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What went wrong? Examining teachers’ data use and instructional decision making through a bottom-up data intervention in Denmark

Ida Gran Andersen*

Abstract: This study investigates the bottom-up implementation of a data informed evaluation culture in public schools in two Danish municipalities. The study examines attitudinal and behavioral changes to the teachers’ data use during a data intervention by analyzing longitudinal mixed methods data. Results show that 1) teachers are very reluctant to use data, which resulted in low fidelity with the intervention 2) teachers lack the competencies to act didactically on data, and 3) when there is a mismatch between data and their subjective assessment of a student, they look for individual explanations, which may explain why the data is wrong.

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1. Introduction

Teachers have always based their instructional decisions on subjective factors, such as intuition and experience. Every day, educators all over the world and at all educational levels use their professional judgment, i.e. their ability to decide what is best in a particular situation, to make educational decisions that may impact student learning. Although intuition is an important element of teachers’ professional judgment and the teaching profession, basing decisions on this alone potentially leads to incorrect, ineffective, inadequate and perhaps even undesirable decisions (Kippers, Poortman, Schildkamp, & Visscher, 2018). Inevitably, some of teachers’ judgments will be biased due to, for instance, not having all the information or time constraints. To counter such potential bias, providing teachers with systematic information about their students’ academic performance can help improve learning outcomes for all students and close achievement gaps by informing decisions grounded in carefully considered professional judgment rather than intuition and gut feeling.

In contrast to teachers’ intuition, data is “information that is systematically collected and organized to represent some aspect of schools” (Lai & Schildkamp, 2013). Data has several functions, such as documentation and accountability, and both researchers and policymakers often argue that data-informed decision-making can raise the quality of education. In addition, research suggests that data use can contribute to increased student learning (Lai, Wilson, McNaughton, & Hsiao, 2014; McNaughton, Lai, & Hsiao, 2012; Poortman & Schildkamp, 2016; Schildkamp, 2019; van Geel, Keuning, Visscher, & Fox, 2016). Thus, in recent decades, there has been a growing expectation that teachers should use data to inform their decisions since it increases student learning and equality by preventing and correcting the possible biases associated with intuitive judgement (Park & Datnow, 2016; Schildkamp, Poortman, & Handelzalts, 2016a; Vanlommel & Schildkamp, 2019).
Despite the promising nature of using data to improve teaching and learning, teachers often do not use data effectively, if at all (Schildkamp & Kuiper, 2010; Schildkamp & Teddlie, 2008). The literature on teachers’ data use has shown that the reasons why teachers do not use data effectively are many and diverse: Sometimes the relevant data is not available (at the appropriate time) for them to make informed decisions; sometimes they lack the skills to interpret and use the data they have (Lai & Schildkamp, 2013); and sometimes their personal attitudes towards data and its relevance to instruction stands in the way of implementing data in their decision-making process (Poortman & Schildkamp, 2016). Accordingly, to realize the full potential of data in education, more research is needed on how to use data to improve the quality of schools (Schildkamp, 2019).

In recent decades, a large body of literature has been occupied with the question of how to best support or facilitate professional development for in-service teachers concerning the use of data. Research on professional development activities for teachers suggests that such activities are frequently seen as ineffective (van Schaik, Volman, Admiraal, & Schenke, 2019). At the same time, empirical studies suggest that collaborative activities are more effective in fostering teachers’ professional learning (van Schaik et al., 2019) and that teachers’ interactions with colleagues regarding data provide valuable opportunities for teachers to learn (Van Gasse, Vanlommel, Vanhoof, & Van Petegem, 2016). Accordingly, recent studies have focused on interventions aimed at building capacity surrounding teachers’ data use and increasing their data literacy. Although some of these studies find a positive impact of such interventions on teachers’ data literacy (Kippers et al., 2018; van Geel et al., 2016), the findings are generally mixed (Ebbeler, Poortman, Schildkamp, & Pieters, 2017; Poortman & Schildkamp, 2016). While there is no doubt that structured interventions can provide an important contribution to improving data use capacity in schools, it is crucial that these data literacy skills are developed using data from the teachers’ own context and that teachers use data collaboratively in real-world professional settings (Ebbeler et al., 2017). As such, interventions
centering on teachers use of data need to be more directly applicable to teachers’ everyday teaching practices and thus focus more directly on a smaller micro-level of their everyday practice and interaction with colleagues (Kippers et al., 2018). This study aims to fill this gap.

The purpose of this study was to develop a data-informed evaluation culture in schools in two Danish municipalities through the implementation of a data intervention in teachers’ (preexisting) class teams. The intervention consisted of two parts. First, a digital learning tool, tjek.me, was made available to the teachers at the participating schools. Tjek.me works as a two-sided platform and consists of a game (played by students) and a student learning report (for the teacher). Contrary to many other data sources, the data from this intervention was specifically tailored to inform the teachers’ future instruction, as well as reporting on students’ progression (between two points in time) rather than their achievement (at a single point in time). Accordingly, the data is much more suitable for formative use than the data sources usually available to educators. Second, the teachers participated in a training program during which they learned how to use the data from the digital learning tool in their everyday practice. The professional development was implemented through teacher teams at the class level that were already in place prior to the intervention. This is important since several studies show that professional development is more effective when it takes place in teams (Schildkamp, Poortman, & Handelzalts, 2016). However, in previous data interventions, data teams are often only established for the intervention, which potentially decouples the collaboration from the teachers’ everyday practice.

In this paper, I examine attitudinal and behavioral changes in the teachers’ use of data by analyzing longitudinal mixed-methods data. Specifically, the following research questions will be answered:

1) How does the data intervention affect teachers’ attitudes and instruction?

2) How do teachers incorporate data on students’ progression into their decision-making processes?
Developing a positive attitude towards the use of data among teachers, or “buy-in/belief in data” (Schildkamp and Kuiper, 2010), is necessary if such approaches are to be successfully implemented in schools (Datnow et al., 2007). In this study, having a positive attitude towards the use of data means that participants recognize the added value of analyzing and using data and of having evidence for the claims they make regarding their instruction. Furthermore, positive attitudes towards data can be a strong predictor of subsequent behavior and decision-making. In this study, the teachers were provided with data collected through the digital learning tool tjek.me. Accordingly, in this context, teachers’ data-based decision-making refers to their use of the available data to inform their everyday instructional and didactic decisions and practices.

2. Theoretical background and previous research

The study’s theoretical framework consists of two parts. First, it is embedded in research on data-based decision-making and intuitive judgement. Second, it draws on previous research on teacher collaboration and professional development.

2.1 Data-based decision-making in schools

Data-based decision-making can be defined as the entire process of data use (e.g., assessment data, classroom observations, surveys) by teachers, data experts, school leaders, and school board members. This involves collecting, analyzing and interpreting data in order to study educational practices, using the information obtained as a basis for making decisions with regard to adapting educational practices, implementing these changes, and subsequently evaluating whether these adaptations have had the desired effect in terms of improved learning outcomes (Gelderblom et al., 2016). Thus, data use can take place at different organizational levels and can look very different
depending on who is using data and for what. At the school level, data can be used to gain insight into the coherence of the curriculum, for example. At the classroom and student levels, data is often used for adapting teaching and learning activities to address student needs and thereby maximize learning (Hoogland et al., 2016; Poortman & Schildkamp, 2016).

2.1.1 Student assessment data

Within education, a distinction is typically made between formative and summative assessment. In the literature, the dominant view is that the difference between the two lies in the purpose of the data. Whenever assessment results are intended to play a role in a decision about the mastery of a defined content domain, is has a summative purpose; for example, in making a decision regarding selection, classification, certification or placement. If assessment results are intended to steer the learning process, assessment is formative in purpose (Van der Kleij, Vermeulen, Schildkamp, & Eggen, 2015). However, the purposes of summative and formative assessments are not mutually exclusive; they can coexist as primary and secondary purposes of the same assessment (Bennett, 2010). Research about data use in schools shows that educators most commonly use summative data, such as student achievement data (Shen et al., 2010). However, student achievement data provides little information about the reasons for a given student’s results or about useful instructional strategies that can support learning (Ebbeler et al., 2017). The formative use of data to inform instruction at the classroom level consists of several steps: Establishing a clear purpose for the use of data with regard to improving teaching and learning; data collection; analyzing data to identify learning progress and specific students’ needs in relation to the goals; interpreting the data to identify possible actions to enhance student learning; taking actions to improve student learning; evaluating the results of such actions. Evaluation may result in a new cycle of data collection, and a
feedback loop is created, making data-based decision-making a cyclic and iterative process (Hoogland et al., 2016; Schildkamp et al., 2016; Van der Kleij et al., 2015). Consequently, data provides teachers with feedback on their methods of instruction (Mandinach & Jackson, 2012) and thereby allows them to engage in an iterative and cyclic procedure, studying the effects of their own actions on students’ results and adapting their instruction based on the outcomes (Gelderblom et al., 2016).

2.1.2 Data and intuition

Intuition plays a central role in teachers’ decision-making (Vanlommel et al., 2017). Intuition refers to the domain-specific ability to make an appropriate decision without deliberately analyzing various data (Kahneman & Frederick, 2005). In contrast to data-based decision-making, the intuitive basis for decision-making refers to information processing that is not based on data (Vanlommel et al., 2017). Although intuition is a highly valuable and necessary source of evaluation in teaching and learning, it is not necessarily valid, which might lead to poor decisions (Vanlommel et al., 2017). However, intuition is not the opposite of rationality. In practice, rational and intuitive processes are intertwined and mutually influence each other (Kahneman & Frederick, 2005). Teachers’ decision-making is based on concurrent rational and intuitive strategies (Vanlommel et al., 2017). Consequently, teachers’ assessments of students are based on the interplay between objectivity and judgment (Allal, 2013).

Teachers, like all people, tend to see things that confirm their existing beliefs and to (unconsciously) avoid data that points to the contrary (Kahneman & Frederick, 2005). Because intuition refers to recognizing patterns and feelings of knowing, it is likely that teachers will have more confidence in their intuition than in the alternatives suggested by data (Kelly & Downey,
Therefore, teachers tend to seek data that confirm what they believe to be true and avoid data that point in other directions. This so-called confirmation bias also suggests that, when presented with new data, teachers might look for interpretations consistent with their existing beliefs (Vanlommel et al., 2017). By extension, teachers will not necessarily independently and voluntarily question their current practices (Van Gasse et al., 2016), preferring to try to accommodate data within their current thinking, whereby existing assumptions are not challenged and professional learning might not occur (Katz & Dack, 2014).

2.2 Collaborative learning in teams

In many countries, the teaching profession has developed from teachers being individually responsible for the quality of teaching and student outcomes to a shared responsibility for providing education. Consequently, a growing body of literature stresses the importance of a culture of collaboration in which teachers have the professional space to share and discuss each other’s teaching practices, and to experiment with innovative teaching in an environment where they feel they can safely give and receive feedback. Furthermore, collaboration is often considered important in terms of overcoming barriers stemming from personal factors that influence teachers’ data use because it involves internal support among teachers, alignment in terms of norms and agendas, and a shared responsibility with regard to data use (Van Gasse et al., 2017). Consequently, many schools have developed a culture that implies that teachers collaboratively develop, discuss, improve, share and evaluate teaching practices (van Schaik et al., 2019).

Professional development activities have also been shown to be more effective in terms of teachers’ learning if they require active participation and collaboration, and are clearly linked to everyday practice (van Schaik et al., 2019). By building capacity for data use, teachers can be empowered to
drive their own learning in ways that are sensitive to the specific needs of the local context (Mandinach & Jimerson, 2016). Accordingly, collaboration in the context of data use can be seen as a structural support for data use, with research showing that engaging in collaboration around data motivates teachers to use data in order to improve their instruction (Young, 2006).
3. **Data and methods**

The current study employs a longitudinal mixed-methods design in which digital data, quantitative survey data and qualitative focus group data are collected concurrently at three points during the project (Plano Clark et al., 2015). The purpose of this design was twofold. First, longitudinal quantitative and qualitative data were collected in order to examine changes to teachers’ use of data during the project. Second, the data sources largely pertain to two different sorts of measure regarding the teachers’ use of data: objective and subjective data. The digital data from tjek.me provides a standardized and objective measure of the teachers’ data use while the quantitative and the qualitative data represent a more subjective and detailed measure of the development of a data-informed evaluation culture at the participating schools. Figure 1 shows the research design of the study.

![Figure 1 about here](image)

While the digital data was collected continuously and thus available throughout the project period, the qualitative and quantitative data were collected at three points during the project period, providing data pre-intervention (T0), during the intervention (T1), and post-intervention (T2).

### 3.1 The project: “The learning school”

The data in this study stems from a larger project called *The Learning School*. The project, funded by the A.P. Møller Foundation, was a collaboration between Aarhus University, public schools in the Danish municipalities Elsinore and Gentofte, and Knowmio, which is a company specializing in
digital solutions to support learning analytics. The project’s overall objective was to develop a data-informed evaluation culture in the participating schools through a data intervention in teacher teams.

3.2 The intervention

The intervention consisted of two parts. First, the digital learning tool, tjek.me, was made available to teachers at the participating schools. Tjek.me works as a two-sided platform and consists of a game (played by students) and a student learning report. The data used to compile the student learning report is generated through three steps: 1) the teacher's formulation of relevant questions for students to answer in the game, 2) collection of data through students' playing the game, and 3) visualization of the data in student learning reports made available to the teacher immediately after the game. In terms of questions for the game, teachers could choose to write their own questions based on the lesson or lessons they had taught or they could search the database for already played games and reuse those questions. Tjek.me is supposed to be used at three different stages of a learning cycle - before, during and after introducing new content - thus producing progression data on students’ academic competencies within a specific topic or domain.

The second part of the intervention concerned the teachers’ participation in a training program during which they learned how to use the data from tjek.me in their everyday practice. The training program took place during the school year 2017/18 and was led by a learning consultant from Knowmio. The project was founded on a belief that teacher development and learning can be viewed as a loop in which teachers: 1) identify students’ learning needs, 2) organize a targeted intervention, and 3) evaluate the impact of the intervention. Accordingly, in addition to an initial workshop in which teachers learned how to use the digital learning tool, the training program was
organized in three learning loops. Each loop consisted of three activities. First, the teacher organizes a specific learning cycle within a particular topic, including setting a general aim with specific learning objectives for the student. On this basis, the teacher derives concrete content areas for the learning objectives and formulates items for the game played by the students through the digital learning tool. Second, the teachers conduct the planned learning cycle and the students play the game three times using tjek.me at the beginning, during and after the learning cycle. After each game, the teacher is given access to a learning report with each student’s results and progression. Third, each loop ends with a learning dialog, which is a structured discussion within the teacher team facilitated by a learning consultant from Knowmio.

3.3 Implementation

The intervention was implemented using a bottom-up strategy as research has indicated that this is more likely to lead to the successful introduction of innovations in schools than a top-down strategy (Fullan, 2003). Interventions introduced using a top-down strategy are often considered an add-on that take important time away from core activities and as a potential cause of stress (Petko, Egger, Cantieni, & Wespi, 2015). Consequently, the implementation of a successful school intervention depends primarily on whether the staff who are involved experience ownership of the process and see a coherent rationale and not just “extra work”. Schools and teachers participated in the intervention on a voluntary basis, meaning that the municipalities encouraged their schools and teachers to participate, but the final decision was left to the individual teachers.

3.4 Participants
The intervention included 93 teachers at 11 participating schools. As mentioned earlier, this was a self-selected sample with teachers volunteering for the project to ensure motivation, engagement and ownership. The teachers participated as part of their teams, which were typically formed as class teams. The teachers taught a range of subjects, including Danish, mathematics, history, science and English, as well as different grades ranging from grade 1 (where students are seven years old) to grade 9 (where students are 15 years old).

3.5 Data collection and instruments

For each participant (teacher team) quantitative (qualitative) data was collected at the beginning of the project (June 2017), during the project (December-February 2017/18) and at the end of the project (May-June 2018).

The quantitative data is based on a survey that was completed by the participating teachers. The survey included seven questions that the teachers were asked at the beginning of the project (T0), during the project (T1) and at the end of the project (T2). Specifically, using a response scale with five categories (1 = “Strongly disagree” to 5 = “Strongly agree”), the respondent was asked how much he or she agrees that the project has: 1) “Increased your knowledge of the students’ academic progression”, 2) “Provided you with the knowledge and competencies to interpret and use data from tjek.me”, 3) “Focused your attention on the specific learning goals of your instruction”, 4) “Made you aware of the need and/or possible adjustments for didactical improvements in your instruction”, 5) ”Strengthened your collaboration with colleagues on student learning”, 6) “Strengthened your dialogue with students about their learning”, 7) “Changed your attitude towards using data to
explore and develop your practice”. The qualitative focus group interviews took place in the teachers’ teams and went into further detail concerning responses to the seven survey questions. The questions from the survey were thereby used as a semi-structured interview guide. The focus group interviews lasted approximately one hour and were carried out by learning consultants from Knowmio as a part of a broader process of professional sparring concerning the data use intervention. The interviews were recorded and transcribed by researchers from Aarhus University.

The digital data from tjek.me was available to teachers throughout the project period. It includes information on the teachers’ actual use of tjek.me, including: 1) number of unique visits to tjek.me, 2) number of actions (measured as “clicks”), 3) total number of games played, 4) number of teacher-written questions used in games, and 5) number of times the teacher has accessed student reports.

Table 1 illustrates the availability of the three data sources across the intervention’s three measurement points.

- Table 1 about here -

3.6 Empirical strategies

In my analysis, I draw on the three different types of data for different purposes. I use the digital data from tjek.me to examine the teachers’ specific use of the platform. Accordingly, the digital data from tjek.me to examine the teachers’ specific use of the platform. Accordingly, the digital

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1 Since the baseline (T0) questionnaire is slightly different from the other two (T1 and T2), the longitudinal design only includes T1 and T2.
data provides objective information about the teachers’ data use and the implementation of and fidelity with the intervention. The quantitative survey provides information on the teachers’ subjective assessment of the impact of the intervention on their attitudes and behavior. I analyze both the digital and quantitative survey data by means of descriptive statistics.

By basing the interview guide on the survey questions, I am able to use the qualitative data from the focus group interviews conducted with teacher teams to supplement the quantitative survey data. Thus, whereas the two quantitative data sources can answer questions on how the teacher has used data and how they perceive its impact on their everyday practices, the qualitative data provides more in-depth information on why the teachers act as they do and how they rationalize their decisions and practices during the process of developing a data-informed evaluation culture. I analyze the qualitative data by means of content analysis in the form of systematic coding and display analysis. All transcripts are coded and analyzed using Nvivo. The coding process followed two coding cycles (Miles, Huberman, & Saldaña, 2014):

- 1st cycle: First, all transcripts were coded inductively using open coding. In this process, all data were coded. All codes were then sorted, condensed and structured into main and sub-codes.
- 2nd cycle: Second, all transcripts were coded again, but this time deductively using the codes from the 1st cycle. This time only content that fitted the codes was coded.

3.7 Validity and reliability

Several steps were taken to ensure the validity and reliability of the analyses. The questionnaire and interviewer guide were based on an operationalization of the key concepts of the study, and then
piloted on a small scale. Both instruments were discussed with relevant experts and teachers who commented on overly complex and/or ambiguous questions. Based on their comments, the instruments were adjusted. Furthermore, during the coding process, the data was coded twice: inductively during the first cycle, and then deductively during the second cycle. This coding process ensured a high level of both reliability and validity because concepts first emerged from the data (first cycle) and then were carefully described in the codebook with precise definitions of each code (second cycle).

4. Results

In this section, I present the main findings from the study. First, I use the digital data to examine the teachers’ actual use of the platform and to evaluate the implementation of and fidelity with the intervention. Second, I turn to the survey data to investigate how the teachers perceived the intervention’s impact on their attitudes to and use of data. Third, I explore a number of more detailed perspectives on the teachers’ reflections on using data emerging from the qualitative data.

4.1 Teachers’ use of tjek.me

The aim of the project was to develop a data-informed evaluation culture at the participating schools. To this end, the teachers’ data use was facilitated through a data intervention in the teachers’ class teams. The results from the study shows that the teachers only participated in the intervention to a limited degree. Table 2 presents descriptive statistics based on the digital data concerning the teachers’ actions on the tjek.me platform. The number of unique visits and actions per visit can be seen as a proxy for their fidelity with the intervention. A visit is defined as a user “logging in”, whereas an action is a “click”, for instance requesting student progression reports. The
table shows that the 93 participating teachers logged in to tjek.me a total of 1,949 times, which is an average of 21 times per teacher.

The teachers have played 299 games in total, which is an average of 3.2 games per participating teacher. Three games is consistent with one learning cycle (pre-, mid-, and post-cycle), thereby indicating that the average teacher has only used the platform once throughout the intervention. 27 of the 93 teachers played no games at all, meaning that they de facto did not participate in the intervention. 49 of the 93 teachers did not write questions for the games themselves, instead using the pool of questions which had been written by other teachers for the same subject. This means that some teachers did play games using tjek.me, but they only participated in the intervention at a superficial level since they did not formulate their own questions based on the specific learning cycle they taught. Finally, 64 (corresponding to two-thirds) of the participating teachers did not request a student progression report from the platform. These results show that the overall implementation of and fidelity with the intervention was very poor.

Figure 2 shows the teachers use of tjek.me throughout the intervention from August to May.
As shown in this figure, the number of visits to tjek.me by teachers, measured as logins, has been somewhat stable throughout the intervention period. However, their actions, i.e. what they actually did when logged in, decreased in quantity during the intervention.

While most teachers had played games and some have also written questions themselves, only one third of the teachers actually used the resulting data. One teacher says: “My focus has been on getting the checks [games] to roll and helping the students understand the concept and be able to participate. And then I actually did not even think about looking at the results” (teacher, T1). The quote clearly indicates one of the project’s major barriers: Despite the bottom-up implementation, teachers experienced the intervention as a requirement and not as something that could support their teaching. The quote shows that this teacher’s focus is on the different areas of the platform, namely the games and the student progression reports. And as she says: she did not even think about the second part. What is striking is that the teacher is not curious about the results of her efforts. She does not even consider that she could look at the data and results and actually get new information that could improve her instruction. The idea of the intervention was that the platform would provide the teachers with information they lacked and would find useful in their everyday practice. However, the findings from the digital and qualitative data do not support this hypothesis.

4.2 Teacher-reported impact of the intervention

During the intervention, the teachers were asked to report on the perceived impact of the intervention. Figure 3 shows the teachers’ answers to seven question concerning how they think the intervention affected different aspects of their everyday practice.
As the figure shows, the teachers answered most questions as “neutral”. Mean values range from 2.3 (on the question of whether the intervention has strengthened the teacher’s collaboration with his/her colleagues about students' learning) to 3.0 (on the question of whether the intervention has equipped the teacher to interpret and use data from tjeq.me). If we look at the development from T1 to T2, there are no significant changes. Accordingly, the participating teachers generally did not perceive an effect of the data intervention on their attitudes and behavior. This is expected since intervention fidelity was low. In the next sections, I explore the teachers’ perspectives on working with data during the intervention.

4.3 Beliefs about and attitudes towards data

One of the major reasons for the low fidelity implementation of the intervention was the teachers’ beliefs about data and their attitudes towards the value of data for instructional purposes. From the beginning of the project, the teachers generally expressed a feeling of “data overload”. Many teachers experienced that there is an overwhelming amount of data, different evaluation criteria and different purposes for data use at different organizational levels. Prior to the intervention, the teachers often used summative tests, which they found problematic for instructional purposes though: “[There is] no doubt that these tests are a ‘scatter gun approach’. We don’t target the individual student” (teacher, T0). However, teachers continued using summative tests anyway based on the rationale that they are relatively easy to implement since they often come with a manual. In this way, they were able to access standardized data without it taking too much of their time.

The idea of the intervention was to provide the teachers with better quality data than they usually have available; data which is accessible at the relevant time, and closely connected to their own
practice. Such data could be used in a formative manner to improve instructional quality; for instance, through more and better feedback, better collaboration in teams and more effective instruction. However, as I stated in the previous section, the teachers only used this data to a minor extent despite their dissatisfaction with the summative data that was typically available to them. The most common type of resistance towards data use arose from the fact that the majority of the teachers simply did not have faith in data in general. For many teachers, data is closely associated with testing and measurement by objectives, which is not a popular approach among Danish teachers. Accordingly, many teachers do not differentiate between different types of data, nor do they investigate if their general prejudices about data and testing are accurate.

4.4 Data and intuition

As described in the previous section, the teachers in the study generally distrusted data; for many teachers, not only data from tjek.me, but data in general. One teacher says: “It is when I am sitting down with one of the students [to look at the learning report], I think: does he understand this, or does he not understand it in this situation, or when the language is like this?” (teacher, T1). This is an example of a general tendency within the study that the teachers do not trust data other than their own subjective evaluation. Rather than accepting that the test is one (standardized) view of a student’s ability within a certain domain, the teacher keeps questioning whether students’ failure to answer correctly could somehow be due to the test. In addition, there is a widespread belief that data cannot stand alone: “But then it is important that data cannot stand alone. It only makes sense when combined with a dialogue, for instance with the student or one of the student’s other teachers: What went wrong here? Is there something going on at home? Or has [the student] been sick?” (teacher T2).
The teachers generally have very strong faith in their “gut feeling”, i.e. their basic intuitive instinct: “I know that when you spend as much time as I do with the students, then you can quickly get to know them, learn their strengths and weaknesses, and you can easily spot how they are doing with a topic” (teacher, T2). Basically, most teachers think that they know all there is to know about the students and their academic abilities and achievement without further rationalization. As a result, they did not think that they lacked data in the first place or that they learned something from the data that they did not already know. Furthermore, whenever data did not confirm their subjective intuition about their students, they looked for alternative explanations for why the data was wrong; for instance, that the student was having problems at home or had a bad day on the test day, or that there are data validity issues: “Then you have to look at the ‘whole student’. You have to have some idea of whether there has been a divorce at home during the period and that that is the reason why they simply do not get Romanticism” (teacher T1). This finding is in line with many previous studies, which have likewise suggested that teachers tend to seek out data that confirms what they believe to be true and try to avoid data that points in other directions. Accordingly, tests results are questioned and alternative explanations are sought when these results do not correspond with teachers’ intuition. Somewhat surprisingly, teachers also never questioned their own instruction when there was a mismatch between the test data and their subjective beliefs. Not once in the interviews did a teacher consider the student progression data as a reflection of his or her own didactic practice.

4.5 Didactic responses to data

The use of data does not automatically mean that teachers will make decisions that enhance student learning, nor does the availability of data ensure it will actually be used to improve instructional
practices. The findings from this study show that teachers struggle to take instructional actions based on data. The teachers simply did not have the necessary competencies to transform the information drawn from the data into instructional change: “In addition to having the time to interpret the results, you also need to know how you can actually act on them” (teacher, T1). As the quote shows, the teachers did not necessarily think that taking action based on data was something different from more specific data literacy. While the latter was provided by the intervention, the former was assumed to be a part of the teachers’ pre-existing professional knowledge. In addition, as pointed out by this teacher, they do not necessarily know what to do with the information drawn from the data. As such, the process of using data seems to stop at the information or knowledge phase. Data was collected, analyzed and turned into information. However, while this probably leads to teachers having greater awareness of their own instruction, it does not necessarily result in instructional improvement if the teachers are unable to act on the information. Some teachers did mention examples of improvements to their instruction, but primarily in the form of re-teaching specific content: “I thought it was interesting that [the results showed] that I had not taught it well enough. And then you can just teach it again, and that’s great, I think” (teacher, T1). However, simply re-teaching a topic does not change the way the instruction is delivered. The teachers use the same instructional strategy in the same group of children, or a smaller group, which does not constitute a significant change in instructional practice. In sum, the findings from this study show that implementing didactic actions based on data is not an easy task for teachers. It is one thing to use and interpret data, but another to connect it to educational content.
5. Discussion and implications for policy and practice

Based on the presented results, I will highlight a number of important, more general meta-conclusions regarding the development of a data-informed evaluation culture in schools. First, the professional development provided in this study was inadequate in getting teachers to “buy in” to the benefits of data use. Teachers need more support in interpreting data and, especially, in connecting this information to specific instructional approaches and strategies than the professional development provided them with. More particularly, teachers’ attitudes towards and distrust of data was something the interventions could have addressed more explicitly, since successful data use is dependent on open engagement with such approaches. In this sense, the study was naïve in assuming that teachers would instantly see the generated data’s relevance to their everyday practice and know what to do with it.

Second, the study points to an important conclusion in terms of the organizational “infrastructure” required to implement a data-informed evaluation culture in schools. In order for data teams to function effectively, certain structures and processes must be in place (Mandinach & Jimerson, 2016). In the present study, there are at least three ways in which the infrastructure at the school level turned out to be lacking in terms of supporting and facilitating the successful development of a data-informed evaluation culture. 1) There was a lack of a systematic approach to teaching and learning both at the school level and in the teachers’ individual professional practice. Implementing a data-informed evaluation culture requires systematic reflection on the relationship between learning objectives, instructional methods/didactics, and criteria for indicators of learning. The study assumed that this was a well-established part of the participating teachers’ everyday practice and that they would be experienced in reflecting on these relationships. Therefore, it came as a surprise to find that this was not the case at all. The teachers often approached these issues on an ad-hoc basis and found it hard to think systematically about how instruction can act as a means to
achieve specific learning goals and how these goals can be broken down into indicators and evaluated. The lack of such competencies and experience made it difficult for the teachers to capitalize on the data intervention. 2) Feedback to students plays a key role if data is to be used effectively to improve student learning and this was therefore an important part of the learning cycle in the intervention. The qualitative interviews from this study show that, although teachers think that feedback to students is crucial, they often assume that students already know how they are doing and thus refrain from providing them with as much feedback as they could. The feedback they do give to students is often characterized by an ad-hoc approach, which makes it haphazard rather than systematic. In addition, feedback is not viewed as an integral part of every learning cycle, but rather as a “remedial” practice aimed at students at risk or experiencing learning difficulties. In order to take full advantage of the data intervention in this study, it is necessary to work much more systematically with feedback. Feedback should be a part of every teaching cycle and be provided based on data which is closely connected to the learning process. 3) The development of a data-informed evaluation culture in teacher teams requires the teachers to collaborate closely together on increasing student learning and that this collaboration is well-structured and facilitated. In this study, the teachers’ collaboration paid little attention to pedagogical content and didactics, almost exclusively focusing on practical issues and logistics. In addition, in relation to the students, teachers’ collaboration typically focused on behavioral problems and individual students’ issues rather than broader aspects of learning. Thus, there is a long way to go if teachers are to effectively collaborate on teaching and learning, which there are several reasons for. First, the teachers are often expected to structure, facilitate and lead the collaboration themselves. This is a problem since they have neither the time nor the competencies to do so. Accordingly, collaboration becomes something that takes place “in the corridor” or at meetings, which are often experienced as a “waste of time”. Second, the idea of the autonomous
teacher who teaches alone behind closed doors is very much alive in Danish schools - not necessarily because teachers themselves embrace such an ideal, but because opening the door to one’s instructional practices is a sensitive matter and because teachers feel hard-pressed for time. It takes time to develop instructional practices that you feel comfortable letting your colleagues observe and it also takes time to observe colleagues’ instruction. While the aforementioned idea of the autonomous teacher teaching alone behind closed doors is not necessarily a problem in itself, it stands in the way of developing a data-informed evaluation culture in teams because such a culture requires close didactic collaboration where colleagues observe each other’s instruction, provide feedback and actually collaborate on the development of instructional goals and content, didactics, learning objectives and evaluation. In sum, professional development programs seeking to establish a data use culture must not only address whether or not teachers have the expertise to analyze data, but also whether they are able to more closely reflect on their own instructional practices and whether they are able to conduct meetings and plan measures to improve their instruction based on data (Gelderblom et al., 2016). In this study, this was clearly not the case.

Third, the results important implications for practice and policy. In general, there is a paradox between, on the one hand, an increasing expectation among policymakers and school leaders that teachers use data to improve student achievement and, on the other hand, the surprisingly low level of faith in (the value of) data among Danish teachers. At the policy level, the results from this study point to the fact that generating more data on student achievement is by no means a quick fix. It does not make sense to simply ask teachers to use more data or – as in this project – to provide them with data and expect them to use it. Developing a data use culture is not just a question of generating specific data or of data literacy; it is about establishing an organizational infrastructure that facilitates data use in teachers’ everyday practice. In this sense, many data interventions are far too narrow in focusing on the individual competencies that are a prerequisites for teachers’ data use.
thereby underestimating the cultural and organizational changes needed to develop a truly data-informed practice. Such cultural and organizational changes need to be implemented at the policy level, mandating an infrastructure that can facilitate a data-informed evaluation culture and providing the necessary time and resources instead of only focusing on the technical instruments to generate data. From a practice perspective, there is no doubt that, at least in Denmark, teachers are highly critical of the very idea of data and of using data to inform educational practice in particular. For many teachers, a very strong ideological resistance towards the recent growth in testing and measurement in schools prevents them from giving data a fair chance. This cannot be solved through professional development at the teacher level alone, but rather reflects the deep divisions in the public debate on education in Denmark, where “data” is currently held hostage in an ideological fight.

6. Conclusion

This paper investigated how access to data that is closely connected to teachers’ instruction affects their everyday practice. Results show, first, that the data intervention did not impact teachers’ attitudes or behavior, a finding supported by previous research (Ebbeler et al., 2017). One important reason why the intervention was not successful is that the fidelity was very low. Some teachers did not participate at all, while many only participated in a small part of the intervention. There are many reasons why teachers did not participate as planned, the most important being the prevalence of negative attitudes towards data and testing in general. Accordingly, in line with the findings in previous research, teachers’ knowledge, skills and attitudes are important factors that likely influenced (the lack of) data use (Kippers et al., 2018). This highlights the importance of teachers’
attitudes towards data, because teachers need to be willing to use data if data interventions are to be successful (Ebbeler et al., 2017).

Second, I found that teachers generally believe that their intuition, based on experience and a personal connection with their students, is a better source of knowledge concerning students’ competencies and learning needs. Test results were questioned and alternative explanations sought when these results did not correspond with teachers’ intuition (Vanlommel et al., 2017). This coincides with previous research that has shown that teachers have strong faith in the validity of their intuition since it is based on personal experiences and feelings (Kahneman & Klein, 2009). This is generally a good thing, as teachers’ subjective intuition is an important part of their professional judgment. However, in this case, the trust in their instincts is so strong that it actually prevents them using data from the intervention efficiently. Instead of integrating the information they get from data into their overall understanding of the students, the teachers reject it as less valid than their subjective intuition. This is problematic because teachers’ intuition can (also) be biased and objective information can function as an important reality check (and vice versa).

Third, the study showed that the teachers lack the necessary didactic competencies to act on data. In line with previous research, I find that using data for instructional improvement is not an easy task (Gelderblom et al., 2016), and that teachers struggle to interpret data and to take steps to adapt their instruction accordingly (Datnow & Hubbard, 2015; Kippers et al., 2018). The most frequent didactic response to data is re-teaching, which hardly constitutes a significant change in instructional strategy. Doing something again that did not work in the first place can be interpreted as a kind of single-loop learning where the teachers simply repeat their instruction instead of using the information the data provides them with to reflect on the underlying assumptions of their instruction. In sum, taking action based on data may be the hardest part of the process (Datnow &
Hubbard, 2015; Kippers et al., 2018). As such, the concept of data literacy should not solely refer to the possession of specific skills and knowledge, but also the ability to take instructional action.

The results from this study should be viewed in the context of its limitations. First, participating teachers were a self-selected sample, volunteering for the intervention to ensure motivation and ownership. However, this has potential drawbacks for the quality of the data and the generalizability of the results. The teachers who agreed to participate in the intervention are likely to be more positive towards data and data use than the average teacher. In addition, they may be more curious and willing to experiment with new ways of organizing their work and instruction. Therefore, I assume that the teachers in my sample represent a “most-likely” case in terms of data use. In this context, the results presented in this study are even more surprising, since the participating teachers could be expected to be those most committed to data use and thus those who would benefit most from the intervention. Consequently, the data from this study represents a “hard case”; if these teachers did not develop a data-informed evaluation culture based on the intervention, no teacher would. Second, the low fidelity with the intervention makes it difficult to evaluate its impact. Therefore, the research question concerning how the intervention affected the teachers’ attitudes and instruction became a question of how teachers’ attitudes hindered the implementation of the intervention. The decision to make participation voluntary thereby came at a cost in this study. Future research should take this experience into consideration when planning interventions.

In conclusion, having access to high quality data does not guarantee the actual use of this data. By extension, it is too simple to think that the generation and use of data will automatically lead to decisions that enhance student learning. Nevertheless, thinking that instructional decisions can be driven completely by data is naïve. Teachers filter data through their own lenses and experiences, and, as suggested by this and previous research, intuition plays a central role in this process. In order to make sense of data, teachers need certain knowledge, skills and dispositions, but also trust
and a personal belief that data can be didactically meaningful. The effective implementation of data use in the classroom thus requires that teachers are data literate in a very broad sense. Relying on professional development alone to enhance teachers’ data literacy in this broad sense may be inadequate.
References


Mandinach, E. B., & Gummer, E. S. (2016). What does it mean for teachers to be data literate: Laying out the skills, knowledge, and dispositions. *Teaching and Teacher Education*.


Figure 1. Research design.

INTERVENTION

T0  T1  T2

Qualitative data
Quantitative data

Qualitative data
Quantitative data

Qualitative data
Quantitative data

Digital data
Figure 2. Teachers’ use of tjek.me across the intervention period. Visits and actions per teacher.
Figure 3. Teacher-reported impact of the intervention.

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<tr>
<th>Impact</th>
<th>T1</th>
<th>T2</th>
</tr>
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<tbody>
<tr>
<td>…increased your knowledge of the students’ academic progression</td>
<td>2.8</td>
<td>2.5</td>
</tr>
<tr>
<td>…provided you with the knowledge and competencies to interpret and use data from tjek.me</td>
<td>2.5</td>
<td>3.0</td>
</tr>
<tr>
<td>…focused your attention on the specific learning goals of your instruction</td>
<td>2.9</td>
<td>2.6</td>
</tr>
<tr>
<td>…made you aware of the need and/or possible adjustments for didactical improvements in your instruction</td>
<td>2.8</td>
<td>2.6</td>
</tr>
<tr>
<td>…strengthened your collaboration with colleagues on student learning</td>
<td>2.3</td>
<td>2.0</td>
</tr>
<tr>
<td>…strengthened your dialogue with students about their learning</td>
<td>2.4</td>
<td>2.5</td>
</tr>
<tr>
<td>…changed your attitude towards using data to explore and develop your practice</td>
<td>2.6</td>
<td>2.5</td>
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