Learning Analytics and Deep Learning: New Quantification for STEM Instruction

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ABSTRACT

The better quantification of results, analysis of efficacy, and enhancement of teaching techniques is now being enabled by advances in emerging technologies. Learning Analytics, Deep Learning, Neural Net Training, and Meta-Disciplinary approaches to the evaluation, selection, and preparation of instructional personnel are now feasible. Across the millennia, history reports that sages, teachers, and mentors have been sought to help prepare people for productive lives. Most of the evaluation of that search has been based on subjective and unquantified impressions. The obfuscation by human emotions has masked even the modest ability that previous generations had to evaluate pedagogical effectiveness. This paper adduces data to show how this conflation of the teacher's attractiveness and their effect on students has predestined early attempts to evaluate teacher skills to disappointment. During research into virtual conversational interfaces, the authors observed a number of issues concerning teacher evaluation. Researchers have made significant strides in Learning Analytics suggesting Artificial Intelligence communities may have insights that could be useful in live-instruction environments. Also, several emerging capabilities in the computational sciences have showed both results and future promise. These new technologies are outlined and reviewed. The paper disuses emerging capabilities of machine learning and learning analytics. They might deliver improved evaluation of human teachers. All of these issues are then synthesized to produce a viable path to a new set of psycho-metric tools for a better pre-selection evaluation, tailored training, and final competency assessment of instructional personnel. This is an especially pressing current concern of the authors.

ABOUT THE AUTHORS

Dan M. Davis is a research staff member at Catholic Polytechnic University and is active as a consultant at the Institute for Creative Technologies, University of Southern California (USC), focusing on large-scale DoD simulations and avatar uses. Prior to retirement, he was the Director of the JESPP project at USC for a decade. As the Assistant Director of Advanced Computing Research at Caltech, he ran Synthetic Forces Express, bringing HPC to DoD simulations. He also served as a Director at the Maui High Performance Computing Center and in computer research roles at the Jet Propulsion Laboratory and Martin Marietta. He was the Chairman of the Coalition of Academic Supercomputing Centers and has taught at the undergraduate and graduate levels. As early as 1971, Dan was writing programs in FORTRAN on one of Seymour Cray's CDC 6500's. While in the Marine Corps, he saw duty in Vietnam as a Cryptologist and retired in 2002 as a Commander, U.S.N. He received B.A. and J.D. degrees from the University of Colorado in Boulder.

Jerome C. Placido serves on the Advisory Board for Catholic Polytechnic University in the San Gabriel Valley, California. He also is the Director of Software Application Development at Workday, Inc. in the Bay Area. With over a decade of experience in higher education technology and his primary research interests are in organizational effectiveness and concrete applications for combinatorial optimization in student success scenarios. He has also held leadership and technology positions at Envisions in Irvine California and while serving on the board for YCP Silicon Valley. His continuing professional interests are in developing an integrative understanding of the human/machine interfaces in application to service delivery. Jerome received a B.S. degree in Computer Science from the University of California Riverside and an M.S. degree in Psychology from Divine Mercy University..

John J. Tran is the Chairman of the Computer Science Department of the Catholic Polytechnic University and he is a Major in the California Air National Guard. He has worked at ISI, USC, the Stanford Linear Accelerator Center, Safetopia, and Intel Corporation. At USC, he focused on Object-oriented software engineering, large-scale software system design and implementation, and high performance parallel and scientific computing. Air Force tours included the White House Communications Agency and Kirkuk Regional Air Base (Iraq), where he was the Communications Squadron Commander. He received both his BS and MS Degrees in Computer Science and Engineering from the University of Notre Dame and was

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Jennifer H. Nolan, PhD, is the President of Catholic Polytechnic University and Professor of Psychology in their College of Arts and Sciences. Her earlier work specialized in memory, dementias, stroke and insulin resistance. She is a brain plasticity specialist and certified Cogmed provider. Previously, she was the C.O.O. and co-founder of a stroke and brain injury rehabilitation center. Dr. Nolan has taught university courses at the University of California Irvine, Loyola Marymount University, and Glendale Community College. She has conducted local and nationwide clinical trials, and published in both scientific journals and popular magazines. She received a BA in Psychology from Loyola Marymount University, Los Angeles and a Ph.D. in Psychology from the Dept. of Cognitive Science at the University of California, Irvine.**Frederica J. Stassi** is a Science Education Analyst, working in the Central Coast of California. Her background includes research for the National Science Foundation in which she was funded to study pedagogies and efficacies in U.S. Science museums. This research involved museums from the East Coast to Oʻahu in Hawaiʻi. Her doctoral research was conducted under the guidance of Professor William McComas and focused on the development of science standards for the State of California. She received a B.A. degree from Tabor college in Hillsboro, Kansas as well as an M.A. Degree in music performance and an Ed.D., both from the University of Southern California in Los Angeles.

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INTRODUCTION

BACKGROUND .

Stakeholders

IMPLEMENTATION

DATA VALIDATION

ANALYSIS

CONCLUSIONS

As this paper focuses more on relating the lessons learned from a development process than a formal investigation of a previously advance thesis, the conclusions match this theme.

Thesis one

Thesis two

Thesis three

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