

Teachers' and school leaders' sensemaking of formal achievement data: A conceptual review

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Abstract

Formal achievement data such as test scores and school performance feedback from standardised assessments can be a powerful tool for data-based decision making and school improvement. However, teachers' and school leaders' usage of these data is not necessarily straightforward or predictable. In order to illuminate how educational professionals engage with data in their daily practice, from their own subjective backgrounds and within their own contexts, data use researchers increasingly adopt a sensemaking perspective. Sensemaking, a theoretical construct grounded in psychological and organisational scholarship, offers a framework and a vocabulary to explain how cues such as educational output data are processed in real-life educational settings. As such, sensemaking research sheds light on reasons why educational professionals' use of these formal achievement data may deviate from normative expectations. The present study is a conceptual review of how sensemaking is conceived and applied in literature on educational professionals' use of formal achievement data. In total, 25 empirical and theoretical studies were selected and subjected to thematic analysis. Findings include that sensemaking is used as a lens to study data use, as well as a label for interpretive micro-processes of data analysis and interpretation, and that formal achievement data can be

regarded as sensemaking resources. An integrated conceptual framework on educational professionals' sensemaking of formal achievement data is presented, including a discussion of critical insights that may inspire future research on data-based decision making in education.

KEYWORDS

sensemaking, formal achievement data, data-based decision making, data use, standardised assessments

Context and implications

Rationale for this study

Formal achievement data can be used for school improvement. We need a deeper conceptual understanding of how teachers and school leaders make sense of such data in practice.

Why the new findings matter

By integrating existing conceptualisations and critical insights, our framework illuminates challenges and opportunities pertaining to educational professionals' sense making of formal achievement data.

Implications for educational researchers, policy makers and test developers

This study can serve as a reference for further research on teachers' and school leaders' data-based decision making, specifically with regard to how they make sense of formal achievement data. Keys and clues are provided as to why actual use of formal achievement data may diverge from data providers' intentions, and why real-life data use does not necessarily fit into normative theoretical molds. The kaleidoscopic nature of sense making reflects sensemakers' interpretive and social processes, and the way these processes interplay with the data themselves as well as the broader context.

INTRODUCTION

Educational professionals are increasingly expected to use data in order to inform, shape and strengthen school policy and instructional practice. A host of sources can and should serve data-based decision making (DBDM) in education, ranging from informal data such as classroom observations, over formal (i.e., systematically collected) data such as test scores and information about school composition, to research findings and big data (Mandinach & Schildkamp, 2021; Schildkamp, 2019). However, teachers and school leaders often struggle to effectively engage with these data. In the past decades, the DBDM research field has been unravelling data use dynamics in order to find ways to address those struggles. Still, in order

to truly empower educational professionals as data-based decision makers, a more thorough theoretical understanding is needed (Mandinach & Schildkamp, 2021; Schildkamp, 2019).

The present study contributes to the DBDM knowledge base by zooming in on educational professionals' engagement with formal data that provide insight into individual student outcomes and school performance—which we will henceforth refer to as 'formal achievement data' for short. We particularly want to inform the debate on affordances and challenges related to educational professionals' use of formal achievement data that hail from school-external systems and standardised testing. Well-known examples are state-level or national assessments such as those organised in the USA, and certification examinations such as the UK's GCSEs. However, output data offered by school performance feedback systems that are designated self-evaluation tools or that give achievement-based feedback to schools that participated in a research project also fall into this category (Coe & Visscher, 2002b; Schildkamp & Teddlie, 2008; Verhaeghe et al., 2015).

The formal achievement data provided by external assessments and feedback systems are generally regarded as a powerful resource for school improvement. The assumption is that educational professionals (teachers, school leaders, supporting staff) can and will use the data as a mirror in order to inform subsequent policy and instructional decisions (Coe & Visscher, 2002b; Hulpia & Valcke, 2004; Schildkamp & Teddlie, 2008). In practice, however, such data are often underused or misused (Coe & Visscher, 2002a) because of how stakeholders approach and engage with these data. Variability in data use can be contributed to a great extent to the way stakeholders understand, explain, position and value the data that they have at their disposal, and the way they determine a course of action based on what they take away from the data—for short: the way they *make sense* of the data.

Numerous sensemaking challenges have been identified in DBDM research. For instance, educational professionals may overly rely on their intuition when interpreting results and making decisions based on formal achievement data (Vanlommel et al., 2017; Vanlommel & Schildkamp, 2019) or lack the capacity to understand reports and turn data into actionable information (van der Kleij & Eggen, 2013; Mandinach & Gummer, 2016; Vanhoof et al., 2011). As a result, critical cues may not be picked up on, or worse, inaccurate or invalid inferences may lead to misguided decisions. Misuse or unintended use of formal achievement data can also be a result of conflated purposes, especially in situations where output data (also) serve to formally hold schools accountable for their outcomes in a high-stakes manner (Coe & Visscher, 2002a; Datnow & Park, 2018; Mandinach & Schildkamp, 2021; Vanhoof & Van Petegem, 2007). Furthermore, although advancements in the past decades have contributed to a growing availability of robust tools and data sources for schools, it has been found that educational professionals are at risk of 'drowning in data' (Mandinach & Schildkamp, 2021; Schildkamp et al., 2014). Effective data use requires substantiated prioritisation, interpretation and triangulation, which in turn require sophisticated knowledge and skills. However, it seems like the more snapshots educational professionals receive, the greater the risk of losing sight of the big picture.

In the interest of addressing these challenges and finding ways to support schools in data use for school improvement, DBDM researchers urgently call for more insight into real-life data use sensemaking mechanisms (Schildkamp, 2019). Consequently, sensemaking is gradually becoming a central theme in recent research on DBDM in education. Sensemaking perspectives provide a more human-centred outlook on data use than the technical-rational perspectives that underlie many theoretical models of DBDM. Those models are largely based on the assumptions that information borne in data is somehow set and unequivocal, and that the mere availability of data will enable educators to diagnose problems and guide them towards improvement (Datnow et al., 2012; Farrell & Marsh, 2016; Horn et al., 2015). Although such models provide a clear, normative framework and as such a vital baseline for studying data use in education, explanations for the fact that data use in reality is 'messy' (Bertrand & Marsh,

2015) need to be sought elsewhere. A sensemaking perspective accounts for the fact that stakeholders' personal lenses and their context strongly impact how data use takes shape. It acknowledges that DBDM is what happens when people of flesh and blood encounter data, deal with data, and decide how to move forward based on what they take away from these data (Coburn & Talbert, 2006; Datnow et al., 2012; Farrell & Marsh, 2016; Ikemoto & Marsh, 2007; Schildkamp, 2019; Spillane, 2012). A sensemaking perspective fits in with insights that data use in practice is not a linear or straightforward process (Ikemoto & Marsh, 2007; Mandinach & Gummer, 2016; Mandinach & Schildkamp, 2021) as one of its central tenets is that the meaning of data is not given but constructed by data users (Spillane, 2012).

Because sensemaking is essential in data use for school improvement, and more insight is needed into how users make sense of data in reality (Mandinach & Schildkamp, 2021; Schildkamp, 2019) we argue that further conceptual exploration of what sensemaking entails would benefit DBDM research. In research accounts on DBDM in education, much like in other areas such as organisational research, work on (human) sensemaking of (environmental) cues is currently proliferating. At the same time, usage of the term 'sensemaking' is diffuse and inspired by different theoretical paradigms. We therefore propose that the field needs to work towards an integrated conceptual framework. The present study contributes to this endeavour by taking stock of how different (DBDM) scholars interpret and apply the concept, and specifically by exploring how sensemaking is conceptualised in research on educational professionals' engagement with formal achievement data. We report on a 'systematically conducted conceptual review' (cf. Amundsen & Wilson, 2012, p. 91; Kennedy, 2007) that takes guidance from the following questions: How is sensemaking conceptualised in relation to teachers' and school leaders' sensemaking of formal achievement data? What are central components of sensemaking in this line of research? And (how) can existing insights be combined into an integrated framework for future scholarship?

In order to give direction to our own exploration of what sensemaking means in relation to educational professionals' engagement with formal achievement data, we first set the scene by exploring the theoretical roots of the sensemaking construct. Next, we present our methodological approach for searching and reviewing the literature teachers' and school leaders' sensemaking of formal achievement data. Subsequently, we present the results of this process by drafting an integrated conceptual framework based on the themes we have identified. We conclude with a discussion of how the present study contributes to the knowledge base, and a reflection on potential further advancements.

MAKING SENSE OF SENSEMAKING

Sensemaking is an abstract but semantically rich word in the English language. In scientific research, however, it is not a neutral term but a theoretical construct that is employed in specific ways. Before we set out to explore sensemaking with regard to educational professionals' engagement with formal achievement data, the theoretical framework presented in this section is needed to appreciate the complexity of the sensemaking phenomenon and to establish a sensemaking vocabulary. In the following paragraphs, we first briefly introduce a number of prominent takes on sensemaking. Subsequently we take a bird's-eye view to salient leitmotifs in sensemaking theory and research.

Sensemaking perspectives

The concept of sensemaking originates in cognitive and social psychology and features in numerous scholarly traditions. Sensemaking is generally characterised as a process people

engage in when they find something novel and/or unexpected on their path (Klein et al., 2007; Maitlis & Christianson, 2014; Weick, 1995). They figure out what this means to them, if they need to deal with it and in what way, and how to move forward (Klein et al., 2007; Weick et al., 2005). Throughout, the (social) context of the sensemaker and their prior experiences shape how this process unfolds (Weick, 1995; Weick et al., 2005).

Although there is common ground in conceptualisations, there is no one unified 'sensemaking theory' but rather a wide range of 'sensemaking perspectives' (Maitlis & Christianson, 2014; Sandberg & Tsoukas, 2015; Weick, 1995). In the past decades, such perspectives have particularly thrived in organisational literature (Maitlis & Christianson, 2014). Organisational work by Weick and colleagues (Weick, 1995; Weick et al., 2005) constitutes one of the most influential sensemaking perspectives to date. Another notable take hails from research on naturalistic decision making. Klein and colleagues developed the Data-Frame theory of sensemaking in order to (empirically) study sensemaking as a macro-cognitive process, that is, a set of mental activities that people perform in complex real-life situations (Klein et al., 2006, 2007, 2010). In educational research, the work of Spillane and Coburn on sensemaking may be considered canonical. Both authors apply a sensemaking perspective to educational policy implementation (e.g., Coburn, 2001, 2006; Spillane, Diamond, et al., 2002; Spillane, Reiser, et al., 2002), for instance in the case of instructional reform. Both Coburn and Spillane have also used their frameworks and insights to discuss data use or 'evidence use' as an aspect or materialisation of policy implementation (e.g., Coburn & Talbert, 2006; Coburn et al., 2009; Coburn & Turner, 2011; Spillane, 2012; Spillane & Miele, 2007). Whereas the work of Spillane and colleagues is geared more towards the cognitive aspects of sensemaking, the work of Coburn et al. is more focused on mechanisms of co-construction (Walls, 2017). Nevertheless, as is the case throughout the sensemaking literature, and given the very nature of sensemaking, interpretive and social or context-related aspects are intertwined in both bodies of work.

Sensemaking leitmotifs

Sensemaking begins with a sensemaker and is triggered by ambiguity

People engage in sensemaking when they encounter some sort of 'disruptive ambiguity' (Weick et al., 2005, p. 413), an interruption that makes them 'doubt [their] prior understanding' (Klein et al., 2007, p. 114). Sensemaking then means actively trying to figure out what this interruption means in light of what is known and believed. Small cues can trigger sensemaking just as well as larger cues and disruptions. In fact, in Weick's conceptualisation, people are continually shaping and enacting their own reality by making sense of cues, thereby creating 'a more ordered environment from which further cues can be drawn' (Maitlis & Christianson, 2014, p. 67). However, in order for sensemaking to take place, it is not sufficient that a novelty or a surprise is merely present. There has to be a sufficient sense of discrepancy between what one experiences and what one would have expected (Maitlis & Christianson, 2014; Weick, 1995; Weick et al., 2005).

The fact that sensemaking is 'prompted by violated expectations' (Maitlis & Christianson, 2014, p. 67) illustrates how sensemaking 'begins with a sensemaker' (Weick, 1995, p. 18). Cues or stimuli trigger sensemaking only when they are perceived as triggers. Personal lenses guide attention and determine what is noticed and bracketed as ambiguous (Klein et al., 2007; Maitlis & Christianson, 2014; Weick, 1995) and they also shape the further sensemaking process. Personal lenses explain why different people recognise and notice different things from one and the same event or issue (Klein et al., 2007). Thus, in terms of

DBDM, they explain why different data users might come to different conclusions and observations based on the same data or score set.

Klein and colleagues conceptualise these personal lenses as ‘frames’ that reflect ‘a person’s compiled experiences’ (Klein et al., 2007, p. 118) and serve as explanatory structures. Frames consist of knowledge structures (Attfield et al., 2018), such as schemata and mental models, that is, personal (causal) beliefs about and understanding of how the world works (Klein et al., 2007; Spillane & Miele, 2007). However, personal lenses can also refer to attitudes and interests. Values and goals determine whether a sensemaker is motivated to engage in sensemaking in the first place (Attfield et al., 2018). Furthermore, emotion fuels and shapes sensemaking. Sensemakers need to be ‘energised’ in order to engage in sensemaking (Maitlis et al., 2013). Conceptualising sensemaking as concerned with identity-construction, Weick finds that identity threat can be a particularly important trigger for sensemaking (Maitlis & Christianson, 2014; Weick, 1995).

Sensemaking is an active search for coherence, aimed at understanding and action

The idea of seeking fit between salient cues from the environment and personal pre-existing frames (Maitlis & Christianson, 2014; Weick, 1995; Weick et al., 2005) is a central tenet in sensemaking conceptualisations, also in the cognitivist work on sensemaking that preceded Weick’s advancements (e.g., Starbuck & Milliken, 1988). Klein et al.’s Data-Frame theory or Data-Frame model elaborates on this aspect, by characterising sensemaking as a ‘process of fitting data into a frame and fitting a frame around the data’ (Klein et al., 2007, p. 120) and by zooming in on the deliberate and iterative acts of framing and reframing (Klein et al., 2006, 2007). A central proposition is that data are never given, but always constructed. They are ‘the interpreted signals of events’ (Klein et al., 2007, p. 120).

Sensemaking scholars stress that sensemaking may be interpretive, but is not synonymous to interpretation, as it is more active, deliberate and creative (Maitlis & Christianson, 2014; Weick, 1995). In any case, simply connecting data to a frame based on recognition does not constitute sensemaking (Klein et al., 2007). Sensemaking is a process of constructing meaning, forming an understanding, attributing significance (Weick et al., 2005: ‘what’s the story?’), as well as formulating or taking action (Weick et al., 2005: ‘now what?’). Sensemaking can be purely explanatory, that is, aimed at abstract understanding (e.g., making a diagnosis, identifying a problem), and/or anticipatory, that is, aimed at functional understanding (e.g., preparing a scenario for preventing accidents) (Klein et al., 2007, 2010). Ultimately, sensemaking leads to some sort of change, in understanding or behaviour, in beliefs or in actions. In the context of DBDM, this duality is reflected, for instance, in that between conceptual and instrumental uses of data.

The Weickian perspective on sensemaking focuses on its retrospective nature (Weick, 1995), that is, explaining something that *has* occurred by comparing it to *prior* experience. Other accounts debate the prospective elements of sensemaking, precisely because it is aimed at formulating a future course of action (Maitlis & Christianson, 2014; Sandberg & Tsoukas, 2015). However, since it is ‘more likely to see sense that has already been made than to see the actual making of it’ (Weick, 1995, p. 49), Weick proposes that it makes sense to study sensemaking in relation to ‘prolonged puzzles’ in order to unravel what happens during the process (Weick, 1995, p. 49). Whereas Weick characterises sensemaking as an ongoing dynamic (Weick, 1995), with people continually making sense of their environment by seeking order in chaos, Klein’s take on sensemaking is more episodic. In Klein’s interpretation, sensemaking does have an endpoint. When a sensemaker arrives

at an understanding that they deem satisfactory, the process of framing and reframing ceases (Klein et al., 2007). Theorists nevertheless agree that sensemaking is a search for coherence, and not for an objective truth. The aim is to arrive at the feeling that one has found congruence: a sensible explanation from which to move forward (Klein et al., 2007; Weick, 1995).

Given that sensemaking is 'driven by plausibility rather than accuracy' (Weick, 1995), people will be motivated to move on once they feel they have built a satisfactory account. Based on this idea, Weick et al. (2005) propose that (organisational) sensemaking is, at least in part, a skill that can be developed. In order to grow and move forward, people need the drive and the confidence to act upon their interpretations. Furthermore, Klein et al. (2007) propose that expertise in sensemaking is not a question of more sophisticated reasoning, but of having a richer and more elaborate 'repertoire of frames' than novices. Given that frames change over time as people gather or encounter more data (Klein et al., 2006), sensemaking can be 'developed through experience and learning through reflection' (Kahneman & Klein, 2009, as interpreted by Cook & Gregory, 2020, p. 11). In any case, sensemaking is not straightforward and can be biased. As people seek fit between cues and frames, it may be hard to determine which frame is the 'right' one to explain what is going on. People are inclined to frame new information within what is familiar or expected, and what resonates with them in terms of values and norms (Klein et al., 2007; Spillane, Reiser, et al., 2002; Starbuck & Milliken, 1988).

Sensemaking is individual as well as social, cognitive as well as discursive

Regarding the 'ontology of sensemaking', Maitlis and Christianson (2014) point out that it can be studied as something that occurs 'in people's heads' as well as 'in conversations between people'. So, sensemaking is not only a matter of cognition but also of language and discourse. Language is a primary locus of sensemaking, particularly in the Weickian perspective. Here, sensemaking is seen as putting comprehension into words: people draft narrative accounts that enables them to rationalise what they are thinking and doing (Weick et al., 2005). It is constructing and revising a plausible story in which the central questions are what is going on and what to do next (Weick et al., 2005). By emphasising the discursive nature of (organisational) sensemaking, Weick is credited for placing the sensemaking concept into a social constructivist paradigm (Maitlis & Christianson, 2014; Sandberg & Tsoukas, 2015). Consequently, the Weickian perspective devotes a lot of attention to inter-subjectivity and sensegiving mechanisms that act as a precursor to sensemaking (Maitlis & Christianson, 2014; Sandberg & Tsoukas, 2015; Weick, 1995). However, as Weick (1995, p. 40) points out, 'even monologues and one-way communications presume an audience'.

Regardless of whether sensemaking is studied at the individual, interpretive level, or at the collective level—for example, in team settings—it is always acknowledged to be a situated and social phenomenon. People derive their identities from social groups they belong to, and every individual has a 'parliament of selves' (Mead, 1934, as quoted in Weick, 1995, p. 18). Both individuals and organisations or other types of groupings have histories that shape their beliefs, values, norms and expectations (Spillane, Reiser, et al., 2002). Consequently, cognitive frames can be situated as well (Spillane, Reiser, et al., 2002). Such frames can be general or specific (Sandberg & Tsoukas, 2015). The former refer to frames grounded in sociocultural templates such as corporate/industrial or regional/national, or in ideologies, for instance gender or politics. The latter refer to tacit knowledge and internalised theories of action. Furthermore, sense is always made *in situ* (Spillane, 2012; Spillane & Miele, 2007). This means that formal and informal routines and tools shape sensemaking interactions between people (Spillane, 2012; Spillane & Miele, 2007). It also means that people negotiate

meaning in such interactions, that they co-construct accounts and narratives, and that the nature of interactions determine how sensemaking unfolds. Work roles, leadership, and (organisational) (sub)cultures play a part in shaping sensemaking, as do institutional and political forces, authority relationships and mechanisms of problem framing (Coburn, 2001, 2006; Coburn & Talbert, 2006; Coburn et al., 2009; Spillane, Diamond, et al., 2002).

METHODOLOGY

Guided by three methodological frameworks (conceptual reviews, scoping studies and theoretical reviews), we conducted a systematic query of two research databases in pursuit of studies that would help us understand educational professionals' engagement with formal achievement data from a sensemaking perspective. We performed a thematic analysis on the selected studies. In the following paragraphs, we discuss the different steps we undertook in more detail. We end this section by giving an overview of the selected studies.

General approach

Our primary goal was to take stock of how sensemaking is conceptualised and applied in studies on educational professionals' engagement with formal achievement data. We did not set out to answer a narrowed down, empirical research question in order to find evidence for causes and effects for a specific phenomenon. We rather envisioned a fluid yet methodical exercise in mapping out what is of interest to our research field. Therefore, we found a conceptual review (Kennedy, 2007) to be best suited to our purposes. Contrary to a traditional systematic review, a conceptual review has some 'flexibility to address the complexity of the substantive issues we care about' (Kennedy, 2007, p. 146). It allows to refine and extend guiding questions in the course of the review process. Moreover, it also accommodates the application of rigour and transparency to the database search, the study selection and the analyses.

Kennedy's (2007) broad distinction between systematic and conceptual reviews was useful to articulate our epistemological outlook, but we also turned to other frameworks and typologies for further methodological guidance. In terms of approach we position our review as a scoping study. Like systematic reviews, scoping studies or scoping reviews follow 'a structured process' but instead of exploring a delineated empirical research question they aim 'to identify knowledge gaps, scope a body of literature, clarify concepts or to investigate research conduct' (Munn et al., 2018, p. 1). Scoping studies are descriptive and do not necessarily include a critical appraisal of the quality of the included literature (Arksey & O'Malley, 2005). Furthermore, our research aim—to map and possibly integrate current conceptualisations of sensemaking in a specific context—corresponds to that of a theoretical review, as we intended to '[draw] on existing conceptual and empirical studies to provide a context for identifying, describing, and transforming into a higher order of theoretical structure and various concepts, constructs or relationships' (Paré et al., 2015, p. 188).

Database query

The Web of Science (WoS) and ERIC databases were queried in July 2020. As listed in Table 1, we used Boolean operators to combine search terms referring to (1) sensemaking or sensegiving; (2) outcome measures; and (3) educational professionals. We allowed these terms to be present in all search fields. We also repeated the query with search terms referring to DBDM at the second position, but this only yielded one additional reference. The ERIC search query

TABLE 1 Database queries

Database query	Search term combination
1	<i>sensemak* OR sense-mak* OR sensegiv* OR sense-giv*</i> AND <i>data* OR output OR outcome OR score OR feedback OR performance OR</i> <i>assess* OR evaluat*</i> AND <i>edu* school* OR teacher OR principal</i>
2	<i>sensemak* OR sense-mak* OR sensegiv* OR sense-giv*</i> AND <i>data use OR data-based OR data-driven OR data-informed</i> AND <i>edu* school* OR teacher OR principal</i>

was filtered to include peer reviewed sources only, a prerequisite fulfilled by default in WoS. The systematic database query yielded 1426 unique records that were put into a spreadsheet.

Study selection

The selection process comprised four phases. The first one involved comprehensive coding of all 1426 titles and abstracts. During this first phase, a review diary was also kept in which themes for further exploration and striking quotes were noted. This phase allowed us to grasp the breadth of application of the sensemaking construct, yet served primarily to assess the records' eligibility for inclusion. We were specifically in pursuit of theoretical and empirical studies that discuss teachers' and school leaders' engagement with student achievement or school performance data, and use the term 'sensemaking' to refer to this process or phenomenon. Sensemaking did not need to be the (sole) focus of the paper in order for it to be included. Moreover, as our aim was a broad conceptual exploration, we did not a priori exclude papers based on whether they referred to a specific theoretical sense-making paradigm or used 'sensemaking' simply as a descriptive label.

We assigned each record one or more open codes to describe its scope or main focus, and a code for the research methodology employed. Where possible and relevant, we also assigned in vivo thematic codes describing how sensemaking was defined in the study, or what aspects of or perspectives on sensemaking were particularly salient (examples of such codes are *intersubjectivity*, *Weick*, *sociocultural*). In line with our baseline inclusion criteria, we also coded the records for whether or not they pertained to research in an educational setting, and if so, which level. Furthermore, where possible, we coded for the sensemaking actor (examples include *health professionals*, *business executives*, and in educational studies, *students*, *district leaders*, *principals*, *pre-service teachers*). Based on these codes we assigned each record a preliminary mark for inclusion. In total, 114 records were marked for further review.

In a second phase, we reread all 114 abstracts that had received a preliminary mark. This second reading served for further refinement. Studies or papers in which (based upon more thorough review) the sensemaking actor was clearly not an educational professional in a K-12 school context were, for instance, excluded. The same holds for studies in which the object of sensemaking was policy implementation, rather than performance or achievement data. In a small number of cases we diverged from these criteria when we felt the paper in question provided relevant insights needed to enrich our understanding of sensemaking in educational DBDM. At the end of the second phase, our selection was narrowed down to 28 records.

In a third phase, the full text papers of the 28 selected records were read and reviewed. Again, we critically assessed the studies for sensemaking object and actor, as we further refined our selection. Papers with a policy orientation, papers situated more at the district levels, and papers that discussed accountability pressures in general, were only retained if deemed crucial to inform our understanding of the way sensemaking perspectives are employed in data use research in a K-12 context. In total, 20 papers were retained from the database query.

As a sensemaking perspective is on the rise in DBDM research, so are DBDM studies specifically discussing, or at least mentioning sensemaking. Therefore, in a fourth and final phase we included five recent papers that had not been returned by the database query, yet provided insights on sensemaking themes directly relevant to our research aim, and that fit in well with the selection we were making. These papers were available as advance online copies of articles to be published in 2021 in *School Effectiveness and School Improvement* and the 2021 special issue on DBDM of *Studies in Educational Evaluation*. These additions bring the total to 25 papers, as listed in order of publication date in Table 2.

Analysis

The selected papers were ordered into a matrix that would allow for both horizontal and vertical analyses of recurring themes (Miles et al., 2014). As our aim was indeed to identify themes and patterns, and as we acknowledged our own active role in this process, we used a thematic analysis approach (Braun & Clarke, 2006). A combination of charting the data and subsequently performing thematic analysis is considered suitable for the purposes of scoping studies (Levac et al., 2010). The approach facilitates the production of a narrative account, and it allows or even forces the researcher 'to prioritize certain aspects of the literature' throughout the analysis process (Arksey & O'Malley, 2005, p. 28). Charting and coding were primarily guided by the leitmotifs identified in the theoretical framework (cf. supra) and the thematic clusters that served to group the selected papers (cf. infra). These clusters were connected to (and based on) underlying dimensions of sensemaking (micro) processes, actors, locus, outcomes and triggers.

Overview of the selected papers

Type and scope

As indicated in Table 2, 15 out of the 25 selected papers are qualitative studies. For the most part these are (comparative) case studies, sometimes longitudinal, that offer in-depth insight in sensemaking processes in schools, teams or individuals. For some studies, participants had been purposefully selected because their schools are known to face specific challenges, or, on the contrary, because they can be regarded as good-practice schools, or because they were already participating in an intervention. One other empirical paper discusses a mixed-methods study, in which log data from a computer data system were analysed to capture data use patterns (Farley-Ripple et al., 2021). The remaining nine papers are theoretical in nature, some with illustrations based on qualitative data from prior research.

Table 2 includes a short description capturing the general scope of each paper. Achievement or performance data is an object of sensemaking in all the selected papers, but not always the sole object. Some of the papers, for instance, address DBDM in a broader sense, also including use of informal data such as classroom observations. The subject

TABLE 2 Selected studies

Reference	Selection	Source	Type	Short description	Cluster
Even (2005)	DB Query	<i>Mathematics Education Research Journal</i>	Theoretical	Problem analysis of mathematics teachers' use of contemporary assessment approaches and techniques	A
Knight and Yorke (2008)	DB Query	<i>International Journal of Educational Research</i>	Theoretical	(High-stakes) assessment and (public and formal) reporting practices about achievement are 'contexted acts of sense-making about fluxional social practices'	C
Coburn et al. (2009)	DB Query	<i>Teachers College Record</i>	Qualitative	The unfolding of evidence use (decision trajectories) at the district level	B
Coburn and Turner (2011)	DB Query	<i>Measurement: Interdisciplinary Research & Perspective</i>	Theoretical	Data use involves interpretive processes, social and organisational conditions, and politics	B
Cosner (2011)	DB Query	<i>Educational Management Administration and Leadership</i>	Qualitative	Development of teacher knowledge and instructional considerations through data-based collaboration as part of a literacy instructional reform; the influence of principal communication (as a sensegiving mechanism) on teams' sensemaking of standardised student literacy assessment (and other) data	B
Spillane (2012)	DB Query	<i>American Journal of Education</i>	Theoretical	Conceptual and analytical tools for studying data in practice	B
Datnow et al. (2012)	DB Query	<i>Journal of Education for Students Placed at Risk</i>	Qualitative	High school teachers' understanding and implementation of data use to improve instruction	B
Jennings (2012)	DB Query	<i>Teachers College Record</i>	Theoretical	Features of accountability systems influence data use but this influence is mediated by individual and organisational characteristics	B
Park et al. (2013)	DB Query	<i>Educational Policy</i>	Qualitative	Strategic framing by formal leaders (at the local level) mediates the implementation of data-driven decision making	B
Cho and Wayman (2014)	DB Query	<i>Teachers College Record</i>	Qualitative	Role of sensemaking in data system implementation	C

(Continues)

TABLE 2 (Continued)

Reference	Selection	Source	Type	Short description	Cluster
Bertrand and Marsh (2015)	DB Query	<i>American Educational Research Journal</i>	Qualitative	Middle school teachers' sensemaking of student outcome data (with a focus on English language learners and special education students)	A
Sellar (2015)	DB Query	<i>Critical Studies in Education</i>	Theoretical	Relationship between commensuration/datafication and affect	C
Christman et al. (2016)	DB Query	<i>Teachers College Record</i>	Qualitative	One primary school teacher's sensemaking of instructional and assessment data in the context of a PLC (professional learning community) intervention on mathematics, resulting instructional changes	A
Farrell and Marsh (2016)	DB Query	<i>Educational Administration Quarterly</i>	Qualitative	Properties and perceptions of data shape teacher sensemaking of data and instructional responses	C
Wardrip and Herman (2018)	DB Query	<i>Teacher Development</i>	Qualitative	Teachers' collaborative sensemaking of student data, drawing upon informal data	A
Schildkamp (2019)	DB Query	<i>Educational Research</i>	Theoretical	Iterative model of school improvement in which data use (with sensemaking as a central phase) plays an important role	A
Vanlommel and Schildkamp (2019)	DB Query	<i>American Educational Research Journal</i>	Qualitative	Primary school teachers' high-stakes decision making: intuition versus rationality	A
Snodgrass Rangel et al. (2019)	DB Query	<i>Education and Urban Society</i>	Qualitative	Science teachers decide how to use data (and decide which data to use) based on policies and expectations, which they balance with their own understanding of science education	B
Falabella (2020)	DB Query	<i>Journal of Education Policy</i>	Qualitative	Enactment (not mere implementation) of accountability policy including school members' sensemaking of outcome data	B
Sutherland (2020)	DB Query	<i>Educational Policy</i>	Qualitative	Local stakeholders' interpretation and implementation of accountability policies	B

TABLE 2 (Continued)

Reference	Selection	Source	Type	Short description	Cluster
Farley-Ripple et al. (2021)	* Added	<i>School Effectiveness and School Improvement</i>	Mixed methods	Assessment systems (information systems) and their features mediate educators' sensemaking i.e. knowledge creation and deciding on actions	C
Mandinach and Schildkamp (2021)	* Added	<i>Studies in Educational Evaluation</i>	Theoretical	Commentary paper that addresses misconceptions regarding data-based decision making (research)	A
Vanlommel et al. (2021)	* Added	<i>Studies in Educational Evaluation</i>	Qualitative	Primary school teachers' high-stakes decision making process from a dual process perspective	A
Fjørtoft and Lai (2021)	* Added	<i>Studies in Educational Evaluation</i>	Theoretical	Narrative and numerical data have different modal affordances (sensemaking resources)	C
Lasater et al. (2021)	* Added	<i>Studies in Educational Evaluation</i>	Qualitative	Organisational aspects of data use influence sensemaking of data and may induce deficit thinking in educational professionals	B

matter to which the data pertain (mathematics, science, language, arts) varies over those studies that explicitly mention it because it is relevant and where there was a specific focus in the first place. In studies about grade level sensemaking in primary schools, for instance, a distinction is not always made. The sensemaking actors involved or discussed in the research are mainly teachers, and school leaders and (other) administrators (e.g., district leaders) to a smaller extent. The theoretical papers by Knight and Yorke (2008) and Sellar (2015) somewhat stand out from the selection in the sense that they are not typical DBDM-studies and do not (specifically) address achievement data in K-12 contexts. They were included because they discuss datafication in education.

Thematic clusters

Based on patterns observed during analysis, we grouped the 25 selected papers into three thematic clusters. A first group of papers, marked as cluster A in Table 2, discuss the (micro)process of sensemaking, that is, sensemaking as a phase in the DBDM cycle of turning raw data into actionable knowledge. Overall, these papers tend to zoom in on the interpretive nature of sensemaking, attending to processes such as attribution and the role of intuition and pre-existing mental models. Some of these papers address how collaborative data use contributes to individual meaning making by making cognitive processes explicit.

A second group of papers (cluster B) apply a sensemaking perspective to data use in schools. They generally attend to both the cognitive/interpretive and social/situated dimensions of sensemaking. They do so by describing how interpretive processes are shaped by individual teachers' and school leaders' knowledge and beliefs, but also by social interactions and by contextual factors, and how sensemaking can be a question of power and politics. Overall, use of achievement data tends to be approached as an instance of policy enactment here. Consequently, a number of papers in this cluster take a closer look at local reception and interpretation of policy messages. Together, the papers in this cluster provide insight into the interplay of individual and collective sensemaking (sensemaking actors), the interplay of cognition and language (as the locus of sensemaking), and factors that potentially contribute to (un)desirable outcomes of data use.

A third and final group of papers (cluster C) looks at data (systems) as sensemaking resources, that is, as triggers and tools for sensemaking. These papers discuss (interpretive) processes and responses associated with different types of data and representational qualities of data, and the 'interpretive flexibility' of data use technology.

Theoretical underpinnings

When referring to 'sensemaking theory', a number of authors refer at least cursorily to the seminal Weickian perspective on sensemaking. Furthermore, applied and conceptual work by Coburn and Spillane on policy enactment features as a source in a majority of the selected papers. In this particular selection, Vanlommel and colleagues (2021; 2019) are chronologically the first to explicitly link to Klein's Data-Frame theory. A number of papers also build on other sensemaking interpretations, for instance from the information systems literature (e.g., Cho & Wayman, 2014; Sellar, 2015), or do not explicitly refer to a sensemaking paradigm at all but use the term descriptively (Even, 2005; Falabella, 2020; Knight & Yorke, 2008).

Sensemaking perspectives are combined with insights from other psychological scholarship such as attribution theory, self-affirmation theory, heuristics and affect theory, and from

organisational studies, for example, organisational learning, organisational decision making, naturalistic decision making. Furthermore, co-construction paradigms, situative theory and political theory serve to study sensemaking as it comes about in interaction and in daily practice, while social semiotics serves to shed light on modal affordances of data.

TEACHERS' AND SCHOOL LEADERS' SENSEMAKING OF FORMAL ACHIEVEMENT DATA: TOWARDS AN INTEGRATED CONCEPTUAL FRAMEWORK

In this section we bring together conceptualisations and insights drawn from the review, with the aim to get a better and more integrated grasp of what educational professionals' sensemaking of formal achievement data entails. The themes we identified during analysis serve to structure our discussion of our findings. First, we reflect on the place of sensemaking in data use models, and next we zoom in on the interpretive nature of sensemaking (micro) processes. Subsequently, we consider individual and collective aspects of educational professionals' sensemaking of formal achievement data, and the way sensemaking processes interplay with sensemakers' contexts. Finally, we shift our attention to the data and data systems themselves. The 'vocabulary' drawn from our general theoretical framework serves to discuss these various themes and components.

Sensemaking is regarded as a core aspect of DBDM

Sensemaking is a phase in data use cycle

Sensemaking is a prominent phase in contemporary theories of action on data use, such as Schildkamp's (2019) iterative model of DBDM for school improvement. This model is based on the premise that school improvement endeavours start with educational professionals formulating improvement goals. Subsequently they collect or access different types of data, and *make sense* of those data in order to gauge or monitor whether they are achieving the goals. The aim is to be able to formulate and follow up on decisions and actions that will help them (further) realise the goals (Mandinach & Schildkamp, 2021; Schildkamp, 2019). The essence of sensemaking in this cyclical and iterative process is figuring out what data mean in relation to the goals (Mandinach & Schildkamp, 2021; Schildkamp, 2019). Which problems do the data bring to the surface (why are certain goals not met)? How can those problems be explained (where are the gaps)? And, how should one proceed from there in order to realise the goals (how can gaps be closed)? Sensemaking is characterised in this view as a complex problem-solving process (Wardrip & Herman, 2018) involving problem definition, diagnosis and judgement (Coburn et al., 2009; Coburn & Turner, 2011; Datnow et al., 2012; Vanlommel et al., 2021; Vanlommel & Schildkamp, 2019).

What raw data mean is not given but constructed

Sensemaking is seen as a crucial phase in the data use cycle, because data simply do not tell a story by themselves. What raw data mean, and specifically what they mean in relation to goals, is not given: answering the aforementioned questions is rarely self-evident (Mandinach & Schildkamp, 2021; Schildkamp, 2019). Pinpointing problems, hypothesising about causes, and designing solutions, requires educational professionals to actively 'check' a number of things. What do they infer from the data? How does this information fit in

with what they already know, understand and assume about their pupils and their organisation? How does it fit in what they have learnt throughout time about learning and instruction, about educational practice and policy? In other words, making sense of data means looking at those data through the lens of individual and local knowledge, prior experience and professional expertise (Mandinach & Schildkamp, 2021; Schildkamp, 2019). The outcomes of ongoing sensemaking in daily practice, but also the way consecutive and concurrent sensemaking processes unfold, shape individual and organisational thinking. Consequently, it shapes the implementation of change (or preservation) in teacher practice, school policy, and ultimately student learning (Coburn & Turner, 2011; Datnow et al., 2012; Spillane, 2012).

Sensemaking involves interpretive processes

Sensemaking is fundamentally interpretive

Educational professionals' sensemaking of (achievement) data is fundamentally interpretive (Bertrand & Marsh, 2015; Coburn et al., 2009; Coburn & Turner, 2011; Farrell & Marsh, 2016; Vanlommel & Schildkamp, 2019; Wardrip & Herman, 2018). It comprises different steps and interrelated micro-operations, of which we find different characterisations in the reviewed papers. Some authors (implicitly or explicitly) focus on the deliberate nature of sensemaking and the skills needed to 'effectively' make sense of data—effective in the sense that sensemaking and decision-making will result in school improvement. They do so by making a broad distinction between data analysis on the one hand and interpretation on the other hand, that is, being able to read and understand the data, and being able to make valid inferences based on the data (Mandinach & Schildkamp, 2021; Schildkamp, 2019; Vanlommel & Schildkamp, 2019). Authors following this line of thought (e.g., Schildkamp, 2019) explicitly apply the global label of sensemaking to operations unravelled in more detail in data use frameworks put forward by authors such as Marsh et al. (2006), Mandinach et al. (2008), Marsh (2012) and Schildkamp and Poortman (2015). Those models tend to be rooted in a waterfall logic of turning data into information into actionable knowledge, through micro-operations, such as data organisation, analysis and synthesis. However, we also find characterisations of the interpretive sensemaking steps that lean more towards what occurs naturally and automatically (at least to some extent) when people process what they encounter in their environment. Coburn and Turner (2011), for instance, distinguish between phases of 'noticing', 'making meaning', and 'constructing implications'. This classification is in concordance with 'sensemaking moves' as described in organisational sensemaking literature: sensemaking being triggered by an ambiguous issue or event, people constructing an understanding of this issue or event, and them taking action (Maitlis & Christianson, 2014).

Together, in terms of steps and micro-operations, the studies address a number of questions that educational professionals might ask themselves when making sense of test scores and other types of (achievement) data. Examples of questions include: Which aspects of performance have been captured in the presented measure and what is an appropriate way to analyse the symbolic representations of those measures (Fjørtoft & Lai, 2021; Mandinach & Schildkamp, 2021; Spillane, 2012)? Which valence do I attach to this result, that is, am I satisfied or not (Coburn & Turner, 2011)? What could have contributed to this result (Bertrand & Marsh, 2015; Lasater et al., 2021)? Should I (should we) respond and if so, in what manner (Coburn & Turner, 2011)? While it is possible and necessary to distinguish and study different sensemaking steps and micro-operations, sensemaking is not a demarcated process in reality. It is fluid and complex and therefore difficult to fit into a prescription.

Sensemaking is a product of individual lenses

As established, sensemaking does not start with data (external cues or stimuli), but with a sensemaker. Since data need to be processed by human beings in order to convey meaning, and meaning is a subjective construction instead of an objective truth, personal lenses inevitably act as filters. As Even (2005) puts it, instructional decision making involves ‘hearing through’: teachers will use their own knowledge, beliefs and dispositions—their ‘personal and social resources’—to interpret student outcomes. This entails that data can come to mean different things to different people (Schildkamp, 2019). Also, when personal and social resources are limited or overemphasised, this can problematise sensemaking (Even, 2005).

Sensemaking requires human capacity

Sensemaking involves competence and capacity (Mandinach & Schildkamp, 2021; Schildkamp, 2019). In order to go through the sensemaking motions in a meaningful way (e.g., being able to analyse data appropriately, sift through and prioritise information, recognise and articulate problems, formulate workable improvement actions), educational professionals need competence and a certain degree of expertise (Mandinach & Schildkamp, 2021; Schildkamp, 2019). This idea is closely related to contemporary and wide-spanning conceptualisations of data literacy (see, for instance, Beck & Nunnaley, 2021; Mandinach & Gummer, 2016) which acknowledge that data literacy is multi-layered. Data literacy comprises knowledge and skills pertaining to appropriate data analysis, but also, for instance, to learning and instruction and subject matter. Besides knowledge and skills, human capacity for sensemaking also has an attitudinal dimension in terms of confidence, safety and motivation (Coburn & Turner, 2011; Even, 2005; Mandinach & Schildkamp, 2021; Schildkamp, 2019). Educational professionals need to be able to feel they can overcome potential struggles in interpreting data (Mandinach & Schildkamp, 2021; Schildkamp, 2019), that they can use data in a healthy and safe professional environment (Falabella, 2020; Lasater et al., 2021) and that data use is geared towards their own values and those of their organisation (Schildkamp, 2019). Sensemaking can also trigger affective, emotional responses that serve as either an impediment or as a springboard into action (Falabella, 2020; Sellar, 2015).

Personal beliefs and assumptions shape sensemaking

The interpretive nature of sensemaking and the fact that sensemakers’ feelings, attitudes and motivation guide how their sensemaking unfolds, point to the impact of personal beliefs and assumptions (Coburn & Turner, 2011; Schildkamp, 2019). Several studies describe how new information is assessed, coded and used by fitting it in with their own cognitive frameworks or mental models (e.g., Bertrand & Marsh, 2015; Spillane, 2012; Vanlommel et al., 2021; also see earlier work by Spillane & Miele, 2007). A wide range of beliefs and epistemological stances is addressed in the literature. These include beliefs about students, learning and instruction, and assessment (e.g., Bertrand & Marsh, 2015; Lasater et al., 2021), about the nature, utility, relevance and validity of (certain types of) data (e.g., Bertrand & Marsh, 2015; Coburn & Turner, 2011; Farrell & Marsh, 2016; Jennings, 2012; Wardrip & Herman, 2018), but also about data use and data-based inquiry in general (e.g., Cho & Wayman, 2014; Datnow et al., 2012, but also see Jimerson, 2014).

Educational professionals' beliefs are intertwined with the end to which achievement data are ultimately used. Data can be used in order to determine 'how teachers view their schools, students, and themselves ([when test data used as a] lens); how they determine what's working, what's going wrong, and why ([tool for]diagnosis); what they should do in response (compass); how they establish whether it worked (monitoring); and how they justify decisions to themselves or to others (legitimizers)' (Jennings, 2012, p. 4). On a micro-level, filtering through personal beliefs and assumptions occurs even in the nuclear stages of sense-making. People tend to notice and select those cues that accord with their prior experiences and assumptions (Coburn & Turner, 2011; Spillane, 2012). A recognition-primed paradigm describes how people take those familiar elements in order to form quick explanations and conclusions, disregarding potential ambiguity, without thoroughly and truly making sense of data (Klein et al., 2007; Vanlommel et al., 2021). Building on prior sensemaking research (e.g., Coburn & Turner, 2011; Datnow et al., 2012; Spillane & Miele, 2007), Bertrand and Marsh (2015) empirically illustrate how teachers' mental models, that is, their implicit or explicit beliefs about causality, guide attributions of student achievement data and subsequent decision-making. In line with attribution theory, the authors find that the nature of causal inferences influences teachers' motivation to make subsequent changes or improvements (Bertrand & Marsh, 2015). In this respect, they particularly zoom in on the levels of control and malleability associated with perceived causes of outcomes: are scores perceived as the product of instruction, of student understanding, of the nature of the test, or of student background characteristics?

Sensemaking is rooted in identity-construction

The essence of achievement data is to get a picture of how individuals or teams do compared to standards, to others, or to prior performance (the classic typology of criterion-, norm- and self-referenced feedback). Interpreting such data, inherently involves evaluation and judgement. Did we (did you, did they) do well or not, and who is responsible? This can be uncomfortable when the proposed answers to these questions challenge one's self-image and/or self-efficacy, or when the conclusion is undesirable. Sometimes, such friction will increase people's motivation to thoroughly process the information (Coburn & Turner, 2011, referring to Spillane, Reiser, et al., 2002) and get to work on achieving their goals. Typically, however, people have a tendency to dismiss or downplay undesirable information out of self-preservation. This is when mechanisms of confirmation bias and self-affirmation bias come into play (Lasater et al., 2021; Vanlommel & Schildkamp, 2019; Coburn & Turner, 2011, referring to Spillane, Reiser, et al., 2002). Sensemaking of data 'prompts a constant re-examination of identity, and people are naturally inclined to try and validate their pre-existing beliefs and preserve their identity (Lasater et al., 2021).

Sensemaking is not necessarily a rational affair

(Over)reliance on pre-existing assumptions thus explains to a certain extent why sensemaking of data is not necessarily a rational affair (Mandinach & Schildkamp, 2021; Schildkamp, 2019), even when those data have been collected deliberately and systematically. When making inferences and judgements, educational professionals—like other decision makers—are inclined to use mental shortcuts and rely on their intuition (Mandinach & Schildkamp, 2021 and Schildkamp, 2019, referring to Bertrand & Marsh, 2015; Kahneman & Frederick, 2005; Vanlommel et al., 2017). Vanlommel and colleagues enlighten how data use, and particularly teachers' construction of 'interpretive arguments' in high-stakes DBDM, involves dual

processing (Vanlommel et al., 2021). They find that teachers sometimes base conclusions on personal criteria and quick-fire 'judgmental heuristics', instead of considering multiple data sources and evaluating competing explanations (Vanlommel & Schildkamp, 2019).

Intuitive expertise (as described in DBDM research but also by authors on naturalistic decision making such as Kahneman and Klein) has its merits and has even been put on a pedestal in educational decision making for years (Vanlommel et al., 2021). Nevertheless, a critical stance is required. After all, sensemaking can lead to incorrect readings, invalid inferences or biased decisions when personal lenses become blinders. Consciously or unconsciously favouring certain types of data or conjectures that validate one's prior views and assumptions, blocks alternative explanations and incongruent information from vision (Mandinach & Schildkamp, 2021; Schildkamp, 2019; Vanlommel et al., 2021; Vanlommel & Schildkamp, 2019).

Sensemaking is a collective endeavour

Collective sensemaking entails meaning negotiation and co-construction

In a school improvement logic, it is generally considered paramount for educational professionals (in different roles) to collectively make sense of data (Mandinach & Schildkamp, 2021; Schildkamp, 2019). Collective sensemaking, for instance in data discussions, broadens the lens through which data are interpreted and problems are framed, provokes debate, and yields new insights, both on an individual and on a shared level. It also entails meaning negotiation and the co-construction of frames and narratives (Coburn & Turner, 2011; Datnow et al., 2012; Park et al., 2013; Spillane, 2012). Interacting with colleagues and coaches, and participating in professional learning communities with peers and/or facilitators can enhance sensemaking because voicing inferences helps to surface and highlight beliefs and affectivities, as well as ambiguities and 'intuitive pitfalls' (Bertrand & Marsh, 2015; Christman et al., 2016; Even, 2005; Vanlommel & Schildkamp, 2019). Educational professionals' individual sensemaking may benefit from training and coaching concerning both the 'mechanics of data use' and ways of translating insights into daily practice (Coburn & Turner, 2011).

Collective sensemaking takes shape in routines

Coburn and Turner (2011) and Spillane (2012) discuss the dynamics and affordances of (organisational) data use routines in practice: educational professionals' day-to-day interactions with data and with each other. Data use routines, both formalised routines and more informal interactions, give direction to sensemaking as they bring 'a particular configuration of people together around a particular set of data and structure their interactions in specific ways' (Coburn & Turner, 2011, p. 181). Consequently, the interpretations made in data interactions are greatly influenced (a) by the participants involved (which prior experiences, views, interests do they bring to the table?); (b) by the data they use as a starting point (what data are seen as valuable and informative by participants, which data can participants bring in to help with contextualisation?); and (c) by the dynamics of these interactions (whose voice is heard, which observations do they make, and who wields the proverbial gavel?) (Coburn & Turner, 2011).

In terms of participants, individual sensemakers have different positions within a school or system, paired with different vantage points and interests. This enriches the dialogue but can also provoke debate. Moreover, relationships of power and authority, which are often derived from formal roles and structures within an organisation or a system, impact the

influence specific individual actors can exert in meaning negotiation (Coburn & Turner, 2011; Spillane, 2012). Furthermore, data interactions, conversations and routines often focus on specific types of data (Coburn & Turner, 2011). For instance, in a study of teacher discussions in grade-level teams, Wardrip and Herman (2018) find that standardised test scores tend to initiate such conversations, but that educational professionals also use a host of other sources, including informal ones such as observations from daily practice, to explain and contextualise those scores. This points to the importance of knowledge management in schools. The fact that teachers interpret achievement data using a host of other data, as well as their own intuition, is expanded upon as well by authors such as Datnow et al. (2012).

Finally, the mechanisms of data interactions pertain to reasoning and negotiating (Wardrip & Herman, 2018) and can introduce new levels of ambiguity and friction. Christman et al. (2016) use a situative theory perspective, which characterises instructional growth as a form of learning-by-doing and focuses on the interplay of individual cognitive processes and dynamics of co-construction. They find that collective sensemaking of teaching practice and student outcomes in professional learning communities can stimulate productive dissonance. Articulating individual sensemaking and personal views in collegial discussions, deliberations and recurring feedback cycles provokes cognitive conflict (Cobb et al., 1990, as cited by Christman et al., 2016) as new information sometimes challenges prevailing assumptions and practices. When participants commit to taking up this new information to weigh up and potentially revise their held beliefs, instead of simply dismissing it, the experienced dissonance becomes productive. This allows teachers to grow in their reasoning and in their pedagogical expertise and produces instructional change and improvement (Christman et al., 2016).

Sensemaking is embedded in a social and organisational context

Interpretive sensemaking processes are shaped by the social environment of the sensemaker

Making sense of data does not happen in isolation (Mandinach & Schildkamp, 2021). Interpretive sensemaking processes shape and are shaped by the social and contextual surroundings of the sensemaker(s) (Coburn et al., 2009; Coburn & Turner, 2011; Lasater et al., 2021; Spillane, 2012). In order to get a sense of how sensemaking unfolds, both on an individual and on a collective level, and how it contributes to school improvement, it needs to be studied as it takes place in day-to-day practice (Datnow et al., 2012; Spillane, 2012), embedded in a specific organisational and political context (Coburn & Turner, 2011).

Factors that influence individual sensemaking, also play a role in group-level sensemaking

Many of the same factors that influence individual sensemaking, are also at play in group-level sensemaking that takes place at the local level (in schools and, for instance, also in districts). Data interactions involve cognition, as they guide which elements participants notice and focus on, and how they frame information (Spillane, 2012). Drawing on insights pertaining to the relationship between individual cognition and situated and distributed cognition (cf. the cognitive framework developed by Spillane, Reiser, et al., 2002), Spillane (2012) explains how day-to-day educational practice within a community of practice, such as a school (or a system in the wider sense), is shaped by individual mental models, but also by shared, intermental models. In the case of evaluation and assessment, for instance, these can be intermental

models about what constitutes 'successful performance'. Thus, organisational sensemaking is belief- and value-driven as well, for instance because it needs to be geared towards (improvement) goals that have been agreed upon as being important (Mandinach & Schildkamp, 2021; Schildkamp, 2019). Culture, norms and values influence sensemaking at the level of the school, but also within subgroups, such as departments (Coburn & Turner, 2011; Datnow et al., 2012). Furthermore, issues of professional safety and responsibility, but also of collective identity are born and embedded in the (organisational) narratives of groups, schools and systems (Falabella, 2020; Lasater et al., 2021). Christman et al. (2016) argue that sufficient human capital (knowledge and expertise among individual participants) but also social capital (trust and willingness to engage in and commit to interpersonal exchanges) are important preconditions for productive dissonance to occur in data conversations. In describing how culture and interaction shape the mechanics of sensemaking in schools, a number of authors also refer to the work of Supovitz and of Horn and colleagues on educational professionals' organisational learning (e.g., Horn et al., 2015; Horn & Little, 2010; Supovitz, 2010).

Organisational conditions impact individual and collective sensemaking at the local level

A number of more tangible organisational conditions also impact individual and collective sensemaking at the local level. Educational professionals need time and resources for sensemaking (Coburn et al., 2009; Coburn & Turner, 2011; Datnow et al., 2012) and access to data and technology (Coburn & Turner, 2011). Ideally, there is also a system of knowledge management in place (Wardrip & Herman, 2018), productive data use routines (Coburn & Turner, 2011; Spillane, 2012) and of course 'human infrastructure' (Coburn & Turner, 2011).

Key actors in shaping both tangible and intangible conditions for sensemaking are formal and informal leaders, such as school leaders, but also district leaders (Coburn et al., 2009), or school board members (Sutherland, 2020). They not only participate in collective sensemaking and data use routines, but also shape how these processes unfold within their organisation (Coburn & Turner, 2011; Cosner, 2011; Schildkamp, 2019). First, in terms of management and coordination, leaders facilitate sensemaking processes for their team (Schildkamp, 2019). They do so by making sure there are structures, resources and supports (Coburn & Turner, 2011; Cosner, 2011; Datnow et al., 2012; Mandinach & Schildkamp, 2021), by designing and facilitating data use routines (Coburn & Turner, 2011; Cosner, 2011), and by deciding whether and how improvement actions are implemented (Schildkamp, 2019). Secondly, in terms of culture building and leadership, the way leaders establish norms and values, implement data use policies, and set priorities, impacts sensemaking and decision making to a great extent (Coburn et al., 2009; Datnow et al., 2012; Mandinach & Schildkamp, 2021). Finally, in terms of negotiation and sensegiving, local leaders also mediate policy messages and pressures from other levels in the school system and educational system (Coburn & Turner, 2011).

Leaders act as sensegivers

Coburn et al. (2009), Cosner (2011), and Park et al. (2013) combine sensemaking insights with frame analysis to take a detailed look at how local leaders act as sensegivers by framing data and data use within their organisation, how this framing affects the actual implementation of data policies in schools, and how the meaning of data such as test scores is subsequently constructed and negotiated among educational professionals. Leaders construct narratives to frame problems (diagnostic framing) and potential solutions (prognostic

framing), but also to create resonance and buy-in (motivating framing) (Coburn et al., 2009; Park et al., 2013).

This framing is both interpretive and strategic. First, in terms of interpretation, the (content) knowledge of sensegivers determines how frames for articulating problems and designing solutions come into existence and are substantiated (Coburn et al., 2009). Additionally, leaders' own, evolving conceptions of data analysis and collective sensemaking shape the expectations they formulate towards their team and the conditions they create with regard to collaborative data use (Cosner, 2011). Furthermore, in order for framing to be sufficiently credible, sensegivers need to be aware of and 'slightly stretch' beliefs and practices prevalent in their organisations (Park et al., 2013). Secondly, in terms of strategy, authority and politics also play crucial roles (Coburn et al., 2009). Attribution and appraisal can be a delicate story of articulating responsibility for certain results, for instance. Moreover, framing not only creates conditions for sensemaking but it is also a means of persuasion—instilling the idea in a local team that data use can be a meaningful practice (Park et al., 2013). Overall, leaders are 'key communicators' in data-based reform by articulating goals and expectations (Cosner, 2011; Park et al., 2013).

Sensemaking interplays with the broader (policy) context

School-external protocols, interventions and policies shape sensemaking

Much like data use routines that burgeon school internally, *school-externally* devised protocols and interventions harbour the potential to focus attention on specific issues and give direction to data use conversations. However, they are mediated by sensemakers at the local level (Coburn & Turner, 2011). The same holds for educational policy initiatives. Their enactment or implementation is shaped by the individual and collective interpretations of local educational professionals, as well as sensegiving efforts by local leaders. Contextual factors impact teachers' data use in practice by interplaying with local beliefs and practices (Coburn & Turner, 2011; Datnow et al., 2012; Falabella, 2020; Jennings, 2012; Snodgrass Rangel et al., 2019; Sutherland, 2020). The implementation of DBDM and data use policies is a (micro)political act to a certain extent (Coburn et al., 2009; Park et al., 2013).

Sensemaking is a key to understand why data produce unexpected and non-normative outcomes

Multiple authors use a sensemaking outlook and contrast it with techno-rational perspectives on data use in order to explain why (achievement) data are sometimes used in non-normative ways or at least in ways unexpected or unintended by policy makers (e.g., Datnow et al., 2012; Jennings, 2012). Data use policies—and the papers reviewed here tend to specifically discuss accountability-based policies—are often based on the assumption that the availability of data will enforce change and improvement. However, in practice data 'do not objectively guide decisions on their own—people do' (Spillane, 2012, p. 114). Sutherland's (2020) study of school board members' enactment of mandated assessment policies illustrates well how sensemaking, sensegiving and the construction of narratives are scaffolded within systems. She finds that individual board members might take on different positions towards what can and what cannot be achieved with standardised assessments, yet collectively decide to use such instruments in a way that fits into the local narrative of their organisations. In turn, those local interpretations do not necessarily align with system-level messaging regarding the evaluative purposes and value of standardised assessments

(Sutherland, 2020). Similarly, Snodgrass Rangel et al. (2019) find that teachers balance messages about policy requirements and expectations with their own understandings of education and their personal beliefs about assessment and data use, and as a result, favour some types of data over others.

Jennings (2012) discusses how features of accountability systems may induce productive or distortive use of test score data, depending on how these features are received, understood and interpreted by educational professionals. These features pertain, for instance, to the perceived amount and locus of pressure (who is perceived as being held accountable for the results, and what are the consequences associated with accountability) and to the goals and benchmarks that are perceived as salient (long-term versus short-term gains, growth versus proficiency, process versus outcome etc.). Highlighting how sensemaking plays a part in the alignment between perceptions and assumptions of data users on the one hand, and of data providers on the other hand, productive use of test scores is defined as encompassing 'practices that improve student learning and *do not invalidate the inferences about student and school-level performance that policy makers, educators, and parents hope to make* [emphasis added]' (Jennings, 2012, p. 4).

System-level policies are mediated by local sensemakers and sensegivers

Accountability policies and pressures, and the way they are mediated at the local level, also impact individual and collective beliefs and mindsets in schools (Mandinach & Schildkamp, 2021). Lasater et al. (2021) demonstrate how enactment of high-stakes accountability policies and framing by local leaders can cause educational professionals to feel threatened in their professional self-integrity and to push them into deficit thinking. Other authors also address how high-stakes standardised testing can raise questions of autonomy, (institutional) identity and (individual) responsibility in schools (Datnow et al., 2012; Falabella, 2020; Spillane, 2012) and impacts individuals' 'subjectivities and affectivities'. Processing test data can be a struggle for educational professionals, and information that challenges one's self-image can trigger emotional responses and strategic framing (Falabella, 2020).

System-level policies shape local discourse and day-to-day practice

In any case, it is clear that standardised test scores play a role in defining day-to-day instructional practice in schools (Spillane, 2012). Standardised test scores contribute to institutional storytelling, since interpreting such scores triggers questions about the meaning of schooling, about a school's identity and comparative positions to other schools. As such they provide productive discourse: numbers have symbolic power and 'not only describe reality, they also produce it' (Falabella, 2020, p. 30). Falabella (2020) discusses datafication trends and what she calls the 'accountability trap': a growing emphasis on instrumental logic risks blurring schools' goals and making learning subordinate to measurable outcomes.

Data and data systems are sensemaking resources

Different types of data require and activate different sensemaking processes

Different types of data require and will activate different sensemaking processes, and consequently, contribute to different (instructional) responses and other forms of educational decision-making (Farrell & Marsh, 2016; Schildkamp, 2019). Although raw data may not

carry meaning in the absence of a sensemaker, they can trigger connotations and values in the eye of a beholder before actual interpretation is yet to occur. Sensemaking perspectives uncover the mechanisms through which (inter)subjective beliefs shape such perceptions (Farrell & Marsh, 2016).

Data such as state assessment data can be regarded as a manifestation of accountability policy (Jennings, 2012). From an institutional perspective, data such as standardised test scores 'embody particular representations of what it means to learn and teach' (Spillane, 2012, p. 131). They are instances of commensuration (fitting attributes into one common metric). As such, they simplify performance into something that can be measured and thereby draw attention to specific aspects of learning and instruction (Sellar, 2015; Spillane, 2012). As artefacts, standardised test scores are symbolic representations of achievement, but it is important to note they are also the result of a conscious transformation (Knight & Yorke, 2008; Sellar, 2015). And, like sensemaking in itself, any form of commensuration or 'datafication' is creative and adds something to the world (Sellar, 2015). Still, achievement data do not carry stable and general meaning that is received at face value: data are given meaning by local sensemakers, and that meaning can diverge from the meaning intended by those who mandate testing and supply the data (Knight & Yorke, 2008). In this respect, Sellar (2015) also points to the affective nature of both commensuration and ensuing sensemaking. Meaning attributed to data can trigger emotional responses in recipients. Consequently, data can also be used to fuel 'perceptual shifts' (with the PISA-shock as a system-level example).

A sensemaking perspective sheds light on why not all types of data are equal, and not even all (numeric) assessment data trigger the same responses (Farrell & Marsh, 2016). Farrell and Marsh (2016) find that educational professionals' perceptions of data and assessment properties, such as the format in which data are presented, the scope and format of the assessment itself, or their own active involvement in the assessment (design), determine how they will ultimately use the data in their daily practice. Self-designed and self-administered classroom assessments, for instance, are perceived as most closely aligned to daily instruction, and as offering more opportunities for improving rather than proving. State assessments, on the other hand, are presented in such a way that it offers guidance for, for instance, grouping students (Farrell & Marsh, 2016). In that respect, Farrell and Marsh (2016) also find that the logic of classifying students according to proficiency, as is done in state assessments, has found its way to the school and classroom. This points to the fact that data use is performative: policy initiatives and data systems can introduce paradigms that become canon over time, and consequently also start to pervade and shape school-internal discourse. Referring to prior scholarship, Coburn and Turner (2011) give a similar example of how the No Child Left Behind Act in the USA introduced proficiency categories, which became a 'system of meaning' in its own right and also entered school- and district-internal narratives.

Different types of data have different modal affordances

Taking on a social-semiotic perspective, Fjørtoft and Lai (2021) explain how different types of data have different 'modal affordances' according to the conventions, beliefs and strategies that interpretive communities establish around them. Data are material-semiotic artifacts: their concrete representational properties—for example, whether they are narrative or numeric—carry meaning and value because people have grown to interpret them and act upon them in specific ways (Fjørtoft & Lai, 2021). Narrative data tend to be associated with evolving storylines and informal, micro-level decision-making, for instance. Numeric data such as test scores and other statistical, psychometric data, on the other hand, have an

aura of certainty and objectivity even though recipients sometimes struggle with interpreting them appropriately (Fjørtoft & Lai, 2021). Awareness of these modal affordances—the way specific types of data become associated with specific beliefs and practices—offers a way of looking at why certain data are overemphasised or accepted as valuable and valid (Mandinach & Schildkamp, 2021). It also enlightens sensemaking challenges and opportunities, for instance in terms of data triangulation.

Data systems have interpretive flexibility

Finally, computer data systems can help educational professionals turn data into usable information. As such, they have been found to be an important mediator for knowledge development and design of improvement actions (Farley-Ripple et al., 2021). Technology can indeed support the human endeavour that is data use (Mandinach & Schildkamp, 2021). However, much like the availability of data does not automatically lead to school improvement, providing access to systems does not guarantee that those systems will be used, let alone used in unequivocal and productive ways as intended by those who devise them (Cho & Wayman, 2014; Farley-Ripple et al., 2021). Technological determinism can be countered by looking at the ‘interpretive flexibility’ of data systems (Cho & Wayman, 2014). Individual educational professionals differ in their usage of data systems according to the way they make sense of the data systems themselves, according to their personal notions of ‘data’ and ‘data use’, and according to assumptions about the potential affordances of available features and functions (Cho & Wayman, 2014; Farley-Ripple et al., 2021). Opportunities to promote productive use of data technology, for instance through support structures, leadership communication, and professional development or coaching, can only truly succeed when they take into account interpretive sensemaking processes (Cho & Wayman, 2014; Farley-Ripple et al., 2021; Coburn & Turner, 2011, referring to Means et al., 2009).

Framework and applicability

A prevalent assumption in educational policy and test development, is that providing achievement data, such as student test scores and school performance feedback, will successfully inform and drive school improvement endeavours. However, data ‘are only as good as how they are used’ (Coburn & Turner, 2011, p. 173) by individuals and teams at the local level. We reviewed a selection of studies that use or at least echo this perspective when discussing teachers’ and school leaders’ use of formal achievement data. While the studies all have a sensemaking lens in common, authors vary in their use of the metaphorical function wheels. By focusing, zooming in or out, and applying filters, they capture specific aspects of the sensemaking phenomenon in DBDM.

Figure 1 brings together the crucial insights that we identified in the selected studies and discussed in detail in the previous subsections. The framework outlines a number of considerations that need to be taken into account when seeking to understand what ‘happens’ when teachers and school leaders make sense of formal achievement data. Because what happens, in its most basic sense, is that formal achievement *data* are *processed* by *individual* sensemakers. Those individual sensemakers in turn belong to *groups* in which individuals *interact*. And sensemaking always occurs within sensemakers’ *contexts*.

The levelled structure of this framework does not imply a hierarchy or even a strong sense of linearity. In its entirety, the presented framework is precisely an appeal to keep sight of

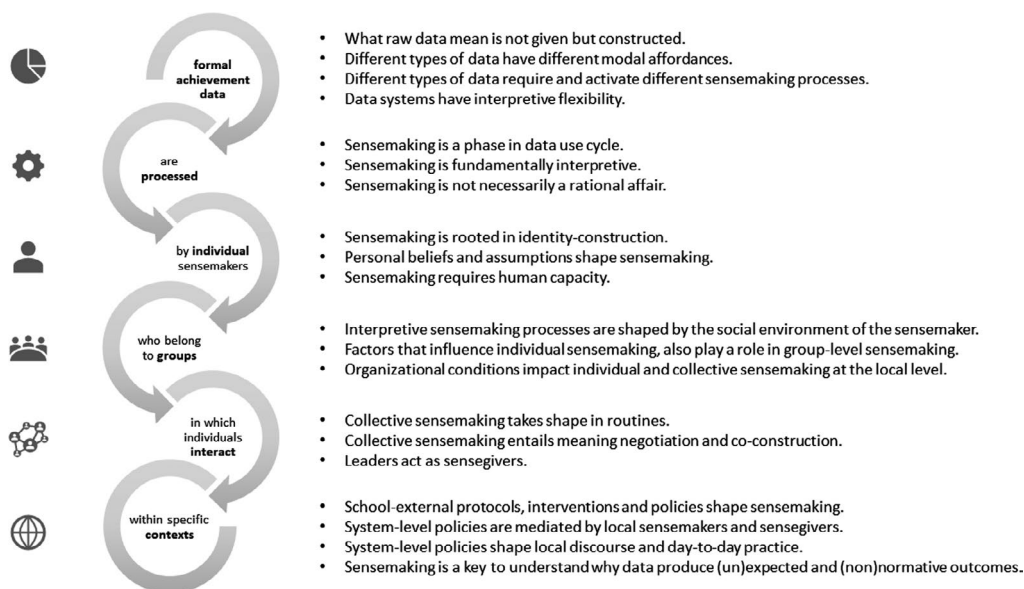


FIGURE 1 Framework for teachers' and school leaders' sensemaking of formal achievement data

the bigger picture when investigating how formal achievement data are actually processed and how educational professionals' engagement with these data might produce normative or non-normative outcomes. Nevertheless, the holistic nature of this framework does not preclude its utility to serve as a 'pantry' of leads for educational researchers, policy makers, and test developers. (Niche) research may want to select some of the presented insights in order to zoom in or out on individual sensemakers in schools within educational contexts, for instance in comparative research on the effectiveness of assessment interventions. They may want to look at tangible aspects such as structures and conditions that are in place for sensemaking. Equally, they may choose to shed light on less tangible aspects that permeate and fuel the entire sensemaking process, such as individual and collective beliefs or interpersonal relationships.

We contend that this framework also has the potential to inspire practitioners, provided it is appropriately translated. The framework substantiates, for instance, *why* it is helpful for school leaders and teachers to collaboratively work with (formal achievement) data. It also elucidates why articulating your own assumptions and convictions (to yourself or towards others) can place interpretations in a new light while giving meaning to data. Furthermore, local leaders may benefit from a more thorough and conscious understanding of their role as sensegivers. Thus, a sensemaking perspective may also help to inform data users themselves, as well as those who support and train them.

CONCLUSION AND DISCUSSION

Taking on a sensemaking perspective opens up the complexity of the DBDM phenomenon, and sheds light on challenges and opportunities. It offers a way of looking at mechanisms and influencing factors that are at play when educational professionals engage with formal achievement data. Sensemaking provides a human-centred key to explain *how* data use is influenced by characteristics of data users, their organisations and their contexts, as well as characteristics of the data(systems) themselves. Characterising data use as an act of sense-making provides counterbalance to rational and deterministic models of data use and to 'naïve' waterfall accounts of transforming data into knowledge. Those models and accounts

assume clear and linear paths which simply do not occur in real-world sensemaking and decision-making (Klein et al., 2010).

We searched and reviewed the literature on sensemaking in DBDM, specifically with regard to formal achievement data, in order to provide some conceptual clarification and take stock of critical insights. While the knowledge base reviewed in the present paper does not capture every possible dimension or niche, we contend it can provide a good starting point to inform further research on educational professionals' use of formal achievement data.

Our findings reflect the kaleidoscopic nature of sensemaking in DBDM. First, the fact that 'sensemaking begins with a sensemaker and is triggered by ambiguity' means that data should be considered as sensemaking resources (Fjørtoft & Lai, 2021). Formal achievement data add something to the world (Sellar, 2015), but they do not make sense on their own (Spillane, 2012). Teachers and school leaders make sense of data, and their own personal lenses and interests guide them in this process. Secondly, 'sensemaking is an active search for coherence, aimed at understanding and action'. It entails an array of interpretive (micro)processes (Schildkamp, 2019) that can be active or unconscious, rational or intuitive (Vanlommel & Schildkamp, 2019), such as noticing, interpreting, inferring, valuing, judging, deciding and so on. And once a sensemaker has found coherence, that is, an explanation that makes sense to their own belief system about what will work (Bertrand & Marsh, 2015), they move on. Finally, 'sensemaking is individual as well as social, cognitive as well as discursive'. Sensemaking is not an isolated affair, it happens in interaction with others and with one's own multilayered context (Coburn & Turner, 2011). Sensemaking and sensegiving mean that you draw up an explanation and (are able to) articulate that explanation to yourself and/or to others.

Limitations

As we carried out this research, we were sensemakers as well. Selections and patterns did not emerge, they are a product of applying our own personal lenses. The result of our conceptual review is a broad, but by no means exhaustive overview of what sensemaking can mean in relation to educational professionals' use of formal achievement data. One (methodological) limitation we need to acknowledge, for instance, is that we narrowed down our search to studies that explicitly use sensemaking as a term or a keyword. That makes sense, given the fact that we aimed for a rather specific conceptual clarification. Nevertheless, we would like to emphasise that there are also other DBDM studies and lines of research that do not use the term, yet have a distinct sensemaking 'flavour' (for instance, when discussing data literacy or organisational learning, or employing concepts that are front and centre in sensemaking perspectives, such as mental models). A further exploration of sensemaking in DBDM could therefore include (more) conceptual snowballing. Furthermore, we did not include related or quasi-synonymous terms like 'meaning making', which would have potentially yielded more material. Finally, we limited our theoretical framework to a number of well-known sensemaking perspectives in order to shed light on the roots of sensemaking theory and give direction to our own review work. Although this choice allowed us to highlight and substantiate a number of trends and salient themes, it also means we disregarded other bodies of work on sensemaking. Noteworthy examples are Dervin's take on sensemaking as a research methodology (Dervin, 1983, 2015) and work on academic/instructional sensemaking (e.g., Fitzgerald & Palincsar, 2019; Odden & Russ, 2019).

Suggestions for further research

Contemporary DBDM research has gradually incorporated a sensemaking logic that builds on foundations laid out by authors such as Coburn and Spillane, over Bertrand and Marsh's reconceptualisation of the data use cycle, to recent work on intuition by Vanlommel and colleagues. In order to further advance this field, scholars call for more insight into the DBDM process and the sensemaking phase in particular, for instance through micro-process studies that also take into account how sensemaking unfolds in interaction (Christman et al., 2016; Mandinach & Schildkamp, 2021; Schildkamp, 2019; Wardrip & Herman, 2018). Research, but also professional development initiatives, would benefit from insight into these micro-processes, for instance when this allows to make assumptions and attributions explicit (Bertrand & Marsh, 2015). In the same vein, more insight is needed into the competences required for sensemaking (Schildkamp, 2019) and into stages of intuitive expertise (Vanlommel & Schildkamp, 2019). Furthermore, future research can further illuminate how specific contexts and external resources affect the sensemaking process (Schildkamp, 2019). Educational professionals' sensemaking of data cannot be disconnected from their sensemaking and enactment of data use policies. Within the context of their schools, educational professionals juggle different expectations, perceptions and interests, emanating from different internal and external stakeholders. The way they balance these expectations and interests with local knowledge, beliefs and structures greatly impact the outcomes of data use (Jennings, 2012). In any case, what is clear from the knowledge base presented here is that when studying data use, we should not only look at outcomes but also at how the process of sensemaking unfolds in practice (Farrell & Marsh, 2016; Spillane, 2012; Vanlommel et al., 2021).

Based on insights from the studies that we reviewed, we propose that a sensemaking perspective will benefit future research on data literacy and user validity in particular. Insight into the malleability of factors that influence sensemaking, including mental models, but also affective responses to data, will benefit professional development and the development of assessment systems that can live up to expectations in terms of promoting school improvement. Methodologically, techniques such as discourse analysis might shed light on the ways different actors make sense of data and where their understandings diverge, for instance between test developers or policy makers versus data users, or teachers versus administrators. Furthermore, more longitudinal research will be able to capture how sensemaking is not only shaped by existing (inter)subjective beliefs, but also shapes future beliefs in an ongoing dynamic of enactment. With regard to the 'shutter speed' to employ in conceptual and empirical work on sensemaking (as a phase in the iterative DBDM cycle, cf. Schildkamp, 2019) it does make sense to unravel episodic 'acts of sensemaking', but at the same time we need to be mindful that sensemaking is ongoing. In their daily practice, educational professionals continually engage with different types of data, making observations and interpreting them, thereby adjusting their own mental models and growing organisational knowledge bases for future sensemaking along the way (Bertrand & Marsh, 2015; Coburn & Turner, 2011; Datnow et al., 2012; Even, 2005; Spillane, 2012; Wardrip & Herman, 2018).

Finally, the great majority of the papers reviewed in this study hail from high-accountability educational contexts. Exceptions are the both Vanlommel papers set in Belgium, the Norway example in the paper by Fjørtoft and Lai, and the Even paper that is focused more on contemporary assessment techniques. Although formal achievement data and scores from standardised tests do not necessarily need to be associated with accountability, an accountability discourse did permeate the findings and theories discussed in many of the selected papers. Future research on sensemaking of formal achievement data should try to contrast systemic narratives rooted in both low and high accountability paradigms, so it might inform both reciprocally.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

ETHICAL APPROVAL

This article reports on a conceptual review. Since no participants were involved, an ethical review was not required.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

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