# A Study of Student Interaction with Online Course Content Provided Through a Learning Management System in a High School Science Classroom: Implications for Educators

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## Abstract

This study investigated student perceptions of a Learning Management System (LMS) and student levels of participation and interaction with course content provided by the LMS in a high school science classroom. A survey was administered to 122 students in a traditional high school, measuring student perceptions of course content provided through the LMS. Statistical data on LMS usage by student participants was compiled from the embedded tracking tools including overall time on the LMS, time of day of student access, and average hourly student use of the LMS. The findings of this study lend support for the benefits of learning management systems and access to online learning content as a means to engage students.

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The 21st Century classroom has a strikingly different landscape than the traditional classroom setting; technology perhaps the most obvious reason. Education in the current K-12 setting can take on many formats. Traditional models in the face to face setting still dominate. However, technology has been the springboard for a variety of new instructional delivery systems. The prevalence of technology in schools has mirrored that of its emergence in society. In fact, it will account for over half of a district's educational resources over the next three years (Meyer, 2014). Synchronous and asynchronous charter public and non-public schools have grown rapidly. Additionally, hybrid or blended classrooms, where a portion of the instruction is delivered outside the traditional setting, have gained popularity as well. While these new models of education have increased in availability due to the prevalence of technology, traditional K-12 schools have responded in various ways to the availability, demand, and need for instructional technology as well.

Many schools have adopted Learning Management Systems (LMS) to add an online presence to their traditional classroom settings. "An LMS is a robust piece of software that provides an online portal for classrooms, serving administrative functions for educators and allowing students to view assignments, grades, and learning materials" (Ash, 2013). These LMS's can carry a hefty price tag in an era when many school districts are facing serious budget constraints. In the current era of high stakes testing and accountability, the reliance on technology has increased. Educators are looking for the most effective and efficient means to increase student achievement. Thus, it is important to study the impact of learning management systems in order to determine their worthiness. School leaders need to know whether or not the money they pour into technology tools, such as learning management systems, do indeed have the desired impact. Do the costs justify the benefits?

The purpose of this study is to investigate whether the implementation of a learning management system might increase student participation, use of resources, and student time on task for content review and assessment preparation in a high school science class. This study attempts to affirm student activity with class content delivered through a learning management system in a traditional school setting. In addition, the study seeks to identify whether or not students will report a preference for using learning management system tools over traditional assignment and study methods, and whether or not students perceive the LMS as beneficial.

Support for providing learning content online might begin with the notion of recognizing today's students as digital natives. Current students are more knowledgeable than many of their teachers when it comes to technology. Prensky (2001) coined the terms "digital natives" to describe students and "digital immigrants" to describe teachers with this notion in mind. These digital natives have been raised in a digital environment that has shaped how they think, behave, and act. Digital natives have a special skill set related to visually-orientated technologies as well as visual communication (Brumberger, 2011). Therefore, an expectation and acceptance of technology usage in schools among digital natives has emerged (Gu and Guo, 2013). By the time students arrive in middle school, they are competent in information retrieval from the internet, using You Tube to learn new skills, and participate daily in social networking sites to connect to other teens. Traditional curriculum in the classroom does not frequently use these skill sets and many teachers do not possess them as they are digital immigrants, meaning that they are learning these new technologies. Teachers are not always comfortable implementing the new technologies into their lessons. Educators must bridge the gap between students' at-home use of their devices to the use of electronic devices in the classroom (Downes and Bishop, 2012). Teachers should change their methodologies to include less step by step content and increase the

random access of content. Today's students are not the same as those the current educational system was designed to teach. With this in mind, the context for a shift in the traditional educational paradigm is established (Prensky 2001).

The traditional delivery system of curriculum in high school classrooms of the United States is evolving into a system of convenience, personalized instruction, and rapid student assessment. Classroom content placed online provides many benefits for students as well as teachers. The top two student-perceived benefits of using an online learning product are the provision of online tools to supplement classroom learning and to extend the learning beyond the brick and mortar classroom. The top two teacher-perceived benefits of using an online learning product are the provision of online tools to supplement classroom instruction and the ability to individualize instruction (Eduviews, 2009).

Providing an online instructional component to the traditional classroom often is a result of teacher desire to increase student time on task and increase interaction with class content. Most researchers agree that there is a postive relationship between time on task and student achievement. However, the quality of time on task must be optimized. While educators generally agree that time-on-task, or that time an individual student devotes to subject content, is essential to academic success, they will also agree that not all time-on-task is equal. A study of online adult learners and their performance was conducted to determine when the best quality of time-on-task could be achieved. (Romero & Babera, 2011). The authors of this study investigated the impact of quality versus quantity of time-on-task in an adult online course. They also wanted to see if there was a correlation between the time of day and quality of time-on-task. Recommendations from the authors for online institutes who are structuring a new course are to set the class schedule as flexible as possible, and to use as many asynchronous group activities as

possible; allowing participants to work on the project at a convenient time of day to assure quality time-on-task.

Although this study was gathering data for a way to increase the quality of time-on-task for adult online learners, it has value for the teachers and administrators who are considering how to best leverage instructional technology. Some studies suggest that high school students would perform better if school started later in the day (Jacob and Rockoff, 2011). If this is the case, then online learning content can afford students the opportunity to access content at a time that optimizes their opportunity to learn.

Learning management systems (LMS) are becoming an essential tool for providing online learning content and assessments to college and high school students in the United States. Henke (2007) approached the subject of online education from the perspective of students, educators, and parents. The online instruction discussed through the report was provided through a learning management system that offered the students an online site to allow interaction between teacher and student as well as peer interactions. The study revealed a need for different services to be provided as requested by students. Students in middle school focused on receiving extra help from the online components in their classes and the ability to work at their own pace to master the concepts, while high school students preferred specialized online courses and the flexibility to work around their schedules. The option to personalize the pathway to education via a learning management system is one reason for the increased positive attitude toward online options. These valuable experiences provided by an LMS are important to students and parents since these experiences continue in college and in the workplace.

A positive attitude toward any learning, including learning accomplished via the internet, is essential for student success. A study on high school students' views on blended learning focused on attitude changes of students after participating in a blended learning curriculum for a 10 week period (Yapici and Akbayin, 2012). The goal of the study was to see if students had a positive attitude toward the blended learning model and preferred it over the traditional face-to-face model. The conclusions reached in the study were that the test group had a high positive attitude to the blended learning model and the students particularly preferred aspects such as online practice tests, access to lessons and assignments during times that fit their schedule, and an increase in acquiring background of subject matter from watching posted videos and animations.

The focus of a study on Blackboard usage and student achievement (DeNeui and Dodge, 2007) was to find a relationship between frequency of usage and increase in exam scores. Participants in this study included 80 students enrolled in an Introduction to Psychology course at a medium-sized university in northwestern United States. The class was a traditional face-to-face format but with an online component that gave students access to all handouts, assignments, study guides, exam reminders, and email contact with instructor. While use of the online component was not required, it was encourage by the instructor. Data for the study was collected through the tracking options built into the Blackboard interface and accessible to course instructors. To determine student achievement on exams, the scores of three exams were collected and averaged for an overall performance score. The results of the study revealed a small correlation between total amount of Blackboard usage and final grade in the course. These results represented positive statistical evidence for the benefits of Blackboard usage by the students. The authors of the study stated that the experimental group was small and that

differences in student learning style could influence final results. They suggested a study with a larger, more diverse group and a focus on collecting data of long-term retention of content taught in class.

If a relationship between amount of interaction with online course content and student achievement exists, then it is important for educators to encourage such interaction. A survey-based study was initiated for the purpose of investigating the types of factors present that can increase students' willingness to engage in technology-based learning through experiences like Blackboard. (Friedrich and Hron, 2010). The e-learning system used was composed of two parts, one that included the subject matter of math and several language classes and the other component was the learning management system (LMS) used to deliver the class content. Students were more likely to accept new computer related experiences if they had greater computer skills and an overall positive outcome while working with computers. The data did support the idea that student's perception of the usefulness of the e-system's learning components brought about student willingness to engage in learning. Results also revealed that the students' perceived usefulness of the learning management system carried the greatest weight in influencing their willingness to use it to complete their work.

The United States Department of Education (2010) indicated that online learning can be enhanced by giving learners more control of their interactions with the media. However, the same study also concluded that "few rigorous research studies of the effectiveness of online learning for K-12 students have been published" (xiv). This study seeks to extend the range of knowledge regarding the impact of blended learning environments via the utilization of a learning management system on student achievement.

As measured by the results of the questionnaire and the statistics from the learning management system tracking tools, this study hypothesizes that the ability to access LMS online modules on demand will increase student contact time with science subject content. In addition, the hypothesis states that student surveys will indicate a student preference for using LMS tools over traditional assignment and study methods and students will perceive the LMS as beneficial.

## Method

### *Participants*

One hundred twenty-two students in an urban Ohio high school science class participated in the survey portion of this study. Permission to conduct the survey was obtained from the high school principal. Permission for student participation was obtained through signed parent permission letters. Students were given the online survey web address and logged in to complete the survey.

### *Apparatus*

The apparatus for this study was a non-experimental survey questionnaire in order to measure students' perceptions of their use of Blackboard Learn online modules to support their science class curriculum. The reliability and internal validity of the survey was verified by three expert judges. Along with the survey, a statistical examination was conducted of student time spent using online modules by reviewing data collected by Blackboard Learn tracking tools.

### *Procedures*

All participating students completed the "Blackboard and Your Science Class" survey. Students answered questions about Blackboard use in their science classes. Statistical data on Blackboard usage by student participants was compiled from the available Blackboard tracking

tools. Data was gathered from the tracking tools embedded in the Blackboard Learn system used by the students of the high school in order to report student interaction with science content. The results reported included overall time on Blackboard, overall time and log in totals per content offerings per class, overall total on time of day for student interaction on Blackboard, and average hourly student use of Blackboard. The data was collected over a period of five months that included a total of 100 actual school days in session.

## Results

Survey results demonstrate that students did use the LMS on a regular basis outside the classroom setting. Over 60% of all students reported that they used Blackboard at least one hour per week for test/quiz preparation or to complete other assignments (see Tables 1 and 2).

Table 1
*Time spent per week at home on BLACKBOARD for test/quiz preparation:*

| Answer Choices | % Responses |
|---|---|
| 0 hours | 20.83 |
| 1-2 hours | 61.67 |
| 3-4 hours | 15 |
| 5-6 hours | 1.67 |
| 6+ hours | 0.83 |

Table 2

*Time spent per week at home on BLACKBOARD for science assignments:*

| Answer Choices | % Responses |
|---|---|
| 0 hours | 36.97 |
| 1-2 hours | 55.46 |
| 3-4 hours | 5.88 |
| 5-6 hours | 1.68 |
| 6+ hours | 0 |

Table 3 (below) reveals the results of student preference for how the LMS is used in the classroom by the teacher. Clearly the most popular responses were "Class Notes" and "Practice Tests".

Table 3

*Which of the items below would you most like your teacher to use on Blackboard? (Put them in order, giving your first choice the number 1 and your last choice a number 7.)*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Class Notes | 53.39 | 33.05 | 6.78 | 3.39 | 0.85 | 1.69 | 0.85 |
| Practice Tests | 31.36 | 38.98 | 9.32 | 11.86 | 5.08 | 1.69 | 1.6 |
| Videos about the subject | 6.78 | 8.47 | 45.76 | 11.02 | 15.25 | 8.47 | 4.24 |
| Wikis | 1.69 | 0.85 | 2.54 | 33.90 | 15.25 | 14.41 | 31.36 |
| Class Assignments | 0 | 5.93 | 19.49 | 18.64 | 43.22 | 11.86 | 0.85 |
| Homework Assignments | 5.08 | 10.17 | 13.56 | 12.71 | 12.71 | 35.59 | 10.17 |
| Group Work | 1.69 | 2.54 | 2.54 | 8.47 | 7.63 | 26.27 | 50.85 |

*Note: All data reported in percentages*

Data was also collected that asked students whether or not they preferred the LMS to traditional classroom resources for certain tasks. Tables 4 and 5 demonstrate that students prefer to use materials from Blackboard to study for tests and quizzes rather than traditional notes and the textbook.

Table 4

*I would prefer to use BLACKBOARD PRACTICE TESTS to help me study for tests and quizzes rather than my notes and textbook.*

| Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|
| 2.54% | 15.25% | 47.46% | 34.75% |

Table 5

*I would prefer to study from my NOTES AND TEXTBOOK rather than using Blackboard practice tests.*

| Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|
| 13.79% | 50.86% | 29.31% | 6.03% |

Table 6

*Since I have begun using Blackboard for my science class, (Check all that apply.)*

| Answer Choices | % Response |
|---|---|
| I am more willing to complete science assignments in class using Blackboard. | 56.30 |
| I am more willing to complete science assignments at home using Blackboard | 49.58 |
| I am less willing to complete science assignments in class using Blackboard. | 6.72 |
| I am less willing to complete science assignments at home using Blackboard. | 8.40 |
| I will complete assignments whether they are on Blackboard or not. | 61.34 |
| I will not complete assignments whether they are on Blackboard or not. | 2.52 |

Two other survey questions revealed interesting data. When students were asked if they used Blackboard to complete assignments when they were absent from school, 63.87 responded affirmatively. Additionally, 46.22% agreed that their science grade had improved since the class began using Blackboard (1.68% reported their grade worsened), 36.97% said they were more productive in class, and 36.13% responded that they spend more time on task.

Tables 7 and 8 represent data gathered through the Blackboard tracking tool. The data targets the number of hours per day the LMS was used as well as the time of day. The data is displayed each of the 4 science classes that participated.

Table 7

*Summary of LMS user activity per day as measured in hours*

| | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|---|
| Biology | 12.72 | 45.48 | 44.25 | 11.45 | 12.71 | 15.36 | 9.31 |
| Chem. | 9.01 | 73.29 | 69.26 | 19.35 | 26.18 | 17.46 | 2.41 |
| Phys. | 48.33 | 48.33 | 28.57 | 25.92 | 22.37 | 32.52 | 3.47 |
| Sci. | | | | | | | |
| Chem. | 0.57 | 7.97 | 2.36 | 4.13 | 4.19 | 0.87 | 0.00 |
| Total | 70.63 | 175.07 | 144.44 | 60.85 | 65.45 | 66.21 | 15.19 |

Table 8

*Number of times students accessed an LMS module by hour of day*

| | Biology | Chem. A | Phys. Science | Chem. B | Total |
|---|---|---|---|---|---|
| Mid | 89 | 16 | 2 | 0 | 107 |
| 1:00 AM | 163 | 3 | 5 | 0 | 171 |
| 2:00 AM | 16 | 8 | 47 | 0 | 71 |
| 3:00 AM | 0 | 0 | 5 | 0 | 5 |
| 4:00 AM | 0 | 0 | 0 | 0 | 0 |
| 5:00 AM | 0 | 14 | 0 | 0 | 14 |
| 6:00 AM | 2 | 80 | 25 | 0 | 107 |
| 7:00 AM | 173 | 210 | 260 | 4 | 647 |
| 8:00 AM | 272 | 2229 | 76 | 26 | 2603 |
| 9:00 AM | 603 | 958 | 1335 | 43 | 2939 |
| 10:00AM | 700 | 277 | 574 | 405 | 1956 |
| 11:00AM | 2120 | 230 | 123 | 79 | 2552 |
| 12 noon | 3765 | 357 | 248 | 128 | 4498 |
| 1:00 PM | 432 | 468 | 1888 | 47 | 2835 |
| 2:00 PM | 280 | 403 | 152 | 65 | 900 |
| 3:00 PM | 339 | 292 | 225 | 11 | 867 |
| 4:00 PM | 298 | 767 | 313 | 57 | 1435 |
| 5:00 PM | 465 | 634 | 403 | 0 | 1502 |
| 6:00 PM | 794 | 689 | 409 | 0 | 1892 |
| 7:00 PM | 888 | 962 | 315 | 0 | 2165 |
| 8:00 PM | 893 | 504 | 382 | 4 | 1783 |
| 9:00 PM | 705 | 890 | 313 | 0 | 1908 |
| 10:00 PM | 621 | 469 | 281 | 0 | 1371 |
| 11:00 PM | 463 | 224 | 50 | 0 | 737 |
| Totals | 14081 | 10864 | 7431 | 869 | 33065 |

## Discussion

As measured by the results of the survey and the statistics from the Blackboard Learn tracking tools, a portion of the hypothesis is supported, while another is inconclusive. Tables 4 and 5 indicate student preference to study using various instructional materials located online than from traditional means. This supports the portion of the hypothesis that predicted students would report such a preference. It also supports the literature reviewed in this manuscript signaling a positive attitude of students towards online learning content. The ability to access Blackboard modules online resulted in sustained contact time. Thus, students did indeed utilize the instructional and support materials that were available online. This was supported by the student survey responses in Tables 1 and 2 as well as the tracking data displayed in Tables 7 and 8. However, one cannot accurately assess whether or not the total amount of student contact time with science subject content increased due to the availability of the online content. Although the study revealed that students are more willing to complete assignments using Blackboard, it is possible that students would spend the same amount of contact time with science instructional and support materials whether an online component was available or not. The second part of the hypothesis predicted that student contact with instructional materials would increase given the accessibility of online content. This portion of the hypothesis was neither supported nor refuted.

The data reported in the narrative portion of the results section states that 46.22% of students agreed that their science grade had improved since the class began using Blackboard (1.68% reported their grade worsened), 36.97% said they were more productive in class, and 36.13% responded that they spend more time on task. This data also support information from the literature review regarding the positive attitude and perception students have about online

learning.

The data in Table 3 shows student preferences with the type of content they prefer loaded onto the LMS. Clearly they favor access to Class Notes as well as Practice Tests. This does not mean that other content is without value. However, it may suggest a reason why 46.22% of students agreed that their science grade had improved since the class began using Blackboard. Use of class notes and practice tests can play an important role in student learning (and performance) on assessments. If loading class notes and practice tests on an LMS leads to an increase in student contact with such test preparation materials, then this lends support to the value of adopting and implementing an LMS in the classroom setting.

Data displayed in Table 6 supports student preference for Blackboard components, and also supports student perceptions that they are benefiting from Blackboard use in their science classroom. Forty-six percent of students surveyed stated that their science grades have improved since using Blackboard compared to 2% who report that their science grade has declined since using Blackboard in their class. Seventy-three percent report that they believe that they are more productive and spend more time on task since using Blackboard with their science classes. Fifty-six percent of surveyed students state that they are more willing to complete in-class assignments using Blackboard than traditional assignments while 7% say they are less willing to use Blackboard for in-class assignments. When asked about completing assignments at home, 50% of the students surveyed reported that they are more willing to complete the assignments using Blackboard compared to 8% who state they are less willing.

The data in Tables 7 and 8 summarize the number of hours per day students accessed the LMS and the hour of the day in which students were active on the LMS. The data from these tables was compiled through the statistics tracking tools available in Blackboard. The results support the notion that students accessed learning materials on the LMS regularly; suggesting they preferred the online

materials over the traditional study materials. Furthermore, the data indicates the days and times of student access. A substantial number of times the LMS learning materials were accessed occurred on non-school days or during after school hours. This lends additional support to the idea that students preferred access of learning materials through a learning management system.

Students reported in the survey that they spend more time on task since Blackboard is used as a component of their science class and the tracking data supports this survey finding. Student time spent on Blackboard components after class hours was not required since a few students did not have internet access at home. All hits on class components outside of class time were voluntary. The tracking tools report 18,623 hits to various Blackboard components by the high school science students during hours outside of class time. Students were accessing content components that provided them with a variety of instructional methods for each concept. These components included videos, power point notes, web sites, and class resources. Articles in the literature review of this project have reported that by engaging students in technology supported curriculum, students show increased interest and participation. The voluntary access of the Blackboard components by the Steubenville students outside of regular science class time supports these findings.

This study has implications for a variety of stakeholders. Teachers may be alerted to the value of LMS usage to store content for student access. According to the results, many students reported that they preferred access to content provided online rather than traditional access of materials. In addition, many students believed their grades had improved, they were more productive, and they were more willing to complete assignments. This perceived increase in student engagement may benefit both the teacher and the learner. Teachers may see an additional benefit by providing content online to offset the loss of learning time attributed to student absences and calamity days.

Educators might also benefit from the knowledge that using an LMS may help them differentiate instruction and target various subgroups. Students in academic risk can use a learning management system for lesson support or even credit recovery if the school system has classes developed that can be delivered through the district's LMS. Gifted students could access online classes and receive credit for completing some classes outside of the normal school day. Special needs students can have lessons tailored for their strengths.

The results of this study also help to inform school administrators considering the adoption of an LMS. As dollars become scarcer, school leaders must be efficient stewards of district finances. Those considering the adoption of an LMS can take note that the results of this study suggest many benefits of this teaching and learning tool. Administrators in traditional schools looking for ways to develop an online presence can find support in this study for acquisition and implementation of an LMS. In addition to the benefits mentioned previously, school leaders could gain flexibility in scheduling by using a learning management system to develop blended learning and flipped classrooms. Traditional schools aiming to respond to the changing needs of digital natives and their parents may develop an online presence using an LMS as a response. School administrators should also understand that adoption of an LMS alone is not enough. Any integration of new technology tools must be paired with an adequate amount of high quality professional development. School leaders must avoid the one size fits all approach to professional development, and focus on a more personalized approach to meet the needs of individual teachers (Hixon and Buckenmeyer, 2009).

Research suggests the importance of recognizing the evolution of high school classrooms and instructional methods. Today's students are digital natives. They access technology on a regular and consistent basis, and they are comfortable doing so. Parents are provided with a variety of options for their children to acquire a high school education. Traditional, online, and blended-learning schools are

competing for students. The variety of tools, flexibility of scheduling, and the ability to tailor curriculum to meet a student's individual needs can be provided and promoted as an incentive by schools using a learning management system. Instructional methods need to be multimodal and constructed for students with a variety of needs and time constraints. This research project highlights the readiness and willingness of students to work with class content beyond traditional lecture and textbooks, and their preference of online content access over traditional access. An increase in the time the students engage in content is equivalent to an increase in time on task; research shows that increasing time on task is likely to increase student achievement.

Educators are working in an era of high stakes accountability. Student performance on standardized tests has become increasingly important to all stakeholders. Current trends indicate student achievement will factor into the evaluations of an increasing number of school administrators and teachers. These pressures exist under the cloud of reductions in school funding, which make resources scarcer and underscore the importance of fiscal responsibility. The findings of this study lend support for the benefits of learning management systems and access to online learning content as a means to engage students.

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