different stages. Examples of these stages can be found in Copland et al. (2009), Kowalski (2009) and Vanhoof et al. (2014). By combining these approaches, we arrive at the stages of evidence--informed practice and the corresponding competencies and illustrations of skills, knowledge and attitudes (Table 1).

STAGES OF EVIDENCE-INFORMED PRACTICE	SAMPLE COMPETENCIES	SAMPLE SKILLS, KNOWLEDGE AND ATTITUDES
Focusing and reframing problems for inquiry	Being able to help staff define information needs	– Being willing to and skilled at reframing problems from multiple vantage points – Being willing to and skilled at helping staff reframe problems from multiple vantage points – Being knowledgeable about school self-evaluation
Accessing or searching for data and evidence	Being able to help staff commission research	– Being conscious of possible uses of data – Being aware of the need for different data for different purposes – Being knowledgeable about data collection and analysis tools – Being willing to and skilled at helping staff become conscious of possible uses of data, aware of the need for different data for different purposes and knowledgeable about data collection and analysis tools
Invitation to discussion of alternative (or contrary) perspectives	Being able to initiate dialogues in the school to make sense of data together Being able to help staff integrate this information into other data sources	– Reserving judgment – Tolerating ambiguity – Valuing and promoting deep understanding – Engaging others (teachers, critical friends) in a professional dialogue about the data – Taking a range of perspectives and systematically posing increasingly focused questions – Recognizing other kinds of data (numbers, opinions, anecdotes, observations) – Being willing to and skilled at helping staff to develop an attitude of critical thinking (reserving judgment, tolerating ambiguity, valuing deep understanding) – Being willing to and skilled at helping staff recognize other kinds of data

Interpretation of the data	Being able to help staff read, understand and interpret data	– Being knowledgeable about statistical and measurement concepts – Being willing and able to make collective sense of the data – Being willing to and skilled at helping staff recognize sound and unsound data
Diagnosis of the problem	Being able to help staff provide explanations of the strengths and weaknesses of their own school as these appear in the data	– Being knowledgeable about curriculum, teaching and learning problems – Being knowledgeable about school development and organizational learning problems – Being willing to and skilled at helping staff become knowledgeable about curriculum, teaching and learning problems and school development and organizational learning problems
Planning: implication for actions	Being able to help staff plan quality assurance initiatives or improvement actions based on these explanations	– Being knowledgeable about how to improve curriculum, teaching and learning – Being knowledgeable about how to improve school development and organizational learning – Being willing to and skilled at helping staff become knowledgeable about how to improve curriculum, teaching, learning, school development and organizational learning

Table 1: Stages of evidence-informed practice, sample competencies and samples of skills, knowledge and attitudes

Using the concept of data-informed educational leadership, Copland et al. (2009) warned against a deterministic interpretation of data "driving" action. While wise leaders are fully cognisant of available data when taking action, they also bring to their work core values and insights into those aspects of practice for which good data is not yet and may never be available. In addition, data are more useful in the practice of leadership than in the making of decisions per se. Given the inherent ambiguity and multiple meanings of much of the data in educational settings, data may prompt questions and deliberation to a greater extent than they point to specific decision options. Of course, data can inform conversations about possible actions, but they do not necessarily "drive" decisions or provide information about how best to address an issue at hand, e.g. low performance of boys compared with that of girls.

Anderson et al. (2010) stressed that data use per se does not affect the quality of teaching and learning; instead, the effect is based on the appropriateness of the actions actually taken based on data-informed decisions about the nature of the problem and how it might be solved. In other words, the problem-solving capacity of the organization plays a decisive role. A focus on working with data means that school leaders stimulate, in a critical sense, teachers to generate data, give meaning to data and use data with the aim of improvement. Certain studies, e.g. by Boudett et al. (2005) and Katz et al. (2010), confirm that school leaders who

are most successful at using data effectively are those who engage their school staff in collaborative decision-making. Consequently, in forming competencies, we emphasize the supporting role of the school leader and the process of organizational learning about data use.

Effective professional development of school leaders

Pont et al. (2008) stated that although school leadership development has become a reality in many countries during the past 10 to 15 years, the need for more coherent approaches to leadership development is still present. Other authors point to the scarce research about school leaders' professional development (e.g. Darling-Hammond et al. 2007; Dempster et al. 2011).

Timperley et al. (2007; see also Denis and Van Damme 2010; Robinson and Timperley 2007) performed an extended review of over 100 studies and compiled the most important findings about effective teacher professional learning and development. As adult learners, teachers (and school leaders) do not approach learning situations as empty vessels. They have ideas about what and how students learn and have to learn and about what and how to teach. These mostly implicit theories of action on the part of professionals have a powerful effect on their learning. New information that is dissonant with school leaders' or teachers' existing positions can easily be rejected. Therefore, it is important to pay attention to school leaders' ideas about the use of data. Effective professional learning implies that professionals make sense of professional development messages. Sense-making is not simply a matter of making these messages clear to learners or leaving them to make their own professional judgments without first having had the adequacy of their existing theories challenged; it is a complex process involving interactions between a professional's existing position, the situation in which he or she practices and professional development messages. Deeper learning typically requires repeated cycles of engagement with learning processes, practice, and outcomes.

Forde (2011) distinguished three broad models of leadership development:

– an apprentice-based approach, in which prerequisite skills in leadership and management are acquired through experience in schools, i.e. learning "on the job";

– a knowledge-based approach, in which masters-level qualifications in the area of leadership and management are acquired at a university; and

– an experiential learning-based approach, which focuses on structured sets of experiences to acquire the necessary understandings, skills and personal development.

These three approaches clearly overlap, but distinctions can be made in terms of the foundational idea upon which leadership development is premised. The apprentice-based approach can offer more insight into the principal's role, can help in the development of a principal's identity and can contribute to the building of greater confidence. However, some have concerns about the potential haphazard nature

of this development process and its deep conserving tendencies. Knowledge-based approaches can provide a range of structured learning opportunities in which learners can access wider bodies of knowledge and reflect deeply on their experiences and their own purposes as a principal. However, doubts remain regarding the practical relevancy of such an approach and the built-in tension in academic programmes that not only have to meet the academic demands of post-graduates, which include a strong research element, but also must ensure the achievement of competencies set out in professional standards. Therefore, although these two approaches have limitations, experience and knowledge development are both significant aspects of the more complex process of becoming a principal. Forde (ibid.) stated that these approaches work most powerfully in an experiential learning-based approach, i.e. in combining of different learning opportunities to build ideas, explore the nature of these ideas through practice and reflect on these experiences (see Bush and Glover 2004; Huber 2011).

Based on scarce research (Darling-Hammond et al. 2007; Verbiest et al. 2000), we can summarize some important features effective professional development programmes have in common:

– a comprehensive and coherent curriculum aligned with state and professional standards that emphasizes instructional leadership and school improvement;
– lectures and reading articles and books, thus offering conceptual frameworks to interpret experiences and formulate goals to act on;
– active, student-centred instruction employing pedagogies that facilitate the integration of theory and practice and stimulate reflection;
– well-designed and supervised administrative internships that provide opportunities for candidates to engage in leadership responsibilities for substantial periods of time under the tutelage of expert veterans;
– leadership learning grounded in practice, including analyses of classroom practice, supervision and professional development using on-the-job observations connected to readings and discussions and organized around a model of leadership; and
– collegial learning networks, such as principals' networks, study groups and mentoring or peer coaching, that offer communities of practice and sources of on-going support for problem solving.

Based on these characteristics, we again see the importance of an experiential learning-based approach.

Becoming data-wise: guidelines for a curriculum and examples

In this section, we summarize the most important guidelines for developing a curriculum to train aspiring school leaders to become more data literate. We begin with guidelines concerning the didactical approach. Then we formulate some guidelines regarding competencies and the more specific knowledge needed

for school leaders to become data literate. We illustrate these guidelines with examples (shown in italics) from the training course that were developed in the context of the DELECA project (DELECA 2014) (see note 1). First, we provide an overview of this training course (Table 2). That overview shows that the programme is divided into five modules (each with one day of contact time). Each module is centred around one of the main competencies of data-wise leadership.

MODULE	SAMPLE COMPETENCIES	MAIN CONTENT
1. Meaning and aim of working with data	Being able to help staff define information needs	– Introduction, expectations of participants, course objectives and plans – What do we consider to be data, and what kind of data do schools worked? – What does it mean for school development? Introduction of the concept of data-wise leadership – What is feasible in schools? Anticipated barriers to implementing data-wise leadership – Educational needs of principals and schools related to working with data
2. Data collection/ assessing or searching for data and evidence	Being able to help staff commission research	– Different kinds of data – Methods of collecting data – Reliability and validity of data and methods
3. Analysis and interpretation	Being able to initiate dialogues in the school to make sense of data together Being able to help staff integrate this information into other data sources	– Introduction to analysis and interpretation; using data for school improvements – Reading quantitative and qualitative data – Assessing and valuing outcomes – Implications for school leaders
4. From results to school improvement	Being able to help staff provide explanations of the strengths and weaknesses of their own school as shown in the data	– Managing and leading change in practice: experiences from the field – Reflections on days 1, 2, and 3: the view on data and their use in school improvement; theoretical overview of "new instructional" leadership and school improvement – From data into action: planning a data-wise improvement process and the role of school leaders – Planning for change
5. Creating a culture of inquiry	Being able to help staff plan quality assurance initiatives or improvement actions based on these explanations	– Analysis of the existing culture of inquiry, introduction of course objectives and plans for module 5 – Importance of a culture of inquiry and definition – Working on a culture of inquiry: from reflection to action – Sustainability – Concluding principles: enhancing and hindering factors

Table 2: Overview of the DELECA programme

Didactics

Professional development enabling school leaders to become data literate demands an experiential learning-based approach, in which a group of students can actively reflect on their views on data use in schools, evaluate them in light of new information about data use and formulate new goals and activities concerning data use in their own schools. To refine the competencies of a data-literate school leader, such an approach also includes lectures, reading articles and books and conceptual frameworks used to interpret experiences and formulate goals to act on practices in one's own school (with feedback from peers or tutors).

In module 1 ("Meaning and aim of working with data"), participants are asked to explore the data they use in their own school and the sources of these data. In addition, they must report on what they consider to be data and their experiences with data. Furthermore, the module includes a discussion about what data are, which provides a conceptual framework about data. At the end of the module, the participants receive some literature to study (e.g. Earl and Katz 2006).

In module 5 ("Creating a culture of inquiry"), participants receive a survey that has been developed to measure the existing culture of inquiry. Participants are asked to complete the form and define their school's strengths and weaknesses. The participants are then asked to share their answers with the rest of the group. The strengths and weaknesses are discussed briefly. This leads to a consideration of the possible hindering and promoting factors concerning a culture of inquiry. This input is used as a starting point for a lecture and dialogue about the idea of a culture of inquiry and the factors that positively or negatively influence this culture.

Content

Professional development to train school leaders to become data literate is based on a set of competencies derived from the stages of evidence-informed practice. These competencies are focused on the school leader's role in the process of generating and using data in organizational learning to help teachers learn about data. To become more competent, participants must process specific information in a critical sense.

The competencies themselves are described in Table 1; they emphasise the supporting role of the school leader and the process of organizational learning about data use in helping staff read, understand and interpret data.

The modules include many examples of the school leader's supporting role and the process of organizational learning about data use. In module 3 ("Analyses and interpretation"), the participants are organized into small groups for a workshop. During these workshops, the leader briefly shares with the group members the focus of an inquiry conducted earlier (questions, collection of data, first impressions). The group members then ask clarifying questions (e.g. "How many teachers did you work with?" and "How have you categorized your data?"). Next, the group members perform an analysis (what one sees, possible interpretations, questions

and limitations of the interpretation). The group members provide feedback to the leader. At the end of the module, the group leader writes a report on the feedback he or she received and a reflection protocol regarding the implications.

In module 4 ("From results to school improvement"), the participants work in small groups to make an action plan based on a document with data (e.g. students' results on national tests, a report on a lesson observation). The groups plan improvement strategies and prepare posters, which are exhibited in the lecture room. The groups present their improvement plans, discuss similarities and differences in their improvement strategies and find reasons for common or different solutions. After a lecture on the theory of school improvement and "new instructional leadership" (the role of school leaders in data-wise improvement), participants return to their own school's data, which they analysed during module 3. They develop action plans individually for their own schools by following a template.

To make decisions regarding the generation of data concerning the variables of classroom instruction and school organization and the organizational conditions for using data in school, the participants process information during the modules on research methods, the reliability and validity of data and methods, policies on using data in schools and education (e.g. the data-driven movement), the distinction between an external accountability perspective and an internal development perspective and a framework connecting school organization to classroom instruction and students' results.

Conclusion and discussion

In this article, we deal with two main questions regarding school leaders' professional development to make them more data wise. The first question concerns the "what" or the focus of school leaders' professional development, while the second concerns the "how" or the process of professional development. By approaching data use as a process consisting of different stages, it is possible to derive competencies (skills, knowledge, attitudes) of data-wise school leaders. These competencies are not restricted to collecting and interpreting data. The problem-solving capacity of the organization plays a decisive role and not the data per se. This means that school leaders stimulate, in a critical sense, teachers to generate data, give meaning to data and use data with the aim of improvement.

With regard to the professional development process, we summarized some important common features of effective professional development programmes found in the scarce research. These features illustrate an experiential learning--based approach focusing on structured sets of experiences to acquire the necessary understandings, skills and personal development combined with the study of theory and critical reflections on experiences and the theory.

Although these conclusions reflect the current state of professional development to train school leaders to become more data wise, we know very little about developing school leaders and face the issue of school leader development

with remarkably little empirical evidence to guide us. Educational leadership development is a complex process. It asks for knowledge of effective leadership practices, the capacities necessary for those practices, the psychological and social processes these capacities bring into development and the learning strategies and sources that influence these processes. We know about many effective practices, but we know very little about the other elements (Smylie and Bennet 2005). Leithwood (2012) summarized the commonly cited weaknesses in efforts to define management and (especially) leadership competencies. For instance, he noted the fragmented character of school leader roles that are better understood as integrated wholes assuming that a generic set of capacities is suitable in all contexts. In addition, he highlighted the lack of empirical evidence linking competencies to improved organizational outcomes (see also Canole and Young 2013; Robinson et al. 2009). Most descriptions of competencies, including the one in this article, are theoretical derivations of school leaders' practices and as such are not based on empirical research. Of course, those training school leaders cannot wait until science has done its work; they need descriptions of competencies to help school leaders during their professional development.

We must admit the lack of an empirical foundation concerning professional development programmes and approaches; the existing research (Darling-Hammond et al. 2007; Davis et al. 2005; Dempster et al. 2011; Pont et al. 2008; Smylie and Bennet 2005) is scarce and its theory is weak.

Therefore, the formulation of well-developed theories (e.g. on relationships between competencies and school leader behaviour and among professional development approaches, leadership behaviours, teacher behaviours and student outcomes) is a matter of some urgency.

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