

**Rensselaer Polytechnic Institute
Application for HASS Fellowship
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Summary

Despite a century of growth, academic assessment is in crisis.

My thesis research specifically explores those access-granting tests used to evaluate and predict student language and critical thinking proficiencies. These gateway tests, though demonstrably unable to accurately predict future student performance, nevertheless remain key to our attempts to admit literate and capable students to higher education. Unfortunately, they also contribute to the disparities in academic advancement of those of minority status. We can, quite simply, do better.

Potential solutions to the complex problems posed by standardized assessment do not arise from a single discipline, rather they come from the consideration of assessment from many angles. In my prior experience as an educator and educational administrator, I began in-depth analyses of these problems. Here at RPI, I have redoubled my efforts, working to both produce prototypes of viable, alternative designs and to detail and operationalize computer-mediated solutions for language and critical thinking assessment. Though the problems are complex, they are not insurmountable. Work like Lee Sheldon's points to new multi-modal, technology-based possibilities. The innovative solutions based in established theories, sound science, and careful consideration are ready for testing, may result in valuable intellectual property, and are the beginning of what I hope will be an important contribution to the field.

Working Title for Dissertation

This is not a test! : Developing new sustainable methods of academic assessment to predict performance using a SOLVE (socially optimized learning in virtual environments) approach.

Overview of planned research

The Current Problem

There are many answers to the question "why not change the world" we ask here at RPI. One is 'because we are partners with our students in this endeavor, and it is difficult to know who to admit.' Our reputation draws good students who can and do change the world, and we have a first year initiatives in place to ease their transition into this new life. Particularly in the Humanities, Arts, and Social Sciences, however, here and everywhere, it is not unusual to discover some students who seem underprepared in core component areas. A high verbal score on the SAT, for example, does not guarantee oral or written language proficiencies. This and other metrics we rely upon in the admission process struggle to reliably predict our students' performances after they

are part of the RPI community. This problem of prediction is even greater when we seek to draw a diverse student body from demographics who commonly fall into assessment gaps.

Assessments that form the basis of the metrics available for our consideration are fundamentally unlike the academic work we expect students to complete. To use a term from rhetorical analysis, they are not mimetic, i.e. do not imitate what they propose to measure and predict. The ETS databank contains 250,000 different tests, but they all more closely resemble each other than they are like the kind of work we hope for from students in HASS. Most of these tests, for pragmatic reasons, are based on simple component tasks like the multiple choice question.

In 2002, University of California president Richard Atkinson gave voice to California's insistence that the SAT include a writing component (introduced in 2005). Unfortunately, that task, to be completed by writing longhand for 25 minutes inside a box on a form, is still very unlike most academic writing tasks both in the execution and in the evaluation and also very unlike writing tasks familiar to most students. The new test has not lived up to our hopes for it.

Standardized tests in our society have become a mass medium. These gateway tests, taken by juniors and many others in addition to the 2.5-3.0 million students who will receive high school diplomas each year in the United States, send several erroneous or misleading messages to the young people who may join us here. The overuse of the most simple component task type sends the message that we have already identified the 'answer' to most questions they will encounter and that we recommend solving most problems by selecting from a set of answers using simple rules. *This is far from the case.*

The number of students graduating from high school each year peaked at 2.9 million in 08-09 after a 15 year climb, and is projected to decline until about 2015¹. The coming "buyer's market" for top high school graduates means greater difficulty attracting the best. To maintain both our revenue streams from tuition and the quality of our incoming classes, it follows that it will become even more important for us to be able to identify students with the proficiencies we want from among the rest.

Elsewhere in our society, people share unprecedented amounts of information about themselves via social media in simultaneous competition and collaboration, and increasingly make use of video games, some incredibly complex, which score their relative abilities. Terms like 'gamefication' and 'serious games' have come into use to describe attempts to create educational media that make use of these new literacies, something advocated for by academics like James Paul Gee² and authors like science writer Steven Berlin Johnson³. Work such as Lee Sheldon's effectively demonstrates assessment concepts (such as 'experience points') being used in an academic context, describe ways in which the approaches so successful in popular culture can be integrated into academic assessment.

To date, unfortunately, most migration of standardized assessments to electronically mediated contexts has rarely involved considerable innovation beyond the replacement of the student's pencil with a mouse click or keystroke.

¹ Kalim Batti writing for the New York Times, 2008

² J.P. Gee, author of *What Video Games Have to Teach Us About Literacy and Learning* (2003).

³ S.B. Johnson, author of *Mind Wide Open: Your Brain and Neuroscience in Everyday Life* (2004).

While there are some studies that consist of meta-analysis of student writing and publications that outline the discrepancies between standardized assessment practices and the work expected of students in higher education, no research to date describes how we can viably jump the gap using best practices in design and advances in our understanding of human brain. The centrality of the issue of assessment to education, the timeliness of the problem, and the inter-disciplinary nature of the research offer me the opportunity to draw from and collaborate with scholars and professionals in many fields and, in turn, to aspire to make a long-lasting contribution to the field of educational assessment using new media.

Approaches and Methodologies

I am currently a review of extant literature and best practices with regard to assessment. This includes the review of studies that combine recent, specific work in cognitive science, social psychology, and education with the more general aims of the Humanities. For examples, work by Heiner Mühlmann and Paul Glimcherl stress the interplay between cooperation between subjects and levels of stress (for additional examples, refer to appendix I). The greater the level of stress and cognitive load, the less likely a subject a subject is to succeed at a given task or to successfully cooperate. We like to be challenged, however, and stress, up to a point, also leads to creativity and innovation. Tools and adaptations that provide for survival in the real world are rarely assessed comparatively in academic settings under circumstances that guarantee external validity.

I am seeking to publish and present my work demonstrating assessment components which takes on this challenge via the development and incorporation of virtual and augmented reality systems. This work offers examples of component tasks which are standardized, require the student to make choices and complete work without relying on multiple-choice questions, and could be deployed to supplement or replace existing assessment products. I am also seeking to support my application process for multiple patents under U.S. guidelines for utility patent and design patent applications. Visuals and additional details are available at my website (vidanto.com).

With the assistance of Dr. Nathan Freier (LLC) and with advice from Dr. Carlos Godoy (LLC) and Dr. Mark Changizi (Cognitive Science), I am designing a pilot study to consider the effects of cognitive load on student performance on computer-media tasks incorporating real-time feedback. This human-computer-interaction study is informed by developmental psychology, cognitive theory, and trust game experiments in neuroeconomics. In brief, we will use software to present students with component tasks (such as writing a sentence) while requiring them to multi-task, to deal with and select from multiple sources of information presented via the interface. We provide basic feedback on performance while the test is underway by automated means. We document the cognitive load level⁴ at the time of student success at the task. In subsequent experiments, after the completion of a series of component tasks, the student will be given the opportunity to complete them in combination (to, for example, quickly research and write an essay) in the same interface at the optimal cognitive load level. These experiments will inform the development of instruments of assessment that

⁴ Sweller, van Merriënboer, and Paas. Refer to the appendix for additional information.

more thoroughly engage the student and provide predictive data for use by educators and admissions. My directed research will take place under Dr. Godoy's supervision.

I am also working with Dr. Carlos Godoy on his grant-funded research projects which use interactive video as a component of formative assessments, i.e. experiential tests that document provide feedback to the test taker intended to inform future behavior and also serve to predict it effectively. In addition to representing an opportunity to observe the design and implementation process, this is a valuable opportunity to work with multivariate system analysis of psychometrics in a social scientific context.

Significance

The time is right to propose new models for assessment informed by advances in our understanding of how the workings of the brain affect the completion of sophisticated tasks. Our fields, the Humanities, Arts, and Social Sciences, have been transformed by technological advance and social change. We face increasing pressure to identify, admit, and graduate students who will meet high standards from a population of students whose prior educations may not have prepared them well to meet our expectations. Unlike a manufacturing process that could be taken offline while it is reconsidered, reengineered, and replaced, the admission and education processes will not be stopped while we consider our options. Education, in addition to being our avocation, is also our profession, and the market will be the ultimate judge of the value of our students. Rather than expend our efforts complaining about the perceived failings of education at other levels or about mainstream anti-intellectual trends, we must develop new tools to meet this challenge; at very least, we must demonstrate our intention to do so.

Despite the advances of our age, the problem we face is almost exactly the same problem that prompted Alfred Binet and Theodore Simon to develop the first IQ tests: identifying students who will succeed in school. They created component tasks (test questions) that seek to identify proficiencies and problem solving ability rather than knowledge of a given subject. As early as 1905, Binet understood that many factors influence intelligence, that it can change over time, that the comparison between students from different backgrounds is problematic. Further, he knew that intelligence was not a single, inborn and permanent quality and that a single metric would be insufficient to describe it completely. He understood the difference between the ability to recall rote knowledge and the ability to solve problems. The standardized assessments we use today owe more, however, to the Edison Test of 1925, as eccentric as Edison himself, which asked test takers to demonstrate knowledge by selecting a correct answer from a list of choices. Einstein is said to have taken the Edison test (a few years after his receipt of the Nobel Prize) and failed it, and we remember his contributions far better than we do any of those 'winners' identified for scholarships, celebrity, and employment by Edison's design. Nevertheless, though no admissions process is based solely on a single number, we do place disproportionate trust in the SAT, the ETS, and established high-stakes scores.

Lev Vygotsky described "the difference between the actual development level as determined by independent problem solving and the level of potential development as

determined through problem solving under adult guidance, or in collaboration with more capable peers”⁵ The theory begins to explain how we can understand the interconnectedness of challenge and success, but does not provide an easy means to identify an individual’s zone, complicating the creation of virtual education agents and educational tools to stand in place of basic adult guidance or simple collaborations. I hypothesize, however, that the combination with trust metrics and cognitive load theory in new mediums will allow us to pinpoint individual ZPD and use them as a basis for comparison between individuals (additional information in appendix I).

It is my belief that our students can, do, and will change the world. It is my conviction that we have the means necessary to identify students worthy of our investment in them even from populations falling into assessment gaps. My work will serve to demonstrate how it can be done, ethically, responsibly, and scientifically, even in non-quantitative disciplines.

Description of Prior Experience and Preparation

Work

I came to RPI after seven years in higher education teaching at Plymouth State University in Plymouth, NH. I spent four as adjunct faculty teaching Composition and literature primarily to first year students, and technical writing to multiple levels. I spent three teaching a first year seminar in critical thinking as contract faculty and serving in university administration as the director of a program in the newly formed department of the First Year Experience intended to help and support students who were admitted without a declared major. Among other projects, in collaboration with colleagues, I edited and helped to publish an annual anthology of middle and high school writing and our university’s composition journal. My teaching position was a low ranking one, but the experiences teaching first year students was invaluable and I prized it highly and held to very high standards. I stand by my record and am proud to have played a small role in the education of my many successful students.

I take the same pride in my roles here at RPI as a teaching assistant to Roger Grice, research assistant to Dr. Carlos Godoy, and PhD candidate in Communication and Rhetoric in the department of Language, Literature, and Communication.

I have assisted in the preparation of a paper on the recruitment of hidden populations to be presented at the upcoming Kentucky Conference on Health Communication, and am listed as an author alongside Dr. Godoy, Charisse Corsbie-Massey (a colleague at USC Annenberg School of Communication), and some other graduate students at RPI.

While it is true that my publications during my time here to date are limited, few other students in my position are as near entry into the patent process.

Ethnography

⁵ Vygotsky, L.S. *Mind in Society: Development of Higher Psychological Processes*. -- (theory is from the early 20th century – Vygotsky died in 1934 – but is not published in the West until 1978).

Last semester, I received IRB approval for and completed a preliminary ethnographic study of student and teacher perspectives on assessment (“There Will Be a Test: Creation and Experience of Academic Assessments”). The study highlights, among other things, student discomfort with alternative assessment forms that are less familiar to them, suggesting that we should take greater care to make our tests more like the work we want from our students rather than like other, established tests lest they come to prefer familiar, wrote-memory-based tasks.

Coursework

In addition to providing a venue for preliminary writing and research, my PhD coursework has helped to broaden my knowledge of design, cross-cultural communication, communication and rhetorical theories, and the state of research in human-computer interaction. As my transcript will show, I am an exemplary student. It is an honor and a pleasure to learn and work in this context.

Description of Future Research and Career Plans

Following my cognitive load-related experiments in 2010, I will finalize my extant design for a mobile communication network-based augmented reality system and apply for grant funding of a pilot project to test it. The system could be adapted for and tested in a developing world context with a reliable cellular phone network and an ailing educational infrastructure and could form the basis for a Fullbright application. It could also be tested here in the United States. Dr. Godoy and I are currently exploring a variety of funding possibilities.

On completion of my PhD, I plan to return to the classroom as an instructor and to continue to develop, design, present, and publish on alternative assessment practices, expanding my research from the measurement of writing and critical thinking proficiencies using standardized gateway assessments into additional adjacent areas of inquiry. Should the intellectual property I develop here prove valuable by the time I receive my degree, I will also consider partnering with industry to make the assessment designs and practices developed during my time here available to a wider audience.

My committee members and colleagues provide an important check-and-balance system for me not only by challenging my ideas but also by challenging me to seek credit for them. To put it frankly, my instincts are altruistic and, if the future finds it easier for schools like the HASS at RPI to identify, admit, and graduate students who will excel, I would be content whether or not I has been awarded the HASS Fellowship or some other recognition for my efforts along the way. Higher education, in my opinion, is far more than a competition. I am grateful for your consideration and invite your support knowing that my work will continue whether or not I receive it.

We are not in the roles we are simply because of convenience. We are also here to serve our convictions. We are here because we dare to dream we can, in ways great or small, change our world, expanding not only our own knowledge but the sum of all knowledge. We are here, quite simply, to ask “why not change the world.”