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THE IMPACT OF OPPORTUNITY, PROPENSITY, AND DISTAL FACTORS ON SECONDARY EDUCATION SCIENCE, TECHNOLOGY, ENGINEERING, AND MATH (STEM) PROGRAM AND ACADEMIC OUTCOMES (189 pp.)

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The 2012 Program for International Student Assessment (PISA) placed the U.S. in the bottom fourth of mathematics achievement, and less than 9% of U.S. 15-year olds were top performers in the same subject. Research into addressing this issue has involved Inquiry Based (IB) programs, such as Project Lead the Way (PLTW). The studies have focused on general Science, Mathematics, Pre-Engineering, state-wide scores, or national assessment scores. Important variables such as individual transcript data, End of Course (EoC) assessment scores, mathematics and/or science Grade Point Average (GPA), or participation in the Biomedicine program of PLTW have not been researched in the context of PLTW programs. Additionally, there is a lack of research using more sophisticated statistical analyses to examine the above relationships. Therefore, the goal of the current study is to determine the relationship between the opportunity factors (i.e., mathematics and science coursework and PLTW coursework), distal factors (i.e., demographics and prior achievement) and propensity factors (i.e., GPA, mathematics and science grades and PLTW grade) with immediate academic year achievement (i.e., EoC scores) with different statistical modeling techniques. Secondly, repeated measures analyses were also used to examine the relationship between the aforementioned variables and academic achievement over time.

The Freshmen Model ($N = 259$) and the Junior Model ($N = 73$) were developed using Path Analysis. The Sophomore Model ($N = 135$) and the Senior Model ($N = 51$) were developed using Hierarchical Multiple Regression. The impact on STEM PLTW grades over time and academic achievement over time (EoC scores) was analyzed by using Repeated Measures Split-Plot ANOVAs and One-Way Repeated Measures ANCOVAs. This exploratory investigation focused on the following main goals: (1) Investigating if a combination of distal, opportunity, and propensity variables can be used to predict current high school year academic achievement, and (2) Determining if a combination of distal, opportunity, and propensity factors can be used to predict high school academic achievement over time (i.e., across the four years of high school from Freshmen to Senior Year).

In summary, a few themes emerged from the results of the study. As shown in the Freshmen Model, Gender plays a positive role on the EoC, but a substantial negative role in the Sophomore Model. By the Junior and Senior Models, it plays no role in academic outcome. As shown in examining PLTWG and EoC over time, there is a significant interaction with Gender. These results suggest that PLTW may have a positive effect on females, as EoC and PLTWG improve over time, which may be tied to an increased interest in the STEM fields. Secondly, as mentioned in earlier research, the performance gap between males and females is largely erased, as shown in EoC and PLTWG over time, and the lack of Gender in the Junior Model or Senior Model. By increasing female

performance over time and showing that gender plays a non-significant role in predicting academic performance, it would appear that PLTW is moving towards the goal of positively impacting females in STEM (PLTW, 2012).

Another trend in the analysis was the relationship between Propensity factors and predicting end of year performance. Math Grade (MG), GPA, and PLTWG were prevalent in three of the four models. By the definition, Propensity factors are impacted by efficacy, effort, and student ability, therefore it may be that this why student achievement is greatly affected by Propensity factors. Also, these variables occurred closely in time to the academic outcomes, which may explain the numerous occurrences in the static models and also the magnitude of the variable coefficients.