MLDS Center
Maryland Longitudinal Data System

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Memorandum

TO: MLDS Governing Board

FROM: Ross Goldstien, Executive Director

              Angela Henneberger, Research Branch Director and Assistant Research Professor,
              University of Maryland School of Social Work

DATE: June 4, 2021

SUBJECT: External Researcher and Grant Funded Projects

Purpose
The purpose of this agenda item is to get Governing Board approval for two applications under the Policies and Procedures for External Researcher and Grant Funded Projects and to provide updates on previously approved projects.

Application #1
Dr. Jessaca Spybrook submitted an application for approval to use MLDS data for research on the following project: Best Practices for Modeling the Multilevel STEM Learning Environment.

Project Abstract
The STEM learning environment is complex and multilevel in nature. That is, students are nested within teachers, teachers are nested within schools, and schools are nested within local school systems. It is important to understand the role of students, teachers, schools, and local school systems as they relate to math and science student achievement. Past research has largely ignored the teacher level therefore potentially incorrectly attributing variance in STEM student achievement at the teacher level to the school or student level. The proposed study seeks to directly model the teacher level by using MLDS data, which links students, teachers, and schools, in order to estimate:
1. What portion of the variance in math and science student achievement (e.g., test scores) is at the student, teacher, school, and local school system level,
2. What portion of the variance in whether or not a student enrolls in remedial coursework in math is at the student, teacher, school, and local school system level, and
3. How much of the variance at each level can be explained by student, teacher, school, and local school system characteristics.

This is a methodological study. However, Dr. Spybrook plans to use the statistical models developed through this research to further analyze a prior Research Branch report on *Remedial Coursework in Maryland Community Colleges: Disentangling Individual and High School Level Predictors*.   Working closely with the Research Branch and other stakeholders, Dr. Spybrook will build on this research in several key ways. First, adding the teacher level will allow for an examination of whether incorporating the teacher level into statistical models improves those models. Further, it will provide a better understanding of the ways that teacher characteristics contribute to the need for remedial coursework. Second, adding the local school system level will provide a better understanding of how the demographic characteristics of the local school systems are related to the need for remedial coursework. Third, examining STEM outcomes across students, teachers, schools, and local school systems and

characteristics that explain variability in outcomes in the K-12 context will contribute to a greater understanding of the STEM educational landscape leading up to college.

Grant Funding
Dr. Spybrook applied for and received a National Science Foundation grant for $1,328,108.

Researchers
Dr. Jessaca Spybrook, Professor of Evaluation, Measurement and Research, Western Michigan University.
Ms. Dea Mulolli, Doctoral Graduate Assistant at Western Michigan University
Dr. Tracy Sweet, Associate Professor, University of Maryland, College Park and Associate Director of Research, MLDS Center Research Branch,

Request for Approval
Governing Board approval for this application is recommended. Dr. Spybrook is a well respected researcher with a proven track record of conducting methodological research and providing applied guidance to researchers in education. The methodological research being undertaken is unique and will help the MLDS Center Research Branch better understand the multilevel nature of the MLDS, improving future research studies for the Center. Additionally, the project benefits the State by examining the multilevel structure of the data that were used for an existing research report on remedial education, a topic of high priority to the State and a topic requested for additional research by the Maryland Higher Education Commission.

Application #2
Miriam Wiglesworth submitted an application for approval to use MLDS data for research on the following project: The Impact of Dual Enrollment on Maryland Colleges

Project Abstract
Using data from the MLDS, Ms. Wiglesworth plans to analyze the number of Maryland high school students who pass dual enrollment classes during the 12th grade year. This information will be disaggregated by gender, race, ethnicity, economic status and county. The research will also explore the number of students who matriculate to Maryland institutions after high school. This information will be subdivided by the type of institution the student attends after high school graduation to include MD two-year colleges, MD four-year colleges, and out-of-state four-year colleges.

Background Information
Ms. Wiglesworth is an Associate Professor of Business at Harford Community College. She is also a student at Wilmington University working towards her doctorate in Business Administration. The proposed research is in furtherance of her dissertation. Her work will be overseen by her dissertation adviser, Dr. Amay Danley. Dr. Henneberger will also provide input and local representation.

Researchers
Ms. Miriam Wiglesworth
Dr. Amay Danley, Wilmington University

Request for Approval
Governing Board approval for this application is recommended. This is a topic that will further expand the Center's research on dual enrollment by looking at additional student characteristics, local school

system variation in dual enrollment patterns, and the correlation between the dual enrollment college and the first college enrollment after high school.

Updates

Dr. Ken Elpus, Associate Professor of Music Education at the University of Maryland College Park received IES funding for a project that was previously approved by the Governing Board. His project focuses on possible links between academic outcomes and arts education in the International Baccalaureate Diploma Programme (IBDP). The main analyses have used internal data from the IB which were linked with data from the National Student Clearinghouse to understand postsecondary enrollment, persistence, and degree attainment differences between IB students who did and did not elect an arts course as part of their IBDP. IB data have a large N but relatively few observable covariates. The Dr. Elpus and his research team plan to use MLDS data to replicate the analyses for IB students who pursued the IBDP at Maryland IB world schools and use the richer set of covariates to more completely model selection into IB arts classes. They plan to use the MLDS data starting this summer. The MLDS research phase of the project is anticipated to last through June 30, 2022.

[ERA-18] Best Practices for Modeling the Multilevel STEM Learning Environment
Dr. Jessaca Spybrook

Project Title:	Best Practices for Modeling the Multilevel STEM Learning Environment
Abstract or Brief Description:	The STEM learning environment is complex and multilevel in nature. That is, students are nested within teachers, teachers are nested within schools, and schools are nested within local school systems. It is important to understand the role of students, teachers, schools, and local school systems as they relate to math and science student achievement. Past research has largely ignored the teacher level therefore potentially incorrectly attributing variance in STEM student achievement at the teacher level to the school or student level. The proposed study seeks to directly model the teacher level. That is, we plan to use the Maryland data which links students, teachers, and schools in order to estimate 1) what portion of the variance in math and science student achievement (e.g., test scores) is at the student, teacher, school, and local school system level, 2) what portion of the variance in whether or not a student enrolls in remedial coursework in math is at the student, teacher, school, and local school system level, and 3) how much of the variance at each level can be explained by student, teacher, school, and local school system characteristics.

How statistical models approach the nested structure of educational data is an important methodological consideration. It is well known that failing to account for nested data structures can result in incorrect inference, meaning education researchers may make incorrect conclusions. Education research has largely ignored the nesting of students within teachers, despite both methodological concerns and other research on the importance of teachers on student outcomes.

This methodological study aims to examine the extent to which the common practice of ignoring the teacher level can lead to different inferences. The findings from this project will have not only practice considerations regarding STEM student achievement, but will provide guidance on the statistical methodology used by the MLDS Center in the future.

Although this work is primarily focused on statistical methodology, we provide a context in prior research examining the need for remedial coursework in Maryland community colleges. The MLDS research branch has modeled the need for remedial coursework using two-level models with students nested in high schools (see *Remedial Coursework in Maryland Community Colleges: Disentangling Individual and High School Level Predictors,* Henneberger et al., 2018 and Uretsky et al., 2019). The Center's research used Rumberger's (2011) theoretical framework to examine demographic, academic, and school-level factors associated with the need for remedial coursework. We will work closely with the MLDS Center research branch and other stakeholders to build on this research in several |

	key ways. First, adding the teacher level better aligns with the structure of the data, and we will examine if incorporating the teacher level into our statistical models improves our models. Further, we will better understand the ways that teacher characteristics contribute to the need for remedial coursework. Second, adding the local school system level will help us to better understand how the demographic characteristics of the local school systems are related to the need for remedial coursework. Third, examining STEM outcomes across students, teachers, schools, and local school systems and characteristics that explain variability in outcomes in the K-12 context will contribute to a greater understanding of the STEM educational landscape leading up to college.
Research Project Question:	Three primary methodological research questions guide this study: 1) What portion of the variance in math and science student achievement is at the student, teacher, school, and local school system level? 2) What portion of the variance in whether or not students need remedial coursework in math in college is at the student, teacher, school, and local school system level? 3) For each of the outcomes, how much of the variance at each level can be explained by student, teacher, school, and local school system characteristics?
Research Agenda Questions:	2. Are Maryland students academically prepared to enter postsecondary institutions?
Methods	To answer the three primary research questions, we will run a series of multilevel models with students nested within teachers nested within schools nested within local school systems. The first type of multilevel models are unconditional models, or models with no student, teacher, school, or local school system-level covariates. This will allow us to estimate how much variance in the outcome is at the student, teacher, school, and local school system-level (research questions 1 and 2). The second type of multilevel models are conditional models with different sets of student, teacher, school, and local school system-level covariates. These models will allow us to calculate the percent of variance explained by student, teacher, school, and local school system-level characteristics (research question3). Student, teacher, school, and local school system-level characteristics of interest will be guided by discussions with stakeholders, but we anticipate demographic characteristics (e.g., gender; race/ethnicity), academic characteristics (e.g., academic achievement; attendance), and program participation (e.g., FARMs; ELL) to be of interest at the student-level. Additionally, we expect teacher experience and demographic characteristics (e.g., gender; race/ethnicity) and school composition and local school system composition

	(e.g., concentrated FARMs; academic achievement) variables to be of interest at the teacher, school, and local school system-levels, respectively.
Benefit to the State of Maryland:	The findings from this study will benefit Maryland in several ways. First, they will help those using Maryland data understand how to appropriately model teacher and school levels in order to account for the variance at each level and reduce the likelihood of drawing erroneous conclusions or misattributing the variance in STEM outcomes. Second, they will contribute to a greater understanding of the role of students, teachers, schools, and local school systems in the need for remedial coursework in math for college students and factors that explain variability in this outcome. Understanding these factors may also lead to opportunities for Maryland personnel to better target resources.
Explanation of Cross-Sector Qualities:	The proposed research utilizes K-12 education data (from MSDE), college enrollment and need for remedial coursework data for students (from MHEC), and workforce data (from MSDE – teacher staffing file).
Proposed Center Output:	Results will be disseminated to Maryland researchers and policymakers through presentations at the MLDS Center research series and through technical and research reports to inform future research and reporting of the MLDS Center research branch. A research seminar on best practices for modeling multilevel education data will also be provided.
Estimated Timeline for the Proposed Project:	We submitted a proposal to the Education and Human Resources Core Research competition in October, 2019. The grant was funded in June, 2020. The grant is for 3 years. In year 1 we are working to obtain data and prepare the state dataset for analysis. Year 2 includes conducting analyses for research questions 1-3. Year 3 focuses on dissemination efforts, which is a central goal for this work. Results will be shared with Maryland researchers and policymakers through presentations at the MLDS Center research series, through technical and research reports to inform future research and reporting in the State of Maryland, and through research seminars on modeling multilevel education data.
Plans for Further Development:	We will disseminate the findings through websites, other workshops, conferences, and papers. Target conferences include the annual meetings for the American Educational Research Association (AERA), the Society for Research on Educational Effectiveness (SREE), and the American Evaluation Association (AEA). Target journals include the Journal for Research on Educational Effectiveness, AERA Open, and American Journal of Evaluation.
Researcher Applicant Name:	Jessaca Spybrook
Researcher Email Address:	jessaca.spybrook@wmich.edu
Researcher Organization:	Western Michigan University

Researcher Phone Number:	2484703888
Research Applicant Background and Qualifications:	Jessaca Spybrook is a Professor in the Evaluation, Measurement, and Research Program at Western Michigan University. Her research focuses on improving the design of causal inference studies, particularly in education. She is an expert in power analyses and is co-author of Optimal Design, a program for conducting power analyses for main effects for multi-level studies, and PowerUp!-Moderator, a program for conducting power analyses for moderator effects for multi-level studies. Spybrook has conducted dozens of workshops on the program over the past decade including, for example, invited sessions for the program officers at the Institute of Education Sciences, the Annual Workshop on Randomized Trials sponsored by the Institute of Education Sciences, the Annual Meeting for the Society for Research on Educational Effectiveness. Spybrook's research has been funded by the Institute of Education Sciences, the National Science Foundation, and the William T. Grant Foundation. She was a National Academy of Education/Spencer Postdoctoral Fellow in 2010-11 and a Fellow for the Society for Research on Educational Effectiveness in 2015-16. She earned her Masters in Applied Statistics and PhD in Education from the University of Michigan. Prior to attending graduate school she was a seventh grade math teacher.
Multiple Research Applicants?:	Yes Jessaca Spybrook Dea Mulolli (Doctoral Graduate Assistant at WMU) Tracy Sweet, Associate Director of Research, MLDS Center Research Branch
Grant Funds:	Grant funds have already been secured for this project (see below).
Description of Grant Program:	National Science Foundation, Education and Human Resources Core Research
Name of Grantor:	Jessaca Spybrook
RFP or Grant Program Information:	https://www.nsf.gov/pubs/2019/nsf19508/nsf19508.htm
Amount of Grant Funds Sought / Awarded:	$1,328,108
Grant Application Date:	Application Date: October 3, 2019 Awarded Date: June 15, 2020

Letter of Support:	Yes
Intent to Proceed Without Grant:	No

Measures

- **Test scores:** Mathematics and science scores in state administered tests in all grades as well as scores in end-of-subject tests administered in selected high school courses such as algebra. We will get these scores from multiple years which will allow us to test lagged scores from one or more years as covariates.

- **College enrollment**: Need for remedial coursework in math in 2-year and 4-year public and private in-state and out-of-state colleges.

- **Student characteristics:** Demographic and socioeconomic characteristics including gender, race/ethnicity, socioeconomic status, ELL status, special education status.

- **Teacher characteristics:** Gender, race/ethnicity, age, teaching experience and credentials, and highest degree.

- **School characteristics:** Local school system, size, and title1 status.

Project Information Worksheet -

Project Title
The Impact of Dual Enrollment on Maryland Colleges

Principal Investigator(s)
Miriam Wiglesworth Dr. Amy Danley, Wilmington University

Abstract or Brief Description
This research will use ex post facto data, provided by MLDS, in the analysis examining the number of Maryland high school students who pass dual enrollment classes during their 12th grade year. This information will be separated by gender, race, ethnicity, economic status, and county. The research will also explore the number of students who matriculate to Maryland institutions after high school. This information will be sub-divided by type of institution the student attends after high school graduation to include MD two-year school, MD four-year school, or four-year schools outside of MD. The analysis will further divide the data by gender, race, ethnicity, and economic status.

Research Project Questions(s)
RQ1: What is the current pass rate of Maryland high school students who are dually enrolled in college courses? RQ2 - What is the relationship between demographic and economic factors of Maryland high school students who are dually enrolled in college courses and student pass rate in their dual enrollment courses? RQ3: What is the relationship between demographic and economic factors of Maryland high school students who took dual enrollment college courses and enrolled in a Maryland college post high school? RQ4: What is the number of dually enrolled Maryland high school students who have their first post-high school college enrollment at the college of dual enrollment? RQ5: Is there a relationship between demographic and economic factors of Maryland high school students who took dual enrollment college courses by county?

Research Methodology

It is my intent to analyze the ex post facto data using statistical analysis. Descriptive statistics to include frequency distribution, will be used to identify students who are enrolled in the dual enrolment programs and where they are going after high school. Additional tests used will include t-tests, and correlations.

B. 3. What percentage of Maryland high school exiters go on to enroll in Maryland postsecondary education?
B. 5. Which financial aid programs are most effective in improving access and success (i.e., retention and graduation) for Maryland students?
C.10. What are the differences in performance, retention, and graduation, including time to degree, of students beginning in dual enrollment programs, at 2-year institutions and at 4-year institutions?

Benefit to the State of Maryland

The proposed research can be used to inform decisions on participation in dual enrolment programs, especially participation by underrepresented groups. This would include consideration of gender, race, ethnicity, and economic status.

The proposed research can additionally be used to improve post-high school matriculation to Maryland 2-year and 4-year institutions.

This research may be used to provide information on where funding is needed to increase dual enrollment opportunities.

Explanation of Cross-Sector Qualities

This project uses data from both K-12 Education, Maryland State Department of Education, and Postsecondary Education, Maryland Higher Education Commission.

MSDE provides the post-high school matriculation information. MHEC provides the pass/fail numbers and the demographic and economic data.

Data
Maryland High School students participating in dual enrollment courses their senior year in high school from 2014 – 2019.

This information will be subdivided by pass/fail, county, gender, race, ethnicity, and economic status.

Matriculation data for Maryland High School students participating in dual enrollment courses their senior year in high school from 2014-2019.

This information will be separated into three groups. These groups will include students matriculating to 2-year MD schools, 4-year MD schools, and 4-year non-MD schools. This information will be further subdivided by pass/fail grades, county, gender, race, ethnicity, and economic status. |

Proposed Center Output (see section 2.3 of the procedures)
The MLDS will be able to add the information to the existing set of dashboards that can be found at https://mldscenter.maryland.gov/Dashboards.html.

I will be happy to present my findings at the monthly research series through the MLDS and share the information with other constituency groups as needed. |

Estimated Timeline for the Proposed Project
May 2021 – Submit application for data.
June 2021 – Board discussion and approval if needed.
August 2021 – Receive requested data.
August – October 2021 – Data analysis
December / January – Research completion.

Plans for Further Development (see section 2.3 of the procedures)
It is my intention to use the research for my dissertation. Upon dissertation defense and approval there will be parts of this research that will be submitted for publication. Publications may include but are not limited to: Chronicle of Higher Education, Community College Review, Review of Higher Education, The Journal of Higher Education and similar periodicals.

I also intend to present my findings at local and national conferences to include AFACCT and NISOD. |