AN INVESTIGATION OF THE BICYCLE DRAWING TEST (BDT) ON STUDENTS’ ACADEMIC SELF-EFFICACY AND ACADEMIC PERFORMANCE IN INTRODUCTORY ECONOMICS COURSES

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ABSTRACT

This study explored whether the Bicycle Drawing Test (BDT) measure was applicable to students’ academic self-efficacy and academic performance in undergraduate students in introductory level economics courses. Two economic courses were assessed using a paper-based questionnaire during the spring of 2016. Data were analyzed using independent t-tests, correlational analyses, and a one-way ANOVA. The results demonstrated that age differences occurred in the completion of the BDT measure. Another finding was that left-handed individuals were more skillful at drawing the frame of the bicycle in comparison to right-handed individuals. Also, students’ performance in a microeconomics problem-solving assessment was positively associated with academic skills and self-efficacy. Additional findings and implications were also discussed in light of the academic self-efficacy and academic performance literature.

INTRODUCTION

The Bicycle Drawing Test (BDT) is a measure commonly used in the fields of neuropsychology and child psychology (Cannoni, Di Norcia, Bombi, & Di Giunta, 2014). In 1930, Piaget developed the BDT measure to understand developmentally challenged children’s mechanical reasoning abilities. The BDT consists of free-writing a bicycle and identifying the positioning of the bicycle parts to assess individuals’ motor and spatial skills (Cannoni et al., 2014). However, Taylor (1959) and Greenberg, Rodriguez, and Sesta (1994) revised and validated the Bicycle Drawing Test (BDT) to determine the causal relationships among visual and graphical cognitive concepts of children with cerebral deficits. More recently, Lawson (2006) and Bolceková et al. (2016) applied the BDT test to assess adult’s drawing efforts of the frame, pedals, and the chain of the bicycle. Lawson’s (2006) experiment found that males were more skillful at drawing the bicycle regardless of previous bicycle expertise in comparison to the women. Interestingly, Lawson (2006) found that age had no impact on participant’s performance on the BDT.

Because of the BDT’s association with individuals’ mechanical, visual-spatial, and cognitive abilities, we explored whether the BDT instrument is applicable to undergraduate business
students’ self-efficacy and academic problem-solving performance in an Introduction to Microeconomics course. A previous study has explored students’ mechanical and spatial abilities and determined that these abilities significantly impact students’ test performance in engineering courses (Hutchinson & Barton, 1987). Because undergraduate students may differ in their mechanical and cognitive skills, these skills may impact students’ academic performance and self-efficacy in a problem-solving course, such as the Principles of Microeconomics and the Principles of Macroeconomics. Thus, the purpose of this study was trifold. First, to explore the differences in sex, age, and the dominant hand and the BDT performance. Second, to explore the associations between the BDT and the problem-solving assessment. Third, to explore the associations between the BDT and students’ self-efficacy and academic skills.

METHODOLOGY

Upon Institutional Review Board approval, students in two undergraduate-level courses (e.g., Principles of Macroeconomics; Principles of Microeconomics) were invited to participate in a paper-based questionnaire in the spring of 2016. Out of the 73 students, 43 students (60.5% males and 37.2% females) adequately completed the questionnaire from both courses. The age of the participants included 15.4% between 13-18 years, 82.1% between 19-29, and 2.6% between 30-49. The ethnic background of the participants included 65.1% Caucasian/Non-Hispanic, 20.9% Hispanic/Latino(a), 4.7% African-American/Black, 7% Asian-American/American Indian, and 2.3% Other. The level of education of the participants included 34.9% Freshman, 30.2% Sophomore, 30.2% Junior, and 4.7% Senior. Of the participants, 34.9% reported being a first generation student and 62.8% reported not being a first generation student. Participants indicated taking an average of 14 credit hours per semester. Participants average Grade Point Average (G.P.A.) was between 3.0 and 3.49.

ANALYSIS AND RESULTS

An independent t-test found no sex differences in the drawing of the bicycle and the positioning of the parts of the bicycle. To add, a One-Way ANOVA revealed no age differences in the positioning of the frame or the pedals. However, significant age differences occurred in the positioning of the chain of the bicycle. Age differences were also found in the drawing of the pedal and the chain of the bicycle.

An independent t-test found no difference on participants’ dominant drawing hand and the drawing of the pedal or the chain. However, significant differences were found in the drawing of the frame of the bicycle. More specifically, left-handed individuals ($M = 1.25$, $SD = 1.19$) were more skillful at drawing the frame of the bicycle in comparison to right-handed individuals ($M = .54$, $SD = .36$).

A correlational analysis also revealed an inverse association between error-making on the microeconomics problem-solving assessment and the positioning of all the parts of the bicycle. Error-making on the microeconomics problem-solving assessment was also inversely associated with drawing the pedals, but not with drawing the frame or the chain.
A correlational analysis also revealed that the performance in the microeconomics problem-solving assessment was significantly and positively associated with academic skills and self-efficacy skills. In addition, identifying the positioning of the chain was also inversely correlated with self-efficacy. Interestingly, the drawing of the bicycle (frame, pedals, and the chain) exercise was positively correlated with academic self-efficacy.

**IMPLICATIONS**

Several business educational implications can be derived from the findings of this BDT study. First, the use of the BDT instrument is demonstrated to be relevant to understanding business students’ spatial and visual-motor skills. Business educators may choose to use the BDT instrument near the beginning of the semester in their classrooms to identify potential at-risk students who may underperform in their courses. Interestingly, performing a basic task, such as drawing a bicycle regardless of exposure, is a challenging task for some undergraduate students. Second, left-handed individuals may be more skillful at drawing the frame of the bicycle, which demonstrate their visual-motor skills in comparison to right-handed individuals. Third, the inability to identify the positions of the parts of the bicycle was found to be inversely associated with poor performance in the microeconomics problem-solving assessment items. Instructors of the Introduction to the Principles of Microeconomics or the Principles of Macroeconomic courses may also adopt the BDT instrument to potentially identify students who may perform poorly on their quizzes or problem-solving assessments. Fourth, educators may use the BDT instrument to assess whether students are skilled at drawing the frame, pedals, and the chain to explore their own students’ self-efficacy and academic performance in a single class period at any point in the semester to determine whether the BDT impacts their students’ self-efficacy and academic performance.

**CONCLUSION**

To summarize, this exploratory pilot study is the first study to explore whether the BDT instrument is relevant to undergraduate business students’ self-efficacy and academic problem-solving performance in the introductory-level principles of economics courses. Future studies need to continue to explore BDT’s impact on students’ self-efficacy and academic performance in the principles of economics courses.

**REFERENCES**


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