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Issues in longitudinal research on motivation☆

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Abstract

This paper discusses two methodological issues regarding the analysis of longitudinal data using structural equation modeling that emerged during the reconsideration of the analysis of a recent study on the relationship between academic motivation and language achievement in elementary education [Stoel R.D., Peetsma, T.T.D. and Roeleveld, J. (2003). Relations between the development of school investment, self-confidence and language achievement in elementary education: a multivariate latent growth curve approach. Learning and individual differences, 13, 313–333]. The issues are related to the factorial structure of the repeatedly measured variables, and to the explanation of interindividual difference by means of covariates [see Stoel, R.D., Van den Wittenboer, G. and Hox, J.J. (2004a). Including time-invariant covariates in the latent growth curve model. Structural Equation Modeling, 11, 155–167, Stoel, R.D., Van den Wittenboer, G. and Hox, J.J. (2004b). Methodological issues in the application of the latent growth curve model. In K. van Montfort, H. Oud, and A. Satorra (Eds.). Recent developments on structural equation modeling: Theory and applications. (pp. 241–262). Amsterdam: Kluwer Academic Press. It is illustrated that standard modeling practices may sometimes lead to incorrect conclusions regarding the concepts under investigation, and that ideally alternative modeling possibilities should be considered in order to check the adequacy of the standard practice.

Keywords: Motivation; Structural equation modeling; Latent growth curve analysis

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1. Introduction

In the last decade there has been an increasing amount of studies on academic motivation that adopted a longitudinal design. Longitudinal designs may provide important information for answering longstanding questions regarding change and growth of individuals on motivation. In order to answer such questions complex models, and techniques, have been developed, and these models and techniques are now becoming part of the standard tool box of many scholars. Examples are structural equation modeling and multilevel analysis of longitudinal data, latent class analysis, and (growth) mixture modeling. However, because of the complexity of these techniques, the application is often plagued by factors that may lead to incorrect estimates of the interesting parameters, and thus to possibly incorrect conclusions. Standard, but sometimes insufficient, modeling practice may have serious consequences for the substantive conclusions. This contribution discusses two methodological issues regarding the analysis of longitudinal data using structural equation modeling that emerged during the reconsideration of the analysis of a recent study on the relationship between academic motivation and language achievement in elementary education (Stoel, Peetsma & Roeleveld, 2003). The issues are related to the factorial structure of the repeatedly measured variables, and to the explanation of interindividual difference by means of covariates. A more formal and detailed treatment of these two issues is provided by Stoel, van den Wittenboer and Hox (2004a,b). The first purpose of this paper is to illustrate that the standard approaches can be easily adapted to overcome these inadequacies, and second to provide practical guidelines on how and when to do so. In the next sections we will first describe the data, and the sample and the variables that were measured, then we will provide a brief introduction into latent growth curve modeling, followed by an overview of the analysis strategy and the results of Stoel, Peetsma and Roeleveld, and successively the two issues will be discussed.

2. Latent growth curve modeling of motivation, school investment and language acquisition

The study of Stoel, Peetsma and Roeleveld (2003) was guided by the following main questions and expectations: (1) How do school investment, self-confidence and language achievements develop during elementary education (from kindergarten to secondary education)? An increase in language achievement is expected, and a decrease in school investment during elementary education. With respect to self-confidence, no expectation was formulated on the direction of development during elementary education. (2) Is the developmental process of language achievement in elementary education related to school investment and self-confidence? It is expected that the developmental trajectories of language achievement, school investment and self-confidence are mutually positively associated. With respect to school investment, this implies that the more positive the developments in achievement and self-confidence, the less the decrease in school investment. (3) To what extent is intelligence related to developmental trajectories in school investment, self-confidence and language achievements in elementary education? It is expected that intelligence accounts for a unique part of the variation in the developmental trajectories of language achievement.

In order to answer these questions data from the large PRIMA cohort project in the Netherlands were analyzed. These data consist of a subsample consisting of 2693 children in 214 elementary schools,