Scholarship of Teaching and Learning Grant Proposal

Exploring the use of learning analytics from Moodle to enhance student learning and engagement in online courses

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November 4, 2014

Abstract

This two year project aims at building quality in online courses for a fully online Master's Program in Instructional Systems Technology. The purpose of this study is to use learning analytics to enhance student learning and engagement in online learning. The LAe-R plugin for data visualization will be integrated in six different Quality Matters certified IST online courses. Data sets will be identified and analyzed via the LAe-R plugin to identify student learning and engagement patterns. A heuristic for other instructors using Moodle in online courses to guide the improvement of online instructional delivery will be developed.

Budget Request for SOTL Grant Year _____

Joint Proposal? X Yes ____ No ____

Title of Project: Exploring the use of learning analytics from Moodle to enhance student learning and engagement in online courses

Duration of Project: January 2015 – December 2015

Primary: Florence Martin; Michael K. Thomas; Patti Wilkins

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UNC Charlotte SOTL Grants Previously Received (please): N/A

Allocate operating budget to Department of: Educational Leadership

		Year One
Account #	**Award**	**January to June 2015**
Faculty Stipend	Transferred directly from Academic Affairs to Grantee on May 15	$ 9,000 ($3,00 for Martin; $3,000 for Thomas; $3,000 for Wilkins)
911250	Doctoral Student Salaries	$1,875
911300	Special Pay (Faculty on UNCC payroll other than Grantee)	
915000	Student Temporary Wages	
915900	Non-student Temporary Wages	
920000	Honorarium (Individual(s) not with UNCC)	
921150	Participant Stipends	
925000	Travel - Domestic	$2,700 ($900 for Martin; $900 for Thomas; $900 for Wilkins)
926000	Travel - Foreign	
928000	Communication and/or Printing	
930000	Supplies	

942000	Computing Equipment	
944000	Educational Equipment	
951000	Other Current Services	
	GRAND TOTAL	**$ 13,575**

Attachments:

1. Attach/provide a narrative that explains how the funds requested will be used.
2. Has funding for the project been requested from other sources? ___ Yes __X__ No.

   If yes, list sources.

Budget Narrative

Faculty Stipends ($9,000)

Summer stipends of $3,000 for the Co-Principal Investigators, Florence Martin, Michael K. Thomas, and Patti Wilkins. Additionally, $900 for each is requested for dissemination of findings by way of conference presentations. This will provide the resources necessary to complete the data analysis and prepare reports and manuscripts during Summer 2016. This is a one year budget for a two year project.

Graduate Student Salary ($1,875)

The budget includes a UNC Charlotte graduate student to contribute to the capturing and cleaning of data, reviews of literature, administrative support, and technical assistance related to dissemination of findings. A total request of $1,875 will allow for 100 hours at $18.75 per hour, consistent with doctoral student graduate assistant rates in the College of Education.

UNC CHARLOTTE
College of Education

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November 3, 2014

Scholarship of Teaching and Learning Grants Committee
Center for Teaching and Learning
UNC Charlotte
9201 University City Boulevard
Charlotte, NC 28223

Dear SOTL Grants Committee:

It is my pleasure to endorse the Scholarship of Teaching and Learning Grant proposal, *Exploring the use of learning analytics from Moodle online courses to enhance student learning and engagement.* This project will investigate the use of learning analytics for the purpose of adding quality to a fully online Instructional Systems Technology (IST) Master's and Graduate Certificate program.

This project focuses on the IST Program in the Department of Educational Leadership in the College of Education and we expect multiple benefits. First, it is clear that the improvement of online instructional delivery is a goal that we all share and that this project will help us to understand how this might be accomplished in more effective and efficient ways. Second, the creation of a heuristic for other instructors using Moodle in online courses to guide the improvement of online instructional delivery is an objective that, if realized, would benefit instructors throughout this department and college. This project also provides opportunities for our faculty to collaborate with others on campus, including the Distance Education Office, and the Center for Teaching and Learning and share expertise in the areas of student engagement and student success in online environments. Collaborations of this sort are welcome and are likely to plant seeds for future fruitful collaborations. The main project personnel, Drs. Martin, Thomas and Wilkins have each published multiple papers related to the design and implementation of technology-rich innovations and developing online programs of study and how they may be evaluated and improved.

I am confident that the outcomes of this work will inform UNC Charlotte's efforts in advancing student success and will result in many contributions to the body of knowledge on the use of learning analytics for distance education courses and programs. This project is likely to increase the general knowledge about how teaching and learning should be handled online. I fully support this project.

Sincerely,

James J. Bird, Ph.D.
Associate Professor & Interim Chair
Department of Educational Leadership
College of Education
UNC Charlotte

Exploring the use of learning analytics from Moodle to enhance student learning and engagement in online courses

(2,414 words)

A. Specific Aims

The primary aim of this project is to use learning analytics data to guide the improvement of online instructional delivery. We are seeking support to enhance online teaching and learning through the Moodle Learning Management System. As such, this is a research project and not a curricular redesign. In the fall of 2012, 6.7 million students were reported to be enrolled in at least one online in higher education course (Allen & Seaman, 2013). At UNC Charlotte, the numbers of both undergraduate and graduate students taking fully online courses is exploding. In the years between 2002 and 2012 the number of students taking at least one online course grew at nearly a 23.8% growth rate from 1.6 million students in 2002 to 6.7 million in 2012 (Allen & Seaman, 2010). The specific aim of this project is to use learning analytics data to enhance the quality of the teaching and learning that occur in a collection of courses in the 100% Online Master's Program in Instructional Systems Technology (IST) in the College of Education at UNC Charlotte. The introduction of learning analytics techniques into education research now enables the analysis of student learning and engagement in online learning based on the data from the Learning Management System. By integrating this data from the learning management system it will be possible to build solid understandings of the pedagogical characteristics of the courses and make solid assessments of student learning and engagement. The term *pedagogical characteristics* refers to the design elements of a course that structure learning. These include course overview & introduction, learning objectives, assessment & measurement, instructional

materials, course activities & learner interaction, course technology, learner support, and accessibility &usability. These terms come from the widely-used Quality Matters (QM) rubric. This project will analyze learning analytics data of the *pedagogical characteristics* of six fully online IST courses.

Purpose

The purpose of this project is to use learning analytics (LA) to assess and enhance the quality of online courses in the IST program at UNC Charlotte. Fournier, Kop, and Sitlia (2011) define learning analytics as "the measurement, collection, analysis, and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs" (p. 3). The IST Program at UNC Charlotte became a fully online program in 2010. The courses are now in the process of being redesigned so that they will be certified by "Quality Matters" (QM) standards. QM is an international organization representing broad inter-institutional collaboration and a shared understanding of online course quality. QM's quality assurance processes have been developed to improve and certify the design of online and blended courses. Academic, government, and education-related organizations use QM rubrics and standards for developing, maintaining and reviewing their online courses and in training their faculty. In North Carolina alone, 18 universities have subscribed to the program. This project will, therefore, inform all of

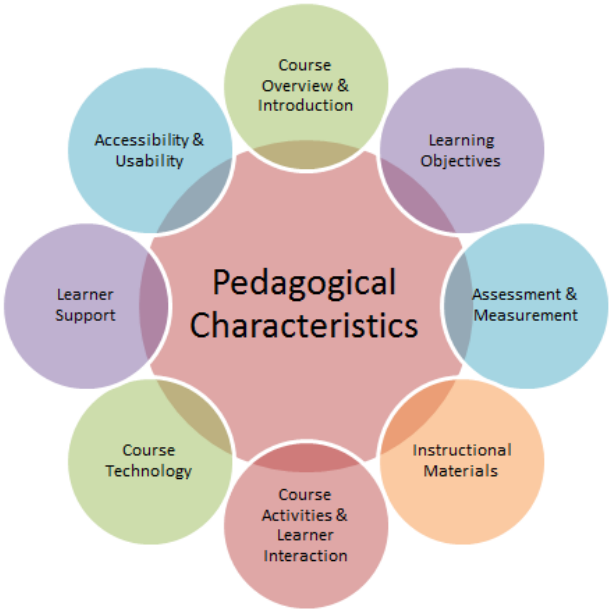

Figure 1: Pedagogical Characteristics

these institutions on how learning analytics based on the QM pedagogical characteristics may be utilized to enhance student learning and engagement in online courses.

Objectives

The central objective of this project is to use learning analytics to enhance student learning and engagement in online courses. This will be accomplished by cross-examining the courses by way of understanding the pedagogical characteristics of the courses using the QM certification rubric and learning analytics generated by the Moodle LMS. The project will also produce a heuristic for other courses on how to do this effectively and efficiently. As a program that focuses on instructional design and distance education, we believe that we are particularly well-positioned to create a highly successfully, nationally renowned Instructional Systems Technology program that is 100% online. This may serve as a model for other higher education programs seeking to enhance their online courses.

Research Questions

The specific objectives to be achieved involve seeking answers to the following research questions:

1. In what ways do *learning analytics data* on the *pedagogical characteristics* of online courses impact student learning and engagement?
2. In what ways might this learning analytics data collection and analysis contribute to the creation of a heuristic for other instructors using Moodle in online courses to guide the improvement of online instructional delivery?

Rationale

The overarching goal of this project is to improve online teaching and learning. This project will advance that goal by exploring pedagogical factors that contribute to student success (learning and engagement) in online learning. Instructors may use this knowledge in online teaching to design effective online courses. Instructional designers may use this knowledge to recommend best practices on online course design. Administrators may use these results to design successful online programs. Bringing together these points of view will help improve online teaching and learning. The goal is to develop a specific rubric for understanding and improving the pedagogical characteristics of online courses. In this way, we may be able to ensure the quality of online courses and enhance student learning and engagement.

Impact

This project will impact all UNC Charlotte students who take online or hybrid courses. It is also likely to impact all UNC System students who take online or hybrid courses. It is likely to inform the design of online courses at UNC Charlotte and elsewhere. The method for identifying pedagogical characteristics for enhancing course quality using LA will be useful for instructors and designers of online courses. This may improve learning and engagement in online courses throughout UNC System.

B. Literature Review

There is massive growth in higher education in the number and percentage of university students taking online courses. As the number of online courses increase so do concerns about student learning and engagement (Nistor & Neubauer, 2010; Patterson & Mcfadden, 2009; Rovai, 2003). Learning analytics is a new approach and a few studies have been conducted to measure online learning and engagement using a learning analytics approach (Macfadyen & Dawson, 2010; Friz, 2011).

Researchers have studied student success in online learning for a number of years. In previous years, researchers were primarily using survey and interview data to predict student success (Chyung, 2001, Park & Choi, 2009). Recently, researchers have begun using learning analytics which is "interpretation of a wide range of data produced by and gathered on behalf of students in order to assess academic progress, predict future performance, and spot potential issues" (Johnson et al., 2011, p.28). Macfadyen and Dawson (2010) mined data from the LMS and studied the relationship between student LMS use (e.g., posting discussion messages, completing quizzes) and academic achievement. Their study used logistic modeling to predict the failing students. They also stated that "pedagogically meaningful information can be extracted from LMS-generated student tracking" (p.1). Fritz (2011) used the *check my activity* tool to study relationship between student performance and activity in the LMS. They found that students earning a D or F used the LMS 39% less than students earning a grade of C or higher. Arnold and Pistilli (2012) used an application called signals which was developed to provide instructors the opportunity to use the power of learner analytics to intervene and provide feedback to students who were not doing well in their courses.

Learning Analytics is an emerging trend that can be used to study online learning. More studies need to be conducted on pedagogical and learners' characteristics and the extent of their utilization of the learning materials and how they impact learners' engagement and achievement. This proposed project will utilize techniques from learning analytics to measure student success in online learning based on the pedagogical characteristics of online courses.

C. Methods

Sample Courses

Six online courses from the Instructional Systems Technology program at the College of Education are being re-designed to align with the Quality Matters Standards to include all the pedagogical components needed for an online course. These courses will be implemented and we will collect learning analytics data and analyze student learning and engagement.

Course Number	Course Title	Course instructor and re-designer
EIST 5100	Technology Integration in Education	Dr. Patti Wilkins
EIST 6135	Learning, Media, Resources, and Technology	Dr. Michael Thomas
EIST 6150	Design, Development, and Evaluation of Online Learning Systems	Dr. Florence Martin
EIST 6100	Foundations in Instructional Systems Technology	Dr. Michael Thomas
EIST 6101	The Adult Learner	Dr. Patti Wilkins
EIST 6170	Human Performance Technology	Dr. Florence Martin

Research Design

We will use observational research design, which is studying without experimental control over the assignment of participants. This design is well-suited for applied research studies in which random assignments of participants is not feasible or would be unethical (Agresti & Finlay, 2009). The data from Moodle will be both quantitative and qualitative in nature. As such, mixed methods research design as outlined by Creswell (2012) and Miles and Huberman (1994) will be employed. We will use quantitative, qualitative and discourse analysis in this project (Creswell, 2012).

Tools used

The LMS log file will be exported and then analyzed using a general purpose data visualization tool known as LAe-R. The Learning Analytics Enriched Rubric (LAe-R) tool is a Moodle plug-in that allows instructors to incorporate multiple criteria such as collaboration, grades on assignments and views of course content and learning resources. For assessing

collaboration, the tool provides a means for the analysis and visualization of data related to forum posts, chat messages, and number of files attachment to these. For assessing students' behavior the tool provides a means for the analysis and visualization of data related to the students' views of specific content. The tool also allows for grades, student interaction, and collaboration to be aggregated. In this way, we will be able to create profiles of student pedagogical characteristics and be able to understand how they interact in the context of a Moodle course and thereby illuminate issues related to student success as it relates to course design. Dimopoulos, Petropoulou, Boloudakis, and Retalis (2013) successfully used learning analytics with Moodle by making use of the LAe-R tool demonstrating the viability of this approach. They assessed student performance related to collaboration by looking at forum posts, chat lines, messages and the number of files attached to forum posts. Additionally, the amount of text generated for these may also be quantified. To examine students "study behavior," these researchers used the LAe-R tool to quantify students access of course content and resources in terms of time and frequency (Dimopoulos, Petropoulou, Boloudakis, & Retalis, 2013).

D. Evaluation

Most importantly, this project will be evaluated based on the research questions and the extent to which we will be able to answer them. Research questions, evaluation methods and instruments/techniques are outlined in the table below.

Research Questions	Evaluation Methods	Instruments/ Techniques
1. In what ways do learning analytics data on the pedagogical characteristics of online courses	Quantitative and Qualitative Reports will be run on the log files from Moodle. Descriptive statistics will be run on this data and emergent	Data set identified for the Student Learning and Engagement Data analysis techniques recommended for each

impact student learning and engagement?	correlations will be identified and weighted for significance. Subsequent to this, T-Tests will be run for two variable analysis and F-Tests ANOVA for three variable (Creswell, 2012). Qualitative textual data will be coded using open coding, axial coding, and selective coding using the constant comparative method for textual analysis and discourse analysis (Strauss & Corbin, 1998).	pedagogical characteristics Rubric to analyze the visualization to find latent patterns in data Additionally there will be an Analysis of Visualization Charts from the LAe-R tool
2. In what ways might this learning analytics data collection and analysis contribute to the *creation of a heuristic* for other instructors using Moodle in online courses to guide the improvement of online instructional delivery?	Expert Review of the heuristic for both formative and summative purposes.	Rubric to evaluate the creation of a heuristic for other instructors

E. Knowledge Dissemination

Researchers will participate in dissemination efforts of presenting at conferences and also in publishing the results in a number of venues in the area of learning sciences. Workshops will be offered for faculty at the university on best practices to design online courses. They will also be trained on how to use learning analytics to inform their teaching via online courses. Effective online course design and facilitation practices from courses that have high success rates will be shared with the faculty in the entire university and also with the other schools in the university

system. Workshops will be offered at the end of the grant period to train faculty on how to use learning analytics to inform their teaching via online courses. Some of the specific venues for dissemination include:

- **UNC Charlotte:**
  - Participation in UNC Charlotte's annual SOTL Showcase
  - Discussions with the Center for Teaching and Learning
  - Discussions with the Top 40 Learning Academy Faculty Learning Community
  - Discussions with the Distance Education
- **Professional Conferences:** Papers or posters will be presented at:
  - Distance Education (The largest distance education conference in the U.S.
  - The Association for Educational Communications and Technology
  - The Sloan Online Learning Consortium
- **Manuscripts:** We anticipate submitting manuscripts to the following venues:
  - The American Journal of Distance Education
  - Educational Technology Research and Development
  - The Journal of Online Teaching and Learning

F. Human Subjects

A Human Subjects Protocol application for the Institutional Review Board (IRB) is currently under development and will be submitted by the end of the Fall 2014 semester. It is understood that the research that is the focus of this project cannot begin until IRB approval is granted.

G. Extramural Funding

This project will serve as a pilot project to test our methodology for using learning analytics to assess online course quality. We will use the results to support a request for funding from the National Science Foundation.

H. Timeline

The following is a timeline for the project:

Timeline	Objectives and Outcomes
Spring 2015	Implement first three courses, Add the LAe-R tool to the courses to aid in the visualization and collection of learning analytics data.
Fall 2015	Implement the second three Online courses Add the LAe-R tool to the courses to aid in the visualization and collection of learning analytics data.
Spring 2016	Collect and Analyze LA Data and course pedagogical characteristics (Answer research questions 1)
Fall 2016	Disseminate the results of the study and complete the lists, typologies, and heuristic for the use of other online course designers (complete research question 2)

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