

MATT J. DAVIDSON

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SUMMARY

- Collaborative and inclusive researcher with demonstrated experience conducting studies and disseminating results in Computing Education and Educational Measurement research communities
- Passion for making assessments fair, equitable, just, and relevant to real world outcomes by applying argument-based validity to item analyses, score interpretations, and uses
- Excellent communicator with ability to clearly explain technical concepts to non-technical audiences
- Strong analysis skills including DIF, IRT, scaling, linking, equating, hierarchical modeling, propensity score analysis, SEM, clustering, principal components analysis, sequential pattern mining, and more
- Expert R user with extensive experience using tidyverse for data wrangling

EDUCATION

Doctoral Student, Measurement and Statistics, College of Education, University of Washington Expected Dec 2021

Advisor: Dr. Min Li

Committee Members: Dr. Chun Wang, Dr. Mo Zhang, Dr. Amy J. Ko

Master of Education, Learning Sciences, College of Education, University of Washington Jun 2014

Advisor: Dr. Virginia W. Berninger

Thesis: Thinking Aloud before Composing: Effects of Oral Production of Ideas and Plans for Writing on Essays

Bachelor of Arts, History, Philosophy, and English, University of Texas Dec 2007

Certification

Massachusetts Preliminary Teacher Certification, English 8-12 Feb 2015

Workshops

National Assessment of Educational Progress (NAEP) Data Training Workshop, Washington, D.C. Jun 2018

International Baccalaureate Theory of Knowledge Category 1, *GEMS World School, Singapore* Feb 2016

International Baccalaureate Psychology Category 1, *Online* Apr 2016

RESEARCH EXPERIENCE

Research Assistant, University of Washington: Seattle, WA Sep 2021 – present

Developing Authentic and Fair Computer Science Assessments (NSF-2055550)

PI: Dr. Mo Zhang, Research Scientist, *Educational Testing Service*

I conducted exploratory research with keystroke logs collected while undergraduate students wrote computer programs to understand critical characteristics of programming tasks. This will identify patterns that indicate proficiencies and suggest fluency or dysfluency. Results will also be used to establish a data collection and analysis pipeline to support increased scale in later years of the grant.

Researcher Intern, *American Institutes of Research, Washington, DC*

NAEP Doctoral Student Internship Program

Supervisor: Dr. Fusun Sahin, *Researcher, AIR*

I worked in the Process Data topic area to understand how 4th grade English learners (ELs) used on-screen tools on the 2017 NAEP mathematics exam, and how all 4th grade students used interactive item components (IICs) on the 2019 mathematics exam. I used propensity score matching to estimate the effect of tool use on EL students' scores. I used descriptive methods to examine how students used IICs, and composed a detailed memo on limitations of collected process data.

Jun 2021 –

Aug 2021

Research Assistant, *University of Washington: Seattle, WA*

Investigating the Effects of Computational Thinking Games on Mathematical and Scientific Practices (NSF-1639576)

PI: Dr. Zoran Popovic, *Paul G. Allen School of Computer Science and Engineering*

I analyzed action sequences collected while K-12 students played an educational game designed to develop computational thinking skills. After filtering and wrangling the data into a format for analysis, I used sequential pattern mining to discover clusters of students, then explore how those clusters are related to how students develop and apply computational thinking skills.

Jan 2021 –

Jun 2021

Research Assistant, *University of Washington: Seattle, WA*

Automatically Synthesizing Valid, Personalized, Formative Assessments of CS1 Concepts (NSF-1735123)

PI: Dr. Amy J. Ko, *The Information School*

I provided psychometric support and guidance to the research team in its goal to develop an adaptive learning tool for introductory Python programming, called Codeitz (codeitz.com). I analyzed existing computer science assessments to guide the design of items for Codeitz, including designing and conducting a thinkaloud study to understand student response processes to items. I actively collaborated with group members on study designs, writing, and conference presentations.

Sep 2017 –

Dec 2020

Psychometric Intern, *National Commission on Certification of Physician*

Assistants: Johns Creek, Georgia

I developed and independently explored research questions arising from a new, longitudinal format for the NCCPA recertification exam. I used data from the exam pilot to assess whether IRT model assumptions held for a longitudinal exam. I explored this by fitting and interpreting multidimensional item response theory models, with and without person-level covariates, using *flexMIRT*. Insights from my analysis were accepted for presentation at the 2020 NCME conference, and also guided development of the operational exam.

Jun 2019 –

Aug 2019

IN PROGRESS

Davidson, M.J. and Ko, A.J. Justice-oriented assessment for the secondary computer science classroom. *Book chapter, expected publication 12/2021.*

Davidson, M.J., Li, M. and Ko, A.J. Exploring the effect of non-construct related item features on student responses in assessments of introductory programming skills. *Manuscript in preparation.*

PUBLICATIONS

Xie, B., **Davidson, M.J.**, Franke, B., McLeod, E., Li, M., & Ko, A.J. Domain Experts' Interpretations of Assessment Bias in a Scaled, Online Computer Science Curriculum. In *L@S '21: Proceedings of the 8th ACM Conference on*

Learning @ Scale, Virtual Event. <https://dx.doi.org/10.1145/3430895.3460141>

Davidson, M.J., Wortzman, B., Ko, A.J., and Li, M. (2021, March). Investigating item bias in a CS1 exam with differential item functioning. In *Proceedings of the 52nd ACM Technical Symposium on Computer Science Education*, Virtual Event. <https://doi.org/10.1145/3408877.3432397>

Ko, A.J., Oleson, A., Ryan, N., Register, Y., Xie, B., Tari, M., **Davidson, M.**, Druga, S., and Loksa, D. (2020, November). It is time for more critical CS education. *Communications of the ACM* 63:11, 31–33. <https://dl.acm.org/doi/10.1145/3424000>

Xie, B., **Davidson, M.J.**, Li, M. & Ko, A. (2019, February). An item response theory evaluation of a language-independent CS1 knowledge assessment. In *Proceedings of the 50th ACM Technical Symposium on Computer Science Education*, Minneapolis, Minnesota. <https://doi.org/10.1145/3287324.3287370>

Xie, B., Loksa, D., Nelson, G.L., **Davidson, M.J.**, Dong, D., Kwik, H., Tan, A.H., Hwa, L., Li, M., & Ko, A.J. (2019). A theory of instruction for introductory programming skills. *Computer Science Education*. <https://doi.org/10.1080/08993408.2019.1565235>

CONFERENCE
PRESENTATIONS

Davidson, M.J., and Li, M. (2021, July). Investigating student response processes on computer programming items: Combining evidence from keystroke logs and thinkalouds for validity arguments. Presented at the 12th International Test Commission Conference, Virtual Event.

Davidson, M.J., and Li, M. (2021, April). Non-construct item features and response processes in CS assessments: Evidence from thinkalouds and sequence analysis. Presented at American Education Research Association Annual Meeting, Virtual Event.

Davidson, M.J., Fan, F. Dallas, D., Goodman, J., Weir, J.B. (2020, April). *Modeling latent ability change in a longitudinal assessment: a MIRT approach*. Accepted for presentation at National Council on Measurement in Education Annual Meeting, original location San Francisco, California.

Davidson M.J., Dong, D., Xie, B., Li, M., & Ko, A. (2019, April). *Exploring item difficulty in assessments of computer programming with cognitive interviews*. Accepted for presentation at National Council on Measurement in Education Annual Meeting, Toronto, Ontario, Canada.

Davidson, M., Dong, D., Xie, B., Loska, D., Li, M., & Ko, A. (2018, June). *Assessing programming knowledge and skills: A theory-based approach*. Presented at the 11th International Test Commission Conference, Montreal, Ontario, Canada

TEACHING
EXPERIENCE

High School Teacher, Grades 9-12, American International School Vietnam: Ho Chi Minh City, Vietnam

Aug 2015 –
Aug 2017

- Taught IB Psychology, IB Theory of Knowledge, AP Psychology, English 9, AP English Language
- Developed unit plans and daily lessons for all subjects based on the principles of Understanding By Design

- Analyzed statistical properties of assessments to guide instructional choices
- Differentiated content, exams, and instruction for entirely English Language Learner international student population

Assistant Director, Odegaard Writing and Research Center (OWRC): Seattle, WA

- Facilitated close staff connections through mentoring program, quarterly interviews, and community-building activities
- Established collaborative partnerships across university to facilitate discussion on English Language Learners and teaching and learning of writing
- Reviewed applications, interviewed applicants, and made hiring decisions
- Developed assessment and record-keeping procedures to evaluate current practices and plan for future growth

Aug 2012 –
Aug 2014

Teaching Assistant, College of Education, University of Washington: Seattle, WA

- Conducted one-on-one meetings with College of Education students to provide feedback on writing process and written work
- Utilized respectful, responsive tutoring practices to foster strong cross-cultural relationships
- Collaborated with Student Services and faculty to assess students' writing needs in the College of Education

Jul 2013 –
Aug 2014

Classroom Instructor, Grades 4-9, ACE Academy: Austin, TX

- Taught Social Studies 4th -9th, Philosophy and Logic 3rd-8th, Language Arts 4th-9th, Debate 7th-9th
- Designed and taught personalized, inquiry-based unit plans and daily lessons to meet the learning needs of gifted and twice exceptional students
- Collaborated with teachers and administration to create and implement new high school program

Aug 2008 –
Aug 2011

COMMUNITY
ENGAGEMENT

Member, Design Use Build Group (DUB), University of Washington: Seattle, WA

Mar 2018 –

Model United Nations Sponsor, American International School, Vietnam: Ho Chi Minh City, Vietnam

Aug 2015 –
Jun 2016

PROFESSIONAL
AFFILIATIONS

International Educational Data Mining Society (IEDMS)
American Education Research Association (AERA), Division D, Measurement and Research Methodologies
National Council on Measurement in Education (NCME)
Association for Computing Machinery Special Interest Group in Computer Science Education (ACM SIGCSE)
CS for All Washginton
AnitaB.org

STATISTICAL
COMPUTING

R, Python, *flex*MIRT 3.0, HLM 7, (ur)GENOVA, *Mplus*, git and GitHub

LANGUAGES

English: Native Language
Spanish: Novice Listening and Speaking, Intermediate Reading and Writing