# Teachers' use of knowledge sources in 'result meetings': Thin data and thick data use.

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**Abstract**

In this article, we examine teachers' use of knowledge sources in meetings where they discuss and formulate initiatives and solutions to develop existing teaching practice based on national test results. While practices of data use have been extensively researched, less attention has been given to the content of data use practices. Analyses of what kind of knowledge sources are used, and how, in discussions about student performance levels and accompanying initiatives to improve teaching can yield important insight into the potential and pitfalls of local data use practices. Based on an analysis of the knowledge sources that Norwegian secondary school teachers draw upon in so-called 'result meetings' and of the prognostic frames that teachers initiate, we find that teachers use several knowledge sources and that their data use practices can be characterised as complex and 'thick', although the data itself is 'thin'. However, although teachers draw upon a range of knowledge sources and integrate these when identifying possible solutions, the solutions themselves are often short-term and directed towards improving test results. In order for teachers to ask more fundamental questions regarding existing practices, more attention should be directed towards problem-solving processes and also whether result meetings can provide arenas for complex problem-solving.

Key words: data use; knowledge sources; teacher knowledge; accountability

## Introduction

In this article, we examine teachers' use of knowledge sources in so-called 'result meetings', where students' national test results are presented and discussed. Our analysis is particularly focussed towards the ways in which teachers formulate initiatives and solutions to develop their existing teaching practice by using national test results. By knowledge sources, we mean different fields of knowledge from which teachers may draw their understanding of a particular task or problem (Shulman, 1987; Grimen, 2008; Iversen & Heggen, 2016). Investigations of teachers' knowledge sources in data use practices are novel and can provide important insights for policy, as well as practice. This is particularly due to a dominating perspective in the data use literature often addressing implementation, effectiveness and how data use practices can be designed and performed (e.g., Wayman, Cho, Jimerson & Spikes, 2012; Kelly & Downey, 2012). Less attention is given to local contexts and the constraints that are often placed upon teachers in interactions around standardised test scores and improvement initiatives within the broader context of accountability (e.g., Day, Flores, & Viana, 2007; Sugrue & Mertkan, 2016). Thus, while forms of data use practice have been extensively researched, less attention has been given to the content in data use practices. Analysis of the kind of knowledge sources used in discussions related to initiatives to improve teachers' work, as well as how these knowledge sources are used, can yield important insight into both the potential and pitfalls of data use.

In recent years and in a range of countries, access to student performance data has increased alongside policy expectations regarding the use of data to better understand, and further develop and correct, existing practices (Easley & Tulowitski, 2016). The data itself can be described as 'thin', as it is presented in numbers and graphics and requires interpretation and meaning making, relating numbers to other types of knowledge sources. Data use practices

can be defined as what happens when individuals use test scores, grades, and other forms of assessment in their work (Coburn & Turner, 2011; Spillane, 2012). Policy expectations to use research-based knowledge in teaching practice have also increased (e.g., Sachs, 2016). Expectations for using research findings and student performance data and have a common feature in that they represent abstract forms of knowledge (Little, 2012; Winch, Oancea & Orchard, 2015; Author, 2016), which can be perceived as 'external' to teachers' work. This is due, first, to the way such data are generated. In some countries, tests are designed and conducted by private companies, in other countries at different universities. Second, the test results are often used as one of the main indicators in quality management systems. As such, these results represent external control of schools' and teachers' work, which is linked to accountability. In many ways, the test scores represent a general measure of student performance, which is expressed in statistical, abstract language. When introduced into local practices, it meets with teachers' experience-based and context-bound language, as well as teachers' internal accountability (Author, 2013).

Increased access to data, as well as expectations about data use, has also occurred in the Norwegian school system. Despite being low-stakes, schools and municipalities are to a greater extent than previously held accountable for student outcomes (Author, 2013; Author, 2014). The national quality assessment system (NQAS) was launched in 2005, systematizing existing assessment tools (such as diagnostic tests and final grades) and including new interventions such as national testing, in addition to other data such as student surveys and international comparative tests such as PISA, TIMSS, and PIRLS. The implementation of new assessment policies implies the introduction of performative accountability in a country with a long tradition of compulsory schooling, non-competiveness, and egalitarian values and where teachers have enjoyed a relatively high degree of classroom autonomy based on the didactic knowledge acquired in teacher education (e.g., Slagstad, 1998; Telhaug, Mediås & Aasen,

2006). The policy rhetoric, however, suggests that data from national tests should be used for learning and development purposes at both the individual and system levels while also contributing to control and monitoring of student performance (Author, 2009).

The tension between development and control is often under-communicated in policy, as well as in research on data use (Author, 2009; Authors, in press) yet it is highly relevant for understanding teachers' data use practices as they unfold locally. The central assumption within this policy of action is that access to data, in combination with accountability, will boost professional development, individually and collectively, and consequently correct and develop existing practices. Specific tools and measures such as national tests are expected to be included in learning loops. Such learning loops, however, imply a somewhat rational-instrumental view of learning (Reichborn-Kjennerud & Vabø, 2016), i.e., the expectation that teachers will use the provided data and development will therefore take place. Yet, such learning loops within organisations only address the ways in which development takes place in practice to a limited extent. Questions remain regarding how data is perceived as a knowledge source, what role it plays in development, and how this contrasts with core knowledge in the teaching profession.

In this article, we address the following research questions: What knowledge sources do teachers use when framing solutions in data use settings? Which prognostic frames can be identified, and what are the characteristic features of content used in result meetings? We first review existing research on teachers' data use, before we outline the characteristics of teacher's knowledge base and how testing data both expand and challenge this knowledge base. Thereafter, we describe our methodological approaches and the data used in our analysis before presenting and discussing our findings. We conclude by drawing implications for data use practices and call for a broader understanding of data use.

**Previous research on teachers' data use**

There has been growing interest in studying data use practices within schools and school districts, especially in the Western world (e.g., Coburn & Turner, 2011; Spillane, 2012; Jennings, 2012; Racherbäumer, Funke, van Ackeren, & Clausen, 2013; Kelly & Downey, 2012; Schildkamp, Karbautzki, & Vanhoof, 2014). A general finding in the literature is that the ways in which data are used depend on a range of factors related to organisational routines, such as access to data, time, norms of interaction, and leadership (Coburn & Turner, 2011). Leadership is found to be especially important for productive data use within schools (e.g., Datnow, 2011), for example, when leaders work with teachers and make data use a joint responsibility. On the one hand, existing literature implies that increased focus on student outcomes, test data, and data use lead to increased collaboration in and attention to assessment practices in schools with the aims of developing and justifying teaching practices, as well as generating learning innovations (e.g., Little, 2012; Singh, Märtsin, & Glasswell, 2015). On the other hand, there is also a substantial body of literature demonstrating the adverse effects of assessment and accountability policies on teachers' work and how data use in schools can work against nurturing student engagement and learning (e.g., Valli & Buese, 2007; Hallett, 2010). Characteristics of the data use literature are that they often aim to identify 'best practices', whilst under-conceptualizing and under-theorizing 'data' and 'data use' (Authors, in press.).

Several studies on teachers' use of test data find that access to such data raises important opportunities but that such data must be understandable for teachers and must be perceived by teachers as useful. Studies highlight the importance of teacher and school leader expertise for understanding what kind of testing result information can be easily translated for use in practical contexts and how (e.g., Jacobs, Gregory, Hoppey, & Yendol-Hoppey, 2009; Datnow, Park, & Kennedy Lewis, 2012). Studies also focus on teachers' lack of competence in

analysis and use of data (Sun, Przybylski, & Johnson, 2016). Some studies indicate that tests and assessment tools developed and implemented by teachers are more useful for formative purposes, others show that where teachers use student test results, these practices are complex, layered, and affected by teachers' own interpretations and social interactions (e.g. Park, Daley, & Guerra, 2012; Author, 2013). These studies are, however, relatively few and provide limited insight into the sources of knowledge that teachers draw upon, which are only addressed to a limited extent.

Relevant studies also include those on teachers' use of research evidence, which conclude that most teachers find research relevant if it matches their personal experiences and think that researchers should concentrate on identifying strategies and techniques that can directly impact their teaching, indicating that research is most applicable when it meets local needs (e.g., Zeuli, 1994; Tierney, 2000; Papasotiriou & Hannan, 2006). In a study on teachers' perceptions of working with evidence-based strategies for formative assessment in Swedish schools, Levinsson (2013) shows how the application of evidence in school practice in many ways violates teachers' experiences of school life as intentional, unpredictable, and context-bound. Levinsson (2013) also shows how evidence-based teaching strategies, derived from evidence-based studies, are often rooted in unrealistic expectations of how school actors should adopt such evidence. This study underscores the importance of teachers being able to assess the scientific basis for teaching strategies recommended by research evidence.

Knowledge sources such as data and research are often presented in policy as tools for strengthening teachers' knowledge bases. In many ways, this challenges what can be described as traditional notions around teachers' knowledge base, understood as individualised, experience-based, and relational (Lortie, 1975; Eraut, 2010), in which teachers have had varying experience with using abstract and decontextualized knowledge sources. Therefore, for teachers to understand what data means for their own practice, they must

interpret and find meaning in that data. Both data on student performance and research findings require translation from more abstract forms of knowledge into more practical and applicable forms of knowledge (Little, 2012; Winch et al., 2015; Author, 2016). Thus, we use analytical perspectives on teachers' knowledge and use of different knowledge sources.

**Teachers' knowledge base**

Relations between theoretical and practical knowledge have been explored and debated within the teaching profession, as well as many other professions. Although there is a broad tendency to agree that a theory-practice distinction is not very fruitful in studies on professional work and professional education (Winch et al., 2015), this distinction can still be analytically useful when addressing some characteristics of teachers' knowledge base. For example, this knowledge base is quite closely related to the individual with the knowledge (i.e., the specific teacher) and the situation in which the knowledge is used in (i.e., in a specific classroom with a specific group of students). The integration that teachers perform is characterised by what Grimen (2008) describes as practical synthesis, that is, where different elements of knowledge are put together in a particular way because they constitute meaningful parts of professional work. Therefore, different elements in the knowledge base are interrelated because they are necessary to perform specific tasks or because they concern particular cases, not because the relationships between them are based on thorough theoretical reasoning (Grimen, 2008). Thus, it could be argued that processes of integration are problem-solving processes that teachers use to solve practical problems while simultaneously unravelling problems of understanding. It is thereby through problem-solving that formal knowledge is transformed into professional knowledge (Bereiter & Scardamalia, 1993). Consequently, Bereiter and Scardamalia (1993) state that formal knowledge is quite easily transformed into skills when

used to solve practical problems and to informal knowledge when used to solve problems of understanding.

Moreover, because teachers' knowledge base is complex and heterogeneous, we need a conceptual framework that enables us to describe a knowledge base and identify its different elements. The classic work of Shulman (1987) identifies four sources for a teacher's knowledge base: (1) scholarship in content disciplines, (2) materials and settings of the educational process, including tests and test material, (3) research on education and schooling, and (4) the wisdom of practice. The latter is the least codified source of knowledge, often acquired in interaction with students, parents, and colleagues. Furthermore, Shulman (1987) demonstrates how content knowledge and pedagogical strategies interact in the minds of teachers. This blend of content and pedagogy into an understanding of how particular tasks are organised, represented, and adapted is conceptualised as pedagogical content knowledge. However, teachers' use and development of professional knowledge and reflective practice have intensified and grown in complexity, for example, through the increase in available data and research and in expectations to utilise these sources of knowledge in daily work (Hargreaves & Fullan, 2012; Winch et al., 2015). This development also downplays the relevance of broader categories such as theoretical and practical knowledge and makes discussions regarding the integration of different knowledge sources more relevant to contemporary teaching. Characteristic of abstract knowledge sources such as test scores and research findings, however, is that they require some kind of 'translation', that is, they must be interpreted and contextualised in such a way that they can be meaningfully integrated into discussions on teaching practices (Author, 2016).

**Data and methods**

The data used in this article is part of an ongoing, longitudinal research project on data use in Norwegian schools and municipalities. Three secondary schools in three municipalities are participating in the qualitative part of the project. Selection criteria were geographic location (rural or urban areas), size, and type of quality assessment system established in the municipality. The analysis draws on data gathered from observations of data use settings in schools that usually are described as 'result meetings' over a two-year period. The observed meetings focused on results from national tests but, as in other studies on data use, test scores are rarely used in isolation (Coburn & Turner, 2011). These meetings can be seen as strategic arenas for examining teachers' data use practices, not only because they entail teacher-to-teacher interaction but also because they have become a routine means for organising that interaction (Little, 2012). In other words, result meetings represent concrete events of data use, arenas where it is possible to observe dynamics between elements of control and development, as well as the transformation of abstract knowledge through meaning-making processes.

During the meetings, two researchers wrote field notes, detailing what was said as specifically and accurately as possible. In total, we analysed 12 hours of result meetings between teachers and school leaders, either within a specific school or between teachers and school leaders at neighbouring schools. Our focus in this paper is teachers' use of knowledge sources in these meetings and accompanying teacher-to-teacher interaction. In the first step of the analysis, we coded the knowledge sources that teachers used in result meetings when formulating initiatives for how to utilize the results on the national tests. Our categorisation of knowledge sources was inspired by Shulman (1987): subject (didactic) knowledge and proven experience; data and statistics; research and researchers; and knowledge from relations to

students and parents.[1] We identified initiatives (*N = 134*) that were taken by teachers who participated in the meetings. In the second step of analysis, we analysed these initiatives in terms of prognostic framing (Benford & Snow, 2000; Coburn, 2004), or solution framing, which focuses on how problems are solved. Rather than focusing on the decision-making in itself, as often is the case in frame analysis, our analytical focus was on the use of knowledge sources in formulation of solutions.

The results and the interpretations have been subject to communicative validation through presentations and discussions with other researchers and to respondent validation. Although the results from this study cannot be generalised, this study offers analytical generalisation by providing transparency and theoretical interpretations involving a reasoned judgment about the extent to which the results can be used as a guide to what might happen in similar contexts (Kvale & Brinkman, 2009).

## Findings

The teachers used a variety of knowledge sources in result meetings; however, there were variations in the prognostic frames that teachers employed across the schools. We first describe the distribution of knowledge sources used. We then present a closer analysis of the different prognostic frames teachers used through examples of initiatives using the teachers' own words.

### *Distribution of knowledge sources in use*

The distribution of different knowledge sources showed similar patterns across the three schools and across the meetings that we observed. With respect to how teachers used different

[1] In the initial coding, we found that it was difficult to distinguish between Shulman's (1987) categories 'proven experience' and 'didactic knowledge'. Knowledge from relations to students and parents included references to student motivation, behaviour, parenting and support from home, friendships and conflicts (and other relational interactions) between students, knowledge the teachers thought was important to include when adapting and developing teaching aimed at these students. In the category 'research', we also included references to individual researchers and references to the Norwegian Directorate of Education and Training's resources (as a 'broker' for research). The category 'data and statistics' included information from different forms of testing, including results of national tests, as well as other comparable tests and examinations.

knowledge sources when formulating initiatives, we found the following: Out of 134 references to initiatives to change teaching practice (solutions/prognostic frames), the main knowledge source used was *experiences and subject didactic knowledge* (45%). Typical examples were ways of teaching that the teachers had already tried and experienced to be positive. Another frequently used knowledge source was what we describe as *knowledge derived from relations to students and parents* (28%), that is, knowledge about specific students' motivations, home situations, etc. The teachers also referred quite extensively to *data and statistics* (21%) in their discussion, while *research* (6 %) is less used as a knowledge source. Figure 1 below visualises teachers' use of knowledge sources when formulating solutions:

- *Insert figure 1 about here*

Across all the schools, we found most references to positive previous experiences with similar solutions or initiatives based on subject didactic knowledge, which the teachers would like to try out again. Another solution proposed relatively often was performing more testing for individual students (diagnostic tests, in particular). This was often framed by the intention to obtain diagnostic information on individual students' competences in order to provide a basis for decisions about specific initiatives. Another approach was linked to knowledge about specific students and perceptions of how they would react to specific solutions (for example, observations that specific students work well together in groups for suggestions for particular students participating in reading courses). Least reference was made to the use of research; however, there are a few examples of teachers referring to specific researchers or consultants that they have been introduced to in courses or school development projects. Some references were made to material that synthesised research findings for teachers. Research was mainly

used to legitimate existing practice. For further insight into how the different knowledge sources were used, we provide an overview over the different categories of proposed prognostic frames, as well as providing examples used in the words of the teachers themselves.

***Prominent prognostic frames***

In the following, we present prognostic frames as they draw upon the four main knowledge source categories. These empirical categories identify the most prominent dimensions of the various knowledge sources as they were used in the result meetings.

In total, we identified 12 prognostic frames. These are explicitly related to initiatives to develop existing teaching practice based on results of national tests, and each was mentioned at least twice in our observations (most of the frames were used in several instances). In the following, we present the prognostic frames as they relate to the various knowledge sources, illustrated by examples in the words of the teachers in brackets.

*Knowledge from proven experience and (subject) didactics.* The most prominent prognostic frames categorised within this knowledge source were the following: conducting intensive courses ('How many will join the reading course? Should we arrange a course just for the boys?'), focusing on learning strategies ("We will work with different strategies for problem solving"), asking for extra teaching resources ('We are worried about the 11 students at level 1 and 2 and feel that these students would benefit from extra resources'), practicing literacy in all subjects ('I have found some really good texts for reading in other subject areas'), and cooperation with colleagues ('We depend upon good collaboration within the teacher team and more collaboration across the teacher teams'). When teachers introduced these solutions, they mainly drew upon their own experiences that had proven successful, in combination with subject didactics and general didactic knowledge.

*Knowledge from relations to students and parents.* Under this knowledge source, we identified prognostic frames such as group composition ('The student works better when he is alone than when he is with the two other students'), closer school-home cooperation ('The student does not read at home; I need to challenge the parents to support him more'), and strengthening relationships between students ('She is not experiencing a safe environment with her friends; I will have a talk with her'). A main knowledge source when introducing these solutions was previous communication with students and parents. This indicates the strength of the relations between the teacher and the students and/or parents and legitimates the suggested solutions.

*Knowledge from data and statistics.* Prominent prognostic frames in this area included further testing because of the need for more data ('Last year we retested the students, and everyone was tired. Could we, for example, give the students grades on the test this year?'), making a diagnosis ('We have to check whether it could be dyslexia'), and calibrating with other test results ('The only student I do not understand the results of is Tom. He scores low on STAS; I guess that is why it is important to perform several tests'). These solutions often also entailed a call to involve specialists and further involve the special education teachers.

*Knowledge from research and researchers.* Explicit references to specific research and/or researchers were scarce. In this category we also included references to research as communicated by others (e.g., consultants that the schools used) and guidance material from various actors in the educational field (e.g., the National Directorate of Education, the Norwegian Centre for Mathematics Education). The latter two examples could also be defined as 'research brokers', translating the research or use of specific methods such as 'writing frames'. Research was either used to legitimate existing practice ('To work with the exercises similar to the test; that is also what researcher X says') or to suggest new practices ('What

about what we heard when we visited the Norwegian Reading Centre? That reading instruction should take place in the classroom, what did we take with us from that?').

Identifying various prognostic frames gives insight into teachers' use of knowledge sources in the result meetings, which can be characterised as complex, thick, layered, and integrated. Although we have compiled the different prognostic frames under each knowledge source, the examples provided show how the knowledge sources are often integrated within the same prognostic frame. That is, teachers' use of knowledge sources can be characterised as 'thick', although the data that prompts the meeting is 'thin'. Making the thin data into thick data can thus be considered a prerequisite for data use and, furthermore, for re-contextualising abstract knowledge sources to provide learning opportunities for the teachers involved.

At the same time, the data is also quite quickly transformed into practical solutions and the knowledge is made more into applicable actions for the teachers that require certain skills – such as grouping students and conducting more tests. The results also show that the prognostic frames serve to prepare for future tests, more than to prompt more fundamental questions about student competence or teacher practice, as well as legitimizing practices already in place.

***Teachers' use of knowledge sources***

When we combine our analysis of the use of different knowledge sources and prognostic frames, we see how the prognostic frames mainly draw on what can be described as the teachers' internal knowledge sources. The more abstract external knowledge sources are first and foremost background information brought into the discussion, comprising a much smaller part of the knowledge sources used in the result meetings. In addition to the original knowledge sources we coded, we identified two other knowledge sources that the teachers used in the result meetings, namely *colleagues* and *'research brokers'*. This points to how all

these different knowledge sources are used in the meetings, demonstrating data use practices to be thick, while the prognostic frames initiated are more narrow. We summarise our results in Figure 2:

- *Insert figure 2 about here*

**Discussion and conclusion**

In this article, we asked what knowledge sources teachers used when framing solutions in result meetings, which prognostic frames could be identified, and what are the characteristic features of the content in these meetings. First, we discuss relations between the thick character of data use and the prognostic frames initiated. Second, we consider whether the use of external knowledge sources broadens or further narrows the prognostic frames, and third, we identify implications for further research on the use of knowledge in data use settings.

We found the main knowledge source used in result meetings to be experience-based knowledge and subject didactic knowledge, knowledge that could be characterised as already integrated from both internal and external knowledge sources (Shulman, 1987; Iversen & Heggen, 2016). Together with knowledge from their relationships with students and parents, this makes up the largest proportion of knowledge sources in use. As such, a characteristic feature of the result meetings is that assemblages of teachers' existing practices are created, and teachers are situated as experts. The prognostic frames used make progress possible and visible. As such, these can be viewed as positive features of teachers' data use and that the test results (the 'thin data') function as a necessary motivator for these 'thick' data use practices. In such thick data use practices, the teachers critically discuss existing and future teaching practice. At the same time, there are some challenges attached to the extensive use of quite narrow and short-term prognostic frames, as these could be characterized as first and foremost

oriented towards the tests and improving the test results. This represents an interesting paradox. The use of knowledge sources is complex and thick, yet the prognostic frames are more limited in scope.

Furthermore, the reasons why the prognostic frames are characterised as short-term relate to unclear notions of what problems must be solved (Bereiter & Scardemalia, 1993). The result meetings, with an explicit emphasis on development, thus also seem to contribute to activating short-term solutions and thereby teachers' skills rather than knowledge, as apparent in the analysis of the prognostic frames. Therefore, an important question to ask is how knowledge from test results becomes professional knowledge, and specifically what kind of professional knowledge. The context of the result meetings seems to focus on solutions, yet an additional interpretation would be that this also stems from the practical character of teachers' work. Problem-solving processes typically become processes where formal knowledge is transformed into skills and informal knowledge (Bereiter & Scardamalia, 1993). According to Tynjälä and Gijbels (2012), an implication of this perspective would be that problem-solving tasks should form the core of learning and development work among professionals.

More extensive use of research knowledge could contribute in such problem-solving processes by challenging existing practices and bring new ideas into the discussion. This is not easy to accomplish, however, because research results are more difficult to re-contextualise for teachers than other knowledge sources (Rasmussen & Holm, 2010; Author, 2016), raising questions about competence in research methodology, as well as relevance for teachers. However, exactly this situation also provides a 'market' for 'brokers' of research, governmental and non-governmental, that provides research-based and/or specific material or methods that teachers could make use of in their work yet that teachers do not necessarily assess the evidence for. Although such brokers have an important task of bridging different

'worlds' and also being appreciated by the teachers for that, there are some challenges attached to how these brokers often are accountable also to others than the teaching profession (Akkerman & Bakker, 2010).

The results imply that data use in education should be viewed within a complex and integrated framework, rather than mainly linearly. For example, knowledge about students from student testing and knowledge from research are not new knowledge sources for teachers; however, the governing context and accountability drivers are new. A relevant question to ask is also whether the result meetings in themselves provide arenas for complex problem-solving, which should be further investigated. More time and effort to analyse problems before identifying solutions, as well as placing more emphasis on how to integrate external and internal knowledge sources, could provide a more substantial foundation for initiating solutions that ask fundamental questions about existing practices and prompt more long-term solutions. Further research should also investigate how teachers and school leaders frame their work within the result meetings, how explorative and critical these are, and how the integration of different knowledge sources occurs in teachers' actual dialogues within such meetings.

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