**PROPOSAL COVER SHEET**

**Initiative:**    2014 Indiana University Learning Analytics Fellows Program

**Title:**    Beyond Surveys and Data Mining:  Searching for New and Potentially More Useful Indicators of Student Engagement

**Proposer:**    Daniel T. Hickey, Associate Professor and Program Coordinator, Learning Sciences Program, Department of Counseling and Educational Psychology, Research Scientist, IU Center for Research on Learning and Technology.

**Title:**    Beyond Surveys and Data Mining: Searching for New and More Useful Indicators of Student Engagement

**Deadline:**    November 14, 2014

**Budget** $2000

**Submission:**    Cover letter, 300 word abstract, 3-page proposal, nomination letter from chair

**Submit to:**    IULearningAnalytics@oncourse.iu.edu

**Abstract**

Measures of student engagement in higher education have traditionally relied on self-report surveys of student's activities (e.g., meeting with faculty, engaging with classmates, extra-curricular work) and student satisfaction with those activities. Unfortunately, such surveys get low response rates and such indicators are very general and account for little actual variance. Not surprisingly, there is scant evidence that institutions or educators use such evidence to improve engagement or other outcomes. Such domain-general approaches appear even more inadequate in light of the rapid expansion of interest-driven digital knowledge networks (that tend to be very discipline specific), increased use of learning management systems (that offer more fine grained data from all students), contemporary theories of engagement (that focus on productive forms of *disciplinary* engagement), and new computational text analysis tools (which promise to automate the assessment of disciplinary engagement). In response, I propose to explore student engagement via disciplinary analysis of unstructured text in student generated artifacts in online and hybrid courses in the School of Education. Specifically, the study will (a) analyze fine-grained evidence of "productive disciplinary engagement," (b) examine the relationship between this "PDE" and other conventional and new indicators of engagement and success, and (c) test the hypothesis that evidence about PDE is more useful for directly impacting these other outcomes. Leading scholars outside of IU who are pursuing directly relevant research will be invited to give talks at IU and consult with the project. The intellectual merit of this proposal resides in its use of a theory of engagement that is widely appreciated among contemporary learning theorists; broader impact is expected because these measures of engagement promise to yield much more actionable evidence that instructors and administrators can use to directly impact other valued outcomes.

**Beyond Surveys and Data Mining:**
**Searching for New and Potentially More Useful Indicators of Student Engagement**

Surveys of student engagement in higher education have become quite well known and widely cited in recent decades. In particular the National Survey of Student Engagement (NSSE) has become a widely accepted index of engagement. However, NSSE and other such measures rely on self-report items asking about students' activities (e.g., meeting with faculty, engaging with classmates, extra-curricular work, etc.) and student satisfaction with those activities. While response rates tend to be quite low (generally around 20%, Herzog & Bowman, 2011) and explained variance even lower (usually less than 20%, Coates & Ainley), the relativistic nature of Likert scale items and mass survey distribution yields statistically significant difference of all manner. Despite the limitations, these difference are widely cited in the news and deeply scrutinized by institutions. While there is certainly evidence that this information leads to institutional efforts that increase the availability of and satisfaction with surveyed activities, there is apparently little evidence that survey-driven changes have any impact on engagement in *learning*

Four recent developments have further qualified the value of survey-centric measures of engagement. The first is the growth of "interest-driven" (as opposed to "friendship-driven") digital knowledge networks. Such networks are defined by disciplinary knowledge and increasingly define knowing and learning of our students. This motivates a search for more discipline-specific measures of engagement within networked contexts. The second development is the increased use of learning management systems like *Sakai* and *Canvas* in conventional and online courses, and the corresponding access to information about actual engagement in learning of every student. While many current "data mining" efforts appear quite scattershot and assumption-free, this information clearly has the potential to yield more discipline-specific measures of networked engagement.

The third development that motivates a search for new assessments is the growing consensus around the notion of "productive disciplinary engagement" among many learning scientists. As introduced by Engle and Conant (2002), "PDE" concerns social discourses and cultural practices associated with widely acknowledged disciplines of knowledge. According to Engle and Conant, engagement is presumed to be disciplinary when contributions are coordinated and on-task, and concern the specific languages and practices associated with recognizable "big D" Discourse communities (Gee, 1999). Disciplinary engagement is presumed to be productive when it raises new relevant questions, clarifies confusion, makes connections, and become more sophisticated. In addition to capturing more fine-grained evidence of engagement in actual learning, Engle and Conant introduced a set of learning design principles for directly fostering PDE. Research in the proposer's own courses (e.g., Hickey & Rehak, 2013; Hickey, Kelly & Shen, 2014) and by others (e.g., Forman et al., 2014; Greeno & Forman, 2013) has shown that these design principles can be remarkably simple to implement in ways that directly enhance the quality and amount of PDE. What is remarkable about these principles is that they appear capable of readily fostering PDE without also undermining the validity of any assessments of PDE. When coupled with contemporary design-based research methods (e.g., Cobb et al., 2004), this presents a very compelling vision of iterative semi-automated cycles of iterative course refinement and improvement.

The fourth development that motivates the proposed research is ready access to a variety of natural language processing routines that appear capable of automatically assessing text for direct evidence of phenomena like PDE. In particular, it appears that latent semantic analysis has particular potential for capturing evidence of PDE in automated analyses of the unstructured text contained in student-generated artifacts (i.e., assignments, papers, etc.) and in threaded discussions of those artifacts (Suthers et al, 2013).

**Research Methods**

This project will explore the use of natural language processing methods to assess productive disciplinary engagement in the corpus of text contained in my own courses as well as those of at least one other Learning Sciences faculty member in the School of Education. For my courses, this includes two "Big Open Online Courses" on Educational Assessment I offered via Google Coursebuilder with a grant from Google. In 2013 my "BOOC" included 160 participants, 60 completers, and 9 credentialed students; in 2014 the course included 60 participants, 24 completers, and 12 credentialed students. Each student completed weekly "wikifolios" (averaging around 1000 words) and students engaged in discussion of wikifolios via threaded comments (averaging around 4 comments/wikifolio and around 100 words/comment). A representative subset of the wikifolios and comments has already been coded for disciplinarity and productivity; these codes will presumably be used to train whatever language processing routine is selected. The results will then be examined in light of other student outcomes including course completion, exam scores, and course survey responses.

While my BOOCs and the Coursebuilder platform are not representative of the larger body of courses at Indiana University, the courses were directly informed by the PDE design principles mentioned above. As such, this analysis is most likely to reveal the fullest potential for directly informing analyses of course design and conduct. In particular this analysis should provide clear evidence of the level and amount of PDE associated with the various elements of the wikifolio assignment and the structure and guidance of student interaction around those wikifolios. These insights will be used to refine the Educational Assessment BOOC that I will offer in summer 2015, where additional analyses will be carried out to examine the direct and indirect impact of those refinements.

A second analysis will be carried out in my graduate courses on Learning and Cognition in Education. I have taught this course numerous times and am currently responsible for ensuring that an online and conventional section are taught every semester. I will be teaching both a face to face and online sections in Spring 2014 using Canvas. My goal here is obtaining baseline evidence of PDE so that I can examine it in subsequent sections delivered by adjunct faculty and further explore the extent to which such faculty can use this evidence to improve engagement in their own courses. Finally, I expect to assess PDE on at least one course taught by one other faculty member in the Learning Sciences and explore the extent to which that faculty member can use the resulting evidence in order to begin exploring how such efforts might scale out beyond the relatively specific context of my own courses.

**Project Participants**

This project will be a collaborative effort between myself and a new Learning Sciences PhD student. Joshua Quick completed an MS in Applied Statistics before entering our PhD program. He is minoring in Informatics and will be taking Dr. Katy Borner's Information Visualization course in Spring 2015. He has already accessed a student copy of *Tableau* and has been using it to visualize the initial coded data from the BOOC as well as from several other related projects.

All of the requested funds will be used to provide modest honoraria to outside experts who appear ideal for directly informing this effort and who are likely collaborators in future externally-funded proposals. I have already interacted with all of these and other scholars and several of them have already agreed in principle to participate in the proposed project. My goal here is a manageable well-informed initial exploration. I intend to offer $500 honoraria for agreeing to meeting with my research team and any other interested learning analytics fellows for three two-hour Google hangouts at the beginning, middle, and end of the Spring 2015 semester. The set of experts I will start with consist of the following:

*Hamish Coates* holds a Chair of Higher Education at the Centre for the Study of Higher Education (CSHE), University of Melbourne. He was Founding Director of Higher Education Research at the Australian Council for Educational Research (ACER) from 2006 to 2013, and between 2010 and 2013

also Program Director at the LH Martin Institute for Tertiary Leadership and Management.  He is currently proposing a large scale exploration of post-survey studies of engagement across Australian higher education.

*Simon Buckingham Shum* is Professor of Learning Informatics at the University of Technology Sydney, where he is Director of the newly founded Centre for Connected Intelligence.  He was the Programme Co-Chair for the LAK12 Learning Analytics conference, and chaired the LAK13 Discourse-Centric Learning Analytics workshop and the LASI13 Dispositional Learning Analytics workshop. He is a co-founder of the Society for Learning Analytics Research.

*Michael Evans* is a Neukom Fellow in the Neukom Institute for Computational Science at Dartmouth College, where he affiliated with the Department of Film & Media Studies and the Department of Sociology. Before coming to Dartmouth he received his PhD in sociology from the University of California, San Diego through the interdisciplinary Science Studies Program.  He studies the complex public intersections of religion, science, media, and politics, using a variety of qualitative, historical, and computational research method

*Carolyn Penstein Rose* is an Associate Professor with the Language Technologies Institute and the HCI Institute at Carnegie Mellon University. She studies the social and pragmatic nature of conversation, and builds computational systems that can improve the efficacy of conversation between people, and between people and computers. She uses approaches from computational discourse analysis and text mining, conversational agents, and computer supported collaborative learning.

## References

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