



# The Relationship Between Online Formative Assessment and State Test Scores Using Multilevel Modeling

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## INTRODUCTION

The main goal of the current study was to examine the relationship between online formative assessments (FAs) and summative, yearly state proficiency test scores. Specifically, the relationship between one online formative assessment (FA) program in reading, known as the Diagnostic Online Reading Assessment (DORA), and state test scores in reading (i.e., the Colorado Student Assessment Program [CSAP]) was examined in four cohorts across elementary, middle, and high school in beginning in the 2004/2005 academic year and ending in 2009/2010. This investigation used Hierarchical Linear Growth Modeling (HLGM; i.e., Multilevel Modeling) to address the following research question: (1) What is the relationship between online formative assessment score growth and state test score growth?

Formal and informal FAs are one of many teaching methods that have been used to increase student performance on end-of-course, academic year, and other high-stakes achievement tests for decades and has a large research base to support

these practices (e.g., Black & Wiliam, 1998a). Additionally, summative assessment data (e.g., yearly state proficiency tests) are continually used as indicators of school and district performance for policymakers and the public. However, these summative data are of little use in the day-to-day activities of teachers in diagnosing student learning progress and modifying teaching strategies, as is done in the FA process (e.g., Black, 2015). Because this collection of abstract theories and research methods have transitioned into actual teaching practices, it is important to build the literature surrounding technology-based methods as teachers continue to use FA in the classroom.

The purposes in conducting this study include the following: (1) To support the burgeoning literature outlining the role of technology in general in teaching and learning, and (2) To bolster support for federal initiatives and administrative demands for more efficient ways to meet state standards. As technology-based assessment is gradually used to support and/or replace traditional forms of evaluation, the need to examine the extent to which these methods are educationally sound is

in high demand. Overall, information presented in this study can provide practical implications to district-wide implementation of supplemental reading instruction in an online environment.

## **BACKGROUND**

E-learning (i.e., learning that is facilitated by electronic technologies) is referred to as part of the equipment of 21st Century scholarship (Buzzetto-More & Guy, 2006). However, e-learning is only half of the equation as government mandates have required schools to use data to inform decision making. The use of data has necessitated the development of improved information technology and access to computers and high-speed Internet in schools (Petrides, 2006). Thus, the other half of the equation is the use of data rendered from e-learning, or e-assessment, which entails using electronic technologies to drive student learning and assessment as with FA (Ridgway, McCusker, & Pead, 2004).

FA can be briefly defined as the use of diagnostic formal and informal assessments to provide feedback to teachers and students over the course of instruction for the purpose of improving performance and achievement (e.g., Black, 2015; Boston, 2002). Previous research in this area has primarily focused on traditional FA practices (e.g., paper-and-pencil quizzes), with the current literature beginning to examine the effectiveness of Internet-based, automated FA programs (e.g., Chua & Don, 2013; Kingston & Nash, 2011). The overall consensus from the traditional body of literature is that FA is an essential component of classroom procedure, and that its proper use can raise standards and achievement (e.g., Black & Wiliam, 1998a; Carlson, Borman, & Robinson, 2011; Gulikers, Biemans, Wesselink, & van der Wel, 2013; Merino & Beckman, 2010), with the latest studies of technology-based FA beginning to echo these findings. Many theories have attempted to describe FA in terms of multilevel relationships (i.e., students, teachers, schools, school districts,

etc.), with few studies focusing on statistically accounting for these nested associations, and hardly any examining technology-based FA practices (Black & Wiliam, 2009).

Regarding previous studies of online FA, the overwhelming majority of these studies have examined college-age populations in the university setting, usually within one course (e.g., Buchanan, 2000; Jenkins, 2004). In addition, past and current FA research has thoroughly examined the relationship between measures of FA and performance on a summative, usually end-of-course or final exam, but not state proficiency test scores. This area of research is just beginning to use more sophisticated statistical analyses, which is in contrast to the many qualitative studies summarizing student perceptions of a technology-based platform for quizzes/exams (Hunt, Hughes, & Rowe, 2002; Peat & Franklin, 2002). Additionally, due to the novelty of the mode of online or computerized administration, understandably research is lacking in longitudinal data analysis, with few studies examining multiple years of data across several cohorts.

## **METHODS**

Existing DORA data were provided from one school district in Colorado from an online testing company, and existing CSAP data were provided from the same school district by the Colorado Department of Education. The data were selected via collaboration with the testing company and one school district in Colorado. The selected school district was one that gave permission to use their student demographic information and state test scores. It was necessary to have permission from both parties as the only way to examine correlated growth is to link the data via a shared student ID number. Additionally, this particular school district was selected because they had fewer missing data, with all students having graduated or left the school district at the present time. Data were linked anonymously producing four cohorts

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