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Unravelling data use in teacher teams: How network patterns and interactive learning activities change across different data use phases

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HIGHLIGHTS

- Teachers' networks change across data use phases.
- Teachers' learning activities change across data use phases.
- Little interdependency in teachers' use of pupil learning outcome data.

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ABSTRACT

Interactions among teachers are assumed to improve the quality of teachers' data use. Grouping teachers together challenges them to a more in-depth investigation of how pupil learning outcomes can be improved. This study combines social network analysis with qualitative data out of six teacher teams to provide insight into how teacher interactions change across data discussion, interpretation, diagnosis and action. We find that teachers' networks become smaller, and that interactions become more intense and interdependent when progressing through the different phases.

1. Introduction

Data use, and particularly teachers' use of pupil learning outcome data, has become an important topic in educational research. After all, different types of actions based upon data, such as a change in teaching strategies or differentiation, have potential benefits for student achievement (Campbell & Levin, 2008; Carlson, Borman, & Robinson, 2011). Researchers generally conceptualize data use as a cycle of sub-processes (Ciampa & Gallagher, 2016; Marsh & Farrell, 2015; Schildkamp, Poortman, & Handelzalts, 2016). The translation from raw data into knowledge and improvement actions is guided by the discussion and correct interpretation of data, diagnosis of problems and design and introduction of improvement actions (Verhaeghe, Vanhoof, Valcke, & Van Petegem, 2010). During these phases, teacher interactions are essential (Copland, 2003; Hubbard, Datnow, & Pruyn, 2014). A variety of knowledge and skills is required to accomplish each of the data use phases, ranging from interpretation and analysing skills to advanced pedagogical knowledge (Gummer & Mandinach, 2015). Grouping teachers together to combine and share expertise challenges teacher groups to more thorough discussion and consideration of potential explanations for, for example, poor student results (Bertrand & Marsh, 2015). Therefore, embedding data use in social structures is assumed to result in better-considered instructional changes and provide teachers with opportunities to learn from one another (Van Gasse, Vanlommel, Vanhoof, & Van Petegem, 2016; Van Waes et al., 2016).

Although research has acknowledged the importance of the interactive and cyclical character of data use, there remain gaps in the literature with regard to both characteristics. First, in particular out of the niche of intervention studies, data use has been insufficiently approached as a cycle of sub-processes. Therefore, teachers' data use often remains a black box in research and little is known on changes in teacher behaviour throughout different data use

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phases (Little, 2012). Second, 'collaboration' is often used as a container concept to study teacher interactions. However, interactions can vary depending on lower or higher levels of interdependence in teachers' mutual activities (Little, 1990; Van Gasse et al., 2016; Van Waes et al., 2016). For example, teachers are not bound to changing their instruction when collaboration only involves data use discussion. This is different when teachers make arrangements in data use collaboration. Therefore, the granularity in the concept 'collaboration' needs to be better addressed (Bertrand & Marsh, 2015; Van Gasse, Vanlommel, Vanhoof, & Van Petegem, 2017). Approaching teachers' interactive activities on a continuum from lower to higher degrees of interdependence is a crucial step to better understand changes in teachers' interactive behaviour in the different phases of data use.

Examining teacher interactions during different data use phases is an essential contribution to the current knowledge base. Up to now, it remains unclear how a potentially supportive environment for a complex task such as data use is used by teachers. Insights into if and how teachers interact with colleagues are needed to generate knowledge on when and how individual expertise is (not) shared within teams. Extending our knowledge base in this regard is crucial bearing in mind the benefits of teacher interactions for data-based instructional change (Bertrand & Marsh, 2015).

The general aim of this study is to unravel how teacher interactions change across the data use cycle. To do so, we distinguish between structural interaction patterns and interactive activities of teachers. Structural interaction patterns are investigated by means of social network analysis. In this method, the information of both actors involved in interactions is combined. Therefore, social network is powerful to unravel teacher interactions in more detail compared to, for example, survey or interview research that investigate collaboration through general questions.

The structural patterns in themselves provide binary information on the (non-) presence of interactions and not on what exactly happens when people interact (Baker-Doyle, 2015; Mohrman, Tenkasi, & Mohrman, 2003). Therefore, social network analysis is complemented by interviews with teachers to provide insights into interactive activities that provide teachers with learning opportunities (i.e., interactive learning activities) and are embedded within the structural patterns determined. The Little (1990) framework is used to address the granularity in these activities by means of the level of interdependency. Four types of interactive learning activities are distinguished: daily conversations (storytelling), asking for help or advice (helping), sharing materials or strategies (sharing) and making arrangements or work groups (joint work).

Up to now, only few studies in the field of data use have drawn upon social network analysis. In combination with insights into teachers' interactive learning activities, this study provides a detailed picture on how the extent and the interdependency of teacher interactions change across the data use phases. Therefore, the contribution of this study can be found in both the methodological approach and the theoretical aim to expose the changes in teacher behaviour. To do so, two main research questions will guide this paper:

1. How do structural interaction patterns in teacher teams remain similar or change across data use discussion, interpretation, diagnosis and action?
2. Which interactive learning activities are embedded in the structural patterns of teacher networks?

2. Conceptual framework

To situate data use interactions in a broader context, we first describe the conceptualization of data use and data in this study. Subsequently, characteristics of structural interaction patterns and interactive learning activities will be discussed.

2.1. Data use and data

Data use is a way of inquiry-based process monitoring and problem solving in schools. The central idea is that the analysis and interpretation of different types of data is powerful to guide practitioners in instructional and school improvement (Campbell & Levin, 2008; Carlson et al., 2011).

The description of diverse data use practices has shown the merit of data use that follows a cycle of sub-processes (Ciampa & Gallagher, 2016; Marsh & Farrell, 2015; Schildkamp et al., 2016). To transform raw data into information and actionable knowledge, a variety in knowledge and skills is needed (Gummer & Mandinach, 2015; Marsh & Farrell, 2015). Approaching data use as an inquiry circle, can guide teachers to accomplish the translation from data into meaningful decisions (Marsh, Bertrand, & Huguet, 2015). This increases the quality of teachers' data use, because the tendency to jump from data to improvement actions without in-depth consideration of potential causes and alternatives is interrupted (Hubers et al., 2017; Schildkamp et al., 2016). Therefore, the approach to data use as a cyclical process is essential in order to expand and refine the knowledge as to how teachers use data to improve educational processes.

In a lot of research, data use phases of discussion, analysis, interpretation and action are distinguished (Gummer & Mandinach, 2015; Marsh, 2012; Schildkamp et al., 2016). Nevertheless, given teachers' difficulties with the translation of data to classroom interventions (Datnow & Hubbard, 2016; Gummer & Mandinach, 2015), we use a conceptualization that explicitly inserts a phase of problem diagnosis. Therefore, in this study, data use is considered as a cyclic process in which phases of discussion, interpretation, diagnosis and action follow on from each other (Verhaeghe et al., 2010). First, data that guides educational decisions must be read and discussed. Second, data must be interpreted correctly. Third, a deliberation of potential causes and explanations is carried out in the diagnosing phase. Finally, improvement actions can be designed and implemented in teachers' classroom practice (Verhaeghe et al., 2010). Although these data use phases may seem linear and straightforward, the literature shows that data use cycles are often interrupted or that teachers return to previous phases (Marsh & Farrell, 2015; Schildkamp et al., 2016).

A great deal of successfully progressing through data use depends on the data that is used (Verhaeghe et al., 2010). This study reports on teachers' use of pupil learning outcome data. These data are generally seen as highly informative given their potential for improving teachers' practice and eventually pupils' achievement (Campbell & Levin, 2008; Carlson et al., 2011).

The use of pupil learning outcome data has been investigated in several studies (Jimerson, 2014). The concept is often delimited to cognitive output indicators, which in themselves fail to provide a complete picture of a pupil's learning (Schildkamp & Kuiper, 2010; Schildkamp, Rekers-Mombarg, & Harms, 2012). Therefore, our conceptualization of pupil learning outcome data includes cognitive outcomes (i.e. linguistic and arithmetic skills) as well as non-cognitive learning outcomes (i.e. attitudes, art and physical education). Additionally, both quantitative data (e.g. class tests) and qualitative data (e.g. observations) fit into our conceptualization.

2.2. Data use interactions

Teachers' data use benefits from interactions with colleagues