

DARC. A New Measure of Reading Comprehension

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Abstract. The *Diagnostic Assessment of Reading Comprehension* (DARC) is a new measure of reading comprehension designed to evaluate four central comprehension processes: remembering newly read text, making inferences licensed by the text, accessing relevant knowledge in long-term memory, and making inferences that require integrating prior knowledge with textual information (Hannon and Daneman, 2001). An adaptation of DARC (Francis, Snow, August, Carlson, Miller & Iglesias, 2006) is presented for Spanish population and its psychometric properties (reliability and validity) are analyzed and compared to the English version of DARC. The sample consisted of 336 participants, 2th to 6th grades. Our findings show that the test is a reliable instrument to measure Spanish reading comprehension. Likewise, results showed that DARC correlated higher than PROLEC-R (Spanish standardized comprehension test) with both students' decoding and academic performance.

Keywords: Reading comprehension; assessment; test adaptation; decoding; academic performance.

The main purpose of this work is to contribute to the improvement of assessing reading comprehension in elementary readers. Reading comprehension assessment is suffering an important transformation. There is a generalized disappointment with the simple measure of comprehension performance which characterizes psychometric tests. They are generally "portmanteau measures"- a single score reflects a large domain -. Thus, they do not reflect the many factors that influence comprehension outcomes (August, Francis, Hsu & Snow, 2006). In this respect, researchers are advancing constructing assessment tools which go some steps beyond by reflecting comprehension processes and providing information about children's strengths as well as their weaknesses.

PISA is a clear example of this line of investigation. PISA tasks were designed guided by a theoretical scheme of comprehension processes (i.e. integrating information, locating information, and global comprehension). Another attempt was carried out by Martínez, Vidal-Abarca, Sellés, & Gilabert, 2008. They designed the TPC (Comprehension Processes Test). The TPC is a test designed to assess comprehension processes based on Kintsch's model (1998). It includes two texts and a set of questions that were generated to evaluate different comprehension processes, i.e. forming ideas, making inferences and forming macro-ideas in Secondary students.

Another example of this line of research, which is also the focus of this work, was conducted by Hannon and Daneman (2001) who tried to isolate four different components of comprehension hypothesized to occur during successful reading comprehension: remembering newly read text,

making inferences licensed by the text, accessing relevant knowledge in long-term memory, and making inferences that require integrating prior knowledge with textual information. The *Diagnostic Assessment of Reading Comprehension* (DARC) is a measure of reading comprehension designed to evaluate these four central processes (August et al., 2006; Francis, et al., 2006). The main difference between this task and other measures of reading comprehension is the DARC's simplicity, given that it was designed to minimize the impact of word reading accuracy or speed, vocabulary, and syntactic structure. Furthermore, DARC is brief and easy to administer. In this work, an adaption of the DARC is presented for Spanish population, and its psychometric properties are studied through the elementary school years. Additionally, it is assessed its relation with other standardized measure of reading and comprehension: the PROLEC-R (Cuetos, Rodríguez, & Ruano, 2007), and it is compared the relation of both tests with decoding and academic performance.

Method

Participants

The sample consisted of 336 students including 174 boys and 162 girls from 2th to 6th grades with an overall mean age of 9.7 years ($SD= 1.49$). All children in this sample had Spanish as a first language and were recruited from two Madrid Elementary schools.

Materials and procedure

The 336 students were assessed on reading comprehension and decoding. All the tasks were group administered in two period sessions of one hour each.

Reading comprehension measures. Children were assessed on two reading comprehension measures:

a) The Spanish version of the DARC (Diagnostic Assessment of Reading Comprehension; Francis, et al., 2006). The DARC is composed of three short texts and 44 related questions. Texts consisted of four small paragraphs that describe relations among a set of real and artificial terms (e.g. *tibas are harder than carrots, bomos are softer than strawberries, mecus are softer than bomos*). Using the information in the text and prior knowledge, readers could construct a five-item linear order. The scores of each participant were obtained by computing the number of correct answers in four categories of questions related to four basic comprehension processes (Hannon & Daneman, 2001): memory, inferences, prior knowledge and integration of knowledge subscales. Children must answer the questions without having the text in front of them.

b) The comprehension subtest of the PROLEC-R (Cuetos, Rodríguez, & Ruano, 2007). Spanish standardized text of reading comprehension composed of four texts and 16 inferential questions. As in the DARC, children must answer the questions without having the text in front of them.

Decoding measures. Two measures were selected to assess students' decoding:

a) An orthographic segmentation paced task (OS) (Braten, Lie, Andreassen, & Olaussen, 1999), where participants had to recognize and separate, as quickly as possible, whole words written together as one word.

b) An orthographic choice task (OC) (López-Higes, Mayoral, & Villoria, 2002) that requires children to recognize the correct orthographic pattern for 20 words, independent from its phonology.

Results and discussion

Our findings show that the DARC is a reliable instrument to measure Spanish reading comprehension. First, we computed the internal consistency for the 44 items of the DARC. Coefficient α for the total

scores was .87. We also examined the reliabilities for the four comprehension processes subscales. Cronbach's α for items loading on memory, inferences, prior knowledge and integration of knowledge were .47, .72, .08 and .80, respectively. It pointed out that reliability for each scale were satisfactory (.4 or above), except for the prior knowledge scale. It should be noted, however, that the items pertaining to prior knowledge subscale were answered correctly by almost all the participants and used as a control measure. Additionally, high intercorrelations among subscales were found, ranging from .12 to .72. Prior knowledge subscale was only somewhat related with the rest of subscales, whereas memory, inferences and integration of prior knowledge were more highly related to one another. Thus, the pattern of relative independence among subscales found in the English version of the DARC was not replicated with this Spanish sample (August et al., 2006).

Predictive validity of the DARC was based on the assumption that reading comprehension is a developmental process that increases with reader's experience. The analyses of variance carried out showed significant differences between grades for the total score of DARC ($p < .01$), for the memory subscale ($p < .01$), for the inferences subscale ($p < .01$) and for the integration subscale ($p < .01$). Construct validity was established by correlating DARC students' scores with PROLEC-R students' score, as a measure of reading comprehension widely used in the Spanish context. The correlation coefficient between both tests was .47 ($p < .01$).

Finally, it was compared the relation of both tests with students' decoding and academic performance measures. The results showed that the DARC correlated higher than PROLEC-R with the orthographic segmentation paced task and the orthographic choice task as well it did with students' academic performance (i.e. Spanish language and mathematics marks). We are, therefore, facing a very useful test to be used in the elementary school for its ability to relatively easily diagnose reading and learning difficulties at various levels.

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