



การวิเคราะห์การเรียนรู้: ความสัมพันธ์ระหว่างความแตกต่างทางวัฒนธรรมและพฤติกรรมออนไลน์

Learning Analytics: The Relationship between Cultural Differences and  
Online Behaviors

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บทคัดย่อ

งานวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาพฤติกรรมออนไลน์ของนักศึกษา 233 คน ในการใช้ระบบการจัดการเรียนรู้ Blackboard โดยใช้สถิติเชิงพรรณนาและอนุมานในการวิเคราะห์ความสัมพันธ์ระหว่างวัฒนธรรมและพฤติกรรมออนไลน์ตามระเบียบวิธีวิจัยของการวิเคราะห์การเรียนรู้ (Learning analytics) ซึ่งผลการวิจัยพบว่า วัฒนธรรมมีผลต่อพฤติกรรมออนไลน์ของนักศึกษา โดยความแตกต่างทางวัฒนธรรมมีผลต่อจำนวนครั้งของการอ่านเนื้อหาวิชาอย่างมีนัยสำคัญทางสถิติ ( $p = .015$ ) แต่ความแตกต่างทางวัฒนธรรมไม่มีผลต่อจำนวนครั้งของการส่งแบบฝึกหัด ( $p = .22$ ) และจำนวนครั้งของการอภิปรายร่วมกัน ( $p = .084$ ) นอกจากนี้การเปรียบเทียบภายหลังการทดสอบรวม พบว่า พฤติกรรมออนไลน์ของกลุ่มนักศึกษาแอฟริกากับกลุ่มนักศึกษายุโรปและอเมริกา กลุ่มนักศึกษาเอเชียใต้กับกลุ่มนักศึกษายุโรปและอเมริกา และกลุ่มนักศึกษาเอเชียตะวันออกกับกลุ่มนักศึกษายุโรปและอเมริกามีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ ( $p < .01$ ) อย่างไรก็ตามพบว่า นักศึกษาชาวเอเชียมีความกระตือรือร้นในการใช้ระบบการจัดการเรียนรู้มากกว่ากลุ่มนักศึกษาชาวตะวันตก

**คำสำคัญ:** ความแตกต่างทางวัฒนธรรม / พฤติกรรมออนไลน์ / การวิเคราะห์การเรียนรู้

Article Info: Received 22 April 2019; Received in revised form 8 June, 2019; Accepted 13 June, 2019

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### Abstract

This paper investigated online behaviors from 233 students using the *Blackboard* platform. Descriptive and inferential statistics were performed, crossing cultures and online behaviors with a focus on Learning Analytics method. Culture was found to have a significant effect on online behaviors, in which there is significant difference between cultures on content view counts ( $p = .015$ ). There is no significant effect of cultures was found on assignment submission counts ( $p = .22$ ) or discussion submission counts ( $p = .084$ ). Further post-hoc analysis with Bonferroni correction confirms the difference between Africa and Europe and America, between South Asia and Europe and America, and between East Asia and Europe and America (all  $p < .01$ ). However, one interesting finding shows that Asian students tend to be more involved in the learning management system as compared to their Western counterparts.

**KEYWORDS:** CULTURAL DIFFERENCES / ONLINE BEHAVIORS / LEARNING ANALYTICS

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### Introduction

Learning management systems such as Moodle and Blackboard have proven useful in facilitating classroom learning (Kauffman, 2015). Such platforms reduce the cost of learning resources, enable self-paced and self-directed learning, facilitate different learning styles, and are intuitive for the current generation of students, who are digital natives (Bartholomew, 2017; Rashid & Asghar, 2016). Consequently, many institutions have adopted blended learning pedagogy which defines a learning approach combining online digital media with traditional classroom methods. Such an approach has been found to promote self-directed learning as students are better able to control the time, place, and pace of learning (El-Seoud, Taj-Eddin, Seddiek, El-Khouly, & Nosseir, 2017; Sun & Chen, 2016). The approach has also been found useful in facilitating new learning concepts, such as the flipped classroom (Kong, 2014).

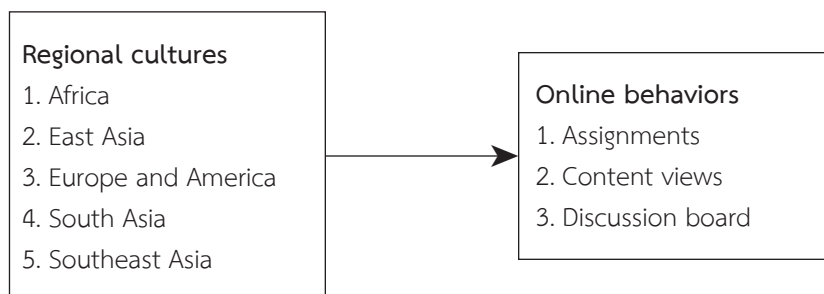
Common topics being researched in regard to learning analytics focuses on using statistical and predictive approaches to analyze students' behavior. Each student interacts with the learning management system, completing online assignments; thus, the student leaves a huge digital footprint and a great deal of log data (Li, Flanagan, Konomi, & Ogata, 2018; Pechenizkiy, 2017). Such a quantitative approach also provides certain advantages over traditional evaluation, which tends to focus only on the use of subjective measures such as surveys or interviews which, if not appropriately employed, can result in biased results (Jara et al., 2017). Given its advantages, the quantitative approach to evaluating learning management systems has been practiced by many researchers. One researcher, for example, examined online behaviors of 377 students in a course which had recently been redesigned to integrate much deeper use of learning technology. He looked at several student characteristics that could potentially influence online behaviors, including gender, minority racial/ethnic group, income, grades, and whether the student was the first in the family to attend college. He found that total number of hits (e.g. online participation) is the strongest predictor of student success (Whitmer, 2014).

There are two specific research studies which involved the collection of many student performance metrics such as points earned so far, interaction with the online platform, student characteristics (e.g. age) via a learning management system, and then input those metrics into a predictive algorithm in order to identify students most in need of support, with the aim of increasing retention rate. It was found that key predictive factors include grades, the subject being studied, the student's certainty in his or her choice of major, and financial support (Agnihotri & Ott, 2014; Arnold, 2012). Another research was conducted to investigate how online usage relates to student

performance. Analyzing 131 courses, it was found that students who obtained a grade of “D” or lower had used the online platform around 40% less than those with higher grades. This implies a strong positive relationship between online participation and student performance (Sclater, Peasgood, & Mullan, 2017).

Culture is defined as behaviors in a collective phenomenon of the mind that differentiate the members of one group from other groups (Hofstede, 2011). However, little is known about how cultural differences impact the way students interact with learning management systems. The differences in the relevant behaviors are often referred to as “cultural differences”, and it is well-known that cultural differences play a big role in shaping learning styles. For example, Asian students are likely to be more passive in discussion groups or in asking questions during lectures (as contrasted with Western students) (Lu, Chin, Yao, Xu, & Xiao, 2010; Manikutty, Anuradha, & Hansen, 2007; Sandel, Buttny, & Varghese, 2018; Swierczek & Bechter, 2010). With this evidence as a starting point, we seek to build upon past work, and investigate how cultural differences relate to the use of learning management systems. For instance, is there any particular culture that favors or feels uncomfortable the use of learning management systems? How should lecturers best utilize a learning management system in a “one-culture” versus “cross-culture” classroom? Our work aims to touch on these questions. In this paper, we took a typical statistical approach to the investigation of these aforementioned questions. The statistical approach combines descriptive and inferential statistics among others to provide instructors and learners with a better understanding of and insight into learning and teaching performance.

## Research framework



**Figure 1** Research Framework

## Research Objectives

To investigate how cultural differences affect online behaviors.

## Methodology

This article describes a study of an international university in Thailand that uses blended learning pedagogy to support students in the development of digital literacy skill. A total of 233 students with 1 independent variable (regional culture) and 3 dependent variables (content view counts, assignment submission counts, and discussion board counts) were analyzed.

### *Classrooms*

The research was conducted during a 13-week General Education course, "Computer Applications", which focuses on Digital Literacy. The entire course of study amounted to 2880 minutes, with face-to-face teaching comprising 1440 minutes (12 weeks \* 2 hours \* 60 minutes), and the same amount of virtual learning -- 1440 minutes -- spanning 11 lessons of study across 8 classes. Six different lecturers, with between one and twenty years of experience, were responsible for the trial teaching.

Learning materials, including slides, supporting videos and references, and assignments were posted on the university's learning management system, *Blackboard*. Materials were provided at least one week prior to the face-to-face sessions. After each of the 2 hour face-to-face sessions with the lecturer, each student was required to access these online learning materials, conduct self-study, and submit the given assignments for that week. Students were allowed to resubmit their assignments until the deadline, which was 7 days from the date of assignment. The use of discussion groups was optional and not graded.

#### *Online Learning resources*

Online learning resources are provided in Blackboard to enable students to revisit the course syllabus, review lesson goals, or download lecture materials, supporting videos, and reference materials. Assignments were given to the students every week, with a total of 11 assignments. Assignments, formative assessments, and summative assessments were the same across the 8 classes. An optional discussion forum was also available to enable students to discuss course material. Along with Blackboard, Microsoft Office 365 Suite was provided, and allowed a number of functions such as sharing documents online using OneDrive or sharing online recordings using OfficeMix.

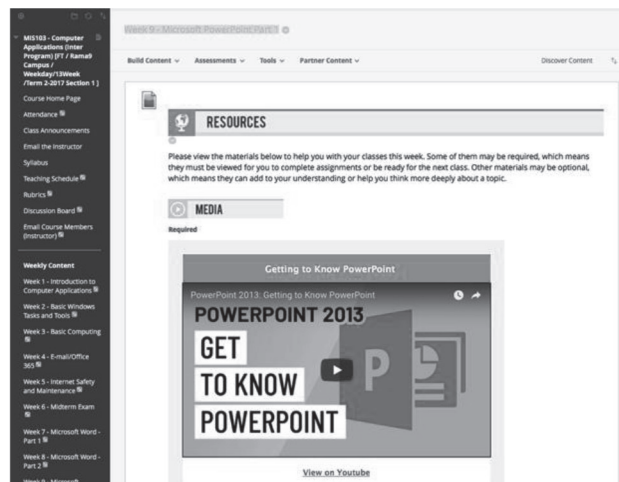


Figure 2 Online learning resources in Blackboard

### *Method*

Information about the 233 students and their online behaviors were gathered after their final exams were completed. The data spanned the entire course, from the first face-to-face class until the last day of final exams, which comprised a total of around 90 days (the final exam date was different between classes). The data were extracted through the Blackboard Statistical Report.

Student nationalities (independent variables) were gathered, while other metadata such as student ID, name, class section, etc. were discarded. For feature engineering, several nationalities were grouped into a regional culture (e.g. Thailand à Southeast Asia) to prepare the data for cultural analysis. Five final cultures groups were identified - Africa, East Asia, South Asia, Southeast Asia, and Europe and America. Any missing values were filled with a mode.

Online behaviors (dependent variables)' which include content view counts, assignment submission counts, and discussion submission counts,

were collected. *Content view counts* measure how often a student visits the contents, defined as any learning materials posted on Blackboard, including lecture notes, supporting videos, and reference materials. *Assignment submission counts* measure how many times each student submits homework. Since students were allowed to resubmit assignments until the deadline, the assignment count could exceed 11 (the number of assignments). *Discussion submission counts* measure how often students participate (visiting/posting) in a discussion forum. Given that the discussion is optional, discussion submission counts for some students could be zero.

## Results and discussion

This section reports on the results of the descriptive and inferential statistical analysis. Analysis of variance (ANOVA) and post-hoc analysis with Bonferroni correction was conducted crossing cultures ~ content view counts, assignment submission counts, discussion submission counts.

**Table 1** Cultural differences and online behaviors

Regional Culture	Assignments			Content views			Discussion board		
	Mean	SD	P	Mean	SD	P	Mean	SD	P
Africa	10.70	2.79	0.22	143.52	55.95	0.015	0.57	0.99	0.084
East Asia	9.84	4.84		162.06	91.51		0.64	1.53	
Europe and America	9.50	4.12		87.30	32.17		0.33	0.89	
South Asia	12.37	3.04		156.89	77.47		0.74	1.24	
Southeast Asia	10.77	4.02		132.58	61.97		1.13	1.72	

Note: \* $p < .01$

Table 1 shows the means and standard deviations of the results. One-way ANOVA test shows significant difference between cultures on content view counts ( $F(2, 228) = 3.12$ ;  $p = 0.015$ ). Further post-hoc analysis



with Bonferroni correction confirms the difference between *Africa, Europe and America*, between *South Asia, Europe and America*, and between *East Asia, Europe and America* (all  $p < 0.01$  after Bonferroni correction). No significant effect of cultures was found on assignment submission counts ( $p = 0.22$ ) or discussion submission counts ( $p = 0.084$ ).

These results confirm that cultural differences have a clear effect on online behavior; in particular, it was found that cultures significantly influence content view counts. It is very tempting to speculate how culture leads to the clear difference in content view counts. One suggestion is that it could be due to the digital proficiency of certain cultures. However, to our surprise, *Europe and America* students have the lowest content view counts among the five groups, which contradicts Lu et al. (2010), Marambe, Vermunt, and Boshuizen (2012), Sandel, Buttny, and Varghese (2018), Swierczek and Bechter (2010), as they found European were more active learners, compared to Asian learners. Another possible explanation is that the students in the Europe and America group may not have been as comfortable with the nature of the online content. This is very plausible because the contents were mostly agreed upon by the six Asian lecturers; thus, the content may be tailored more toward Asians. Further investigation (possibly interviews) should be conducted to confirm this.

## Conclusion

This work studied how cultural differences affect online behaviors, along with other user characteristics. The results showed that culture has a significant effect on the use of learning management systems. Interestingly, Asian students tend to be more involved in the learning management system as compared to their Western counterparts.

This work is significant for its implications regarding the use of the learning management systems; that is, it is important to employ a culturally sensitive instructional design in an international online learning environment. In this study, it was found that *Europe and America* students had the lowest content view counts, seemingly in contrast to past studies, which may be due to the “Asian” design of the online materials.

Certain limitations of the work can be discussed. First, this study primarily focused on Digital Literacy class. Future work will aim to analyze similar data on other courses. Second, although this study involved a fairly large sample, the inferential method used would benefit from a larger sample, as seen in the variability of the results. Third, this study employed a mainly quantitative method. Future work should attempt a mixed method, combining a qualitative method to grind further deep insights regarding student behaviors.

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