Applying Nonlinear Causal Resource Analysis Methods to Incorporation of Personality Traits in Performance Models for Education and Work

Tara Alavi, George V. Kondraske, Ph.D., Advisor

Department of Electrical Engineering, The University of Texas at Arlington, Arlington, Texas 76019

Summary and Conclusions

Our results show that data distributions in scatter plots are all consistent with GSPT predictions and a lower boundary “threshold” relationship can be identified, thus supporting the applicability of GSPT and NCRA cause-and-effect constructs to labor market earnings and questioning previous performance prediction efforts based on correlation. From the RDFS, a relatively greater amount of a particular basic performance resource (conscientiousness, grit, intellectual ability, etc.) is required to achieve higher earnings. The set of RDFSs, when developed for a number of basic performance resources, can be used to provide a performance strategy for developing interventions that increase non-cognitive skills as they begin to develop. We intend to collaborate directly with the authors of the original study in order to create RDFSs for the other measures of cognitive and non-cognitive skills. We then plan to share findings with our students to show that the traditional correlation approach is not an accurate way to analyze relationships between lower level performance resources and higher level task performance. While we did not fully apply NCRA methods to identify limiting resources for individuals who had low earnings, this would be the next logical step.

Materials and Methods

Published papers pertaining to predictions of educational success or utilizing the concept of the characteristic called “grit” were identified. Within those papers, we sought access to raw data via scatter plots including dependent and independent variables. Few papers included such data. We used data from a paper (Sian, Arias & Tudela, 2012) titled “Does Performance Pay as Much as Being Smart? The Return to Cognitive and Non-cognitive Skills in Urban Peru,” which included a random sample of the working-age (16-69) urban population in Peru (n=2,468). Participants completed surveys that measured cognitive and non-cognitive skills, which comprise the participants’ lower level performance capacities. Cognitive skills: intellectual ability was measured by the Peabody Picture Vocabulary Test. Non-cognitive skills: personality traits measured by Conscientiousness (the Big Five personality trait), as well as Grit personality trait (perseverance and will to strive for long term goals). Published scatter plots positioned the HLT (log earnings) on the Y-axis and the BPR on the X-axis. Analyzing the data according to the NCRA-model required that the points be re-ordered so that the HLT is reflected on the X-axis and the BPR on the Y-axis. Scatter plots were then generated for each level lower performance resource using the log of labor market earnings as the independent variable in each. A Resource Demand Function (RDF) was manually added to each scatter plot using NCRA utilizing the specified NCRA strategy.

Results

Figure 3. Original (left) linear regression scatter plot of log earnings performance vs. non-cognitive skill PPVT score and corresponding NCRA-based plot (right). The RDFS indicates the minimum amount of PPVT required to support a given level of earnings.

Figure 4. Original (left) linear regression scatter plot of log earnings performance vs. non-cognitive skill Grit 2: “Persistence of Effort” and corresponding NCRA-based plot (right). The RDFS indicates the minimum amount of Grit 2: “Persistence of Effort” is required to support a given level earnings.

Figure 5. Original (left) linear regression scatter plot of log earnings performance vs. non-cognitive skill conscientiousness and corresponding NCRA-based plot (right). The RDFS indicates the minimum amount of conscientiousness required to support a given level earnings.

Figure 6. Original (left) linear regression scatter plot of log earnings performance vs. cognitive skill PPVT score and corresponding NCRA-based plot (right). The RDFS indicates the minimum amount of PPVT required to support a given level of earnings.

Correlation

The correlation coefficient for a pair of variables is a measure of the strength and direction of the linear relationship between those variables. The correlation coefficient ranges from -1 to +1, with -1 indicating a perfect negative correlation, 0 indicating no correlation, and +1 indicating a perfect positive correlation.

Threshold

“The threshold" represents a minimum level of a resource required to achieve a given level of performance. The threshold is used to identify limiting resources for individuals who have the lowest earnings.

Appendix

Please contact Tara Alavi at alavi@uta.edu

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For further information

G. Kondraske, Ph.D. (advisor)
Human Performance Institute
Univ. of Texas at Arlington
PO Box 19180
Arlington, TX 76019-0180
E-mail: kondraske@uta.edu

Literature Cited