International Journal of Educational Research 80 (2016) 1–14

Contents lists available at ScienceDirect

International Journal of Educational Research

journal homepage: www.elsevier.com/locate/ijedures

Data-based decision making for instructional improvement in primary education

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ARTICLE INFO

Article history:
Received 20 May 2016
Received in revised form 15 July 2016
Accepted 25 July 2016
Available online xxx

Keywords:
Data-based decision making
Instructional improvement
School improvement

ABSTRACT

Data-based decision making can help teachers improve their instruction. Research shows that instruction has a strong impact on students' learning outcomes. This study investigates whether Dutch primary school teachers use data to improve their instruction. Four aspects of instruction were distinguished: purposeful teaching, adaptive instruction, feedback and learning time. Data were collected by means of a survey ($n = 318$) and through interviews with teachers ($n = 18$). The results show that although almost all teachers use data with the intention of improving their instruction, they skip important steps in the data use process. They do not make optimal use of all available data and fail to carry out all the relevant analyses. Teachers mainly use data when their own students have disappointing learning outcomes. They are, however, less interested in using data related to the functioning of the school as a whole.

1. Introduction

Data-based decision making has never been more prevalent. The use of data has become a prominent feature of education policy, not only in the United States (e.g., with the No Child Left Behind Act), but also in other countries. This focus on data-based decision making comes as no surprise, since several studies have shown that effective use of data by teachers and school leaders can result in school improvement and better learning outcomes (Black, Harrison, Lee, Marshall, & Wiliam, 2004; Carlson, Borman, & Robinson, 2011; Earl & Katz, 2006; McNaughton, Lai, & Hsiao, 2012; Protheroe, 2001; Schildkamp, Lai, & Earl, 2013; Walsh, 2003; Young, 2006).

In this study, we define data-based decision making as the entire process of data use (e.g., assessment data, classroom observations, surveys) by teachers, data experts, school leaders, and school board members, which involves: collecting, analysing and interpreting data in order to study educational practices, the use of the obtained information as a basis for making decisions with regard to adapting educational practices, implementing these practices, and subsequently evaluating whether these adaptations have had the desired effect, in terms of improved learning outcomes (Coburn & Turner, 2011; Coburn, Toure, &Yamashita, 2009).

The adaptation of educational practice often involves instructional changes. Several meta-analyses (Hattie & Timperley, 2007; Hattie, 2009; Scheerens, 2007) have indicated that the teacher's instruction plays a crucial role in the students' learning process. Data can inform a teacher's instruction and can indicate where instruction needs to be improved to

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http://dx.doi.org/10.1016/j.ijer.2016.07.004
0883-0355/

enhance student learning. Despite the focus on data-based decision making, there has been relatively little research into data-based decision making in relation to instructional improvement. Therefore, this study is focused on how primary school teachers use data to improve their instruction.

1.1. Research questions

The first question addressed by this study is: *What data do teachers use to adapt their instruction and how much do teachers differ in this respect?* Assessment data, for example, can provide information about the effectiveness of the teacher's instruction. When the assessment data, combined with other data available in school, are properly analysed and interpreted, they can point out possible weaknesses in the teacher's instructional behaviour, thus providing a basis for adapting certain aspects of that instructional behaviour. For example, based on the analysis the teacher can decide to spend more time on certain aspects of the curriculum, to adapt the learning goals for students, to find a more effective way of adapting instruction to differences between students, or to give students feedback on their learning outcomes and their approach. Therefore, the second question of this study is: *What role does data use by teachers play in improving their instruction?*

2. Theoretical framework

The students' learning process and learning progress are to a great degree determined by the quality of education provided by the teacher (Ball & Rowan, 2004; Darling-Hammond, 2010; Marzano, 2000; Rowan, Correnti, & Miller, 2002). Classroom-level factors can explain much of the difference in learning outcomes between students. By analysing instructional results in the form of students' learning outcomes (data), weak and strong aspects of the instruction can be identified and used as a basis for measures for instructional improvement (Schildkamp, Lai et al., 2013; Young, 2006).

2.1. Data use

Teachers' decisions related to designing or adapting their instruction are more often based on experience and intuition than on systematically collected information (Ingram, Louis, & Schroeder, 2004). In particular, teachers use tests to take stock of the students' knowledge and skills and to monitor the students' progress, and less often to make decisions about their own instruction (Schildkamp, Karbautzki, & Vanhoof, 2013; Slavin, 2002, 2003). There is increasing evidence pointing to the fact that data use can help teachers improve their instruction. Data use can lead to school improvement and better learning outcomes (Black et al., 2004; Carlson et al., 2011; Earl & Katz, 2006; McNaughton et al., 2012; Protheroe, 2001; Schildkamp, Karbautzki et al., 2013; Van Geel, Keuning, Visscher, & Fox, 2016; Walsh, 2003; Young, 2006).

In this study, our definition of 'data' is any factual material that is systematically collected and relates to the functioning of a school and its teachers and the learning outcomes of its students. It can consist of assessment data, inspection data, observations, background information on students, and so forth (Ikemoto & Marsh, 2007; Schildkamp & Kuiper, 2010). It is important to distinguish between 'data' and 'information'. Data are raw material and need to interpreted to become useful. Data can be transformed into information by interpreting them in the context in which they were obtained (contextualising), by categorizing them or conducting a trend analysis, by performing calculations and by drawing connections and summarizing (Davenport & Prusak, 1998).

2.2. The process of data use

Data use entails the entire process of collecting, analysing and interpreting data in order to use the obtained information as a basis for decisions about adapting educational practices and subsequently evaluating whether these adaptations have had the desired effect (Coburn & Turner, 2011; Coburn et al., 2009). Data use therefore works according to an iterative cyclical research procedure in which teachers study how their teaching has led to specific learning outcomes (Marsh, 2012; Marsh, Pane, & Hamilton, 2006; Timperley, Wilson, Barrar, & Fung, 2007). Schildkamp and Poortman (2015) describe the steps taken in the data use process (see Fig. 1), based on Coburn and Turner (2011); Lai and Schildkamp (2013); Mandinach, Honey, Light, and Brunner (2008); Marsh (2012, p. 4); Schildkamp and Kuiper (2010); Schildkamp and Lai (2013).

The data use process as they describe it starts with a problem definition and a related *purpose*. Often the *purpose* of data use in schools is to improve learning outcomes. For example, based on assessment data a teacher has the perception that something is wrong with the students' learning outcomes. Hypotheses are formulated that explain the root cause or causes of the problem. *Data* are used to verify or reject the hypotheses. These data can provide teachers with insights into the students' learning outcomes and educational needs. At the same time, teachers can use the data to gain insight into their own educational practices.

To be able to verify or reject a hypothesis, first it is crucial to assess the validity and reliability of the collected data. For data use in day-to-day classroom work, it is not possible to assess validity and reliability in a scientific manner (e.g., Cronbach alpha, Cohen's Kappa). But teachers can check the reliability of the data in terms of, for example whether a sufficient amount of data are collected (e.g., at least data from three cohorts of students) and whether the data set is comprehensive and does not include mistakes. Furthermore, teachers can discuss validity, for example by determining if the data they collected