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Introduction to Causal Analysis Using TIMMS and PISA

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Abstract

PISA and TIMSS have become important resources for studying mathematics education world-wide. The two studies provide extensive background information related to students, to schools, and to countries. This workshop examines, in-depth, the types of research questions related to the effects of schooling that can be studied using the data from these two studies.

The two studies are structured very differently in terms of: sample selection, the age/grade distribution of the students, whether the classrooms are identified in the sampling, and the nature of the mathematics test that the students take, all of which impose serious constraints on casual inferences. Such design differences serve as limiting factors as to what questions can and cannot be addressed from the data. These differences between TIMSS and PISA are discussed especially with respect to the limitations each creates in terms of understanding the casual role of schooling itself or for other related characteristics to student learning of the core knowledge society has deemed appropriate.

One of the inherent difficulties in establishing such robust casual relationships using a single cohort as is the case in both studies is to control for the relevant and salient characteristics that if left uncontrolled introduce relevant and salient bias in the estimated relationship of the studied variable to student performance. History and tradition have led to the almost automatic inclusion of a measure of social class and both studies have included questionnaire items that allow the researcher to develop an SES scale.

In this session we propose still another fundamental concept that similarly must be included as such a control variable – opportunity to learn (OTL). TIMSS and most recently, PISA (2012), have such measures. We review the history of OTL defined as content coverage and propose possible measures. Using both PISA and TIMSS examples we make the case as to why this measure of schooling is as fundamental, if not more so, than SES especially in studies related to academic achievement in mathematics.

Results are shared which suggest the relevance of OTL not only as a control variable but as a concept worthy of study in each participating country and to comparative study worldwide.