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Lecturing style teaching and student performance

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ABSTRACT

Teachers in the Netherlands tend to spend less time in front of the class, and often adopt a more personal approach. This allows them to better adjust their lecturing style to the needs of the individual student with the aim of increasing student performance. However, a more personal approach is also more time consuming and potentially reduces the complementary and scale effects of the more traditional lecture style teaching.

This study examines whether the proportion of time that teachers lecture in front of the class influences the cognitive performance of students in the Netherlands. In this study we find no relationship between the proportion of time spent lecturing in front of the class and student performance.

1. Introduction

In the Netherlands teachers tend to spend less time in front of the class, and instead often adopt a more personal approach. This allows teachers to better adjust their teaching method to the needs of the individual student with the aim of increasing student performance. However, a possible downside is that it is time consuming, potentially reduces the complementary effects of the more traditional lecturing style teaching, and therefore may be less efficient. This study examines if the proportion of time that teachers lecture in front of the class influences the cognitive performance of students in the Netherlands.

Two previous studies examine how the time that teachers spend to different teaching activities influences student performance. Firstly, Aslam and Kingdon (2007) examine how student performance is influenced by several teacher activities and show that lesson planning, involving students by asking questions during class and quizzing them on past material all substantially benefit pupil learning. Secondly, Schwerdt and Wuppermann (2011) examine whether the time that teachers spend on lecturing style teaching can influence the performance of U.S. students. The study shows that students benefit when their teachers spend more time on lecturing style teaching. Both these studies use a within student between subject identification strategy, similar to that used in this investigation.

This study has advantages over the above-mentioned studies. Firstly, Aslam and Kingdon (2007) construct a dependent variable where mathematics test scores are related to language test scores for Pakistani students. Schwerdt and Wuppermann (2011) construct a dependent variable and relate mathematics test scores to average test scores for physics, chemistry, biology and geography, because students in the U.S. usually have the same teacher for these last four science subjects. However, since students in the Netherlands have different teachers for mathematics and physics, we are able to relate test scores for mathematics with test scores for physics. Since mathematics is closer related to physics than it is to a language subject, or to physics, chemistry, biology and geography together, we expect to obtain a more accurate estimate.

Secondly, in this study the effect of previous lecturing styles on current student performance is likely to be smaller. The studies for the U.S. and Pakistan use information on eighth grade students studying at junior high school (or middle school) which bridges elementary school and high school. However, these students have had sev-

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eral years of mathematics and science education prior to the study. The equivalent of eighth grade students in the Netherlands is the second year of secondary school and here students have received no more than one year of education in mathematics and physics. In order to test how first year lecturing styles affect student performance in the second year we use information on how schools assign students to classes based on their mathematics and science skills. In this way we can test how a non-random assignment of students to classes, hence a non-random allocation of previous lecturing styles to students, influences student performance.

In this study we use the TIMSS 2003 data for students in the Netherlands in their second year of secondary education. This describes performance of students in mathematics and physics, has information on student, teacher, school and class characteristics, and has detailed information on how teachers timetable mathematics and physics lectures. From this information we can construct a lecturing style variable that represents the proportion of time teachers spent on lecturing in front of the class.

This paper is structured as follows. Section 2 describes the identification issues and identification strategy. Section 3 discusses the data and describes the descriptive statistics. Section 4 presents and discusses the empirical results based on the within student between subject analysis. Section 5 examines whether measurement error alone can explain the results. Section 6, examines if the results can be explained by non-random assignment of first year students to classes. Section 7, examines if the results can be explained by selection into certain teaching styles based on unobserved teacher characteristics. Finally, Section 8 concludes.

2. Theory and estimation strategy

The effect of lecturing style teaching on student performance can be estimated using an education production function:

$$A_{ijk} = \beta_{0j} + S'_{ik}\beta_{1j} + T'_{ijk}\beta_{2j} + X'_{ijk}\beta_{3j} + L'_{ijk}\beta_{4j} + \epsilon_{ijk}, \tag{1}$$

where A_{ijk} represents the performance of student i on subject j in school k that depends on school (S), teacher (T) and student (X) characteristics. The effect of different lecturing styles on student performance is measured by variable L. This variable measures the share of teaching time that teachers spend on lecturing style teaching. As is usual, the error term, ϵ_{ijk}, is assumed to be normally distributed with mean zero and variance σ^2_ϵ and all explanatory variables are assumed independent of the error term.

If we estimate Eq. (1) using an OLS estimation procedure we would not take into account any selection effects. Selection effects are unobserved student, teacher and school effects that occur systematically in the error term leading to a bias in the parameter estimates. Bias can occur if for example schools determine the lecturing style adopted by the teacher or if, say, high ability students are assigned to high ability teachers.

To account for selection effects, we follow Aslam and Kingdon (2007) and Schwerdt and Wuppermann (2011) and quantify the effect of lecturing style teaching using a within student between subject approach. By comparing mathematics test scores with physics test scores and assuming that school and student characteristics influence these test scores in a similar manner, we account for selection effects both at the school and the student level. The within student between subject approach implies that:

$$\begin{aligned}\Delta A_i &= (\beta_{0,m} - \beta_{0,ph}) + S'_i(\beta_{1,m} - \beta_{1,ph}) + T'_{ik,m}\beta_{2,m} \\ &\quad - T'_{ik,ph}\beta_{2,ph} + X'_i(\beta_{3,m} - \beta_{3,ph}) + L'_{i,m}\beta_{4,m} \\ &\quad - L'_{i,ph}\beta_{4,ph} + \nu_i \end{aligned} \tag{2}$$

which is equivalent to:

$$\Delta A_i = \delta + \Delta T'_i\beta_2 + \Delta L'_i\beta_4 + \nu_i. \tag{3}$$

Subscript m (ph) shows that an observation is related to mathematics (physics), $\Delta A_i = A_{i,m} - A_{i,ph}$ represents the difference between mathematics and science performance and δ stands for $\beta_{0,m} - \beta_{0,ph}$. If school and student characteristics have the same effect on student performance across subjects, and there is no reason to assume that this would not be the case, we can assume that $\beta_{1,m} - \beta_{1,ph} = \beta_{3,m} - \beta_{3,ph} = 0$ and thus these effects fall out of Eq. (3). It is however possible that certain school and student characteristics influence mathematics and physics performance in different ways and therefore, to check robustness, we should also estimate Eq. (2).

It is often stated that bad peers gain more by being exposed to good peers than good peers lose by being exposed to bad peers. It is therefore crucial to control for differences in class characteristics (for example, see Hoxby, 2000; Lazear, 2001). However, in our sample we have identical mathematics and physics classes and, under the assumption that peer effects affect mathematics performance in the same way as physics performance, we automatically account for these unobserved peer effects. By adopting the within student between subject design we furthermore account for potential class size effects.

Two problems may occur when we estimate Eq. (3). Firstly, we may find that lecturing style teaching positively affects student performance, however this effect may be caused by unobserved teacher characteristics. Secondly, measurement errors in the lecturing style variables are compounded when we perform a within student between subject analysis and a consequence may be that we find that lecturing style teaching is not related to student performance while in reality there is a relationship. The measurement error is random noise in the lecturing style variables. The more random measurement error these variables contain the closer the estimated gradient approaches zero instead of the true gradient. Bias due to measurement error is commonly referred to as regression dilution or attenuation bias.

In this study, measurement error is problematic since the effect of measurement error in Eq. (3) is larger than the effect in Eq. (1). If the lecturing style estimate in Eq. (3) is closer to zero than the estimate in Eq. (1), we cannot distinguish if these differences occur due to measurement error or due to other factors such as selection effects. In