International Journal of Educational Research 86 (2017) 109–121

Contents lists available at ScienceDirect

International Journal of Educational Research

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

The interplay between class heterogeneity and teaching quality in primary school☆

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ARTICLE INFO

Keywords:
Class heterogeneity
Class composition
Teaching quality
Cognitive activation
Supportive climate
Classroom management

ABSTRACT

Dealing with students of different abilities in class is a topic of major importance in educational research and practice. While a number of strategies have been implemented to reduce class heterogeneity, there is little empirical evidence of their benefits. Rather, classroom processes are assumed to play a vital role in the effect of heterogeneity on students' achievement. In this longitudinal study of 54 primary school classes, we examine the interplay between class heterogeneity and teaching quality and its effect on students' conceptual understanding. Results of multi-level regression analyses revealed no effect of heterogeneity on student outcomes. Instead, the results indicated a positive interaction: Students in classes of heterogeneous ability particularly benefitted from cognitive activation and a supportive climate.

1. Introduction

Dealing with students of different ability in class is a topic of major importance in educational research and practice. Discussions on heterogeneity in the classroom and its effects on students' learning outcomes have intensified recently as a result of demographic changes (e.g., increased migration enhancing cultural diversity) and educational policies (e.g., the U.N.'s Convention on the Rights of Persons with Disabilities in 2006).

In line with the traditional assumption that teachers can best meet the needs of their students in classes of homogeneous ability, a number of policies at the macro-level (e.g., assigning students to ability-based secondary school tracks) and the micro-level (e.g., grouping students into classes according to ability) to reduce heterogeneity in the classroom have been implemented. Teachers are then expected to provide appropriate challenges and support to their students in the resulting classes of homogenous ability. In classes of heterogeneous ability, on the other hand, high-achieving students might quickly become bored, while too much may be asked of low-achieving students. Teachers themselves often argue that ability grouping helps them meet students' learning needs (e.g., Chorzempa & Graham, 2006).

On the other hand, heterogeneity in the classroom may also provide benefits for student learning. Cognitive-constructivist views consider learning a constructive, cumulative, and individual process (e.g., De Corte, 2000). Thus, teachers must adapt their

☆ This research was funded by the Hessian initiative for the development of scientific and economic excellence (LOEWE).
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http://dx.doi.org/10.1016/j.ijer.2017.09.004
Received 4 January 2017; Received in revised form 6 September 2017; Accepted 19 September 2017

instructional support to meet individual students' needs. Furthermore, socio-constructivism emphasizes the impact of social context, interaction, and collaboration on learning (e.g., Palincsar, 1998). According to Vygotsky (1978), learning takes place within an individual's "zone of proximal development", that is, a range slightly beyond their current level of understanding and skills. Teachers and more advanced students thus can scaffold other students' learning within the zone of proximal development, and individuals with different abilities can trigger cognitive conflict in others by presenting arguments requiring different levels of conceptual understanding. Hence, grouping students into classes of heterogeneous ability may allow teachers to capitalize on students' academic diversity and encourage the use of peers as resources to support learning.

Empirically, research on the effects of heterogeneity in the classroom on students' achievement has a long tradition, and several empirical approaches have been used to assess whether heterogeneity supports or hinders student learning. The following section focuses on research in primary school. Although research has also been conducted in secondary school, the impact of classroom heterogeneity on student achievement at this level is closely intertwined with institutional effects (e.g., due to curriculum differentiation) contributing to learning gaps between school tracks (Gamoran, Nystrand, Berends, & LePore, 1995; Schofield, 2010). Furthermore, compositional effects differ across school tracks (e.g., Kulik & Kulik, 1982), making it difficult to compare their effect on student achievement in different tracks.

2. Effects of class heterogeneity on primary school students' achievement

2.1. Ability-grouped vs. non ability-grouped classes

Grouping students according to ability is a well-known educational strategy for reducing heterogeneity in the classroom. In the 1980s and 1990s, several meta-analyses and literature reviews were conducted to determine the effect of ability grouping on students' outcomes. Kulik and Kulik (1984) conducted a meta-analysis of 28 studies focusing on primary school students. They found that students grouped according to ability had achievement that was 0.19 standard deviations higher on average than their peers who were not grouped according to ability. However, when programs for gifted students were excluded from the meta-analysis, the benefits of grouping students according to ability were rather limited ($SD = 0.07$). Slavin (1987) reviewed 14 studies of primary school students and found no evidence to support grouping students according to ability ($d = 0.00$). Rather, Slavin recommended that students remain in heterogeneous classes most of the day and be reorganized for one or two subjects only. From a methodological point of view, it should be noted that ability-grouping studies often do not account for confounding teacher- and student-related variables and classroom instruction (e.g., Burns & Mason, 2002; Slavin, 1990). Moreover, most primary school students in the United States and Europe today are not grouped in classes according to ability.

2.2. Variation of class heterogeneity between regular classes

2.2.1. Empirical studies of the effect of class heterogeneity as a composition variable

Studies of classroom composition do not rely on the quasi-experimental variation of heterogeneity in the classroom, but rather consider differences in the composition of regular classes. A compositional effect, also often termed a *peer effect* or *peer group effect* (Wilkinson & Fung, 2002), refers to the effect of an aggregated characteristic of a group on learning outcomes. While composition measures can also encompass a group's mean ability or the number of students with a particular characteristic (e.g., low SES, ethnic background) within a group, the most common method of assessing heterogeneity in ability measures is the intra-group variation (i.e., the standard deviation of ability scores within a given group). The larger the standard deviation, the greater is the group's heterogeneity. In terms of the levels of analysis of heterogeneity (e.g., class, school, and cohort), students within the same class are considered more influential than students within the same school (see also Wilkinson, Parr, Fung, Hattie, & Townsend, 2002). Empirically, Van Ewijk and Sleegers (2010) found in their meta-analysis the class level to have the greater predictive power than the cohort/school level. In addition, research focusing on intra-school variation in students' abilities has not found significant connections with student outcomes (e.g., Hanushek, Kain, Markman, & Rivkin, 2003; Hutchison, 2003).

However, the current body of literature does not provide a clear picture of the effects of intra-class variation in student abilities on primary school students' achievement and learning. A study by Luyten and Van der Hoeven-van Doornum (1995) found a significant negative effect of class heterogeneity in cognitive abilities on a global achievement indicator ($\beta = -.06$) using a nation-wide sample of 3993 Dutch primary school students in 211 classes. However, class heterogeneity in cognitive abilities was not significantly associated with achievement ($\beta = -.05$) in another, smaller Dutch sample (698 students in 57 classes), and two studies in the United States and Germany found positive effects of class heterogeneity on primary school students' achievement. Vigdor and Nechyba (2007) analyzed more than 200,000 students in North Carolina and found small, but significant positive effects of class heterogeneity in achievement in 3rd grade on achievement in math ($\beta = .04$) and reading ($\beta = .01$) two years later. Scharenberg (2012) also found evidence for positive effects of intra-class variation in cognitive abilities on German primary school students' math ($\beta = .42$) and reading achievement ($\beta = .22$). However, most studies in both the United States and Europe found no effects of heterogeneity in the classroom on primary school students' achievement: Bellin (2009) analyzed class heterogeneity in cognitive abilities on students' math and reading achievement using a sample of 627 students in 36 classes in Germany. In the United States, an early study by Leiter (1983) comprising 294 students in 15 classes found that class heterogeneity in math achievement did not predict later math achievement ($\beta = -.30$), nor did class heterogeneity in reading achievement predict later reading achievement ($\beta = .10$), although the statistical power to detect such compositional effects was rather small. Wright, Horn, and Sanders (1997) analyzed data from a very large sample ($6{,}527 < N < 14{,}079$) covering two cohorts and achievement gains at three time points in five subjects (math,