

Is MIDFIELD for me? Exploring the Multiple Institution Database for Investigating Engineering Longitudinal Development

Susan M. Lord
Integrated Engineering
University of San Diego
San Diego, CA USA
slord@sandigo.edu

M.W. Ohland and R. A. Long
School of Engineering Education
Purdue University
West Lafayette, IN USA
ohland@purdue.edu, ralong@purdue.edu

Marisa K. Orr
Engineering and Science Education
Mechanical Engineering
Clemson University
Clemson, SC USA
marisak@clemson.edu

Richard A. Layton
Layton Data Display
Terre Haute, IN USA
graphdoctor@gmail.com

Abstract—The Multiple Institution Database for Investigating Engineering Longitudinal Development (MIDFIELD) is a unique research resource offering student record data at an unprecedented scale. This special session aims to introduce participants to MIDFIELD including the data that it contains and some key results from research using MIDFIELD, explore how to conduct research with such a resource, and explain how participants can access MIDFIELD. Understanding what data is available in MIDFIELD and how to access it will help researchers decide if this is a useful resource for their own research.

Keywords—data analysis, pathways, research approaches retention

I. INTRODUCTION

A. Overview

This special session introduces participants to the Multiple-Institution Database for Investigating Longitudinal Development (MIDFIELD). MIDFIELD includes longitudinal, whole population data for multiple institutions. This enables researchers to examine student characteristics such as race/ethnicity, sex, or age and curricular pathways, including coursework, by institution and over time. Because the dataset contains records of all students matriculating over a period of time, researchers can study students in all disciplines, not just engineering. More details about the dataset, including data security and confidentiality available in [1]. A comparison of MIDFIELD to a national dataset from the American Society for Engineering Education (ASEE) in the USA is available in [2].

As of May 1, 2021, MIDFIELD includes longitudinal data for 1,687,100 undergraduates at 19 institutions with ABET-accredited engineering programs. Of those, 302,631 students declared engineering as a major at some point in their undergraduate education. MIDFIELD is a comprehensive

resource that contains a wealth of student unit-record data including demographic, enrollment, course performance, and graduation data. A total of 33 institutions have completed Memoranda of Understanding and are expected to be included in the next release.

B. Research using MIDFIELD

High impact research in engineering education has been conducted with MIDFIELD. The size of the dataset permits disaggregation by multiple factors. For example, detailed studies of student demographics and outcomes disaggregated by race/ethnicity and sex have been conducted in aerospace engineering, chemical engineering, civil engineering, electrical and computer engineering, industrial and systems engineering, and mechanical engineering [3, 4, 5, 6, 7, 8, 9, 10]. MIDFIELD data was used to demonstrate that the apparent high dropout rate in engineering was really the result of a higher-than-typical retention rate and a low replacement rate compared to other disciplines [11]. Research with MIDFIELD showed that women are as likely as men to persist in engineering when disaggregated by race and sex, and that women follow similar pathways to men if they leave engineering [12]. A detailed study of four-year vs six-year graduation rates illuminated a “systematic majority measurement bias” [13]. Research with MIDFIELD data revealed that students who migrate into engineering disciplines are successful contrary to popular stereotypes [14]. Researchers have also established new metrics such as “stickiness” [15] and migration yield [16]. MIDFIELD studies using a proxy for socioeconomic status (SES) revealed that race/ethnicity was no longer as strong a predictor of success when SES was considered [17]. Researchers used MIDFIELD data to illustrate metrics that are informed by pipeline, pathways, and ecosystems metaphors for studying student persistence [16].

Research using MIDFIELD has been recognized by the engineering education research community for its quality and

importance. This includes many invitations for invited talks and awards such as the 2013 Women in Engineering Proactive Network (WEPAN) Betty Vetter Award for Research “for exceptional research committed to understanding the intersectionality of race and gender” [18] and the 2008, 2011, and 2019 William Elgin Wickenden Award for the Best Paper in the *Journal of Engineering Education* (JEE) [11, 13, 16, 20] and the 2011 and 2015 Theodore E. Batchman Best Paper Awards from the *IEEE Transactions on Education* [5, 6, 19].

II. GOALS OF THE SESSION

At the conclusion of the session participants should be able to:

- describe MIDFIELD and the data it contains
- describe student record data
- describe some key research results that have been obtained using MIDFIELD
- determine if MIDFIELD would be useful for their research
- outline process to access MIDFIELD
- plan for future workshops if interested in learning more about MIDFIELD

The intended audience for this work is

- Researchers who are interested in learning about MIDFIELD
- Researchers who want to see if MIDFIELD could be a useful resource for their own research.
- Researchers who are interested in figuring out what advantages there would be for their institution to join the MIDFIELD partnership.

MIDFIELD is a unique research resource offering student record data at an unprecedented scale. Understanding what data is available in MIDFIELD and how to access it will help researchers decide if this is a useful resource for their own research.

III. DESCRIPTION OF THE SESSION

A. Overview

Significant research has been conducted using earlier versions of MIDFIELD, and there has been progress in increasing the number and diversity of institutions included in the partnership. Whereas the original partners were exclusively public institutions, largely in the southeastern U.S., the expansion of MIDFIELD includes a more diverse set of institutions, including private, predominantly liberal arts, historically Black, and Hispanic Serving Institutions. This expansion will allow for comparisons to be made not only by standard demographic variables, but also by institution type. The database is also being made more accessible to researchers. This session will help potential researchers learn more about MIDFIELD. Borrowing a framework from the field of marketing [21], this workshop is intended to increase awareness of MIDFIELD sufficiently for researchers to decide if they are interested in exploring MIDFIELD further in their own work. At

the conclusion of this workshop, participants will learn about opportunities to capitalize on their interest. The MIDFIELD team aims to educate the broader research community, expand the network of researchers capable of conducting this research, and share innovative research methods in addition to the actual data. We have offered workshops at several conferences as well as the MIDFIELD Institute.

Topics include

- Description of the MIDFIELD database including listing common elements of student unit-record data. Selected examples of the variety of types of research done using MIDFIELD to date.
- Participants will engage with sample data in small groups. This will enable them to get hands-on experience with how to select data to answer a specific research question. Specifically, participants will focus on calculating graduation rate.
- Introduction to the R resources available to support research with MIDFIELD including a sample data set and software to calculate metrics such as graduation rate and produce effective data displays [22, 23, 24].

B. Justification

The depth of data available in MIDFIELD allows for detailed longitudinal studies at an unprecedented level. One of the goals of the MIDFIELD research team is to support a research community in asking new questions and providing the tools to answer them. Given the complexity of the data available, it is helpful for potential researchers to have an opportunity to experience a hands-on introduction to this resource and be able to have a discussion with researchers who have used MIDFIELD effectively.

C. Tentative Agenda

The session format will include brief talks and demonstrations by the facilitators interleaved with participant interactions including think-pair-share, small-group discussion, and working in groups arranged by research objective. The session will consist of five parts:

- 1) *Introduction and Objectives (5 min)*
- 2) *MIDFIELD intro and key results (15 min)*
This session will focus on describing MIDFIELD and the common elements of students’ unit-record data. The session will then discuss different types of research done using MIDFIELD through multiple examples.
- 3) *Small group activity: Finding Stories in the Data (30 min)*

Participants will work in groups to combine information from different tables to tell the “story” of an individual student and then discuss how to extrapolate to large-scale analysis.

4) *Resources to facilitate use of MIDFIELD (25 min)*

Facilitators will demonstrate how to access the midfieldr R package and what can be accomplished with it to study undergraduate persistence and other metrics.

5) *Wrap-up (5 min)*

D. Facilitator Biographies

Richard Layton is the MIDFIELD Data Visualization Specialist, Professor Emeritus of Mechanical Engineering at Rose-Hulman Institute of Technology, and the lead developer of the R packages used in this workshop. Dr. Layton has considerable experience facilitating workshops, including a 2014 FIE workshop on data visualization.

Russell Long is MIDFIELD Managing Director and Data Steward. He developed the stratified data sample for the R packages used in this workshop. Mr. Long is a SAS expert with over twenty years of experience in institutional research and assessment.

Susan Lord is Director of the MIDFIELD Institute and Professor and Chair of Integrated Engineering at the University of San Diego. She is a Fellow of the IEEE and the ASEE. Dr. Lord has considerable experience facilitating workshops including the National Effective Teaching Institute (NETI) and award-winning special sessions at FIE.

Matthew Ohland is the MIDFIELD Director & Principal Investigator. He is the Dale and Suzi Gallagher Professor and Associate Head of Engineering Education at Purdue University and a Fellow of IEEE, ASEE, and AAAS. Dr. Ohland has considerable experience facilitating workshops including the NETI and CATME training.

Marisa Orr is the MIDFIELD Associate Director and Assistant Professor in Engineering and Science Education with a joint appointment in Mechanical Engineering at Clemson University. She is a recipient of the 2009 Helen Plants Award for the best nontraditional session at FIE (Enhancing Student Learning Using SCALE-UP Format).

IV. OUTCOMES AND FUTURE WORK

We hope this session will enable participants to gather sufficient information to determine if they want to move from awareness of MIDFIELD to interest in digging deeper or if they want to recommend MIDFIELD to colleagues or recommend that their administration join MIDFIELD. Future workshop offerings will be available.

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