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PATTERNS OF USER ACTIVITY IN
THE BLACKBOARD COURSE MANAGEMENT SYSTEM ACROSS ALL
COURSES IN THE 2004-2005 ACADEMIC YEAR
AT BRIGHAM YOUNG UNIVERSITY

by

Michael E. Griffiths

A master's project submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirement for the degree of

Master of Science

Department of Instructional Psychology and Technology
Brigham Young University

June 2007

BRIGHAM YOUNG UNIVERSITY
GRADUATE COMMITTEE APPROVAL

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ABSTRACT

PATTERNS OF USER ACTIVITY IN THE BLACKBOARD COURSE MANAGEMENT SYSTEM ACROSS ALL COURSES IN THE 2004-2005 ACADEMIC YEAR AT BRIGHAM YOUNG UNIVERSITY

Michael E. Griffiths

Department of Instructional Psychology and Technology

Master of Science

The following report discusses the use of the Blackboard Course Management in terms of overall patterns of activity as recorded in the Blackboard activity database across the whole campus of Brigham Young University during the 2004-2005 academic year. The report contains a set of data represented by tables and graphs that summarize activity, or clicks, in the Blackboard system performed by students, professors, and assistants. The clicks are summarized according to a number of different categories and criteria and analyzed to show interesting patterns of activity. The report is designed to show a general campus wide summary of Blackboard activity and also to briefly explore patterns that may be used as a platform for further detailed research.

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TABLE OF CONTENTS

| | |
|---|-----|
| Introduction..... | 12 |
| Literature Review..... | 15 |
| Methods..... | 22 |
| Data Collection | 22 |
| Data Analysis | 24 |
| Limitations | 26 |
| Results..... | 28 |
| Total Number of Course-sections Using Blackboard | 28 |
| Overall Activity Level of Course-sections | 29 |
| Activity Level of Students, Professors, and Assistants..... | 30 |
| Activity Level of Students, Professors, and Assistants by College | 38 |
| Quartile Ranges of Average Clicks..... | 59 |
| Percentage of Course-sections in Colleges Compared to Overall Quartile Ranges .. | 60 |
| Overall Activity by Feature | 63 |
| College Level Activity by Feature..... | 67 |
| Comparison of College Level Activity for All Features..... | 75 |
| Pedagogical Usage versus Administrative Usage..... | 77 |
| Timing of Activity | 80 |
| Activity in Different Class Sizes..... | 84 |
| Blackboard Feature Use by Class Size | 86 |
| Ratio of Instructor Activity to Student Activity | 89 |
| Discussion..... | 92 |
| Overall Activity | 92 |
| Student, Professor, and Assistant Activity Levels | 93 |
| High Levels of Student Activity | 94 |
| Between College Variance of Assistant Activity..... | 94 |
| The Most Used Features in Blackboard..... | 95 |
| Administrative Versus Pedagogical Activity..... | 95 |
| Blackboard Feature Usage Variance in Different Colleges..... | 97 |
| Blackboard Feature Usage Variance in Different Class Size Ranges..... | 98 |
| Instructor to Student Activity Ratio Variance in Different Class Size Ranges | 98 |
| The Timing of Blackboard Activity..... | 99 |
| Conclusion | 100 |
| References Cited | 101 |
| Appendix A: Data showing usage of Blackboard CMS by Blackboard ASP's top 5 users .. | 103 |
| Appendix B. Detailed explanation of the Blackboard activity database | 105 |
| Appendix C. SQL query code..... | 106 |

LIST OF TABLES

Table 1. Categories Used to Represent Blackboard Activity23

Table 2. Short Name and Number of Course-sections for Each College39

Table 3. Quartile Ranges for Average Clicks Rounded to the Nearest 560

LIST OF FIGURES

| | |
|---|----|
| Figure 1. All course-sections and their average student clicks | 31 |
| Figure 2. All course-sections and their average student clicks, 0-200..... | 32 |
| Figure 3. All course-sections and their average professor clicks..... | 32 |
| Figure 4. All course-sections and their average professor clicks, 0-2000 | 33 |
| Figure 5. All course-sections and their average assistant clicks | 33 |
| Figure 6. All course-sections and their average assistant clicks, 0-1000..... | 34 |
| Figure 7. Course-sections shown by average student clicks | 35 |
| Figure 8. Course-sections shown by average professor clicks..... | 36 |
| Figure 9. Course-sections shown by average professor clicks..... | 36 |
| Figure 10. Course-sections shown by average assistant clicks..... | 37 |
| Figure 11. Course-sections shown by average assistant clicks | 37 |
| Figure 12. Average clicks of students, professors, and assistants..... | 38 |
| Figure 13. Average student clicks as a percentage classes in Religion | 40 |
| Figure 14. Average student clicks as a percentage classes in Math..... | 40 |
| Figure 15. Average student clicks as a percentage classes in Humanities..... | 41 |
| Figure 16. Average student clicks to as a percentage of all classes in HHP | 42 |
| Figure 17. Average student clicks as a percentage of all classes in Fine Arts | 42 |
| Figure 18. Average student clicks as a percentage of all classes in FHS..... | 43 |
| Figure 19. Average student clicks as a percentage of all classes in Engineering | 43 |
| Figure 20. Average student clicks as a percentage of all classes in Education..... | 44 |
| Figure 21. Average student clicks as a percentage of all classes in Business..... | 45 |
| Figure 22. Average student clicks as a percentage of all classes in Biol/Ag | 45 |
| Figure 23. Average professor clicks as a percentage of all classes in Religion..... | 46 |

| | |
|---|----|
| Figure 24. Average professor clicks as a percentage of all classes in Math | 47 |
| Figure 25. Average professor clicks as a percentage of all classes in Humanities | 47 |
| Figure 26. Average professor clicks as a percentage of all classes in HHP..... | 48 |
| Figure 27. Average professor clicks as a percentage of all classes in Fine Arts..... | 49 |
| Figure 28. Average professor clicks as a percentage of all classes in FHS | 49 |
| Figure 29. Average professor clicks as a percentage of all classes in Engineering | 50 |
| Figure 30. Average professor clicks as a percentage of all classes in Education | 51 |
| Figure 31. Average professor clicks as a percentage of all classes in Business | 51 |
| Figure 32. Average professor clicks as a percentage of all classes in Biol/Ag..... | 52 |
| Figure 33. Average assistant clicks as a percentage of all classes in Religion | 53 |
| Figure 34. Average assistant clicks as a percentage of all classes in Math | 53 |
| Figure 35. Average assistant clicks as a percentage of all classes in Humanities | 54 |
| Figure 36. Average assistant clicks as a percentage of all classes in HHP..... | 55 |
| Figure 37. Average assistant clicks as a percentage of all classes in Fine Arts..... | 55 |
| Figure 38. Average assistant clicks as a percentage of all classes in FHS..... | 56 |
| Figure 39. Average assistant clicks as a percentage of all classes in Engineering | 56 |
| Figure 40. Average assistant clicks as a percentage of all classes in Education..... | 57 |
| Figure 41. Average assistant clicks as a percentage of all classes in Business..... | 58 |
| Figure 42. Average assistant clicks as a percentage of all classes in Biol/Ag | 58 |
| Figure 43. Quartiles ranges of average student clicks by college | 62 |
| Figure 44. Quartiles ranges of average professor clicks by college..... | 62 |
| Figure 45. Quartiles ranges of average assistant clicks by college | 63 |
| Figure 46. All clicks in 2004-2005 by feature categories | 65 |
| Figure 47. All professor clicks in 2004-2005 by feature categories | 65 |
| Figure 48. All professor clicks in 2004-2005 by feature categories | 66 |

| | |
|--|----|
| Figure 49. All assistant clicks in 2004-2005 by feature categories | 66 |
| Figure 50. Percentage of student clicks in Announcements for each college | 68 |
| Figure 51. Percentage of student clicks in Grade Book for each college | 68 |
| Figure 52. Percentage of student clicks in Communication/Email for each college | 68 |
| Figure 53. Percentage of student clicks in Content Folder for each college..... | 69 |
| Figure 54. Percentage of student clicks in Content for each college | 69 |
| Figure 55. Percentage of student clicks in Quiz for each college | 69 |
| Figure 56. Percentage of student clicks in Discussion Board feature for each college | 70 |
| Figure 57. Percentage of professor clicks in Announcements for each college..... | 70 |
| Figure 58. Percentage of professor clicks in Grade Book for each college | 71 |
| Figure 59. Percentage of professor clicks in Communication/Email for each college | 71 |
| Figure 60. Percentage of professor clicks in Content Folder for each college | 71 |
| Figure 61. Percentage of professor clicks in Content for each college..... | 72 |
| Figure 62. Percentage of professor clicks in Quiz for each college..... | 72 |
| Figure 63. Percentage of professor clicks in Discussion Board for each college | 72 |
| Figure 64. Percentage of assistant clicks in Announcements for each college..... | 73 |
| Figure 65. Percentage of assistant clicks in Grade Book for each college | 73 |
| Figure 66. Percentage of assistant clicks in Communication/Email for each college | 73 |
| Figure 67. Percentage of assistant clicks in Content Folder for each college..... | 74 |
| Figure 68. Percentage of assistant clicks in Content for each college | 74 |
| Figure 69. Percentage of assistant clicks in Quiz for each college | 75 |
| Figure 70. Percentage of assistant clicks in Discussion Board for each college..... | 75 |
| Figure 71. Percentage of student clicks for each feature in each college | 76 |
| Figure 72. Percentage of professor clicks for each feature in each college | 76 |
| Figure 73. Percentage of assistant clicks for each feature in each college | 77 |

| | |
|---|-----|
| Figure 74. Student activity by administrative, pedagogical, and comm/email clicks..... | 78 |
| Figure 75. Professor activity by administrative, pedagogical, and comm/email clicks..... | 79 |
| Figure 76. Assistant activity by administrative, pedagogical, and comm/email clicks | 79 |
| Figure 77. 2004-2005 Blackboard activity over time | 81 |
| Figure 78. Fall 2004 Blackboard activity over time | 81 |
| Figure 79. Winter 2005 Blackboard activity over time | 82 |
| Figure 80. Spring 2005 Blackboard activity over time..... | 82 |
| Figure 81. Summer 2005 Blackboard activity over time..... | 83 |
| Figure 82. Two month view of timing of Blackboard activity | 83 |
| Figure 83. Average student clicks in different class size groups | 85 |
| Figure 84. Average professor clicks in different class size groups..... | 86 |
| Figure 85. Average assistant clicks in different class size groups | 86 |
| Figure 86. Percentage of student clicks in features of Blackboard by class size..... | 88 |
| Figure 87. Percentage of professor clicks in features of Blackboard by class size..... | 88 |
| Figure 88. Percentage of assistant clicks in features of Blackboard by class size | 89 |
| Figure 89. Course-sections and their instructor to student activity ratio | 90 |
| Figure 90. Instructor to student activity ratio by class size group | 91 |
| Figure 91. Instructor to student activity ratio by class size groups over 200..... | 91 |
| Figure 92. Database size for ASP's top 5 clients..... | 103 |
| Figure 93. Completed assessments for ASP's top 5 clients..... | 104 |
| Figure 94. Unique session count of ASP's top 5 clients..... | 104 |

Introduction

Course Management Systems (CMS) have become very popular as software programs that assist instructors to administer courses by providing on-line access to course documents, announcements, grade entry, discussion forums, and other features. With a CMS, students have on-line access to many course features and information that were previously available only in hard copy format. There are many different CMS products that are available with varying features and capabilities. Some CMS are free open-source products whereas others are commercial products that cost substantial amounts of money. Large investments have been made by many institutions to implement a standard university wide CMS. Brigham Young University has invested large amounts of resources to implement the Blackboard Learning System (defined in this study as Blackboard CMS) throughout the whole university. As is the case with any new technology it has taken time to be adopted by faculty members with wide ranging differences in enthusiasm and depth of implementation. The Blackboard CMS has many tools that can be used by faculty members in their courses and there is a large range of permutations of usage. There is great diversity in the use of Blackboard by faculty members, and many faculty members do not use Blackboard at all. The wide range of usage of Blackboard by faculty members gives rise to many issues posed by different stakeholders:

1. Faculty members want to know what features are being used and how students are using the system to consider the pedagogical implications and the potential for pedagogical improvement.
2. Administrators of an institution of higher education that has already implemented a campus wide CMS want to know what features are most used and to what extent to justify continuing their investment.

3. Administrators of institutions of higher education that are planning to implement a CMS want to know the typical use of a CMS for investment/implementation decisions.
4. Implementation teams and designers of CMS solutions need usage data to forecast data storage, processing and network communications requirements.

This project aims to give some answers to these questions by creating a campus-wide dataset for one academic year and describing some of the patterns of how Blackboard is being used in terms of activity recorded in the Blackboard database. The resulting dataset and description of patterns is necessary as a tool for interpreting the overall use of Blackboard and also as a platform for more detailed research into specific areas.

The detailed research questions below were determined during the initial data analysis phase and were based on the types of analyses that were possible with the data from the Blackboard database that was available to this study and also based on the overall scope of this study. The questions are designed to produce sets of results that to some extent answer the general issues above that are the guiding areas of interest that this study is designed to investigate. The questions are defined in more detail in the Methods section.

1. How many course-sections use Blackboard at BYU?
2. How many clicks were made in the 2004-2005 academic year?
3. What is the pattern of average clicks for users across all course-sections?
4. What is the pattern of average clicks in each college?
5. What are the ranges of clicks when separated into quartiles?
6. What percentage of course-sections are in each quartile of average click ranges in each college?
7. What is the overall number of clicks in each Blackboard feature?

8. What is the activity level for each category of Blackboard features for each college?
9. What percentage of clicks constitutes administrative versus pedagogical activity?
10. What is the overall activity level over time in each semester and term?
11. What is the average activity in different class sizes?
12. What is the difference in feature usage in different class sizes?
13. What is the ratio of instructor to student activity shown in different class sizes?

Literature Review

Although many studies have attempted to analyze the impact of Course Management Systems (CMS) in individual course-sections, there has been very little data gathered that describes the usage of a CMS across a whole institution. The compiling and describing of activity data from all course-sections in an institution is necessary to study patterns of pedagogical and administrative usage patterns as a whole. A complete set of CMS data from an institution will be useful for many reasons some of which are discussed in this review and most of which are driven by a desire to understand the real value or benefit of using a CMS both from educational and administrative perspectives. Institution wide data are necessary to supply professors with information about patterns and practices of all other professors and students. The CMS data from an institution are necessary for making recommendations of usage levels that can also serve as indicators to answer Return on Investment (ROI) questions posed by administrators. These data are also necessary to ascertain usage levels for the purpose of sizing and scoping hardware and network requirements. It is also assumed that institution wide data would be useful to the providers of course management systems for understanding feature usage for future design decisions.

The need to understand how a CMS is really being used is in part motivated by the rapid propagation of these systems. Mott and Granata (2006) assert that virtually every university and college in the United States has implemented a CMS (such as Blackboard, Desire2Learn, Sakai, or WebCT). In 2001, *The Campus Computing Project* reported that over 20% of college courses used a course management system, and 75% of colleges that participated in the study had already established a “single product” standard for their CMS (Green, 2001). These web based applications have options for on-line communication between teachers and students, tools for

administering on-line tests and quizzes, on-line places for students to view course content, and many other tools for administrative functions. Blackboard became the number one producer of CMS in the nation when it recently purchased WebCT, and now is estimated to control 80%-90% of the CMS market (Roach, 2006). Blackboard is the CMS that has been adopted campus-wide by Brigham Young University.

Most research into CMS usage has been for the purpose of understanding the pedagogical implications of using such systems. Some researchers have attempted to evaluate a CMS by surveying and interviewing students and teachers. Klecker (2002) observed that graduate students felt that their learning had been enhanced by using Blackboard as part of the course. The following studies also primarily used surveys and interviews for collecting data. Jones (2005) is an example of a study that used surveys to examine both student and faculty attitudes towards Blackboard. This study also observed that the perception of both students and faculty was that Blackboard was a beneficial educational tool. While some studies began to focus on evaluating a CMS, others focused on describing how a CMS should be used and suggesting advantages that using a CMS can have over traditional methods of communication in on-campus courses. Carmean (2002), for example, explains how a CMS can create new opportunities for participation in learning that were previously not available especially to certain types of students. The challenge is that the benefits that are described by such articles, or that are inferred in evaluations, are notoriously difficult to correlate or compare with any quantitative data showing overall campus-wide patterns of usage. This is due to the fact that the measures available for study have mostly been the opinions of faculty members and students.

There are some studies that have attempted to collect a limited set of quantitative data that shows improved learning and teaching through the use of a CMS. Bryans-Bongey, Cizadlo, and

Kalnbach (2005) report that student test scores increased with the use of self-tests on the WebCT CMS. Teng (2005) attempted to show that using an integrated CMS tool such as Blackboard would help teachers to be more confident in integrating technology into their lessons. There are many interesting studies of this type that attempt to correlate certain features of CMS with improved test results and other variables. However, all of these studies focus on one course or one small set of users.

Another reason for studying CMS data is to provide cost benefit or return on investment information to administrators and decision makers. Hundreds of millions of dollars are spent each year on technology initiatives (Mott, 2006), and campus-wide systems such as Blackboard constitute a major financial investment. Mott (2006) states that virtually every Chief Information Officer at every institution of higher education is asked to report the return on investment. Educational researchers question what pedagogical benefit is gained from a CMS, and administrators question whether they are getting value for money and if the technology is worth the investment. With the heavy cost of campus-wide systems, colleges have now begun to push for cheaper options, and there is now a movement towards free open source products (Olsen, 2004).

Over a decade ago, the question of how to value the use of technology in education was becoming difficult to answer. Moersch (1995) identified a problem that computer technology was being implemented in many instances without a clear set of objectives. It became fashionable to implement the latest fads in technology without any clear methods to evaluate real educational value. Moersch also presented a way of measuring the use of technology in a classroom that was named LoTi (Levels of Technology implementation). However, web based technologies such as a CMS are more complex and much more difficult to measure in terms of use and effectiveness than

previous incarnations of classroom technologies. A CMS for example incorporates many elements of instructional technology into one product as contrasted with something like an LCD projector that is a single item. These multi-element technologies require new evaluation and measurement methods as they have so far been notoriously difficult to evaluate (Mott, 2006). Conn and Roberts (2004) describe an attempt to calculate ROI before purchasing the Blackboard CMS. This evaluation identified the inherent problems with such a task in an educational setting:

Traditional methods for analyzing whether a decision is ultimately a good decision have focused on measures that can be quantified and that ultimately contribute to a financial bottom line. However, in environments that may not be driven by financial bottom lines – educational settings, non-profit organizations or grant activities within a higher education institution – such methods for analyzing an important decision fail to capture the real variables in the decision. (p. 212)

The problem of measuring the value of a CMS is not just in terms of the cost of investment. The other challenge is measuring its impact on learning, which is after all the “bottom line” for an educational establishment. Daniels, Davis, and Servonsky (2005) is an example of the common criteria that are used in deciding whether to implement a CMS. This evaluation describes features of Blackboard, some challenges of using Blackboard, and some recommendations for the future use of Blackboard. The most important question appears to be whether the tool performs the tasks that the establishment specifies, or whether it can do online what is already being done using traditional methods. In other words, the decision has already been made to have a CMS and the question is only to decide which one to implement. This suggests that there is some accepted inherent value of having a CMS. The problem is that this inherent value is rarely explicitly described or measured prior to the implementation of a CMS. Abbitt (2005) also focuses on the

usability of the CMS for his suggested evaluation framework and Bell (2005) describes how the implementation of Blackboard has been successful and what should be done to make sure it is fully utilized. By virtue of how many institutions have implemented campus-wide CMS, there seems to be a universal assumption that a CMS has the potential to improve learning and therefore most efforts seem to be in evaluating or studying implementation and usability of the systems without any data showing how any CMS is actually used in comparable environments.

Usability and implementation are essential elements of a CMS and should rightly be evaluated and studied. However, it appears that there is a lack of data that shows how systems are really being used, and what their real value is in relationship to educational objectives. There is a lack of data from which there could be attempts to describe actual bottom line justifications for the existence of a CMS. This is probably due to the fact that gathering data about actual usage patterns is a difficult task. Either one must survey faculty members and students about how they have used the system, which is possible but extremely labor intensive and would not provide reliable activity data as no one would be able to remember every time that they used the system, or alternatively one must retrieve electronic data from the system about student and faculty member usage if this data can be provided by the system. This latter method will yield more reliable quantitative data, but is a greater technological challenge.

Other studies have also highlighted the lack of sufficiently large datasets and accompanying studies. West, Graham, and Waddoups (2007) state that there is little research directly studying the adoption and diffusion of CMS technologies in higher education contexts and what research exists is narrow in its scope. In the study of West, Graham, and Waddoups (2007) there was at least an attempt at a campus-wide investigation of the adoption and implementation patterns of faculty professors at Brigham Young University in regards to a CMS. In that study, 30

faculty professors were interviewed. Surveys were responded to by 74 full-time, 27 part-time, and 19 graduate professors from 13 colleges. The West, Graham, and Waddoups (2007) study using qualitative data gathering required a great deal of effort and still only managed to sample a little over 100 professors from a campus that has over 2,000 faculty members and thousands of courses where the Blackboard CMS is used.

In another study, West, Graham, Waddoups, and Kennedy (2007) also state how it is surprising how little research and evaluation has been done about the implications of using these tools. In a similar fashion to this study, West, Graham, Waddoups, and Kennedy (2007) conducted a search of several of the major databases in the fall of 2005 and found 164 published articles that mentioned course management systems. Of these articles only 74 appeared to be data-driven articles and most of these were quick evaluations of how a CMS impacted a particular class or context. According to West, Graham, Waddoups, and Kennedy (2007), less than 10 studies seemed to attempt a more general evaluation of the impact from using a CMS over multiple contexts, such as multiple university departments.

One example of a study that did attempt to quantify an element of actual usage of a CMS across an institution was performed at the Tel-Aviv University's School of Education in Israel for the 2002-2003 academic year (Nachmias, Ram, Mioduser, 2005). In this study course web sites were analyzed in respect to the types of pedagogical content (as defined by class professors) that was available on the class websites, and how often the content was accessed. The study showed some interesting statistics pertaining to content access, such as 62 % of students viewed at least one content item, but 38 % of students viewed no content at all. The study also showed that there was a large variance among students with regard to the number of content items viewed. Data and

observations of this nature could only have been shown by gathering statistics from all courses at the institution.

In summary, this study has reviewed research into the rate of implementation of CMS technology, the quest to answer ROI questions in relation to the implementation of a CMS, attempts to analyze multiple course usage of a CMS, analysis of individual course usage and benefits of a CMS, and studies that show a lack of large datasets to answer research questions involving a CMS. It is clear from the results of this review, and the observations made in Nachmias et al (2003) and from the other studies mentioned, that there is much more that needs to be researched as pertaining to student and teacher activity within a CMS. Rather than isolating and studying individual elements of a CMS, it would be highly useful to study a large sample of student and faculty activity data for all classes and all features at an institution that has heavy use of a campus-wide CMS. Trends and patterns of usage of all features could then be examined in greater depth and this would provide a springboard for further research into pedagogical and administrative values and benefits as well as many other areas of research. Without such a large set of data from an institution that uses a CMS, it is difficult to even know which questions to ask.

Methods

This section describes the data collection and data analysis procedures. The first step was to collect and collate the Blackboard activity data at course-section level for the 2004-2005 academic year into Excel spreadsheets. The next step was to analyze all of the different categories of activity according to the questions and parameters described in the data analysis section to show interesting patterns and correlations.

Data Collection

The Blackboard database is stored in an Oracle database on a server that is housed at a Blackboard site off BYU campus. The Blackboard system writes information in various database tables each time that a user clicks on any available links/buttons in the Blackboard system. A database is a set of tables that store information. Each table in a database is like a spreadsheet in that it has rows and columns. Each row is called a record, and each column within a record is called a field. When a click is performed by a user, information about the click is stored in a database table as a new record (or row). For example, when a student clicks on announcements in Blackboard, a record is created in the activity database showing that a click on announcements had been performed by a certain student in a certain course-section. The following explanation about how clicks are recorded is a paragraph from the Blackboard Learning System Manual (2004):

Please note that, when viewing reports that include hit or access statistics, a hit is tracked every time a request is sent to the *Blackboard Learning System*. For example, when tracking use of the Communication Area: a Student accesses the Communication area (1 hit), clicks Discussion Boards (2 hits), clicks a forum (3 hits), and clicks a message to read (4 hits). (“Course Statistics”, para. 5)

Electronic data from the Blackboard database was extracted for all clicks performed by students, professors, and assistants in the Blackboard system for the 2004-2005 Academic Year (fall 2004, winter 2005, spring 2005 and summer 2005). Student Clicks are defined as clicks performed by students. Professor Clicks are defined as clicks performed by professors. Assistant Clicks are defined as clicks performed by assistants. This study defines the clicks performed in the 2004-2005 academic year as clicks that were performed within a date range from the first day of class to the last day of finals in each semester or term. Additionally the Course ID for the click must identify the course-section as belonging to fall 2004, winter 2005, spring 2005, or summer 2005. Blackboard activity that met the above criteria was summarized into course-section level statistics.

Different types of Blackboard clicks were summarized into categories for this study. Table 1 describes the categories that are defined in this study and the types of Blackboard clicks that they represent.

Table 1

Categories Used to Represent Blackboard Activity

| Category name | Blackboard categories |
|----------------------------|---|
| <i>Announcements</i> | Clicks on announcements |
| <i>Comm/Email</i> | Clicks on course communications, course email |
| <i>Discussion Board</i> | Clicks on discussion board |
| <i>Dropbox</i> | Clicks on digital dropbox |
| <i>Group Collaboration</i> | Clicks on collaboration, groups |
| <i>Grades</i> | Clicks on grade book |
| <i>Quiz</i> | Clicks on surveys, quizzes, assignments |
| <i>Content</i> | Clicks on documents, external links, lessons |
| <i>Content Folder</i> | Clicks on folders |
| <i>Course Roster</i> | Clicks on course roster |
| <i>Course Tools</i> | Clicks on course tools |
| <i>Staff Info</i> | Clicks on staff information |
| <i>Other</i> | All other types of click |

Thus for every course-section from fall 2004 to summer 2005, there are statistics for clicks (*activity*) performed by students, professors, and assistants categorized by the following areas of activity: *Announcements, Comm/Email, Discussion Board, Dropbox, Group Collaboration, Grades, Quiz, Content Folder, Content, Course Roster, Course Tools, Staff Info, and Other*. These course-section statistics were imported into Excel spreadsheets for analysis. In order to compare activity levels fairly across large and small enrollment course-sections, the activity data were normalized by replacing actual clicks with average clicks per user type. For some sets of analysis the average clicks are rounded to the nearest 5 to give a set of categories for average clicks that make the analysis process simpler.

Data Analysis

This campus-wide data was analyzed to find general patterns of activity. The report shows results and discussion for the following sets of analysis questions.

Research Questions

There were 13 questions investigated in this study. Each question, defined in detail in this section, will be restated in the results section later in the study.

1. How many course-sections use Blackboard at BYU compared with how many total course-sections are offered at BYU?
2. How many clicks were made in the 2004-2005 academic year? What is the average level of clicks per course-section in the 2004-2005 academic year?
3. What is the pattern of average clicks for students, professors, and assistants across all course-sections?
4. What is the pattern of average clicks for students, professors, and assistants in each college compared with the overall patterns?

5. What are the ranges of clicks for students, professors, and assistants when separated into quartiles? (What range of average clicks constitutes the lowest quartile of course-sections, the second quartile of course-sections, the third quartile of course-sections, and the fourth quartile of course-sections?)
6. What percentage of course-sections is there in each quartile of average click ranges of all course-sections compared with each college for students, professors, and assistants?
7. What is the overall number of clicks in each Blackboard feature for the 2004-2005 academic year for students, professors, and assistants?
8. What is the activity level for each category of Blackboard features for the 2004-2005 academic year for each college for students, professors, and assistants?
9. What percentage of clicks constitutes administrative activity versus pedagogical activity for students, professors, and assistants? (Directly pedagogical usage for this study is defined as activity in the following categories: *Discussion Board, Group Collaboration, Quiz, Content*. Administrative usage is currently defined as the following Blackboard categories: *Announcements, Dropbox, Grades, Course Roster, Course Tools, Staff Info*. *Comm/Email* is separated as emails and communication could be administrative or pedagogical. *Content Folder* is not included as it represents different types of clicks that can not be distinguished one from another. Blackboard categories that have been combined into the *Other* category are not included in this analysis as they all have negligible total activity.)
10. What is activity level over time in each semester and term of the 2005/2005 academic year?

11. What is the average activity of students, professors, and assistants in different class sizes? (For this report, class sizes are categorized by rounding class size to the nearest ten. Class sizes that rounded to zero have been categorized as five as there is no such thing as a class size of zero. Every other class size is rounded to the nearest ten.)
12. What is the difference in feature usage by students, professors, and assistants in different class sizes? (For this report class sizes are categorized the same way as for question 11.)
13. What is the ratio of instructor to student activity shown by different class sizes? (Instructor activity includes Professor Clicks and Assistant Clicks. The ratio formula is professor + assistant average clicks divided by student average clicks.)

Limitations

This section describes the major limitations of this study. They include the limitations that were encountered in attempting to accurately describe and understand certain feature categories of Blackboard as well as the limitations produced by the categorization methods that were used for some sections of the study.

Some features of Blackboard can not be fully understood in this study. For example, Blackboard does not record enough detail to tell the difference between an instructor creating a link for an item of content and an instructor creating a new folder or an instructor clicking on a folder that already exists. This means that we can not accurately quantify pedagogical instructor activity as one type of pedagogical activity performed by instructors (creating a link to course content) is ambiguously categorized in the Blackboard database.

This study attempts to categorize clicks as either pedagogical in nature or administrative in nature, but for the most part it is impossible to know how each professor or students intends to use

the different features of Blackboard. Some features seem to be more administrative such as grades, others seem to be more pedagogical such as quizzes, but all could be used for either administrative or pedagogical purposes, and the definition of administrative and pedagogical activity is subjective and open to interpretation. The purpose of this study was to show general patterns, and for these categories to be fully understood across the whole campus it would require a detailed analysis of every single course-section and the intentions of every professor.

The use of the Announcements feature of Blackboard can not be fully analyzed by this study as the most recent few announcements that are entered into the system by professors or assistants can be viewed by students when they log into a course-section. In other words, when students logs into a course-section in Blackboard, they are presented with the most recent announcements without having to click on the Announcements feature. Students that do click on the Announcements feature are presented with all announcements for the course-section, therefore the data that this study reports for student activity in the Announcements feature only represents when students click on Announcements and are presented with all announcements. There is no way to ascertain how many students viewed announcements when they logged into a course-section.

The normalizing of data that was performed for this study was necessary so that activity levels in course-sections and colleges could be compared with each other. However, normalizing the data in this way limits the ability to comprehend absolute volumes in charts that only show normalized data.

In some sections of the study, average clicks are rounded to the nearest five and class sizes are rounded to the nearest ten so that data could be shown in categorical charts. This helps in the viewing of the overall patterns that this study was designed to analyze, and makes it possible to view large quantities of data in single charts, but in transforming the data into categorical data, certain statistics or ways of reading the data are no longer possible.

Results

This section is organized in order of the 13 questions stated in the Methods section. Each question is followed by the data that constitutes the results of this study which are stated in numerical figures, tables, and charts. The reported data are accompanied by a brief discussion of the results.

Total Number of Course-sections Using Blackboard

How many course-sections use Blackboard at BYU compared with how many total course-sections are offered at BYU?

There were 6,646 course-sections in the Blackboard database for the 2004-2005 academic year but 175 of these course-sections had no students attached to them which means that there were 6,467 course-sections in the Blackboard database for the 2004-2005 academic year that had at least some student activity. According to the Registration Department at BYU there were 11,809 course-sections in 2004-2005 in the AIM database (personal communication, May 9, 2007), which means that there were 11,809 course-sections that could potentially use Blackboard. The overall usage of the Blackboard system on campus (the number of Blackboard course-sections that have at least some student activity) was 6,467 out of an approximate potential of 11,809 course-sections, which is 55%. From this point forward in the study, all data refers to the 6,467 classes that had at least one student enrolled.

There is no standard set for usage levels of course management systems, but it seems reasonable to suggest that 55% or a little over one half of course-sections is a reasonably high level of course-sections that used Blackboard. This may indicate that BYU has a high level of use of this technology across the whole campus. This conclusion is to some extent backed up by data from 2006 given by Blackboard ASP, Blackboard's hosting division, to Jon Mott, Director of the Center for

Instructional Design at BYU, which shows that BYU is one of the top 5 users of Blackboard (personal communication, April 27, 2007) which is shown on Figure 93 in Appendix A.

Overall Activity Level of Course-sections

How many clicks were made in the 2004-2005 academic year? What is the average level of clicks per course-section in the 2004-2005 academic year?

This study defines the clicks performed in the 2004-2005 academic year as clicks that were performed within a date range from the first day of class to the last day of finals in each semester or term, and also the Course ID for the click must identify the class as belonging to fall 2004, or winter, spring, or summer 2005. Based on this criteria, for the 6,467 classes that had at least some student activity in the 2004-2005 academic year, a total of 36,080,401 clicks were performed in the Blackboard system with an average of 91 clicks per user per course-section (which includes students, professors, and assistants). Students performed 32,333,570 clicks with an average of 85 clicks per student per course-section. Professors performed 2,060,153 clicks with an average of 239 clicks per professor per course-section. Assistants performed 1,686,678 with an average of 257 clicks per assistant per course-section.

Clicks that were performed before the first day of class or after the last day of finals were not included in any detailed analysis in this study. However, it is interesting to note that when these clicks were counted, it was found that 1,028,461 clicks were performed by students outside of the regular semester and term dates, 175,641 clicks were performed by assistants outside of the regular semester and term dates, and 533,788 clicks were performed by professors outside of the regular semester and term dates. In effect, 3% of all Student Clicks, 8% of all Assistant Clicks, and 18% of all Professor Clicks were performed outside of the normal semester and term start and

end dates. This is likely due to the fact that much of an instructor's work in a CMS is in setting up the course.

Without any comparable data it is difficult to say if 32.3 million Student Clicks, or 85 clicks per student per course-section is a large or small amount of activity for a large university with a total of 34,000 students of which 27,000 are full-time undergraduates. However, these statistics could be used to provide a comparison or baseline for future studies that also analyze campus wide CMS activity.

Activity Level of Students, Professors, and Assistants

What is the pattern of average clicks for students, professors, and assistants across all course-sections?

The following set of statistics measuring overall Blackboard activity levels is analyzed by average clicks, which is the number of Student/Professor/Assistant Clicks in each course-section divided by the number of students/professors/assistants in the course-section. Scatter charts show the average clicks of students, professors, and assistants in all 6,467 course-sections in two levels of detail.

Figure 1 shows that the vast majority of course-sections have an average Student Click score of less than 200. This data also shows that there were many course-sections with high average Student Clicks, and a few with extremely high averages. Figure 2 shows more detail and clearly demonstrates that the greatest mass of course-sections had average Student Clicks of less than 100. The average of Student Clicks per course-section was 85 and 98% of all course-sections had an average student click score from 0 to 400.

The interesting aspect of this data is that even though the charts show that the vast majority of course-sections have average Student Clicks of less than 200, there are still a good number of course-sections with high, or exceptionally high average Student Clicks. The small number of

course-sections with averages of over 800 are particularly intriguing and these course-sections should be studied in detail to understand what makes them so different.

Figure 3 shows that the vast majority of courses have an average professor click score of less than 1,000. Figure 3 also shows that there were only a few courses with very high average Professor Clicks, and a few with extremely high averages. Figure 4 which demonstrates the data in more detail, shows a great mass of courses having average Professor Clicks of less than 300 with the rest of courses quite well spread out. The average of Professor Clicks per course is 239.

Figure 5 shows that the vast majority of course-sections had an average Assistant Click score of less than 1,000. Figure 5 also shows that there were quite a few course-sections with high average Assistant Clicks, and a few with extremely high averages. Figure 6, which demonstrates the data in more detail, shows a mass of course-sections having average Assistant Clicks of near to zero with the remainder quite well spread out between zero and 500. The average of Assistant Clicks per course-section is 257.

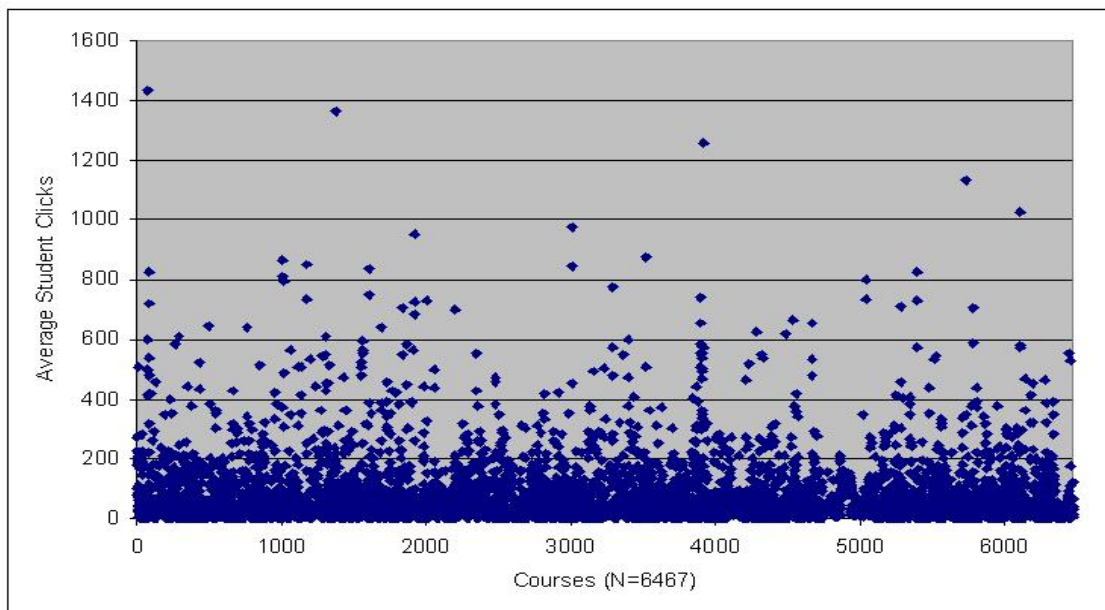


Figure 1. Scatter chart of all course-sections and their average Student Clicks, course-sections are sorted by Course ID.

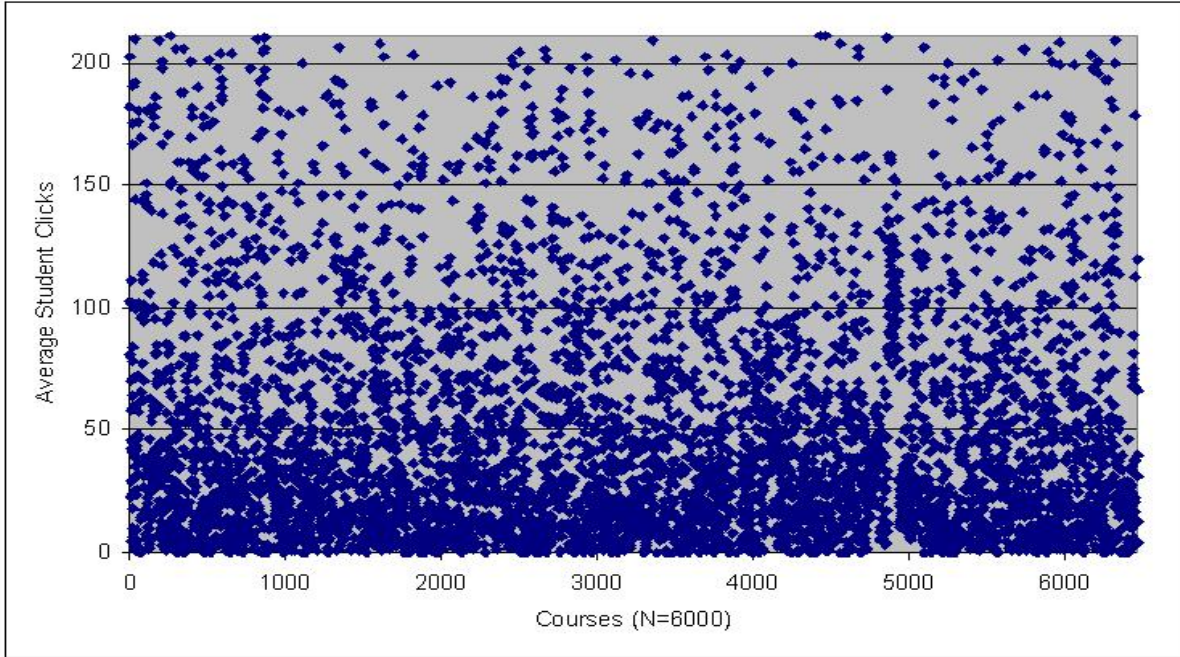


Figure 2. Scatter of all course-sections and their average Student Clicks, limited to average Student Clicks of 0-200.

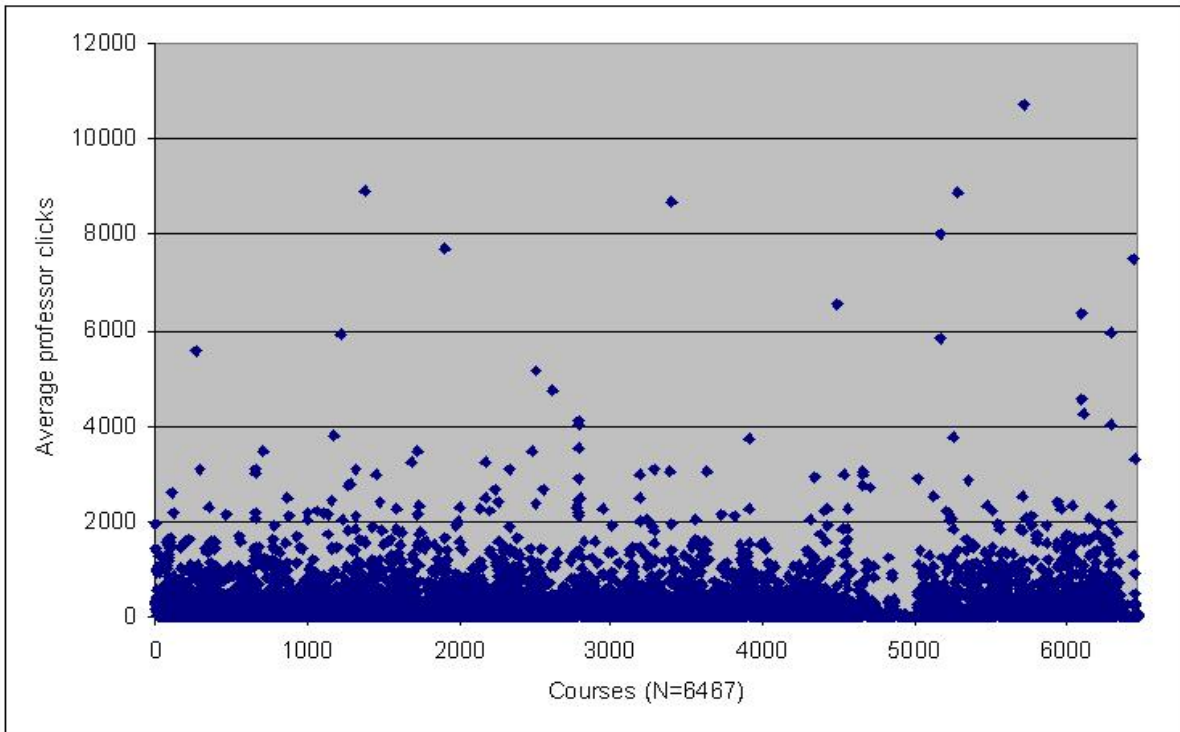


Figure 3. Scatter chart of all course-sections and their average Professor Clicks, courses are sorted by Course ID.

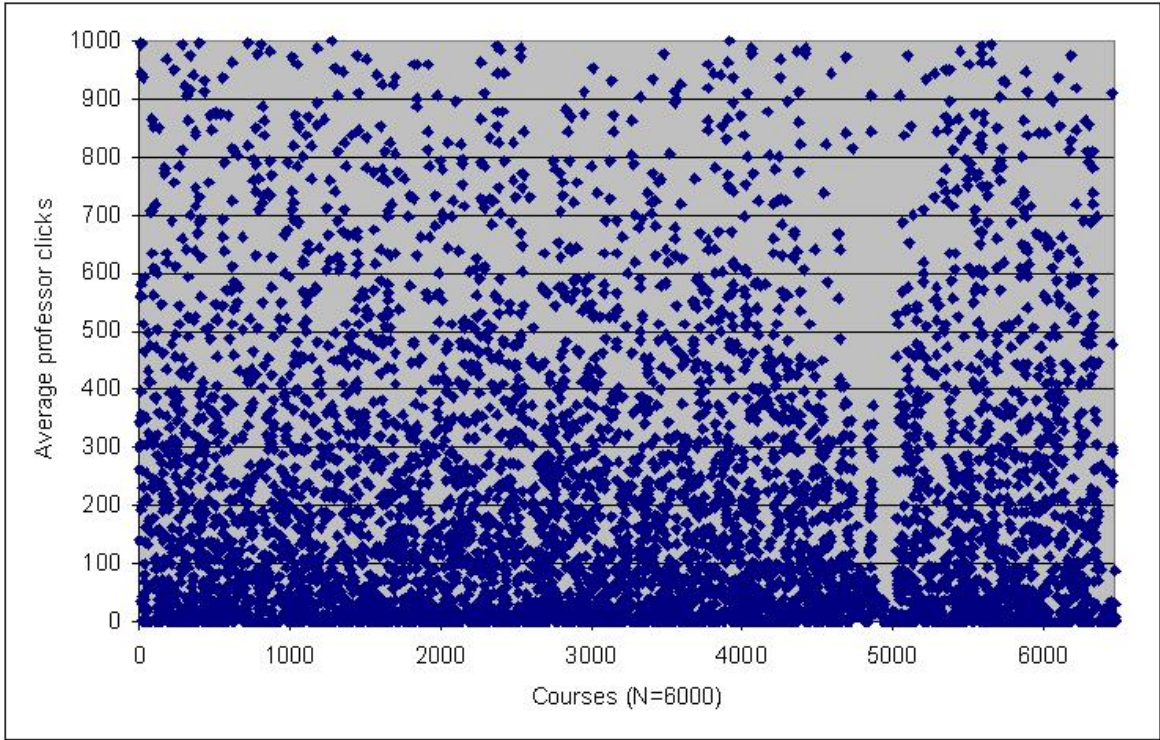


Figure 4. Scatter chart of all course-sections and their average Professor Clicks, limited to average Professor Clicks of 0-1,000.

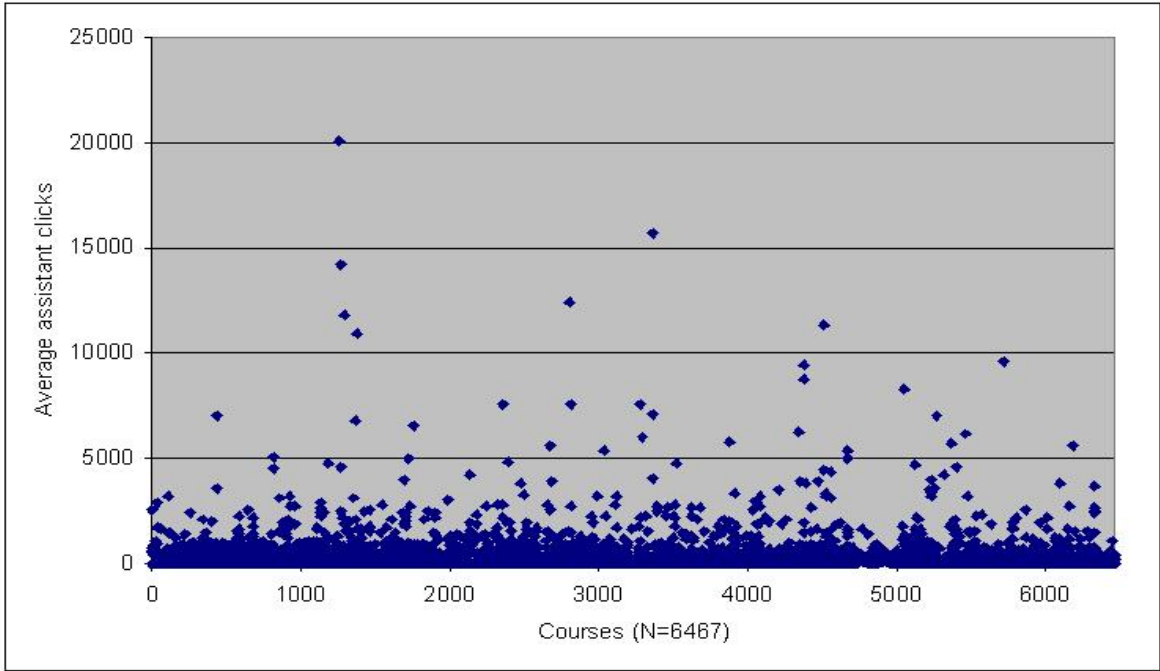


Figure 5. Scatter chart of all course-sections and their average Assistant Clicks, course-sections are sorted by Course ID.

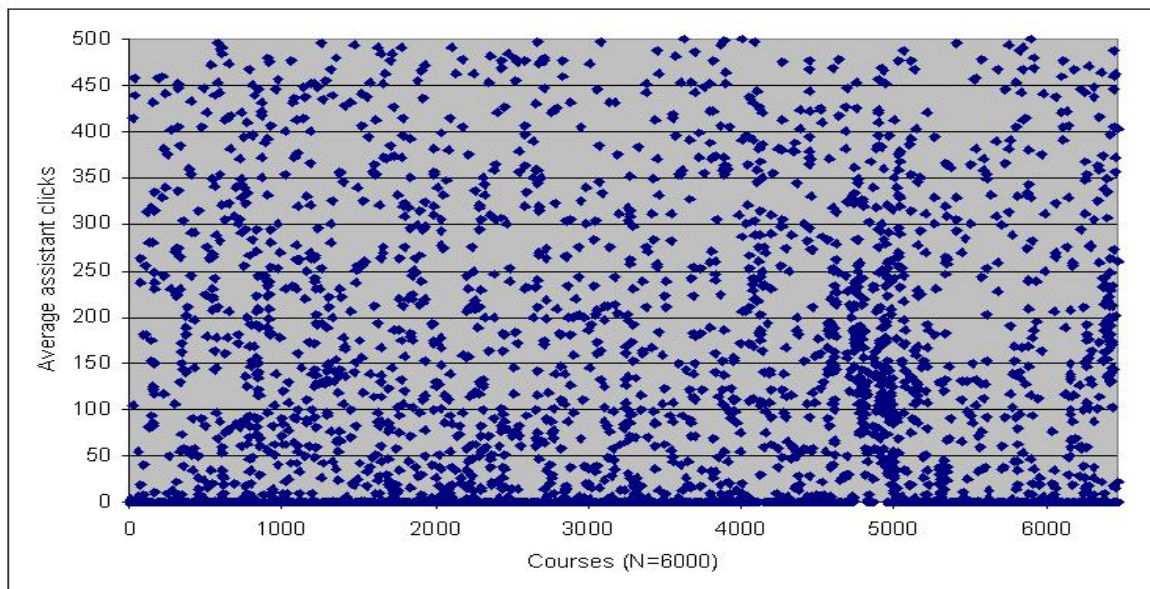


Figure 6. Scatter of course-sections and their average Assistant Clicks, limited to average Assistant Clicks of 0-500.

The following charts representing overall activity levels are analyzed by average clicks rounded to the nearest 5. For the remaining charts in this section, only a certain range of average clicks is shown as there were many outliers that make charts difficult to read when included. For students, an average click range of 0-400 is shown on line charts, for professors an average click range of 0-1,000 is shown, and for assistants an average click range of 0-600 is shown.

Figures 7-12 show an overall view of patterns of activity by charting how many course-sections (as a percentage of all course-sections) have different average clicks. Figure 7 shows that there is a high percentage of course-sections with low and zero average Student Clicks and a low percentage of course-sections with high average Student Clicks. Figure 8 shows that there is a high percentage of course-sections with low and zero average Professor Clicks and a low percentage of course-sections with high average Professor Clicks. Figures 9 and 10 show that there is a very high percentage of course-sections with zero average Assistant Clicks. Figure 11 shows that there were a low percentage of course-sections with high average Assistant Clicks. Figure 12 shows a different summary of average student, professor,

and Assistant Clicks across all course-sections to show the average click data comparing all user types so that the other charts can be understood in context of the overall average ranges. Figure 12 shows that a majority of course-sections have average student clicks of less than 200 and very few have high average student clicks. Figure 12 shows that approximately one third of all course-section have very low average professor clicks of less than 50, but that the rest were fairly evenly distributed. Figure 12 also shows that half of all course-sections have no assistant activity in Blackboard which is obviously because those course-sections have no assistants.

For average Student Clicks, it is curious that such a large percentage of course-sections have such low levels of average activity. Around 8% of course-sections have average Student Clicks of 5, which raises the question of whether using Blackboard is giving any educational benefits to the students in those course-sections. Some of these course-sections should be analyzed to ascertain how and why Blackboard is being used to such a low level. This pattern of low average Student Clicks in such a high percentage of course-sections may also be explained by there being some students in course-sections who use Blackboard a lot, but many who use it very little or not at all. A more in depth study of course-sections with low average Student Clicks is needed to understand the reasons for these patterns.

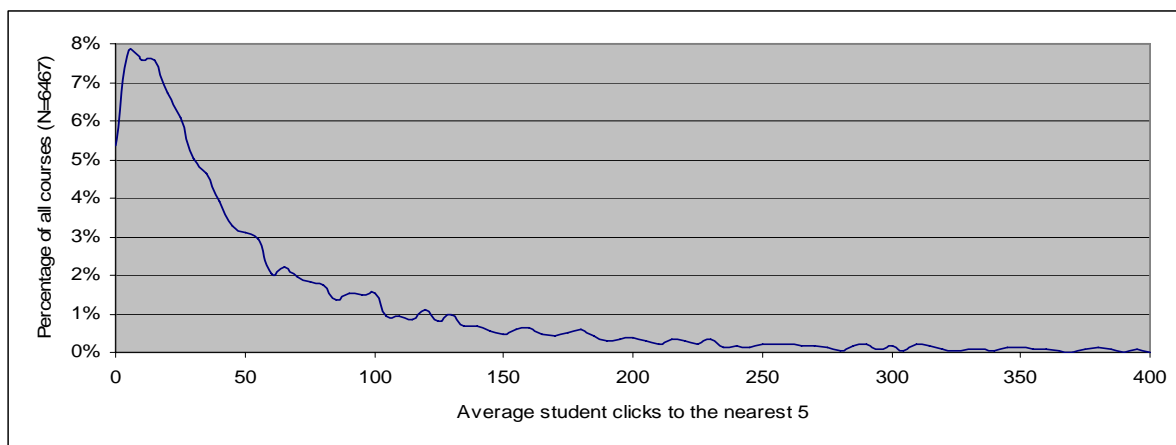


Figure 7. Course-sections shown by average Student Clicks rounded to the nearest 5. Only course-sections with average Student Clicks of 0 to 400 are shown which represents 98% of all course-sections.

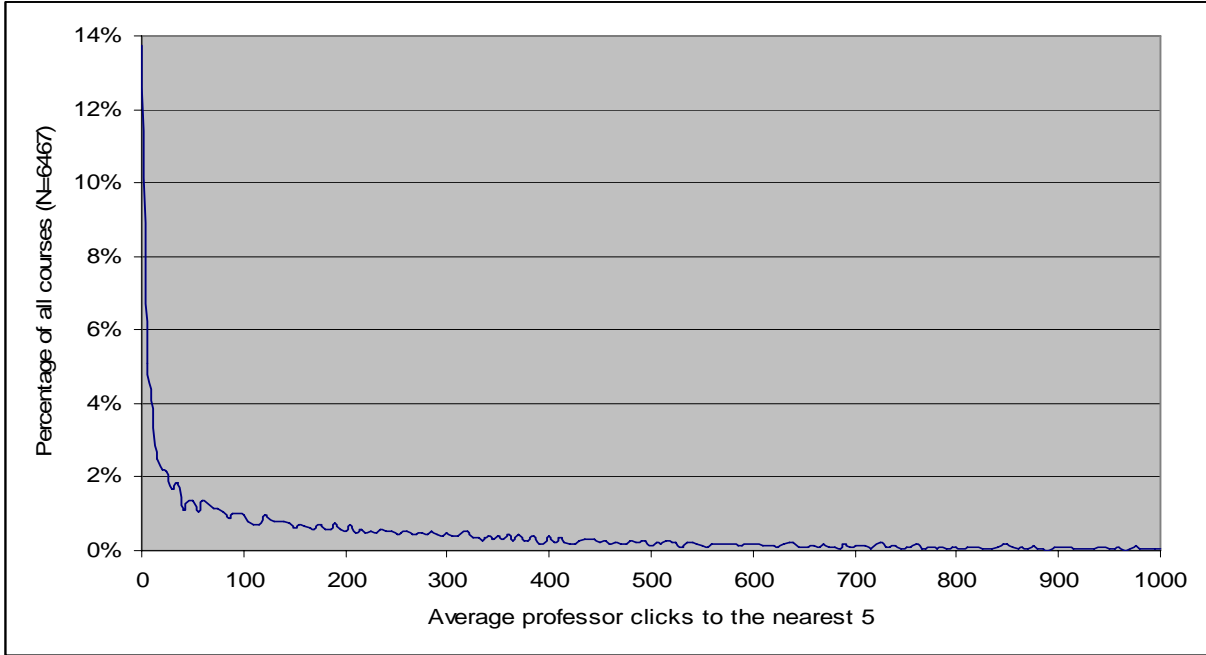


Figure 8. Course-sections shown by average Professor Clicks rounded to the nearest 5. Only course-sections with average Professor Clicks of 0 to 1000 are shown which represents 94% of all course-sections.

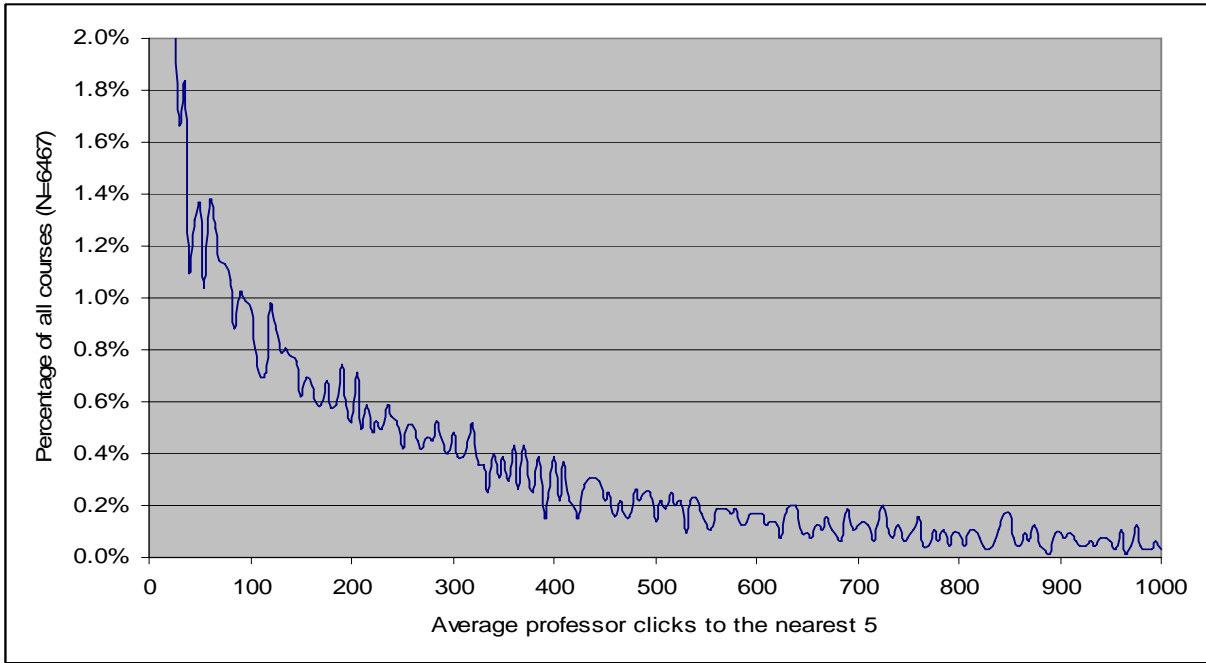


Figure 9. Course-sections ($N = 6,467$) shown by average Professor Clicks rounded to the nearest 5. The chart only shows up to 2% on the Y axis so that the data are more readable than Figure 7. Only course-sections with average Professor Clicks of 0 to 1,000 are shown which represents 94% of all course-sections.

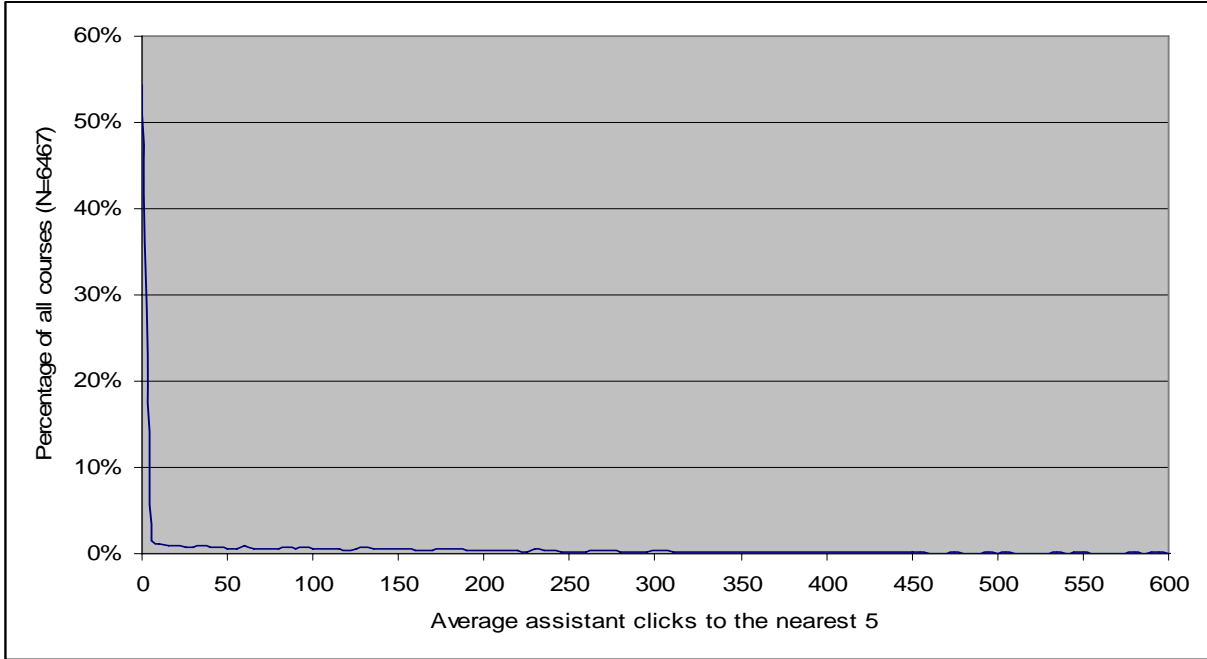


Figure 10. Course-sections in the 2004-2005 academic year ($N = 6,467$) shown by average Assistant Clicks rounded to the nearest 5. Only course-sections with average Assistant Clicks of 0 to 600 are shown which represents 94% of all course-sections.

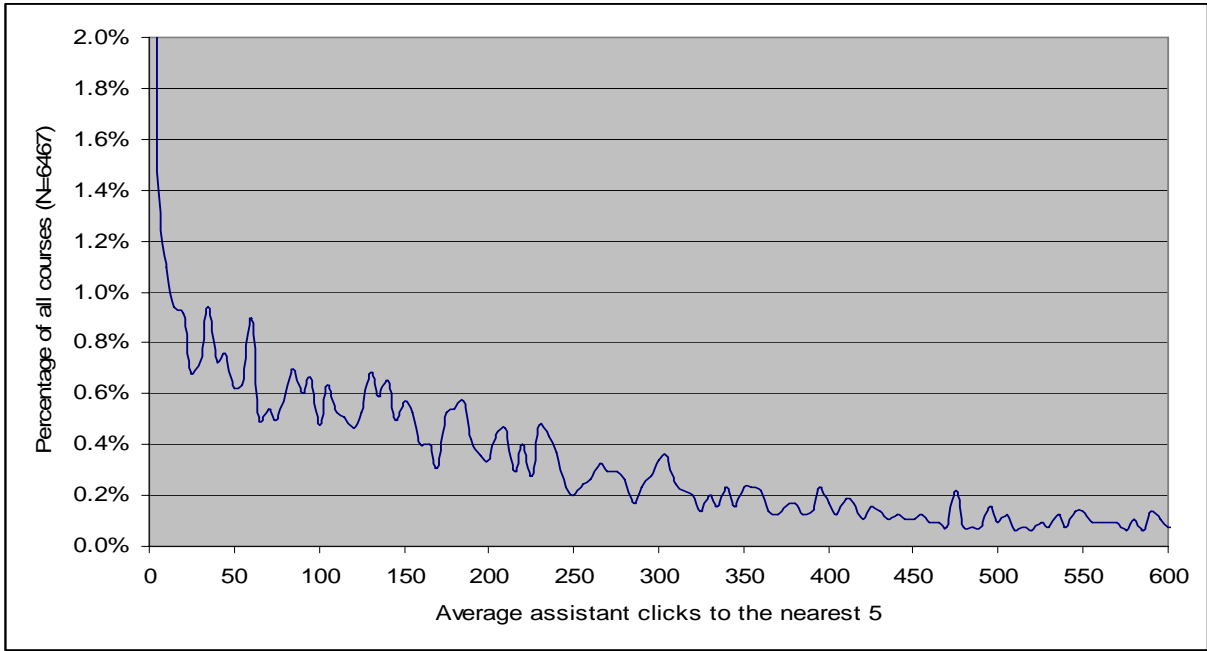


Figure 11. Course-sections in the 2004-2005 academic year ($N = 6,467$) shown by average Assistant Clicks rounded to the nearest 5. The chart only shows up to 2% on the Y axis so that the data are more readable than Figure 10. Only course-sections with average Assistant Clicks of 0 to 600 are shown which represents 94% of all course-sections.

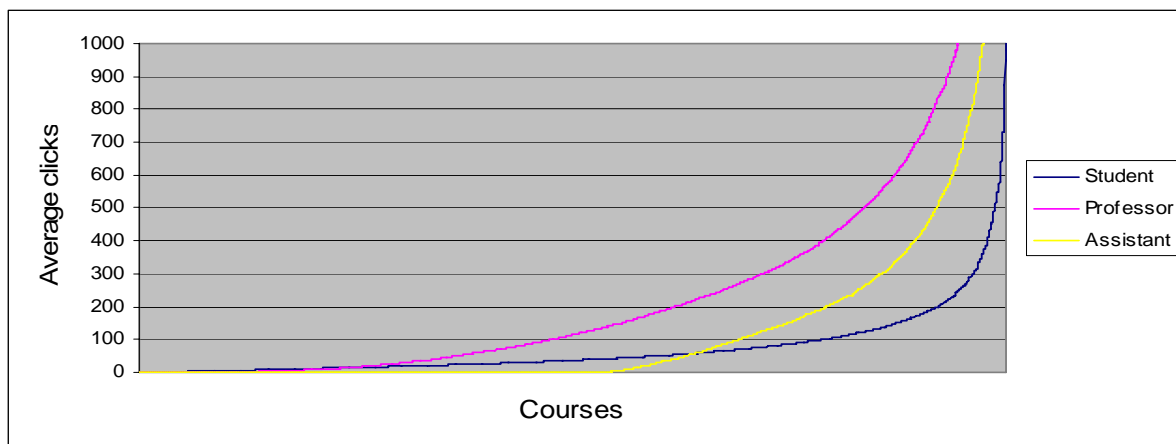


Figure 12. Average clicks of students, professors, and assistants across all course-sections, showing a maximum average clicks lower than 1000.

Activity Level of Students, Professors, and Assistants by College

What is the pattern of average clicks for students, professors, and assistants in each college compared with the overall patterns?

This section shows average clicks rounded to the nearest 5 as a percentage of all course-sections in each college with a comparison against the overall average clicks rounded to the nearest 5 as a percentage of all course-sections in the study ($N = 6,467$). Each college in Table 2 is analyzed for student average clicks, professor average clicks, and assistant average clicks.

Figures 13-22 show average student clicks rounded to the nearest 5 as a percentage of all course-sections in each college with a comparison against the overall average clicks rounded to the nearest 5 as a percentage of all course-sections. Figure 13 shows that the College of Religion has a high percentage of course-sections with low average Student Clicks, but the pattern for the rest of the course-sections is roughly comparable to the overall pattern. Figure 14 shows that the College of Physical and Mathematical Science is comparable to the overall pattern in most average student click ranges, although there were some average student click ranges from 100 to 300 that show a higher percentage of course-sections than the overall pattern. Figure 15 shows that the College of

Humanities is comparable to the overall pattern in all average student click ranges apart from the slightly higher percentage of classes with extremely low average Student Clicks.

This section of charts shows some interesting patterns in only a few cases. One example of an interesting pattern is shown for average Student Clicks in the college of Education shown on Figure 20. For this college, there was a high level of course-sections that had very low average Student Clicks, but high levels of course-sections that had high and very high average Student Clicks. This implies that although a higher than average number of professors do not use Blackboard much at all, the professors who do use Blackboard use it a lot. This is an interesting phenomenon in the college of Education that may justify a more detailed study of Blackboard usage to understand why this pattern exists.

Table 2

Short Name and Number of Course-sections in Blackboard for Each College

| College** | Short Name | Course-sections |
|-------------------------------------|------------|-----------------|
| Religious education | REL | 713 |
| Physical and Mathematical Sciences | PHY | 555 |
| Humanities | HUM | 1136 |
| Health and Human Performance | HHP | 443 |
| Fine Art and Communications | ART | 459 |
| Family, Home and Social Sciences*** | FHS | 1164 |
| Engineering and Technology | ENG | 238 |
| Education** | EDU | 175 |
| Business** | BUS | 537 |
| Biology and Agriculture | BIO | 674 |
| Other* | | 373 |

* Other includes honors courses, international studies, law school and unidentified.

Unidentified are courses where the college was not easily identifiable from the course name.

** For the purpose of this study, the School of Business and the School of Education are termed as colleges.

***The college of Family, Home, and Social Sciences also includes the college of Nursing.

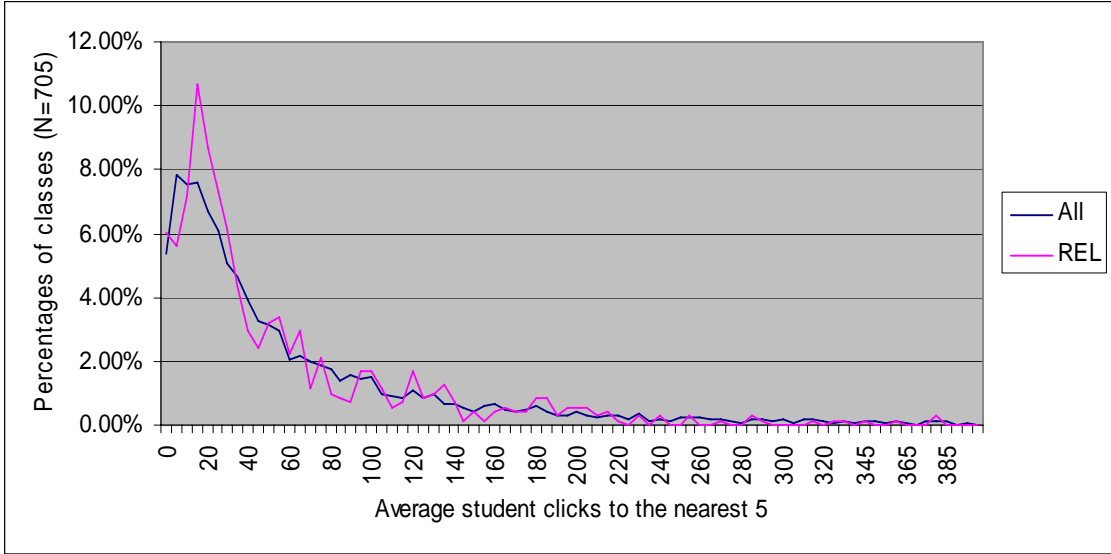


Figure 13. Average Student Clicks to the nearest 5 as a percentage of all classes in the College of Religion compared to the overall average Student Clicks pattern.

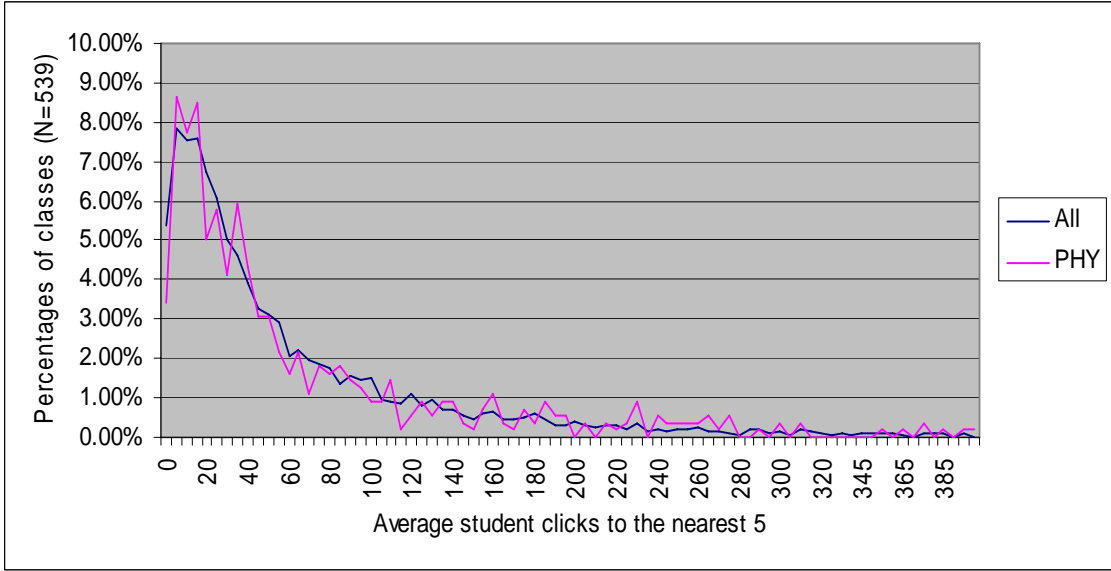


Figure 14. Average Student Clicks to the nearest 5 as a percentage of all classes in the College of Physical and Mathematical Science compared to the overall average Student Clicks pattern.

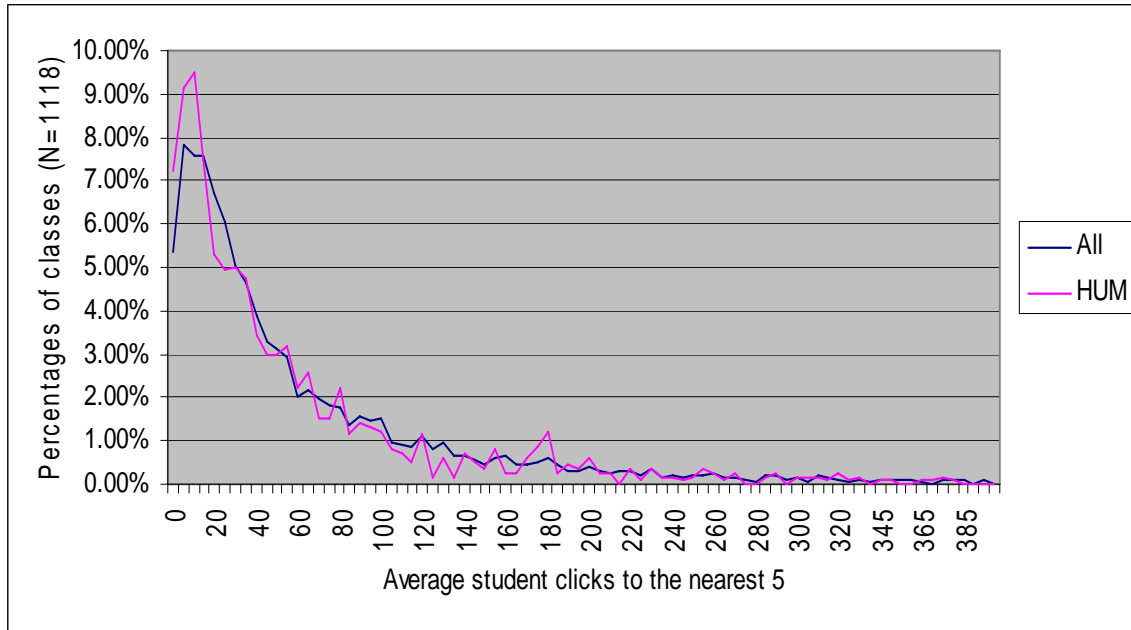


Figure 15. Average Student Clicks to the nearest 5 as a percentage of all classes in the College of Humanities compared to the overall average Student Clicks pattern.

Figure 16 shows that the College of Health and Human Performance is very different from the overall pattern with a very large percentage of classes in the very low ranges of average Student Clicks and a very small percentage in the ranges above the mean (85) of average Student Clicks. Figure 17 shows that the College of Fine Art and Communication has a high percentage of course-sections with extremely low average Student Clicks, but the pattern for the rest of the course-sections is roughly comparable to the overall pattern. Figure 18 shows that the College of Family, Home, and Social Science has a comparatively low percentage of course-sections in the extremely low to low average student click range, but the pattern for the rest of the course-sections is comparable to the overall pattern. Figure 19 shows that the College of Engineering has a high percentage of course-sections with low average Student Clicks, but a high percentage of the medium average Student Click ranges compared with the overall pattern.

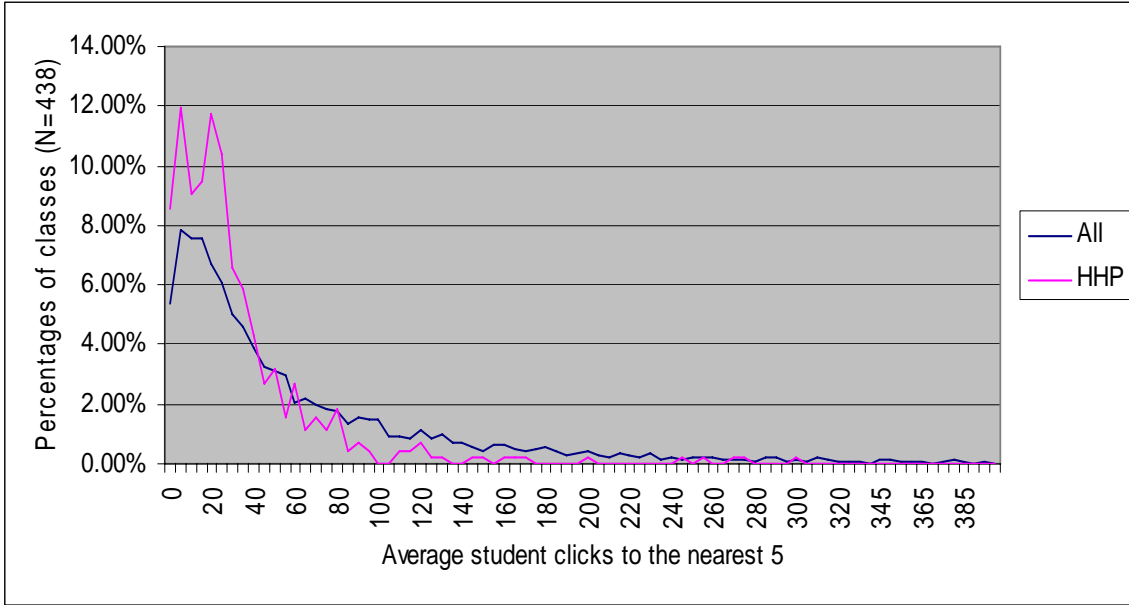


Figure 16. Average Student Clicks to the nearest 5 as a percentage of all classes in the College of Health and Human Performance compared to the overall average Student Clicks pattern.

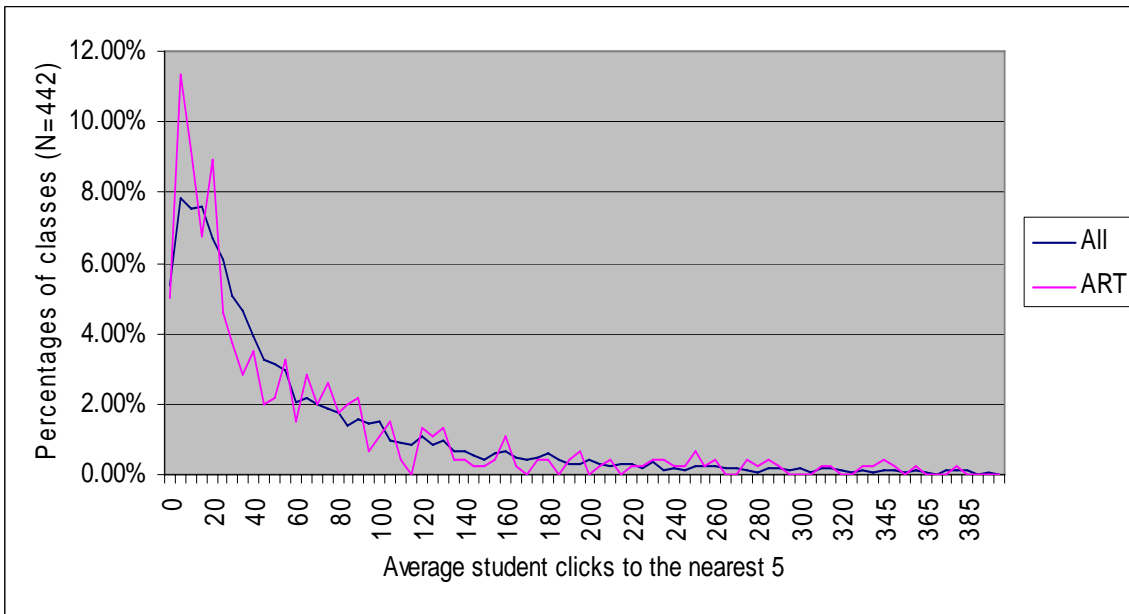


Figure 17. Average Student Clicks to the nearest 5 as a percentage of all classes in the College of Fine Art and Communication compared to the overall average Student Clicks pattern.

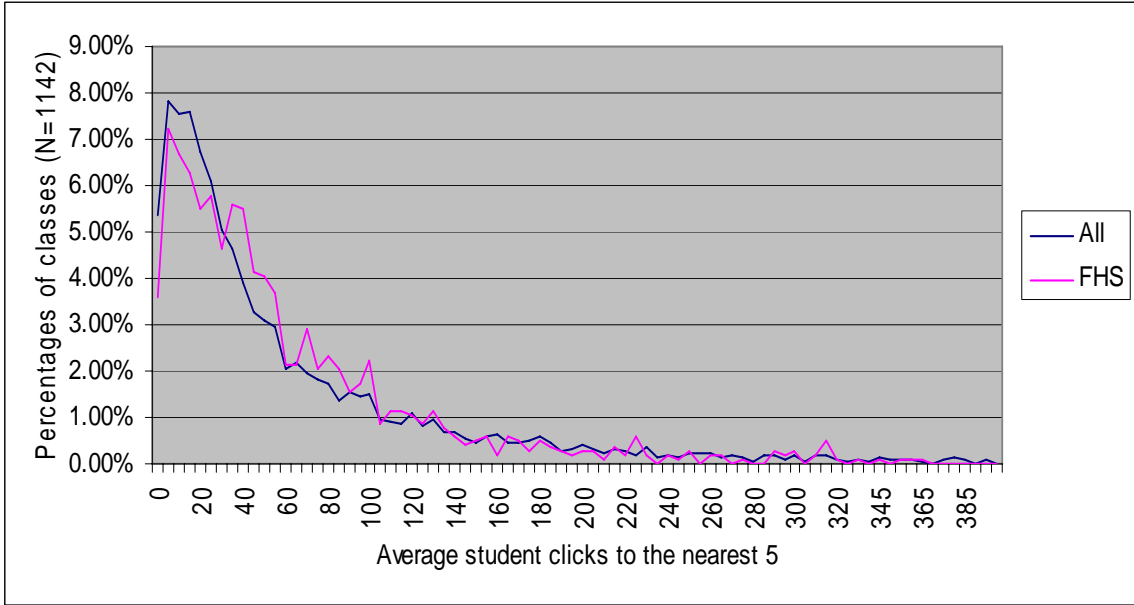


Figure 18. Average Student Clicks to the nearest 5 as a percentage of all classes in the College of Family, Home, and Social Science compared to the overall average Student Clicks pattern.

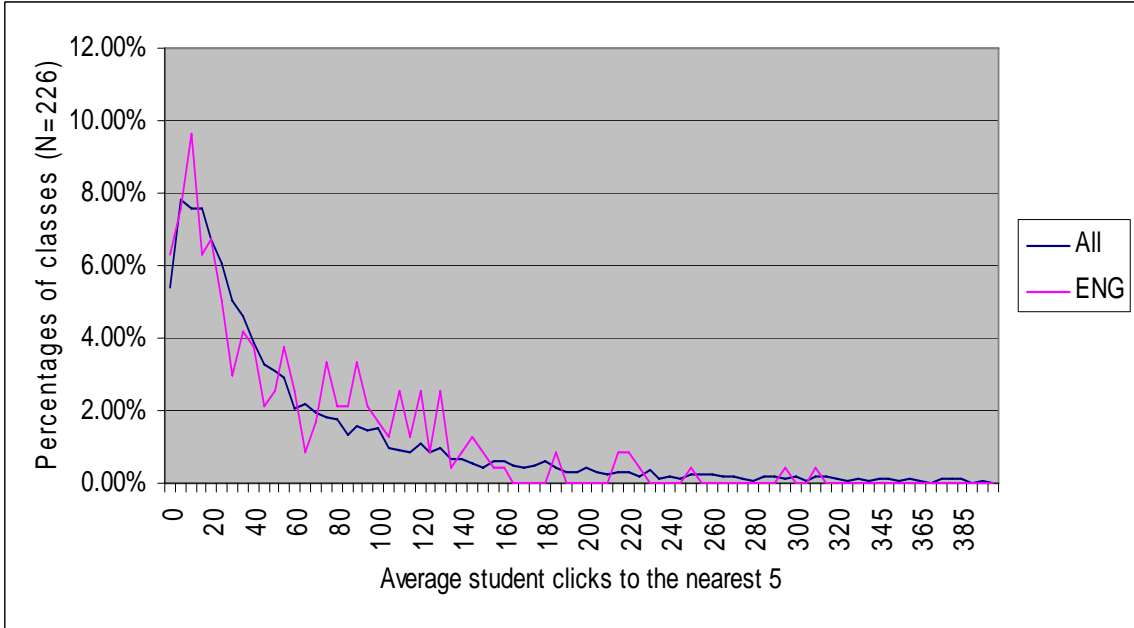


Figure 19. Average Student Clicks to the nearest 5 as a percentage of all classes in the College of Engineering compared to the overall average Student Clicks pattern.

Figure 20 shows that the College of Education has a high percentage of course-sections with extremely low average Student Clicks, but a low percentage of course-sections in the low to medium average student click ranges, and a very high percentage of course-sections in the high average student click ranges. Figure 21 shows that the College of Business has a low percentage of course-sections in the extremely low to low average student click ranges, and an above average percentage of course-sections in almost all other ranges. Figure 22 shows that the College of Biology and Agriculture is comparable to the overall pattern except for the above average percentage of course-sections in the medium average student click ranges.

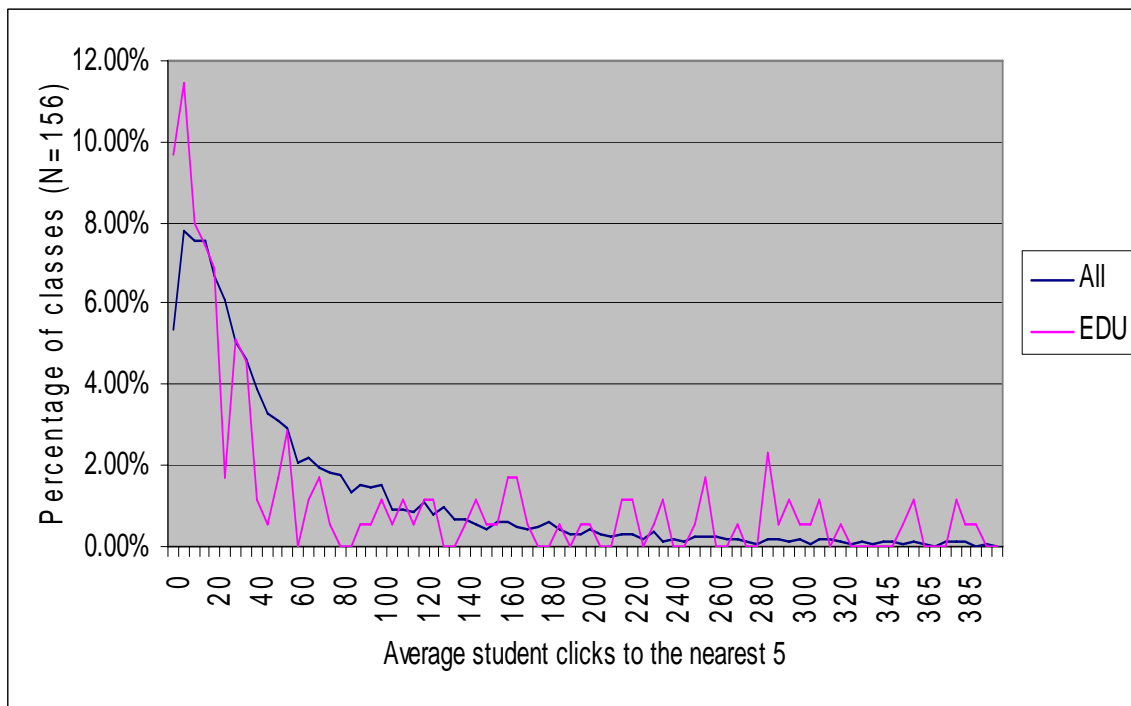


Figure 20. Average Student Clicks to the nearest 5 as a percentage of all classes in the College of Education compared to the overall average Student Clicks pattern.

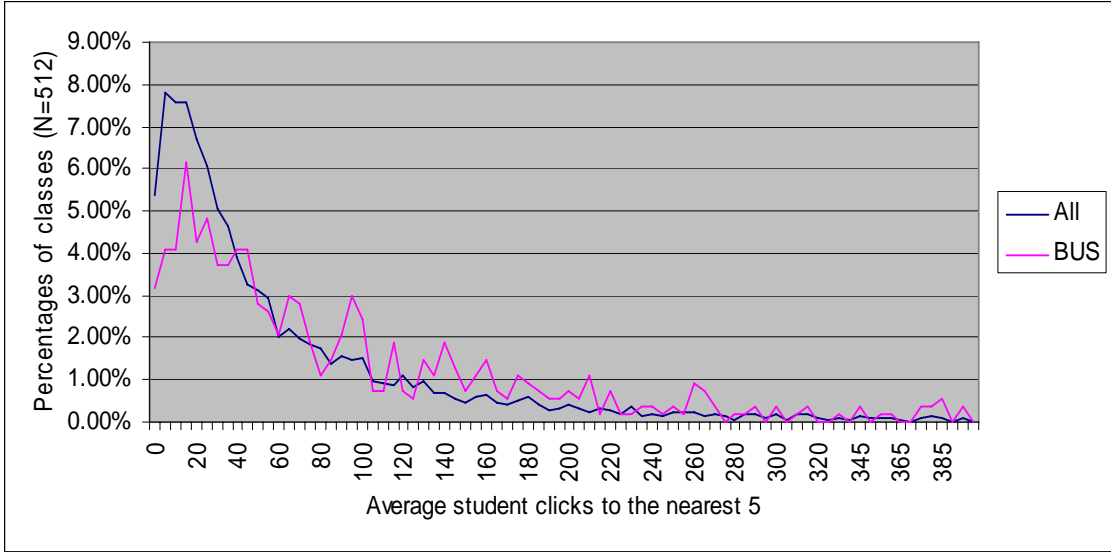


Figure 21. Average Student Clicks to the nearest 5 as a percentage of all classes in the College of Business compared to the overall average Student Clicks pattern.

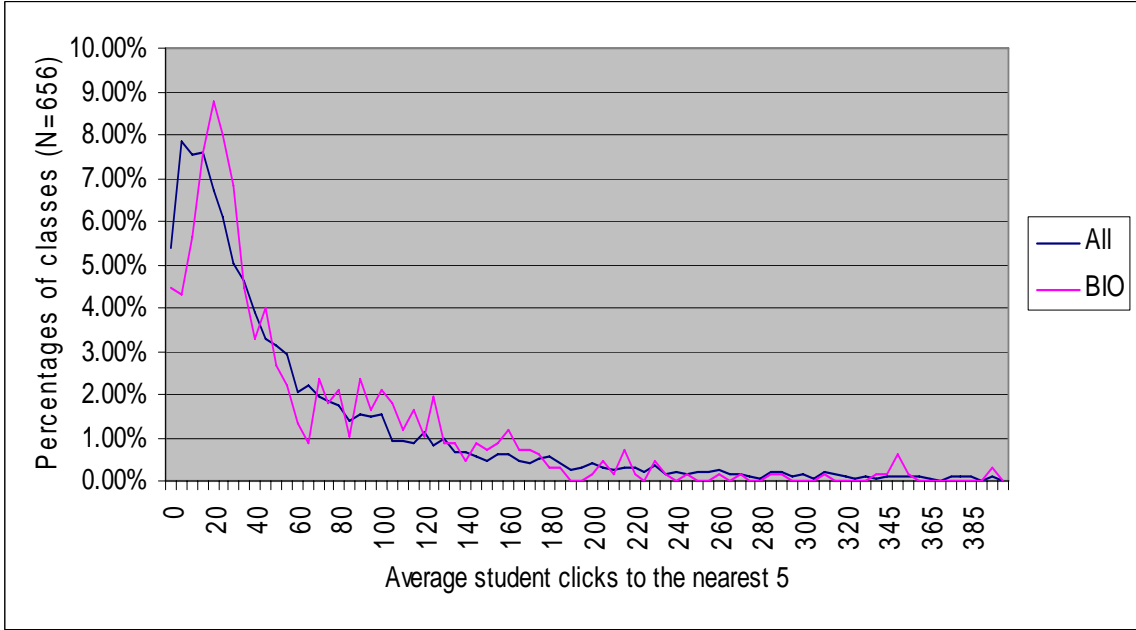


Figure 22. Average Student Clicks to the nearest 5 as a percentage of all classes in the College of Biology and Agriculture compared to the overall average Student Clicks pattern.

Figures 23-32 show average Professor Clicks rounded to the nearest 5 as a percentage of all course-sections in each college with a comparison against the overall average clicks rounded to the nearest 5 as a percentage of all course-sections. Figure 23 shows that the College of Religion shows a large percentage of course-sections with low average Professor Clicks, and a small percentage of classes with high average Professor Clicks. Figure 24 shows that the College of Physical and Mathematical Science shows a below average percentage of course-sections with low average Professor Clicks, and an average or above average percentage of course-sections in all the other Professor Click ranges. Figure 25 shows that the College of Humanities shows an average percentage of course-sections in all ranges of average Professor Clicks.

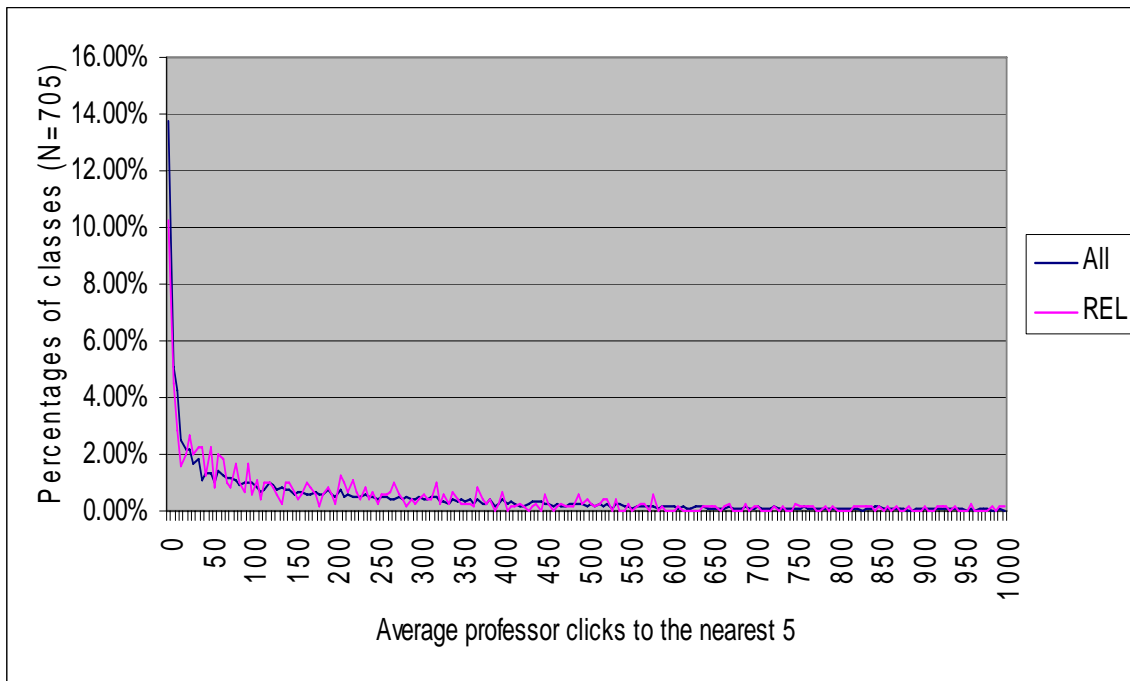


Figure 23. Average Professor Clicks to the nearest 5 as a percentage of all classes in the College of Religion compared to the overall average Professor Clicks pattern.

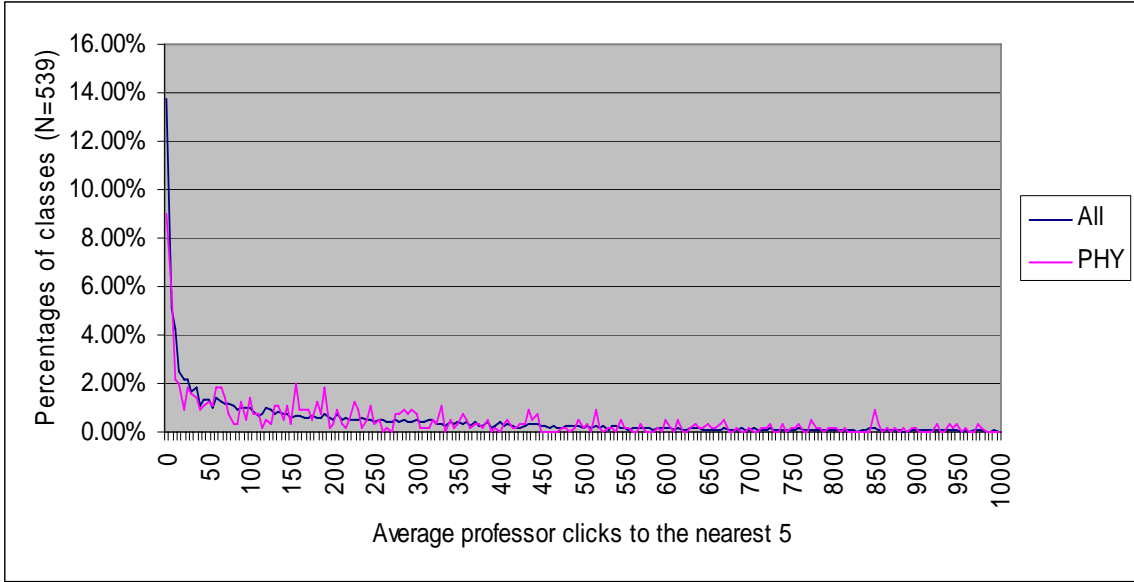


Figure 24. Average Professor Clicks to the nearest 5 as a percentage of all classes in the College of Physical and Mathematical Science compared to the overall average Professor Clicks pattern.

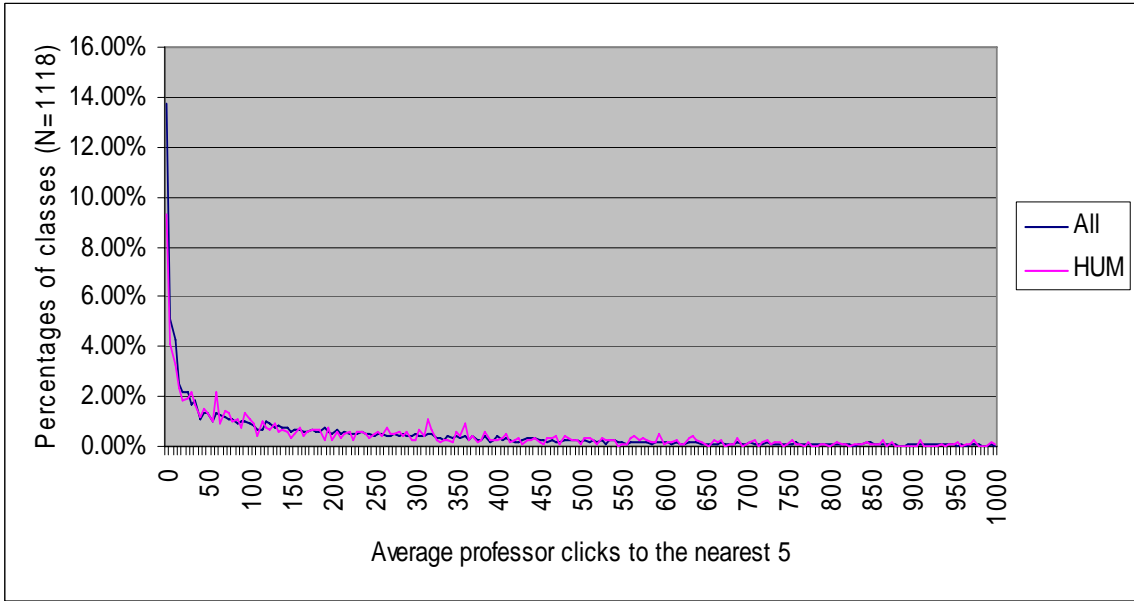


Figure 25. Average Professor Clicks to the nearest 5 as a percentage of all classes in the College of Humanities compared to the overall average Professor Clicks pattern.

Figure 26 shows that the College of Health and Human Performance has a large percentage of course-sections in the low to medium range of average Professor Clicks, and a negligible percentage of course-sections in the high to extremely high range of average Professor Clicks. Figure 27 shows that the College of Fine Art and Communication has a below average percentage of course-sections with low to medium range of average Professor Clicks, and a roughly average percentage of classes in all other ranges. Figure 28 shows that the College of Family, Home, and Social Science has a roughly average percentage of course-sections in all average professor click ranges. Figure 29 shows that the College of Engineering has a fluctuating percentage of course-sections above and below the overall pattern of average Professor Clicks in almost all ranges, and no course-sections in the extremely high range of average Professor Clicks.

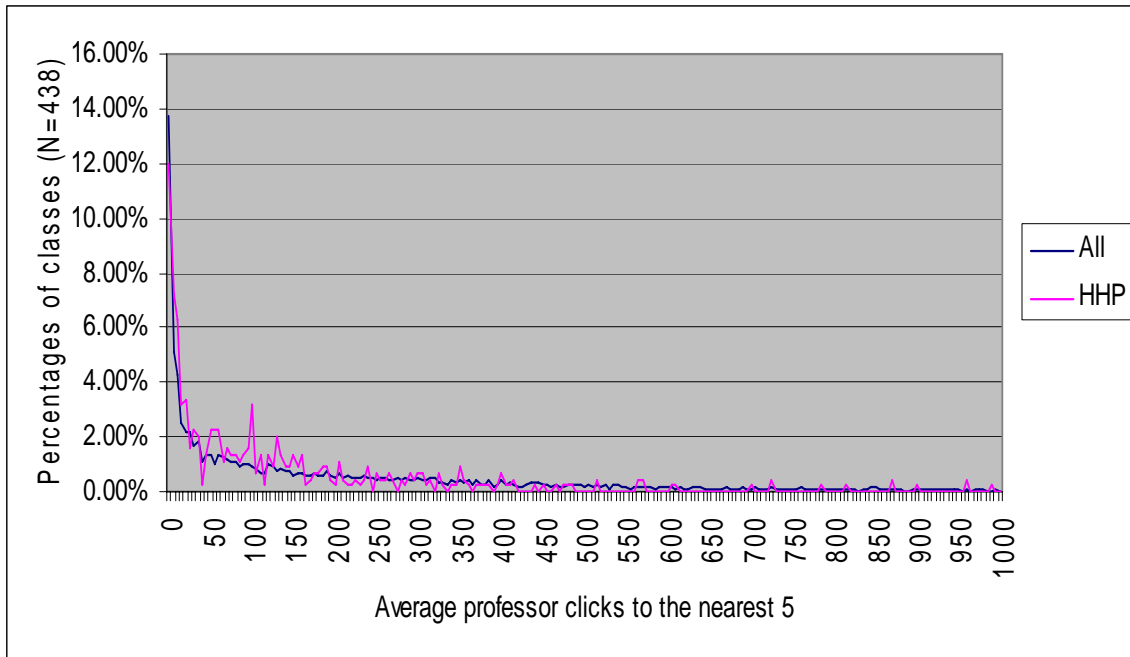


Figure 26. Average Professor Clicks to the nearest 5 as a percentage of all classes in the College of Health and Human Performance compared to the overall average Professor Clicks pattern.

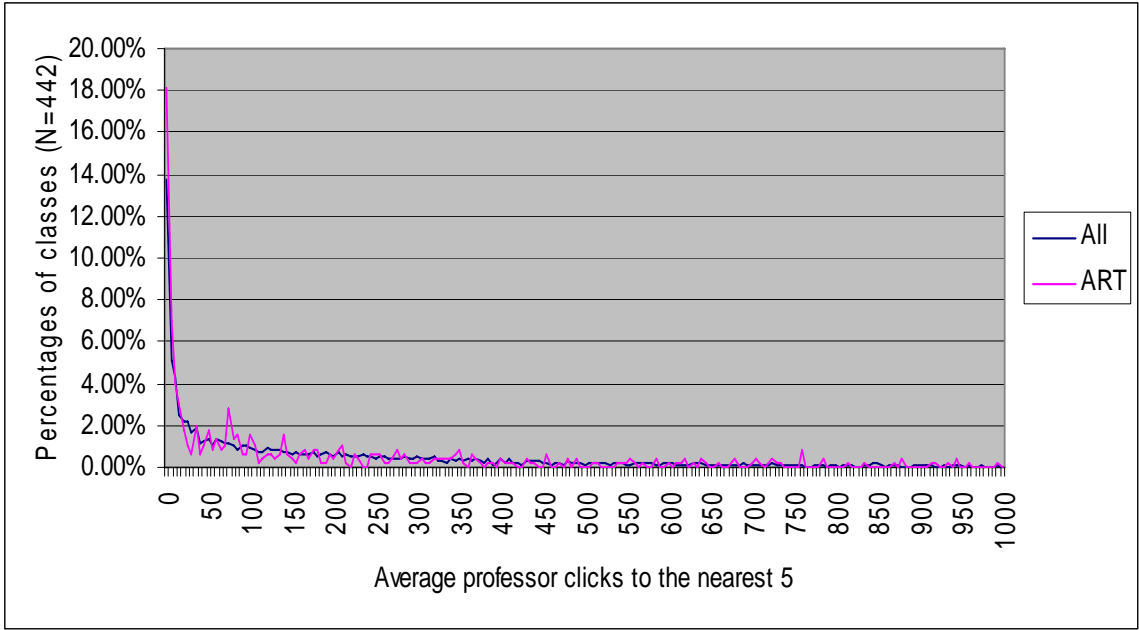


Figure 27. Average Professor Clicks to the nearest 5 as a percentage of all classes in the College of Fine Art and Communication compared to the overall average Professor Clicks pattern.

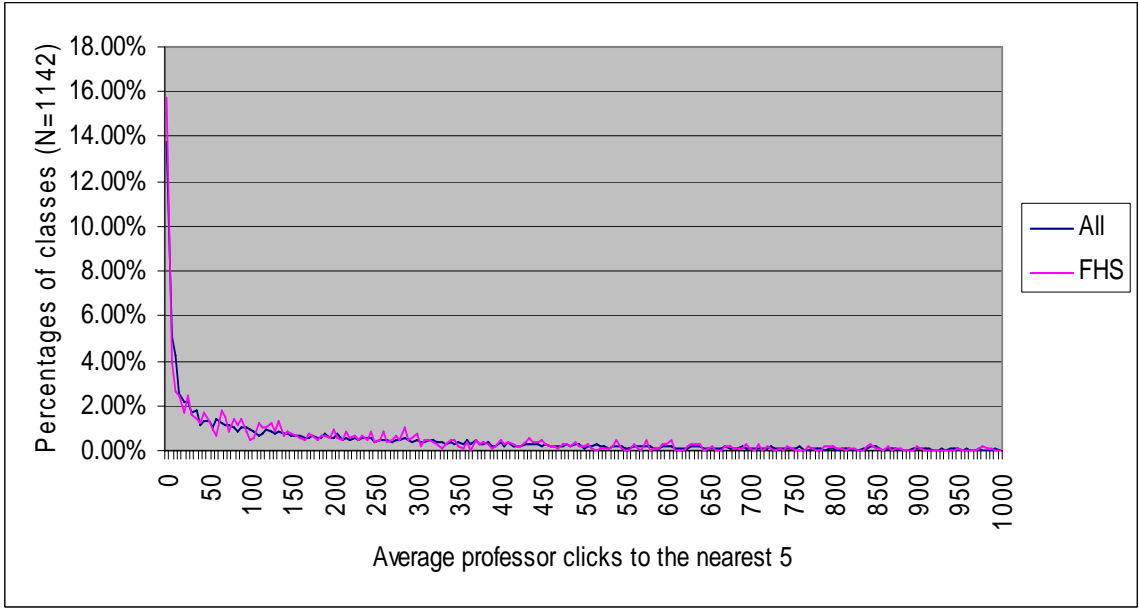


Figure 28. Average Professor Clicks to the nearest 5 as a percentage of all classes in the College of Family, Home, and Social Science compared to the overall average Professor Clicks pattern.

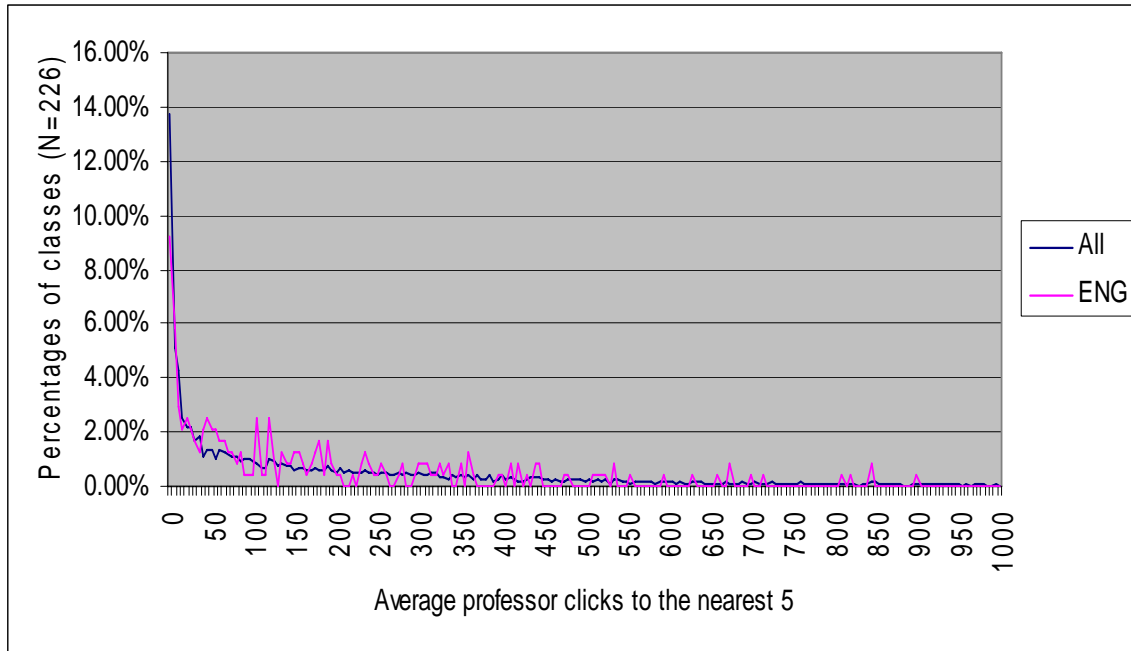


Figure 29. Average Professor Clicks to the nearest 5 as a percentage of all classes in the College of Engineering compared to the overall average Professor Clicks pattern.

Figure 30 shows that the College of Education shows a percentage of course-sections that fluctuate below the overall pattern in the low to medium range of average Professor Clicks, and a significant percentage of classes with high average Professor Clicks, and no classes with extremely high average Professor Clicks. Figure 31 shows that the College of Business shows a low percentage of course-sections with low average Professor Clicks, and a relatively high percentage of course-sections in all other ranges of average Professor Clicks. Figure 32 shows that the College of Biology and Agriculture shows a large percentage of course-sections with extremely low average Professor Clicks, and a small percentage of course-section in all other ranges except for the extremely high range where the percentage of course-sections is comparable to the overall pattern.

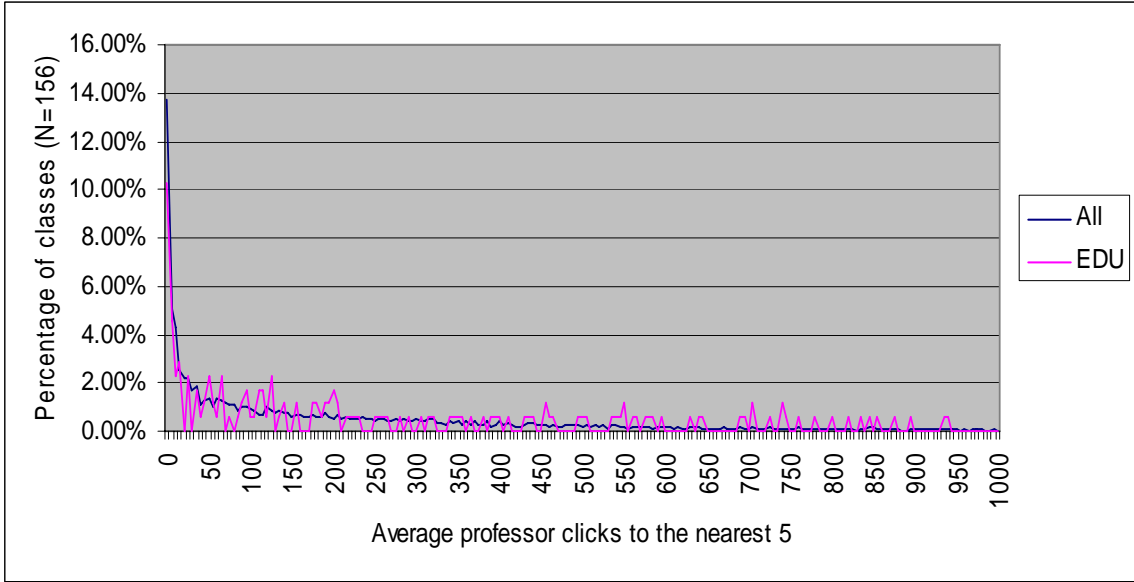


Figure 30. Average Professor Clicks to the nearest 5 as a percentage of all classes in the College of Education compared to the overall average Professor Clicks pattern.

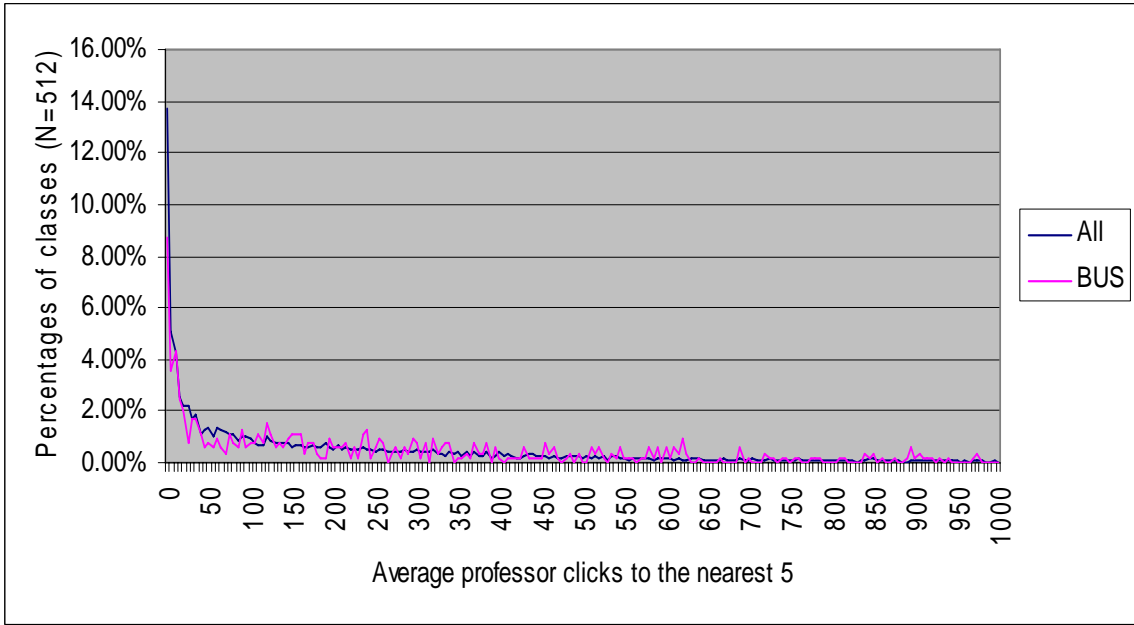


Figure 31. Average Professor Clicks to the nearest 5 as a percentage of all classes in the College of Business compared to the overall average Professor Clicks pattern.

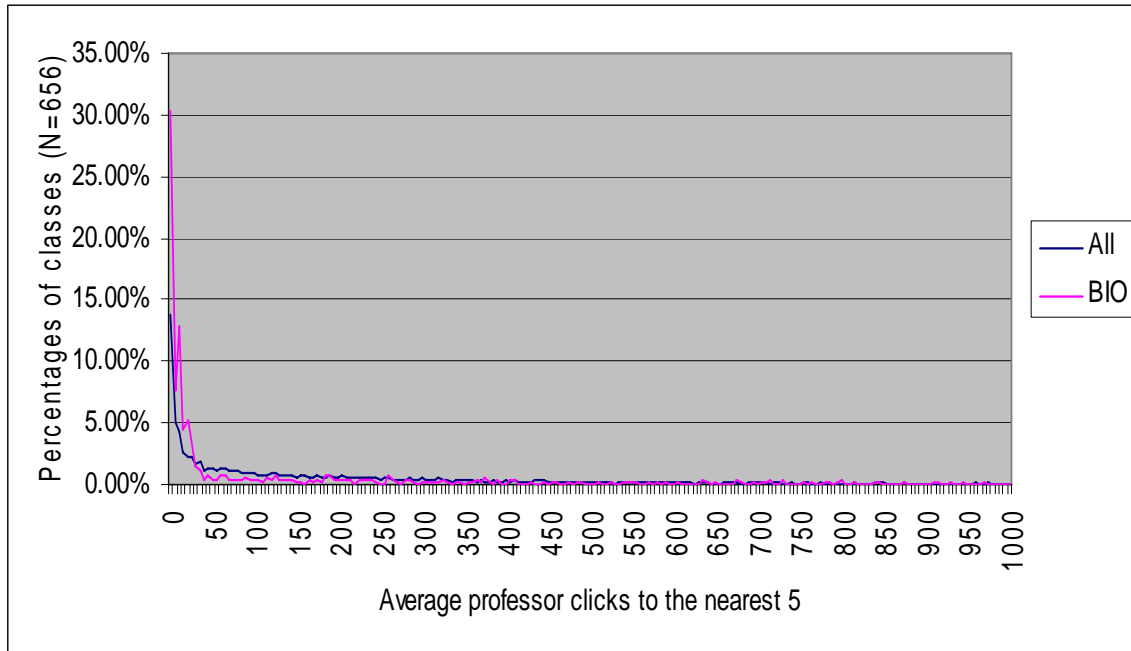


Figure 32. Average Professor Clicks to the nearest 5 as a percentage of all classes in the College of Biology and Agriculture compared to the overall average Professor Clicks pattern.

Figures 33-42 show average Assistant Clicks rounded to the nearest 5 as a percentage of all course-sections in each college with a comparison against the overall average clicks rounded to the nearest 5 as a percentage of all course-sections. Figure 33 shows that the College of Religion shows a high percentage of course-sections with medium average Assistant Clicks, and a roughly average percentage of course-sections in all other ranges of average Assistant Clicks. Figure 34 shows that the College of Physical and Mathematical Science shows a high percentage of course-sections with medium, high, and extremely high average Assistant Clicks. Figure 35 shows that the College of Humanities shows a high percentage of course-sections with zero to extremely low average Assistant Clicks, and a low or below average percentage of course-sections in all other ranges of average Assistant Clicks.

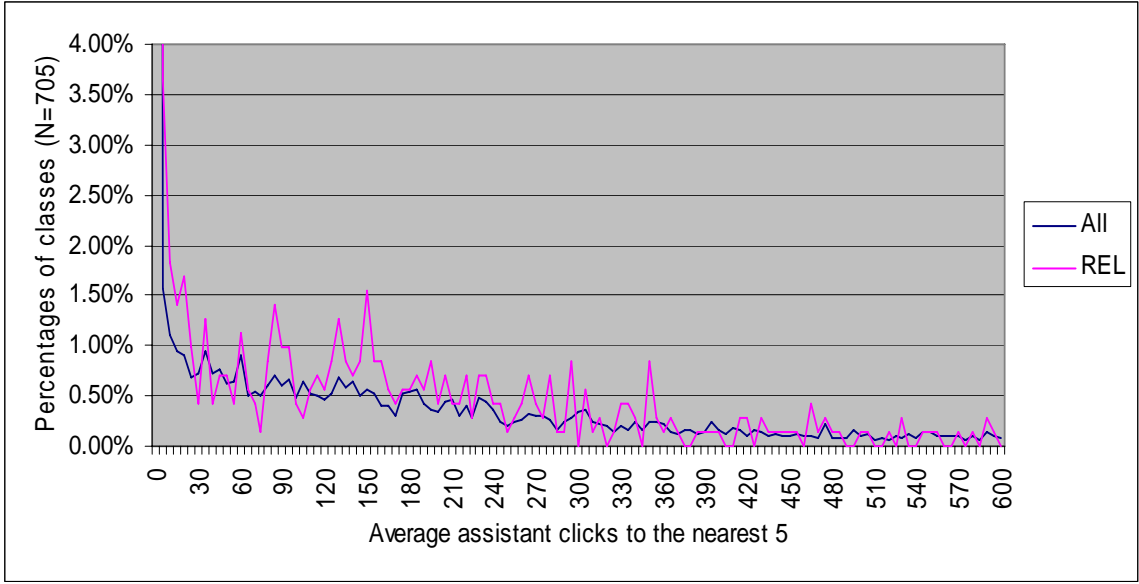


Figure 33. Average Assistant Clicks to the nearest 5 as a percentage of all classes in the College of Religion compared to the overall average Assistant Clicks pattern.

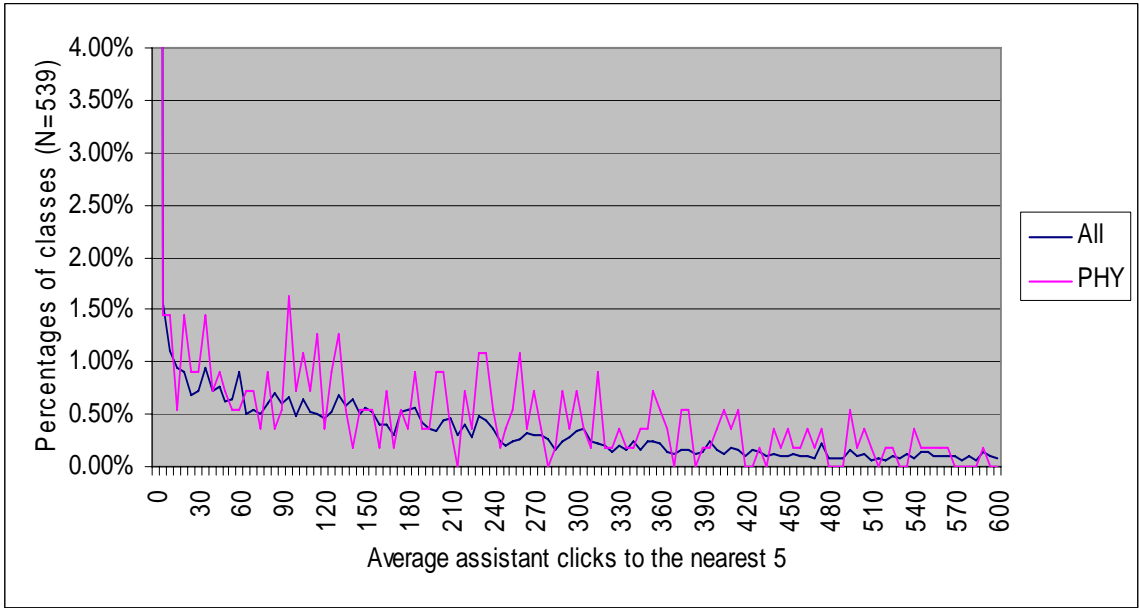


Figure 34. Average Assistant Clicks to the nearest 5 as a percentage of all classes in the College of Physical and Mathematical Science compared to the overall average Assistant Clicks pattern.

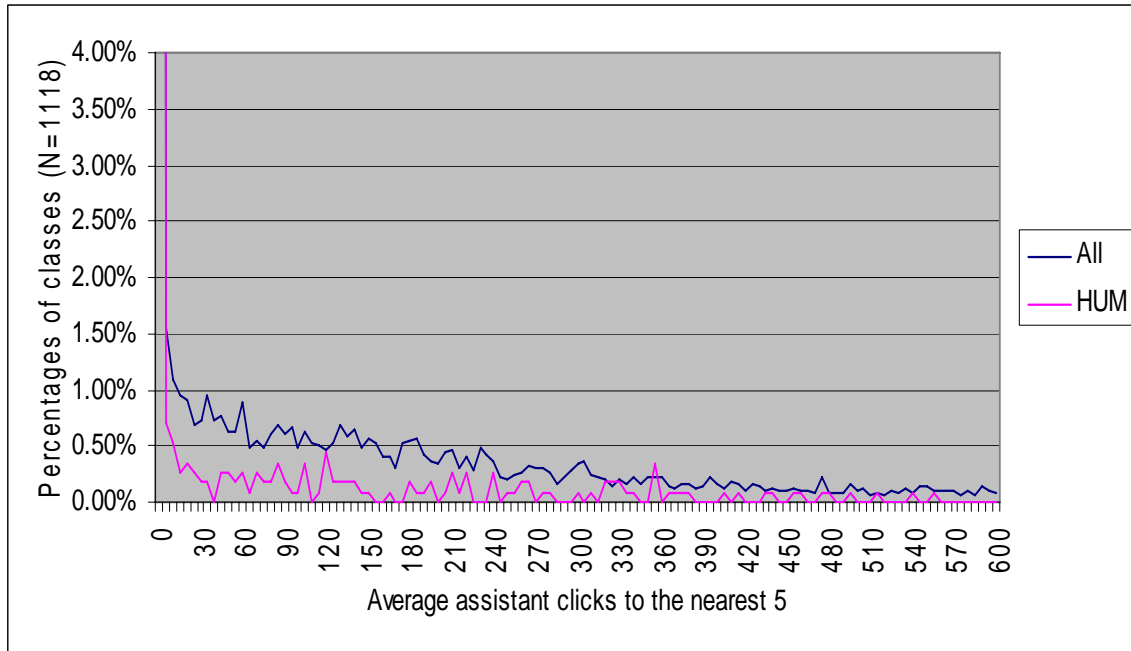


Figure 35. Average Assistant Clicks to the nearest 5 as a percentage of all classes in the College of Humanities compared to the overall average Assistant Clicks pattern.

Figure 36 shows that the College of Health and Human Performance shows a high percentage of course-sections with zero to extremely low average Assistant Clicks, and a low or zero percentage of course-sections in all other ranges of average Assistant Clicks. Figure 37 shows that the College of Fine Art and Communication shows a below average percentage of course-sections with low average Assistant Clicks, and an above average percentage of course-sections in almost all other ranges of average Assistant Clicks. Figure 38 shows that the College of Family, Home, and Social Science shows an above average percentage of course-sections in all ranges of average Assistant Clicks except for the extremely low range. Figure 39 shows that the College of Engineering shows a high percentage of course-sections with no Assistant Clicks, and an above average percentage of course-sections in all other ranges of average Assistant Clicks except for the extremely high range where there were no course-sections.

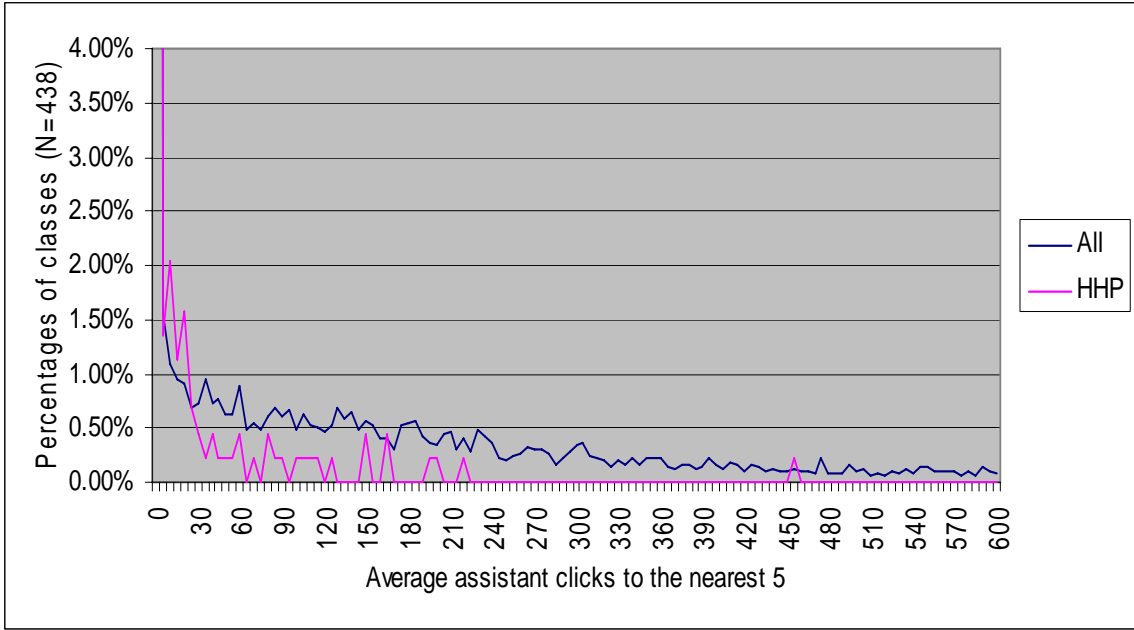


Figure 36. Average Assistant Clicks to the nearest 5 as a percentage of all classes in the College of Health and Human Performance compared to the overall average Assistant Clicks pattern.

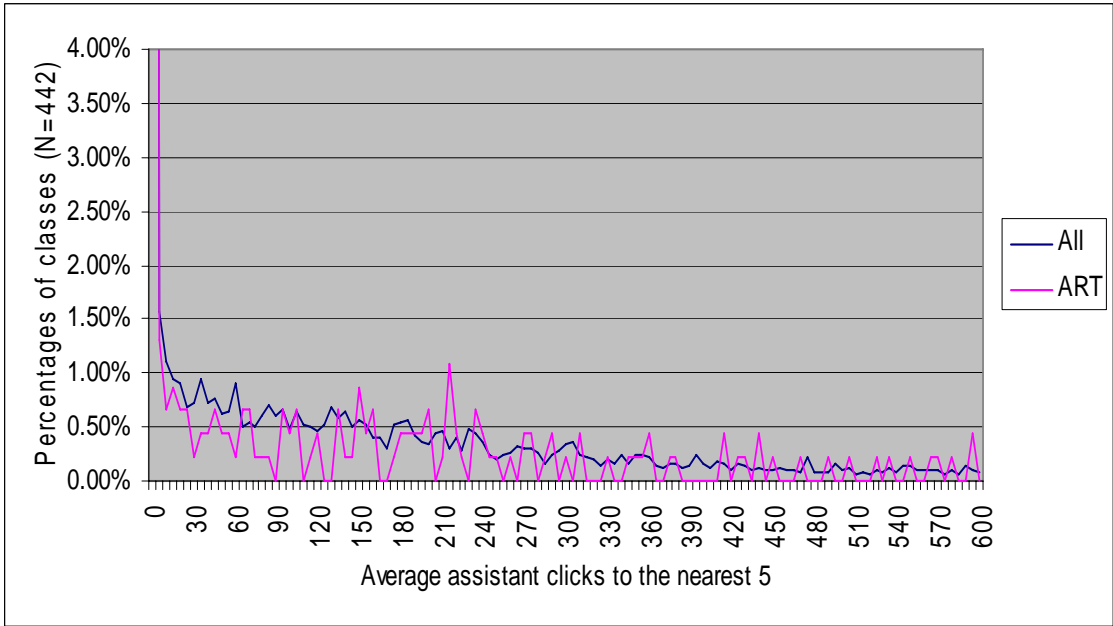


Figure 37. Average Assistant Clicks to the nearest 5 as a percentage of all classes in the College of Fine Art and Communication compared to the overall average Assistant Clicks pattern.

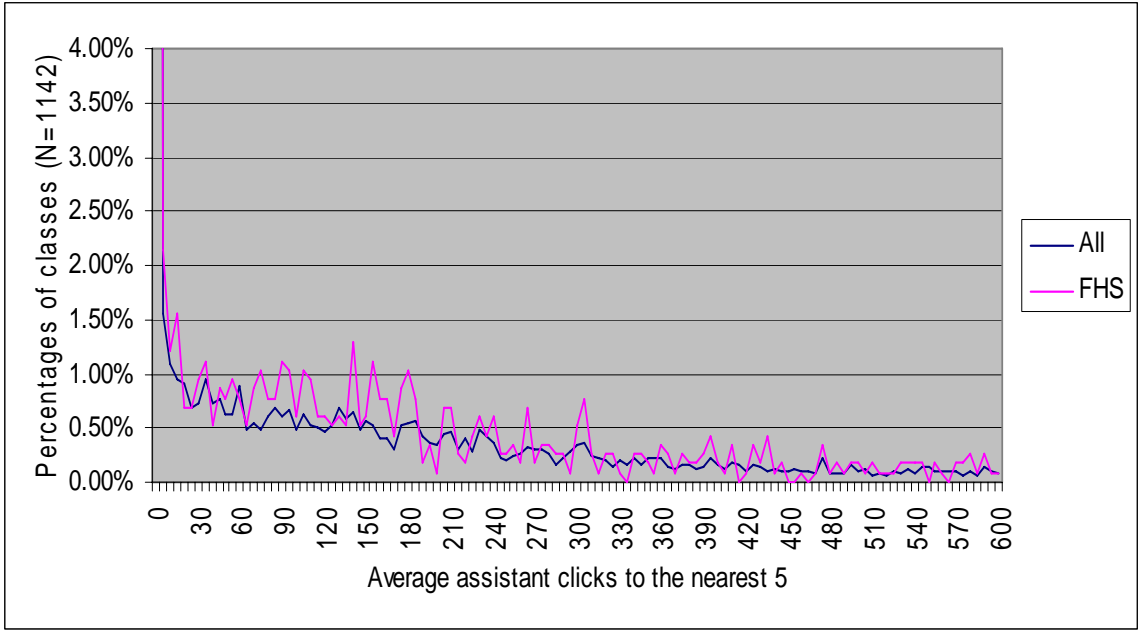


Figure 38. Average Assistant Clicks to the nearest 5 as a percentage of all classes in the College of Family, Home, and Social Science compared to the overall average Assistant Clicks pattern.

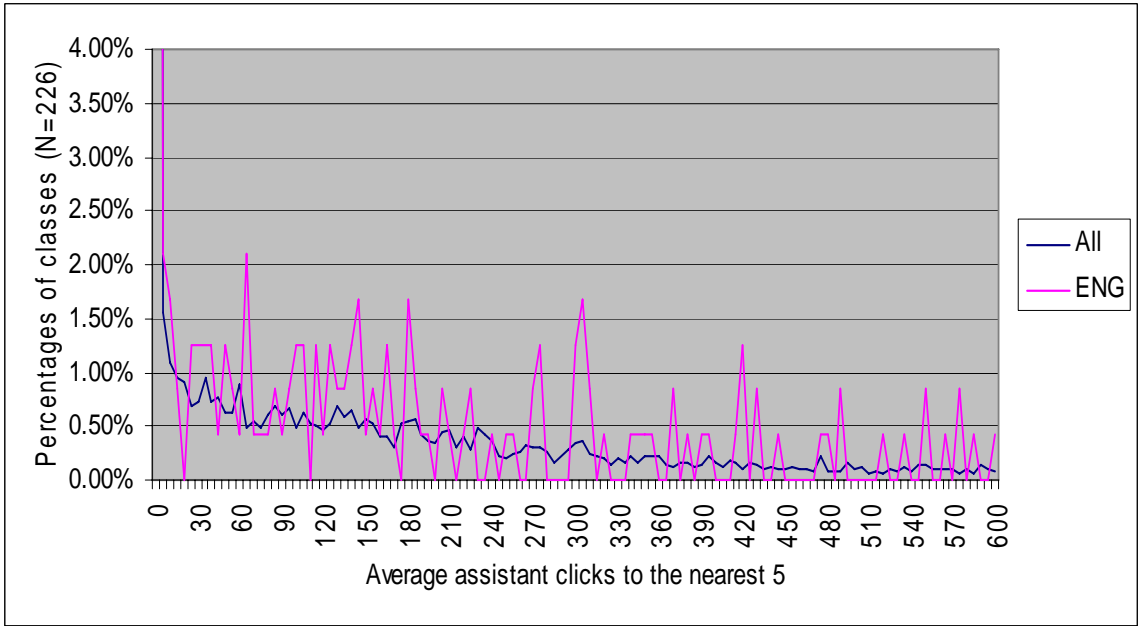


Figure 39. Average Assistant Clicks to the nearest 5 as a percentage of all classes in the College of Engineering compared to the overall average Assistant Clicks pattern.

Figure 40 shows that the College of Education shows a high percentage of course-sections with no Assistant Clicks, a below average percentage of course-sections in low to medium ranges of average Assistant Clicks, and almost no course-sections in high to extremely high ranges of average Assistant Clicks. Figure 41 shows that the College of Business shows a low percentage of course-sections with no Assistant Clicks, and a high or above average percentage of course-sections in all other ranges of average Assistant Clicks. Figure 42 shows that the College of Biology and Agriculture shows a low percentage of course-sections with no Assistant Clicks, and a very high percentage of course-sections in low, medium, and high ranges of average Assistant Clicks. The percentage of course-sections in extremely high ranges of average Assistant Clicks is also above average.

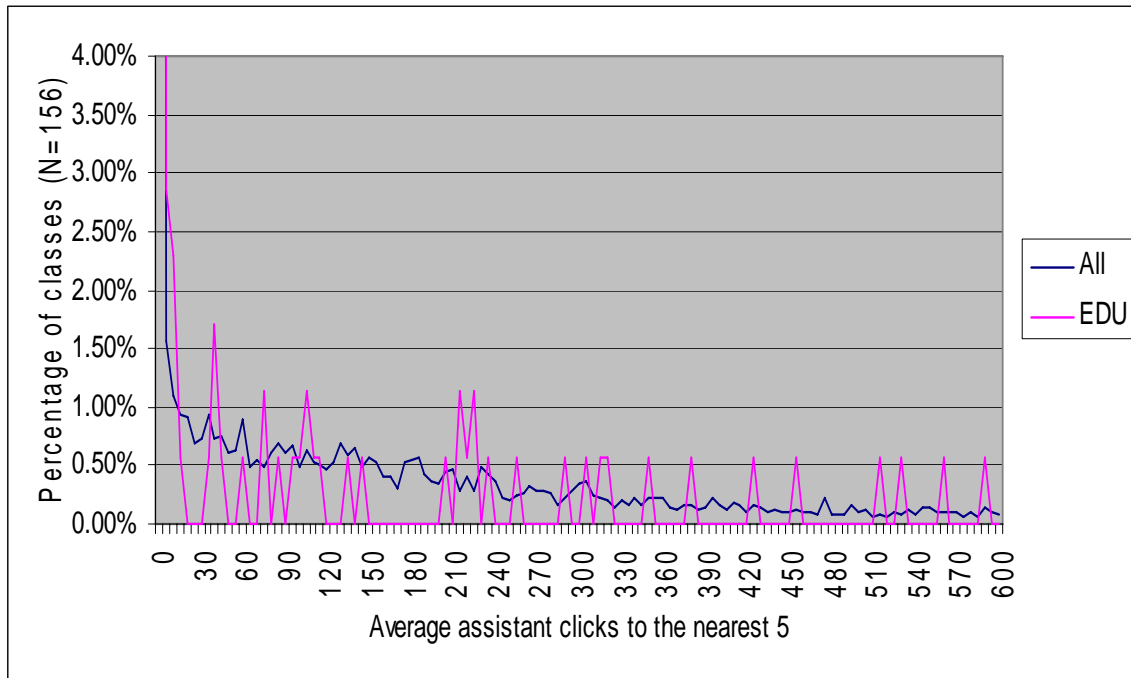


Figure 40. Average Assistant Clicks to the nearest 5 as a percentage of all classes in the College of Education compared to the overall average Assistant Clicks pattern.

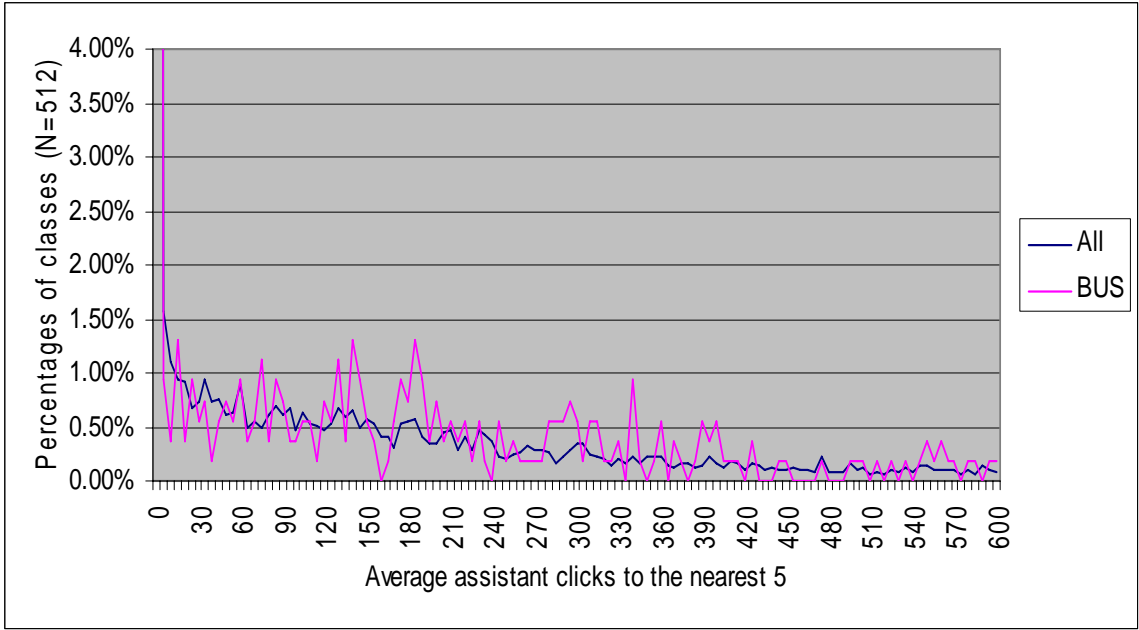


Figure 41. Average Assistant Clicks to the nearest 5 as a percentage of all classes in the College of Business compared to the overall average Assistant Clicks pattern.

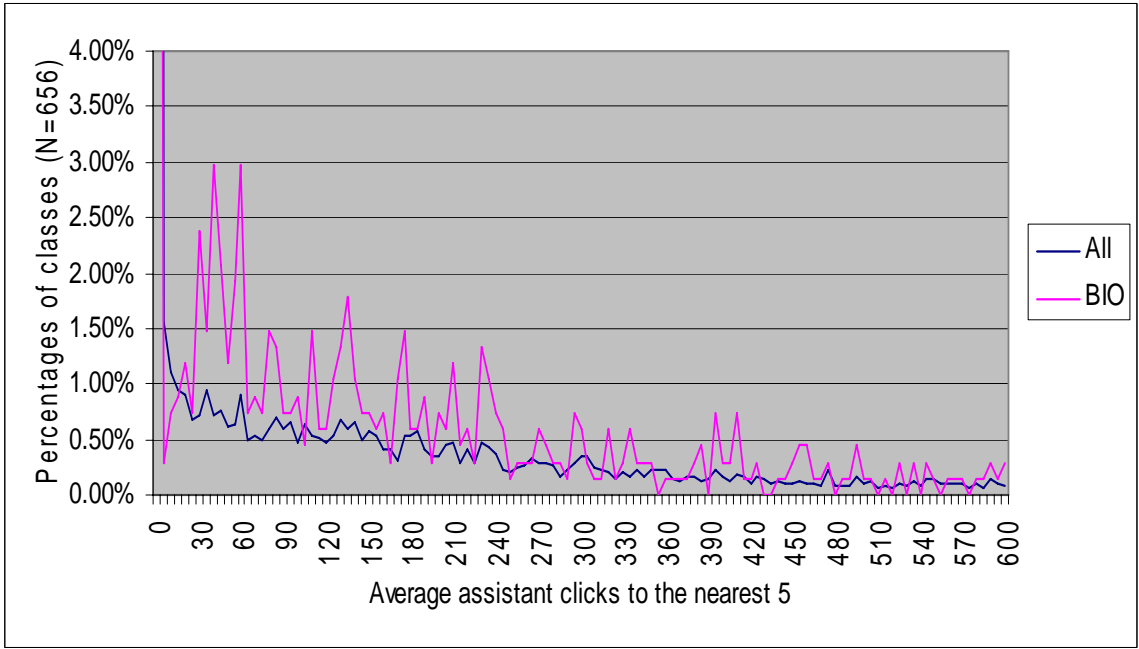


Figure 42. Average Assistant Clicks to the nearest 5 as a percentage of all classes in the College of Biology and Agriculture compared to the overall average Assistant Clicks pattern.

Quartile Ranges of Average Clicks

What are the ranges of clicks for students, professors, and assistants when separated into quartiles? (What range of average clicks constitutes the lowest quartile of course-sections, the second quartile of course-sections, the third quartile of course-sections, and the fourth quartile of course-sections?)

Table 3 shows that 50% of course-sections (quartiles 2 and 3) were in a range of 20 – 85 average clicks per student. The lowest 25% of course-sections have 0 - 15 average clicks per student, and the highest 25% of course-sections have 90 – 1,430 average clicks per student. Whether 90 and above average Student Clicks is really a measure of high usage levels of blackboard, and what this average really measures are questions that require a more detailed study of each range of course-sections. At first glance, an average of 90 clicks does not appear to be very large over the course of a semester. For a range of average clicks described as being in the fourth quartile, an average of 90 clicks does not seem very high at all. This may be due to course-sections having a very wide range of usage by students with some making low levels of clicks and some performing high levels of clicks and further study is needed to understand how the average Student Clicks per course-section actually represent the activity of all students in each course-section.

Table 3 shows a very wide range of average Professor Clicks in the fourth quartile (340-7,730), which makes it difficult to determine what is meant by high average Professor Clicks. Table 3 also shows an extremely wide range of average Assistant Clicks in the fourth quartile. Half of all course-sections have zero Assistant Clicks (which means there were no assistants in that course-section), so there is only a third and fourth quartile.

Table 3

Quartile Ranges for Average Clicks Rounded to the Nearest 5

| User Type | Q1 Range | Q2 Range | Q3 Range | Q4 Range |
|-----------|----------|----------|----------|----------|
| Student | 0-15 | 20-35 | 40-85 | 90-1430 |
| Professor | 0-15 | 20-115 | 120-335 | 340-7730 |
| Assistant | 0 | 0 | 5-150 | 155-7575 |

Percentage of Course-sections in Each College Compared to the Overall Quartile Ranges

What percentage of course-sections is there in each quartile of average click ranges of all course-sections compared with each college for students, professors, and assistants?

The next section shows quartile ranges of average clicks, which means the range of average clicks that represents the first 25%, the second 25%, the third 25% and the fourth 25% of course-sections. Each chart has a column for ALL clicks which shows the overall quartile ranges as recorded in Table 3. The other columns show each college and the percentage of course-sections in each college that fall into the overall average click quartile ranges from Table 3. The colleges in Figures 43 and 44 are sorted by percent of clicks in the fourth quartile of average student and professor activity, and colleges in Figure 45 are sorted by the percent of clicks in the first two quarters (zero clicks) of average assistant activity.

Figure 43 shows that most colleges have a fairly similar percentage of course-sections in all quartiles of average student click ranges. The extremes were the College of Business which has the highest percentage of course-sections in the third and fourth quartile ranges of average Student Clicks and the College of Health and Human Performance which has the lowest percentage of course-sections in the fourth quartile range of average Student Clicks.

The College of Education is interesting in that it has a high percentage of course-sections in the first quartile range of average Student Clicks and a high percentage of course-sections in the fourth quartile range of average Student Clicks. These colleges that show the extremes of low or high activity levels are interesting as all the other colleges have a very similar pattern of the spread of activity levels across the four quartiles. The question that this generates is why are these three colleges so different from the normal pattern, and moreover, can a difference that equates to better education be transferred through training and development to other colleges, and can a difference that equate to inferior education be overcome through training and development.

Figure 44 shows that most colleges have a fairly similar percentage of course-sections in the overall quartile ranges of average professor click ranges. The College of Business sticks out as it has 60% of course-sections in the third and fourth quartile ranges of average Professor Clicks, and the College of Biology and Agriculture has the highest percentage of course-sections in the first quartile range of average Professor Clicks. The colleges follow the same patterns of average Student Clicks compared to average Professor Clicks in the same college.

Figure 45 shows that there is a wide variety of average Assistant Clicks in the different colleges which equates to large differences in how assistants were used in course-sections in the different colleges. The College of Biology and Agriculture has the highest overall usage of Assistant Clicks with around 25% of course-sections with no assistant activity. The College of Health and Human Performance has the highest percentage of classes with no Assistant Clicks followed closely by the College of Humanities. Both of these colleges have over 85% of course-sections with no Assistant Clicks.

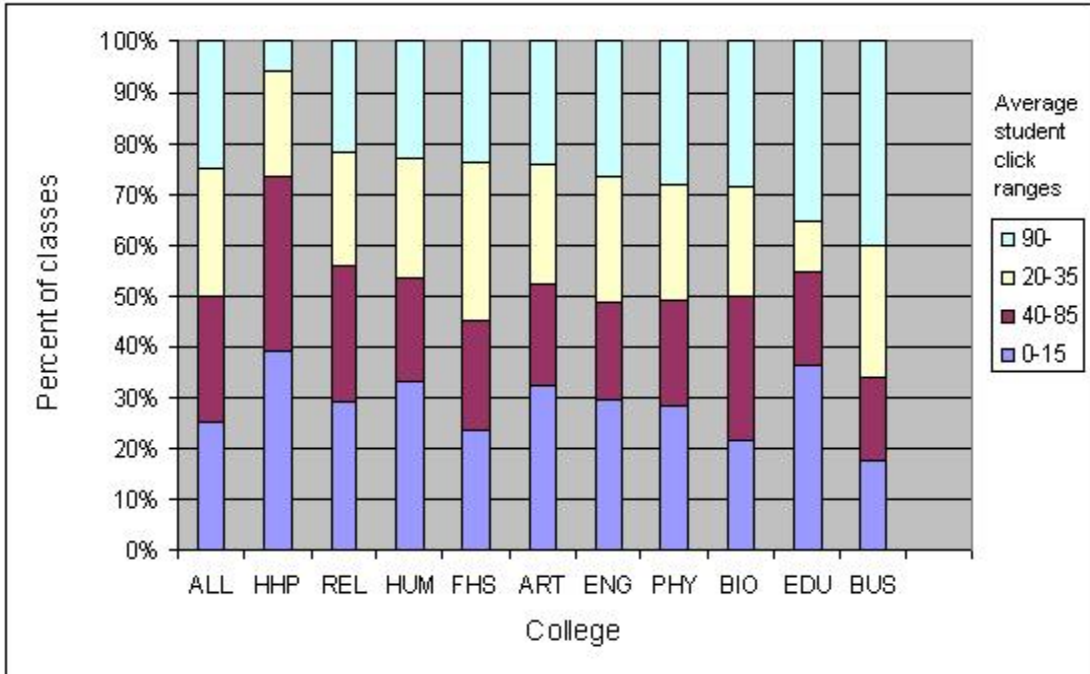


Figure 43. Comparing average Student Clicks by college in quartile ranges of average clicks. For the whole campus, one quarter of all course-sections had an average student click score of 0-15 etc. Average Student Clicks in each college are compared to the overall quartile ranges of average Student Clicks.

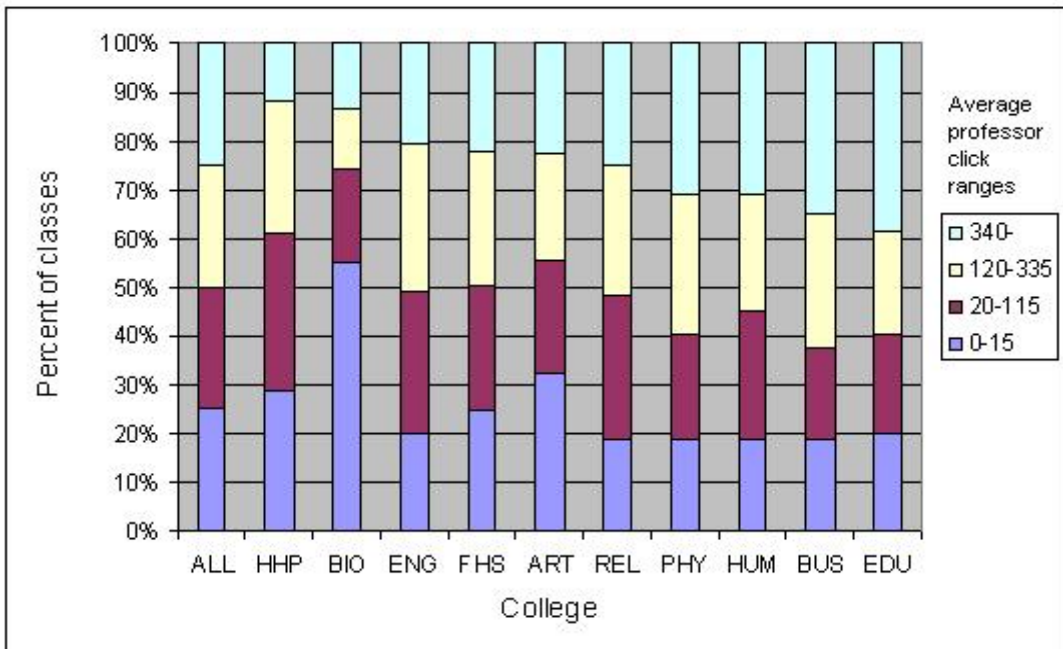


Figure 44. Percentages of course-sections for each college in the overall quartiles ranges of average Professor Clicks.

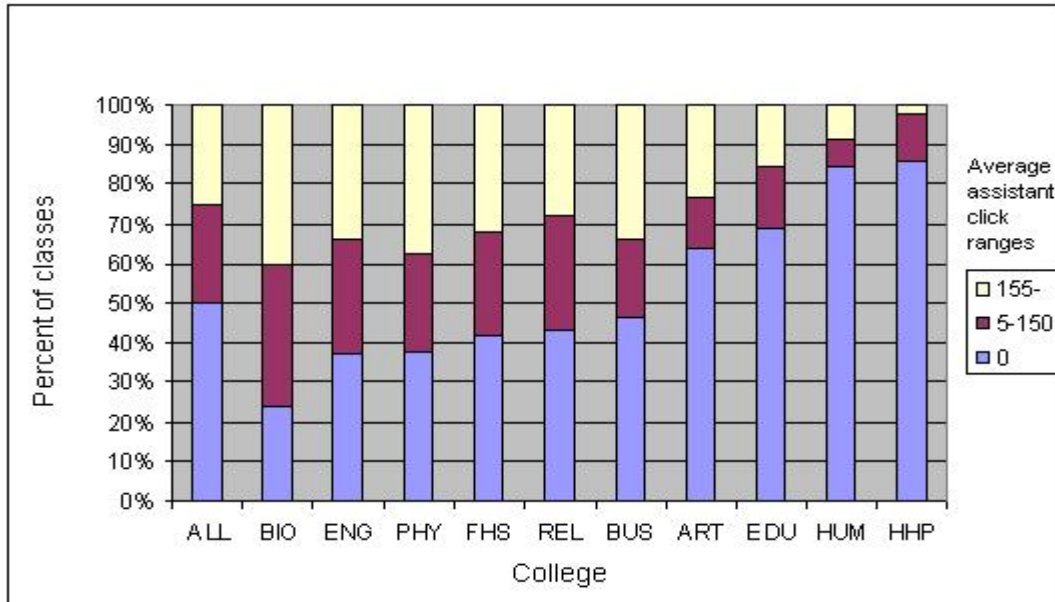


Figure 45. Percentages of course-sections for each college in the overall quartiles ranges of average Assistant Clicks. There are only 3 ranges as the first 2 quartiles of course-sections have 0 Assistant Clicks (50% of all course-sections have no assistant activity in Blackboard)

Overall Activity by Feature

What is the overall number of clicks in each Blackboard feature for the 2004-2005 academic year for students, professors, and assistants?

When all clicks (student, professor, and assistant) are shown together in Figure 46, by far the largest group of clicks is *Content Folder* at close to 13 million. These clicks are mostly navigational which means that the only function they serve is to get to some form of content. *Announcements* is the next highest clicked feature at over 7 million clicks. *Content*, which represents documents, links to web pages, and lesson pages, is the next highest group of clicks at around 4 million. All the other features have clicks of fewer than 4 million. The six most clicked features of *Announcements*, *Content*, *Grades*, *Quiz*, *Discussion Board*, and *Comm/Email* were as expected, but the order of these six is the most interesting part of this analysis. From an educational perspective, it is encouraging that

Content, *Quiz*, and *Discussion Board* clicks were more used than *Grades* and *Comm/Email* which are mostly administrative features.

Overall, students perform far more clicks than professors or assistants as there are so many more students, this is shown on Figure 47 as the chart is almost identical to the overall distribution shown on Figure 46. *Content Folder* clicks represent browsing to a folder in Blackboard as well as posting items of content. Therefore *Content Folder* clicks will represent browsing to folders to add content items as well as browsing just to check or revise something in a folder. Figure 48 therefore shows that professors perform most of their clicks in Blackboard working with *Content*, *Announcements*, and *Grades*. *Grades* is the highest clicked feature for professors which is a purely administrative feature, as is *Announcements*. After the top three clicked features, all of the other features have much lower clicks by professors. Figure 49 shows clearly that assistants were not heavily used for entering grades with almost 900,000 clicks in the *Grades* feature of Blackboard. Assistants also have a reasonable number of clicks in *Announcements* and *Content Folder* features, but the total number of clicks in all other features is low.

The fact that the top six features account for 90% of all activity could lead to several possible conclusions and further questions. It could be that this shows that to be a successful product, a CMS only needs to incorporate these most used features. It could also be the case that some features that are not used to any substantial degree may in fact be useful, but have not yet been discovered by enough faculty members, or that training has not been given in these features, or that the feature could be useful but is too difficult to use. The many features that constitute 10% of all activity should be studied to see what potential for educational benefits exist in using these features, and what training could be given to professors for useful features that have not so far been discovered and used to any significant degree.

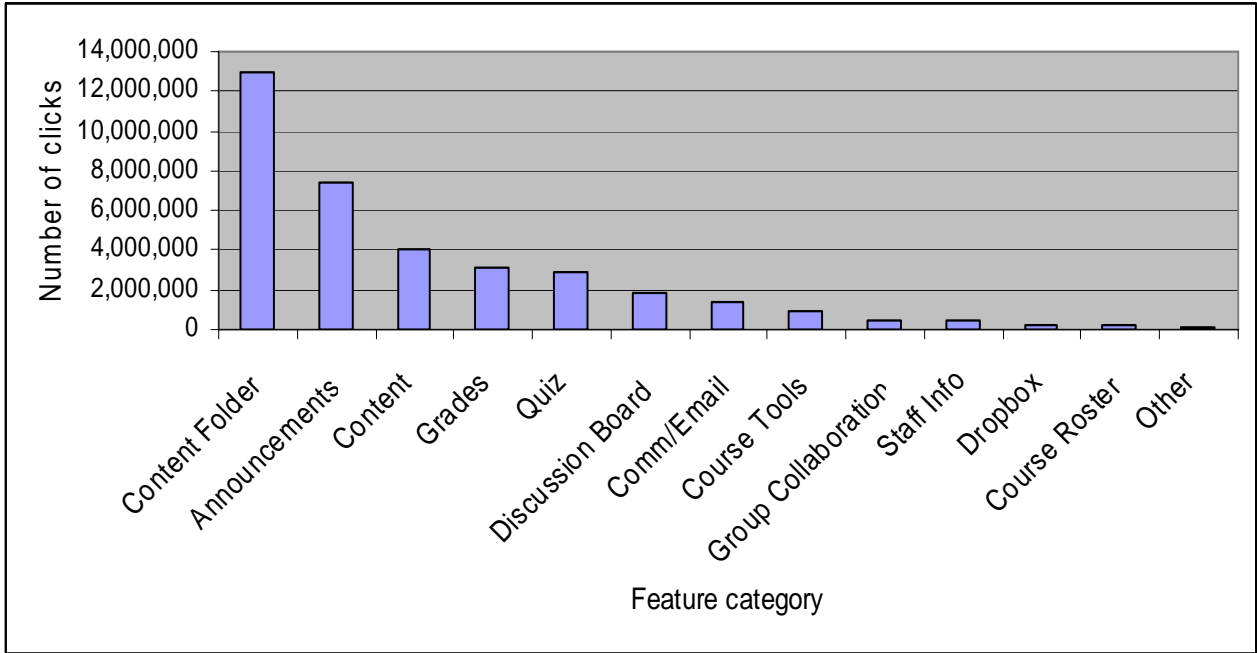


Figure 46. All clicks in the 2004-2005 academic year shown in 13 different feature categories of the Blackboard system.

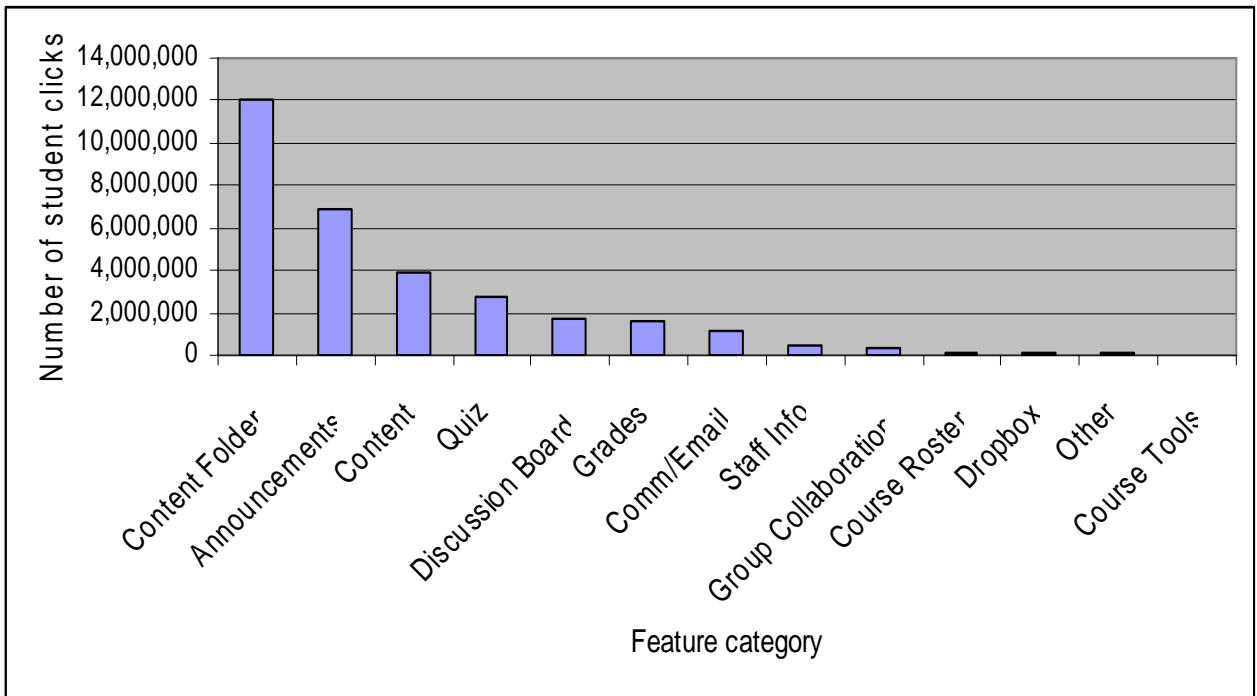


Figure 47. All Student Clicks in the 2004-2005 year academic shown in 13 different feature categories of the Blackboard system.

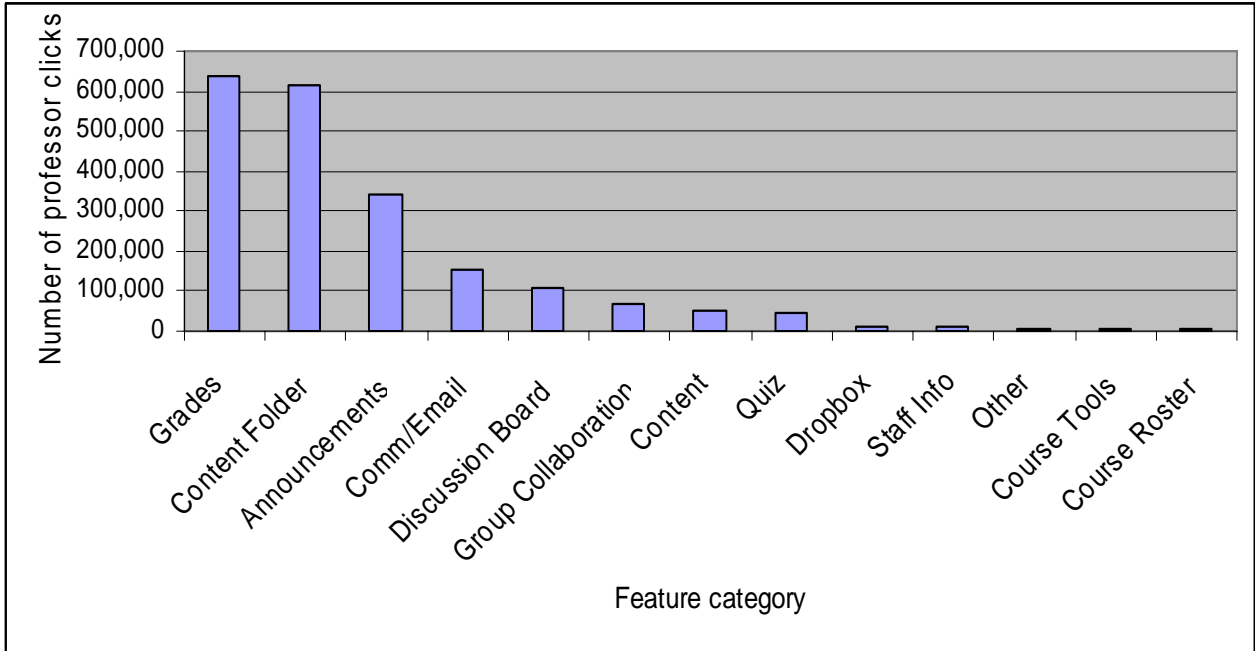


Figure 48. All Professor Clicks in the 2004-2005 academic year shown in 13 different feature categories of the Blackboard system.

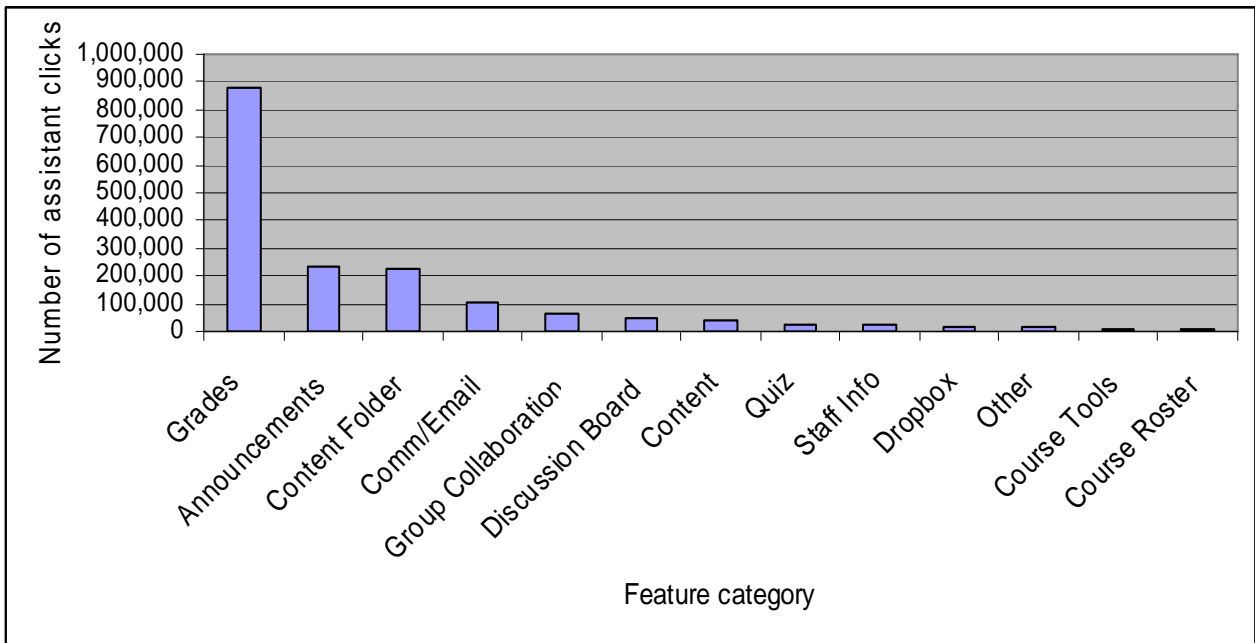


Figure 49. All Assistant Clicks in the 2004-2005 academic year shown in 13 different feature categories of the Blackboard system.

College Level Activity by Feature

What is the activity level for each category of Blackboard features for the 2004-2005 academic year for each college for students, professors, and assistants?

In this section, each feature is analyzed with a chart showing the percentage of clicks for that feature across all colleges. The features charts are organized by administrative versus pedagogical activity with *Announcements*, *Grades*, *Comm/Email*, and *Content Folder* (navigational) first followed by *Content*, *Quiz*, and *Discussion Board*.

Figures 50-53 show that the percentage of Student Clicks in each administrative feature is fairly similar in all colleges apart from the *Comm/Email* feature which has a little more variability. Figures 54 – 56 show that the percentage of Student Clicks in each pedagogical feature is highly variable across all colleges with different colleges having a preference for certain pedagogical features. In the *Discussion Board* feature, for example, the college of Education has a high percentage of all their Student Clicks being performed in the *Discussion Board* compared with the College of Business and the College Physical and Mathematical Sciences which have around 1% of all their Student Clicks being performed in the *Discussion Board* feature.

The variability across colleges in the use of pedagogical features of Blackboard is an interesting aspect that has surfaced in this study. It seems that colleges have favorite educational methods that equate to certain features of Blackboard. Some colleges, such as the college of Education use the *Discussion Board*, some colleges such as the college of Physical and Mathematical Science use *Quiz*, and others such as the college of Biology and Agriculture use *Content*. It may be that colleges have adapted teaching methods that have now translated into the way that they use Blackboard, or it may be the case that the colleges have evolved these methods through their use of Blackboard since it was implemented.

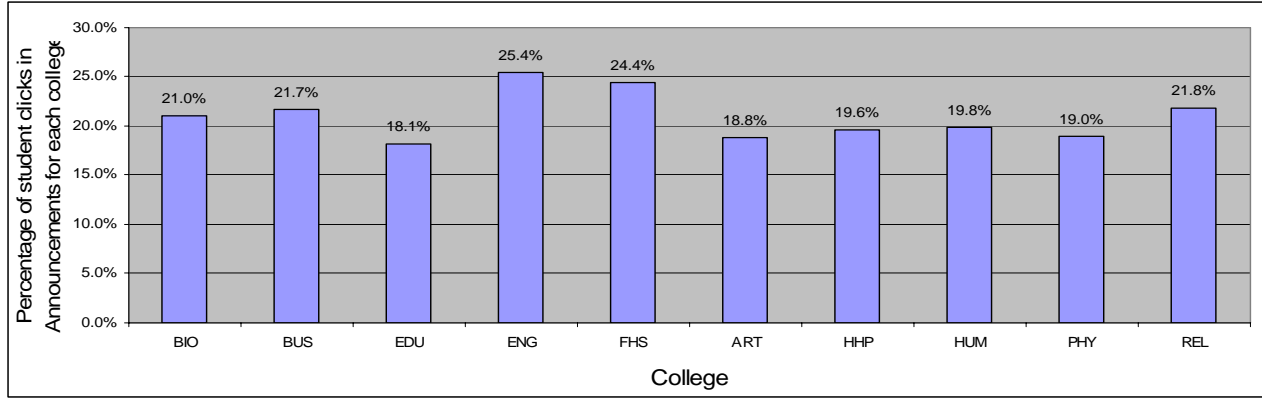


Figure 50. Percentage of Student Clicks using the *Announcements* feature of Blackboard in each college.

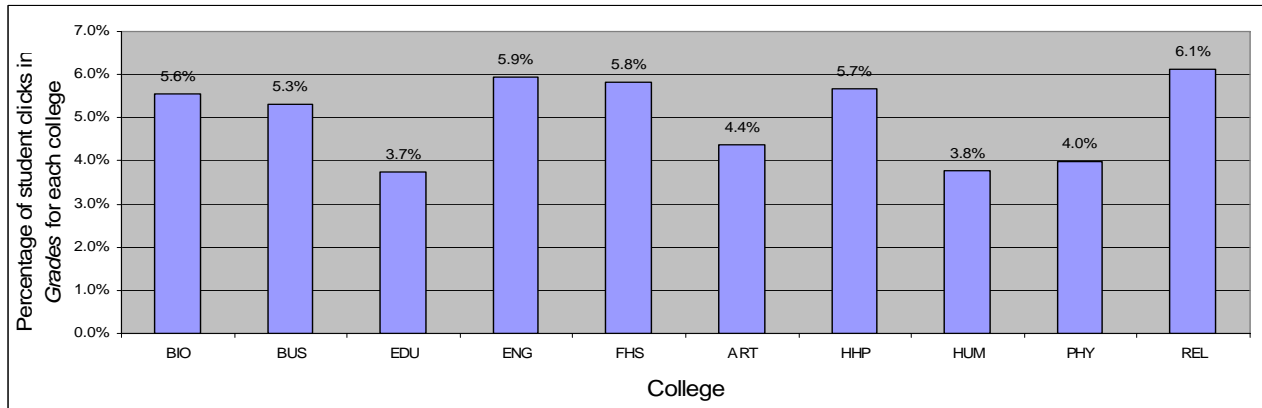


Figure 51. Percentage of Student Clicks using the *Grade Book* feature of Blackboard in each college.

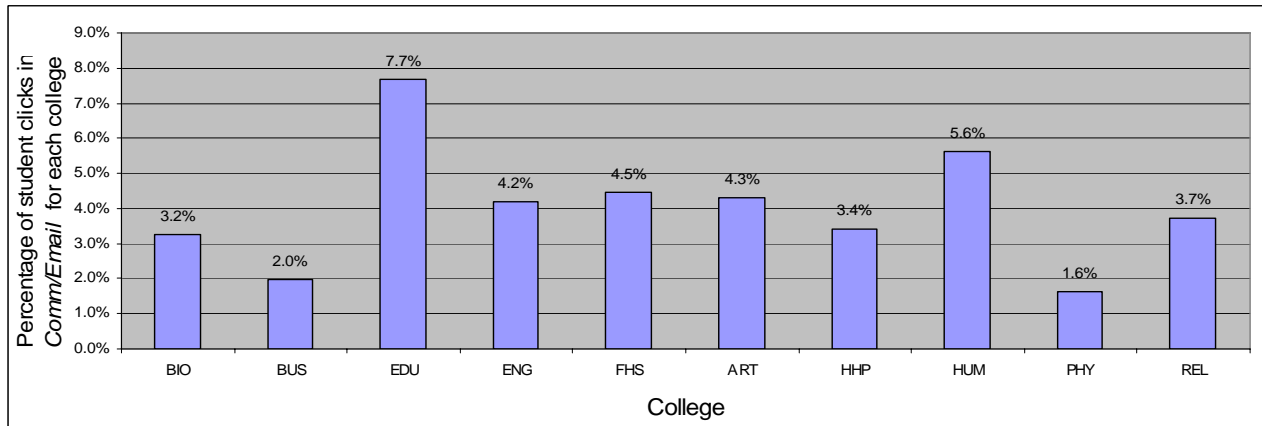


Figure 52. Percentage of Student Clicks using the *Comm/Email* feature of Blackboard in each college.

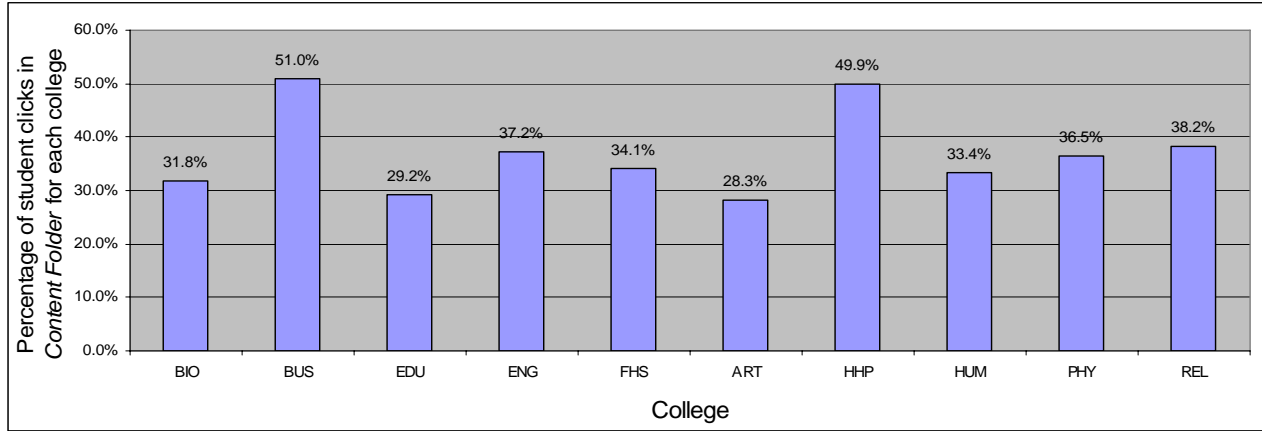


Figure 53. Percentage of Student Clicks using the *Content Folder* feature of Blackboard in each college.

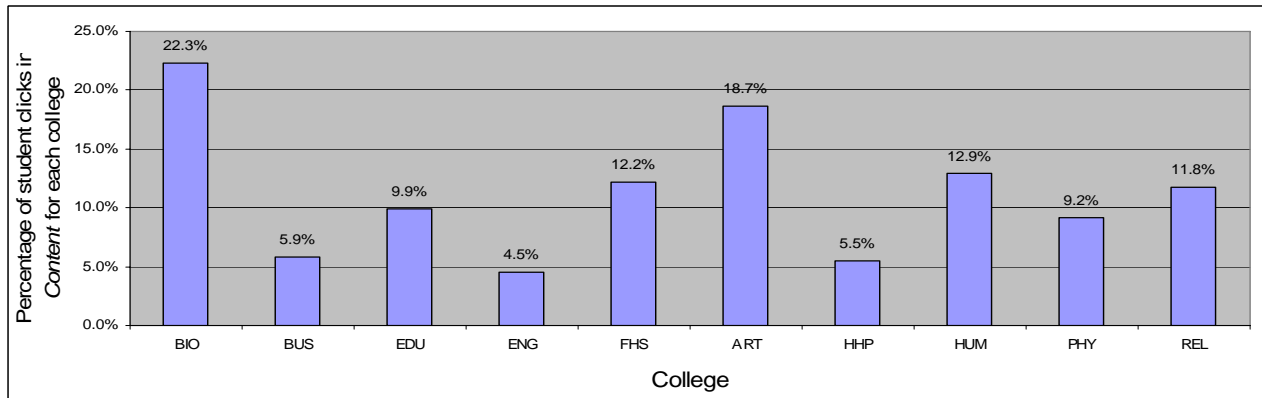


Figure 54. Percentage of Student Clicks using the *Content* feature of Blackboard in each college.

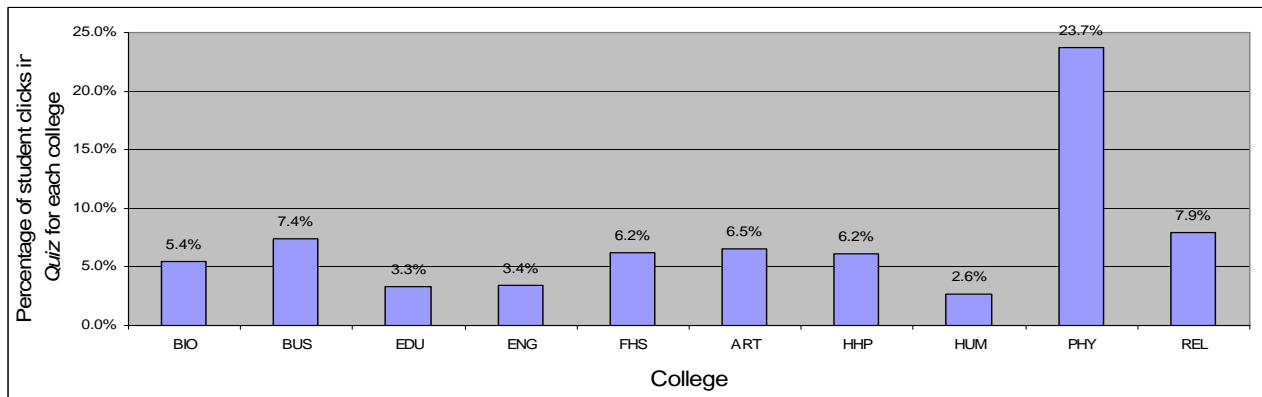


Figure 55. Percentage of Student Clicks using the *Quiz* feature of Blackboard in each college.

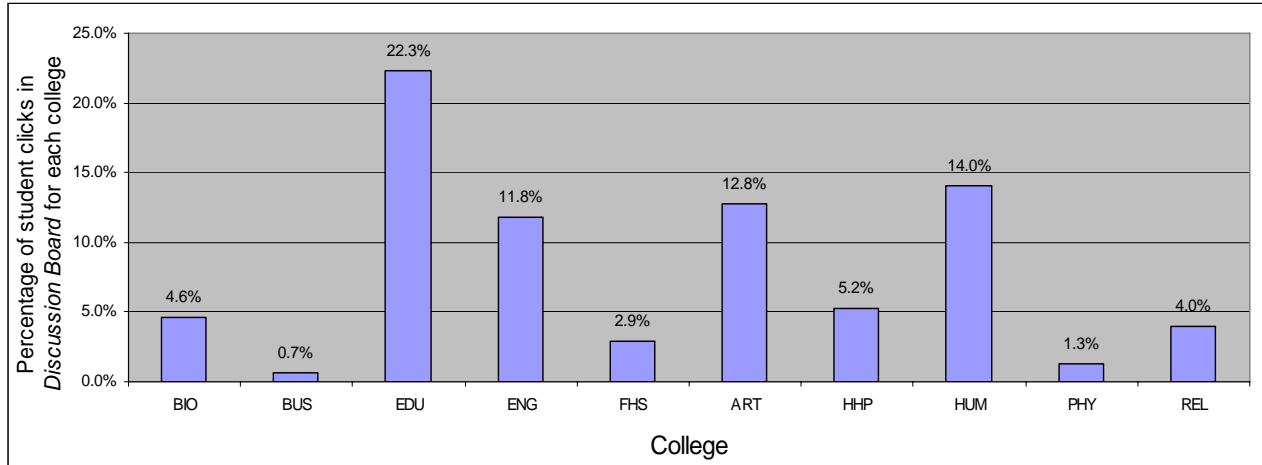


Figure 56. Percentage of Student Clicks using the *Discussion Board* feature of Blackboard in each college.

This same pattern of comparable percentage usage of administrative features and high variability of percentage usage of pedagogical usage across colleges is observed for Professor Clicks and Assistant Clicks. This pattern for Professor Clicks and Assistant Clicks is illustrated in Figures 57-70.

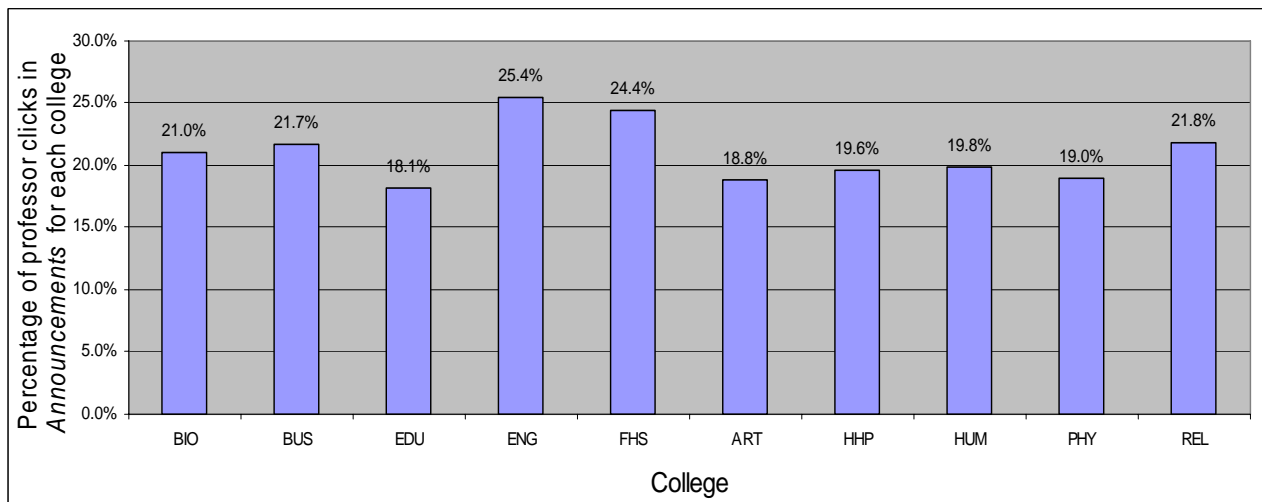


Figure 57. Percentage of Professor Clicks using the *Announcements* feature of Blackboard in each college.

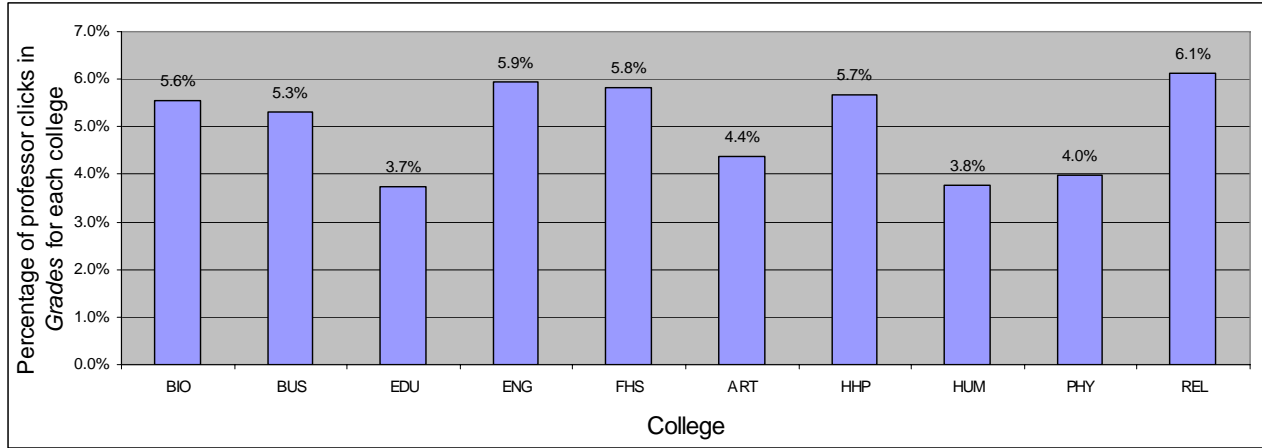


Figure 58. Percentage of Professor Clicks using the *Grades* feature of Blackboard in each college.

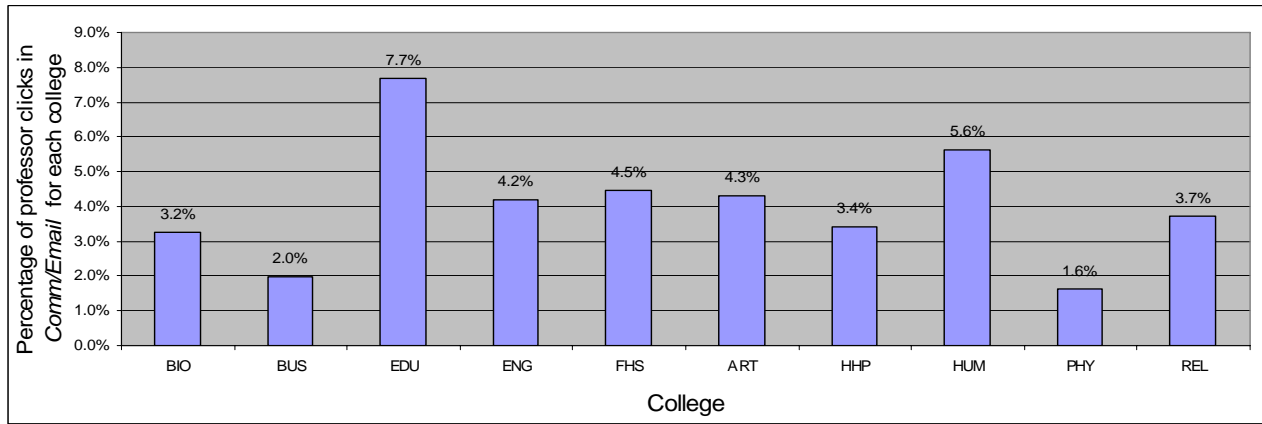


Figure 59. Percentage of Professor Clicks using the *Comm/Email* feature of Blackboard in each college.

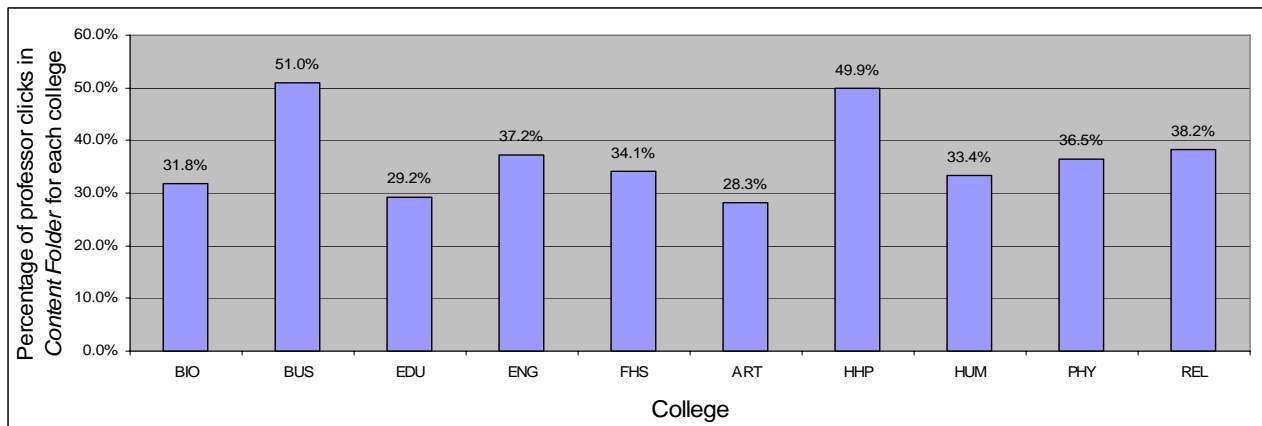


Figure 60. Percentage of Professor Clicks using the *Content Folder* feature of Blackboard in each college.

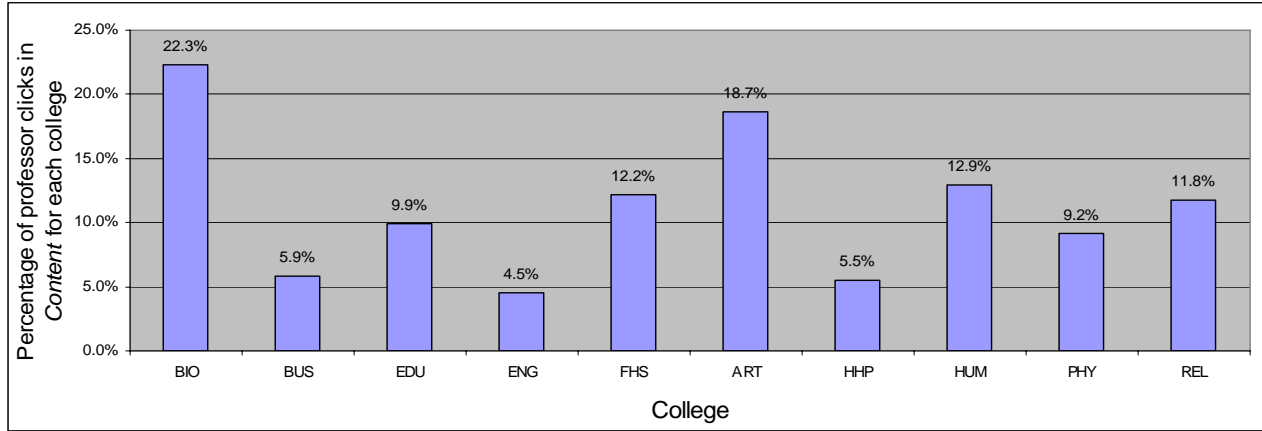


Figure 61. Percentage of Professor Clicks using the *Content* feature of Blackboard in each college.

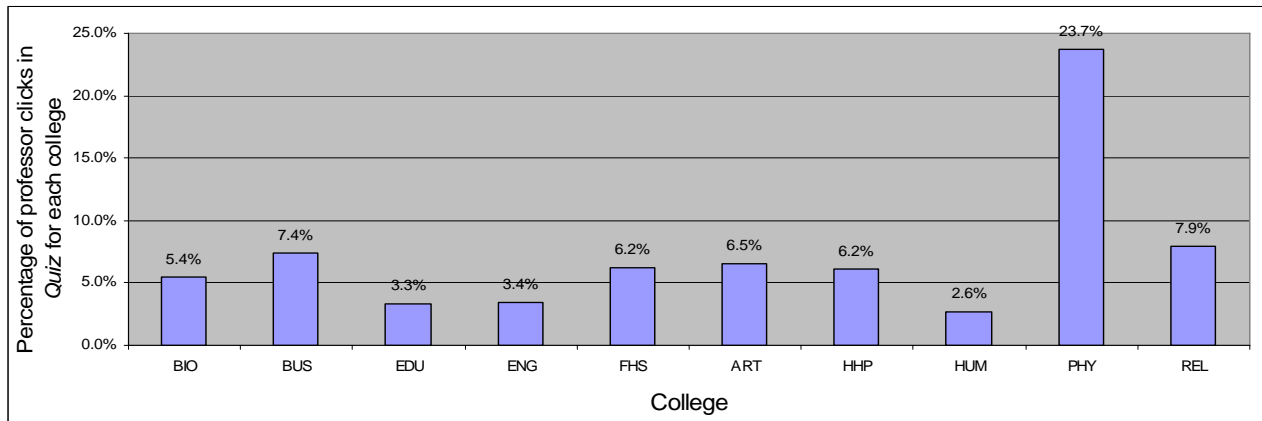


Figure 62. Percentage of Professor Clicks using the *Quiz* feature of Blackboard in each college.

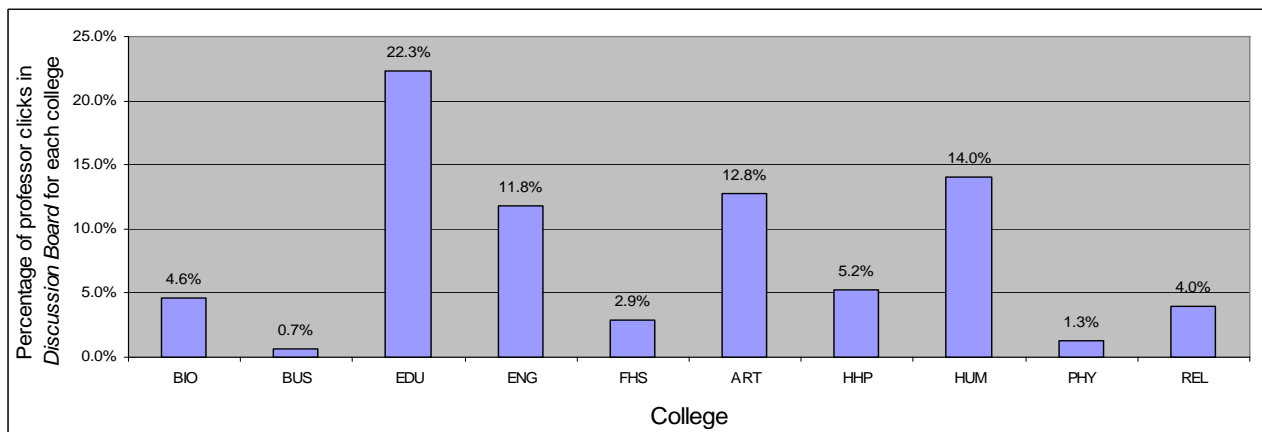


Figure 63. Percentage of Professor Clicks using the *Discussion Board* feature of Blackboard in each college.

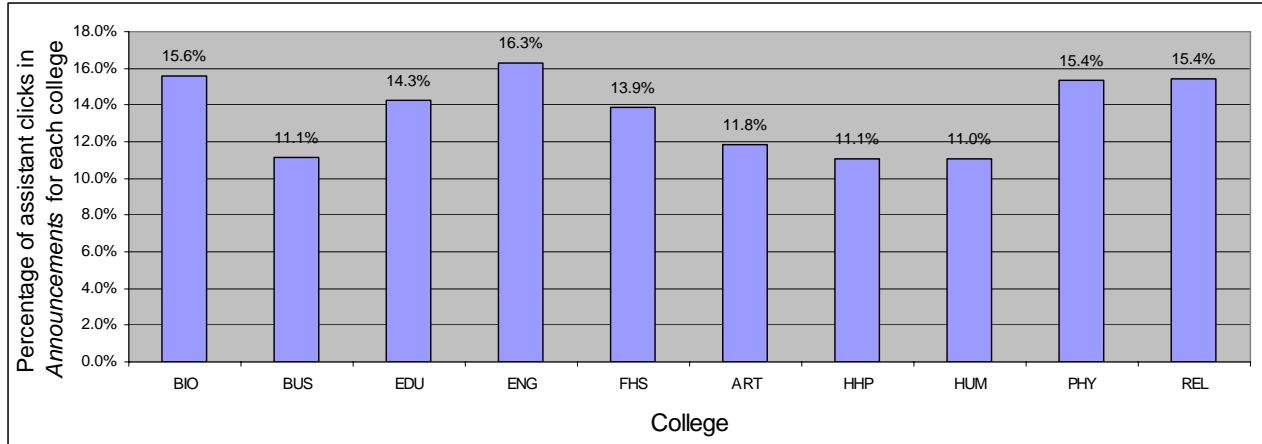


Figure 64. Percentage of Assistant Clicks using the *Announcements* feature of Blackboard in each college.

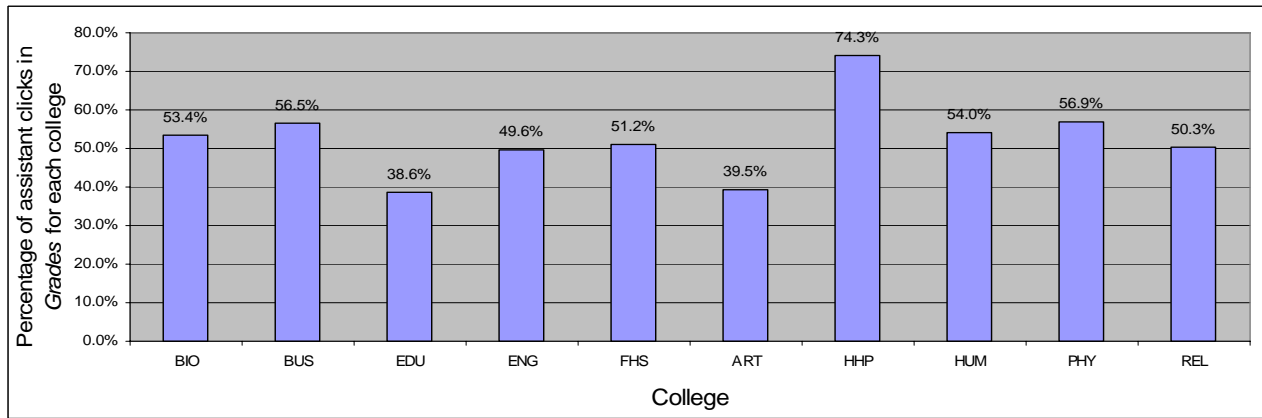


Figure 65. Percentage of Assistant Clicks using the *Grades* feature of Blackboard in each college.

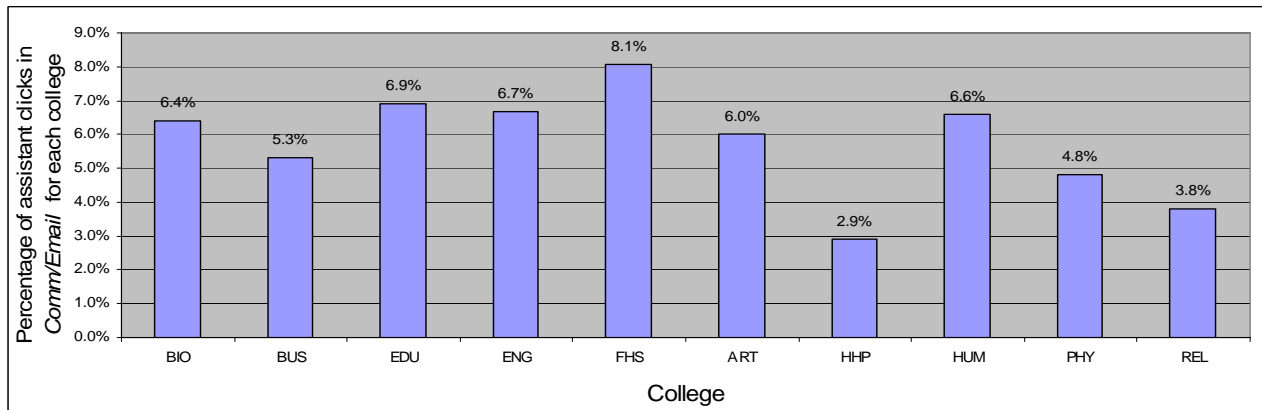


Figure 66. Percentage of Assistant Clicks using the *Comm/Email* feature of Blackboard in each college.

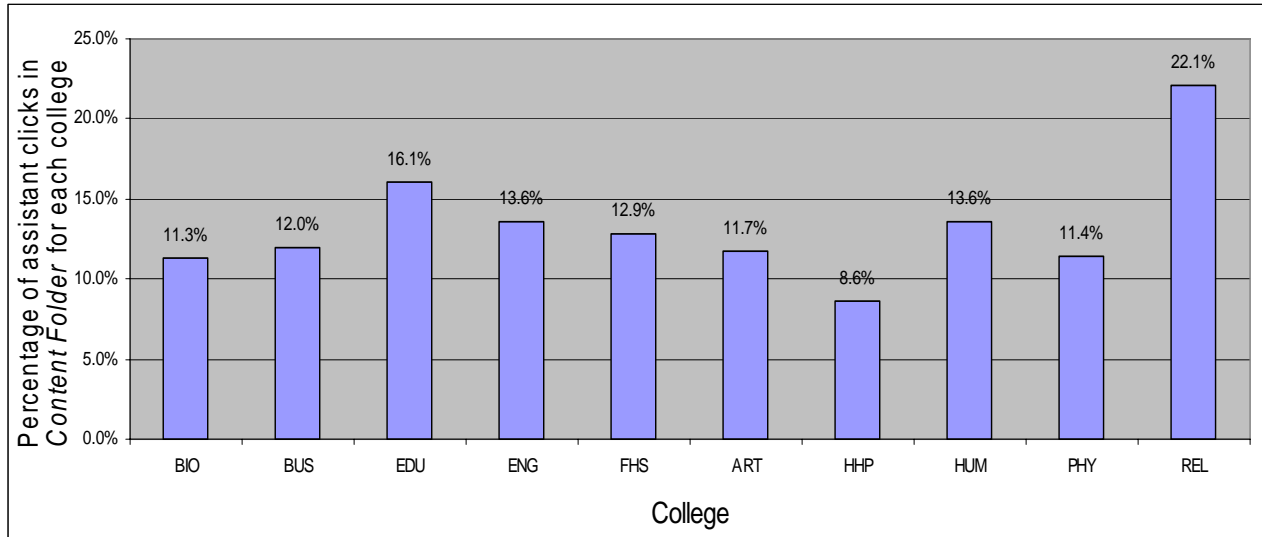


Figure 67. Percentage of Assistant Clicks using the *Content Folder* feature of Blackboard in each college.

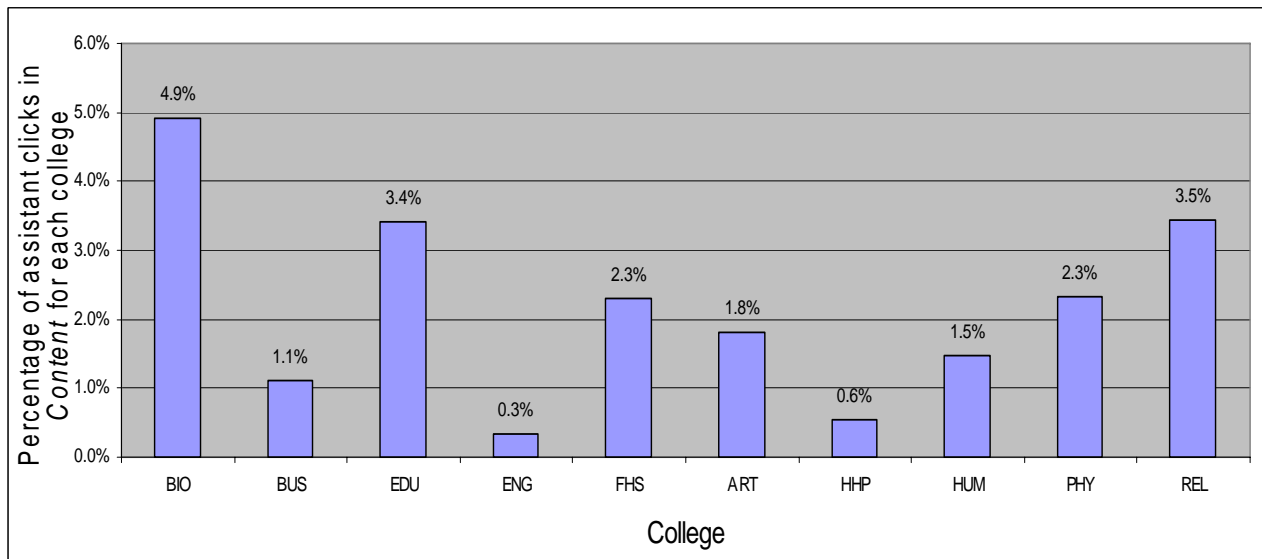


Figure 68. Percentage of Assistant Clicks using the *Content* feature of Blackboard in each college.

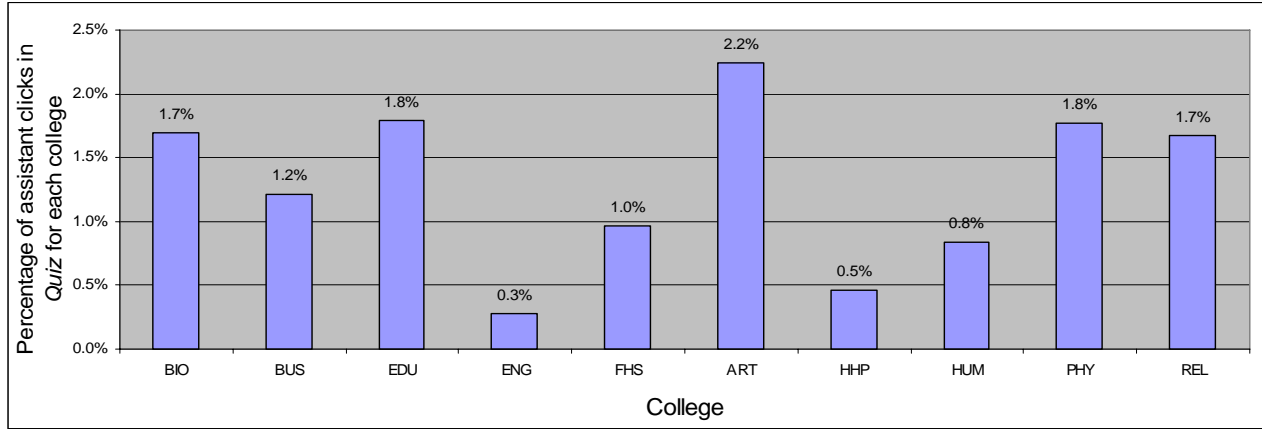


Figure 69. Percentage of Assistant Clicks using the *Quiz* feature of Blackboard in each college.

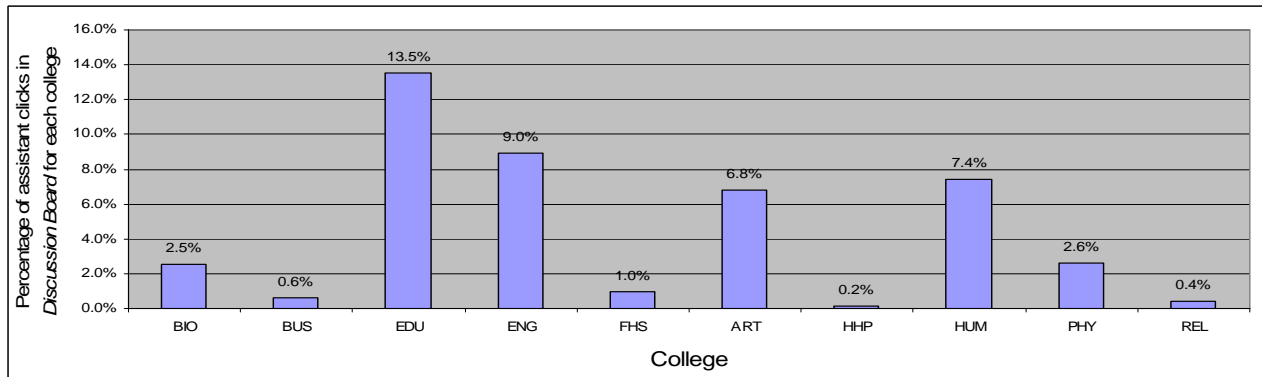


Figure 70. Percentage of Assistant Clicks using the *Discussion Board* feature of Blackboard in each college.

Comparison of College Level Activity for All Features

What is the activity level for each category of Blackboard features for the 2004-2005 academic year comparing all colleges for students, professors, and assistants?

Figures 71 to 73 show the data in summary form with a chart for Student Clicks, Professor Clicks, and Assistant Clicks that show the percentage usage of all features for each college. This data is a repeat of the data in the previous section with all colleges shown together for a cross college comparison. Again, these figures show the highly variable activity levels in the pedagogical features of *Quiz*, *Discussion Board*, and *Content* across all colleges.

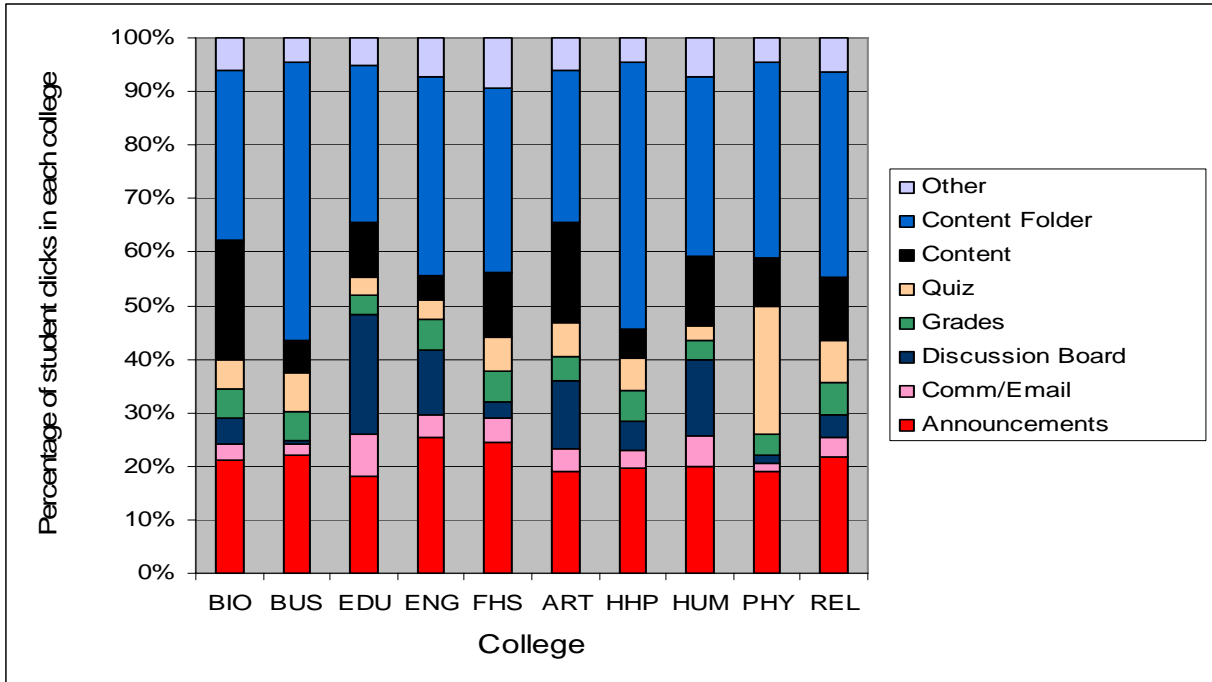


Figure 71. Percentage of Student Clicks for each feature in each college.

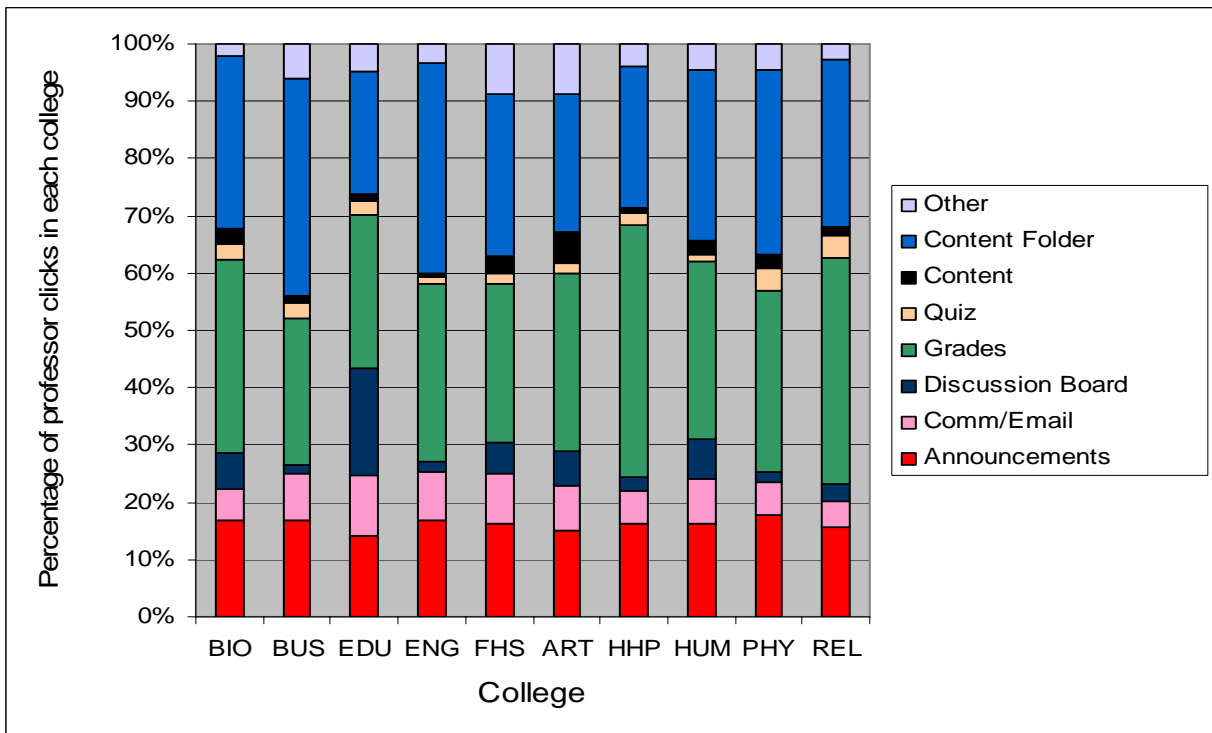


Figure 72. Percentage of Professor Clicks for each feature in each college.

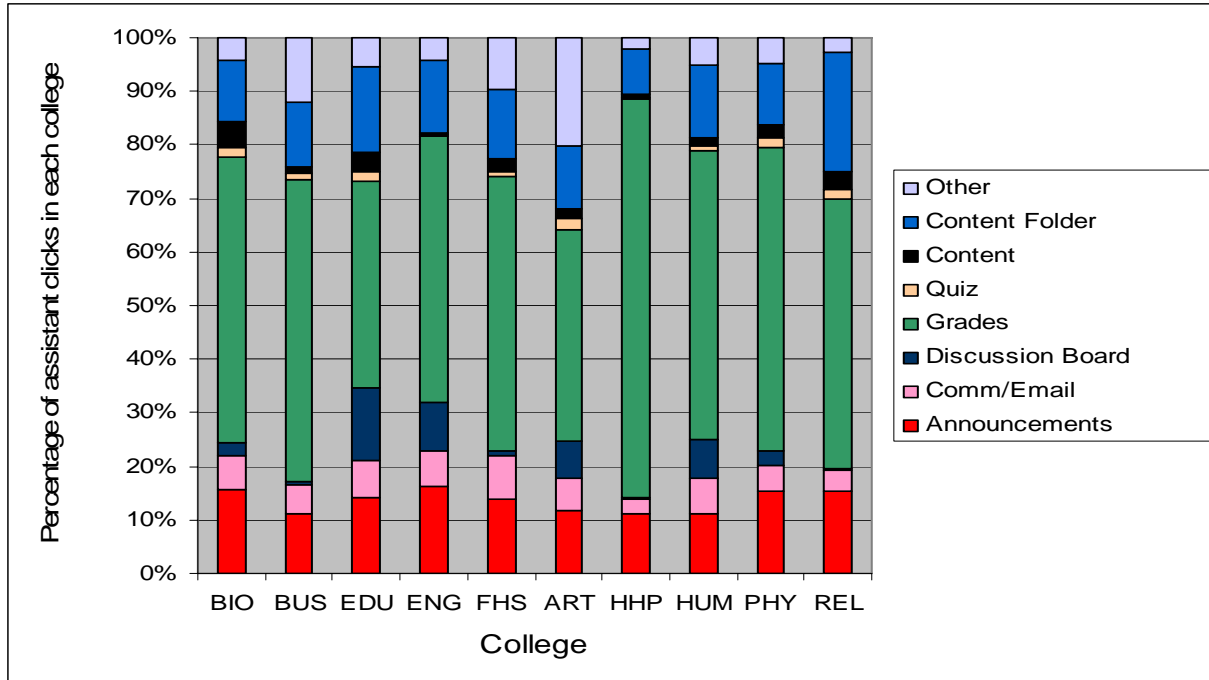


Figure 73. Percentage of Assistant Clicks for each feature in each college.

Pedagogical Usage versus Administrative Usage

What percentage of clicks constitutes administrative activity versus pedagogical activity for students, professors, and assistants?

Although it is impossible to know how features are used by professors without a detailed analysis of each course-section, for a general analysis clicks have been categorized as administrative, pedagogical, and comm/email. Directly pedagogical usage for this study is defined as activity in the following categories: *Discussion Board, Group Collaboration, Quiz, Content*. Administrative usage is currently defined as the following Blackboard categories: *Announcements, Dropbox, Grades, Course Roster, Course Tools, Staff Info*. *Comm/Email* is separated because emails and communication could be administrative or pedagogical. Clicks in *Content Folder* have been omitted from this analysis as they mostly represent navigation clicks on folders. *Content Folder* also includes posting of content by an instructor, but these clicks cannot be distinguished

from the navigation clicks. The navigation *Content Folder* clicks that are not included in this analysis represent 39% of all Student Clicks, 30% of all Professor Clicks, and 13% of all Assistant Clicks.

Figure 74 shows that students perform more clicks in administrative tasks than in pedagogical tasks according to the definitions of administrative and pedagogical clicks in this study. Figure 75 shows that professors perform several times more clicks in administrative tasks than in pedagogical tasks according to the definitions of administrative and pedagogical clicks. Figure 76 shows that 81% of Assistant Clicks were in administrative tasks according to the definitions of administrative and pedagogical clicks in this study.

Conclusions about pedagogical versus administrative activity are hard to make as we really cannot know what activity is purely administrative and what activity is purely pedagogical. Even the definition of administrative and pedagogical activity is subjective and open to interpretation. At best, this data is encouraging in that it shows that around half of all student activity is in features most people agree to be pedagogical in nature.

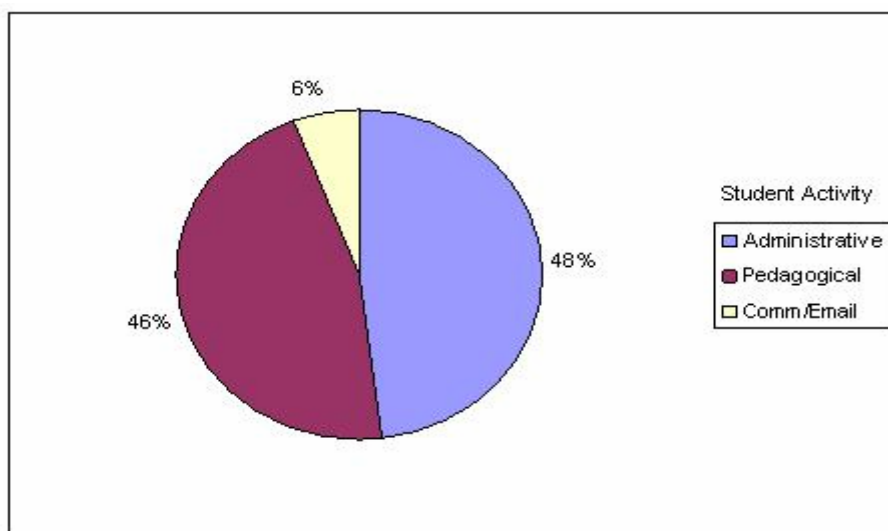


Figure 74. Student activity categorized by administrative, pedagogical, and comm/email clicks.

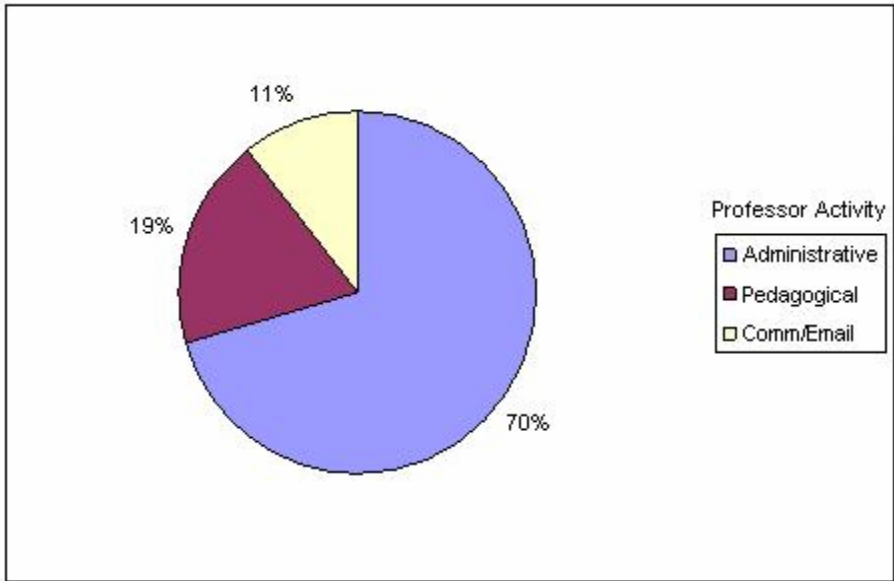


Figure 75. Professor activity categorized by administrative, pedagogical, and comm/email clicks

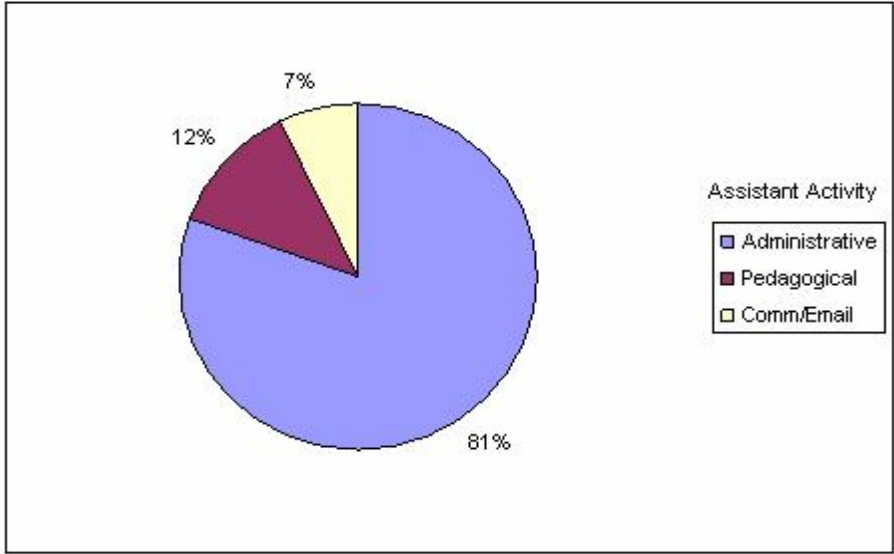


Figure 76. Assistant activity categorized by administrative, pedagogical, and comm/email clicks

Timing of Activity

What is activity level over time in each semester and term of the 2005/2005 academic year?

Figures 77 to 82 show the overall patterns of Blackboard activity per day in the 2004-2005 academic year. Figure 77 is the view of the whole academic year and shows expected levels of activity for all semesters and terms with an upturn in activity at the end of the summer term that represents preparation for the next fall semester. Figure 82 shows a two-month period of activity which clearly shows daily activity and this daily view shows that activity, which is highest on Mondays, gradually decreases over the week and decreases to low levels on the weekend. Figure 78 appears to show a gradual decrease in activity over the fall 2004 semester, which then picks up at the end of the semester as finals approach. Figure 79 shows a low pattern of clicks for a period at the beginning of the winter 2005 semester for which this study has no explanation. After this low period, activity in the winter 2005 semester follows the same pattern as fall 2004 activity. Spring and summer 2005 activity as shown in Figures 80 and 81 is low as expected.

The general downward trend in Blackboard activity over the course of a semester is an interesting facet shown by this data. It may be that professors use Blackboard in such a way that the requirements on students start heavily and gradually reduce over time. It could also be that this trend is indicative of general student behaviors over the course of a semester which may correspond with a gradual reduction of enthusiasm for studying and homework over time. Activity levels over time should be broken out by feature categories so that it can be seen whether activity levels in all features diminish over the course of a semester, or whether some decrease while others increase. The results of such a study will help further the understanding of how to use features at different times in a semester to compensate for the natural tendencies and strategies of students over time.

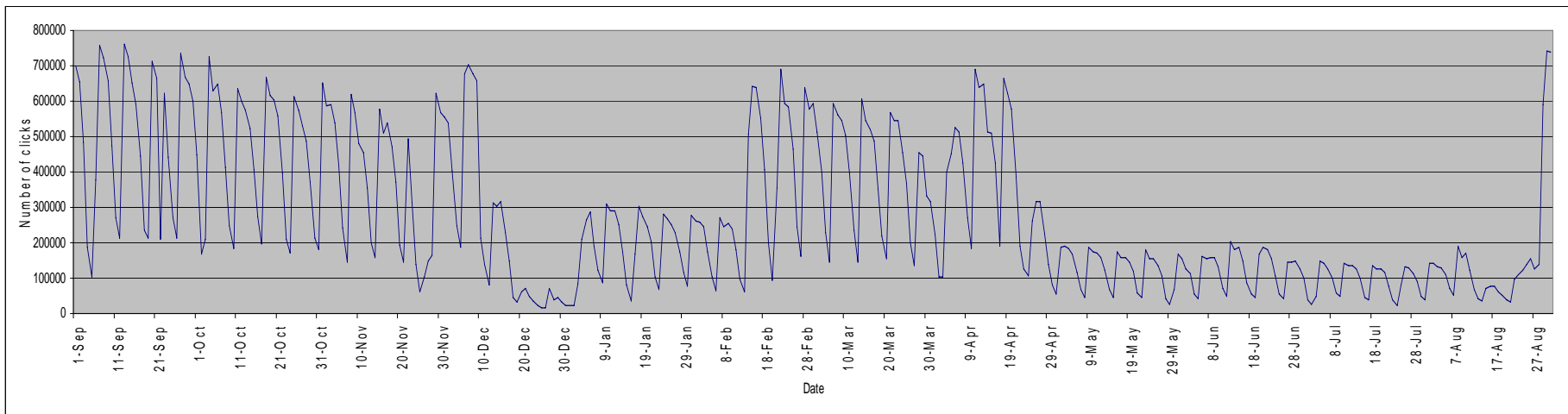


Figure 77. 2004-2005 Blackboard activity over time.

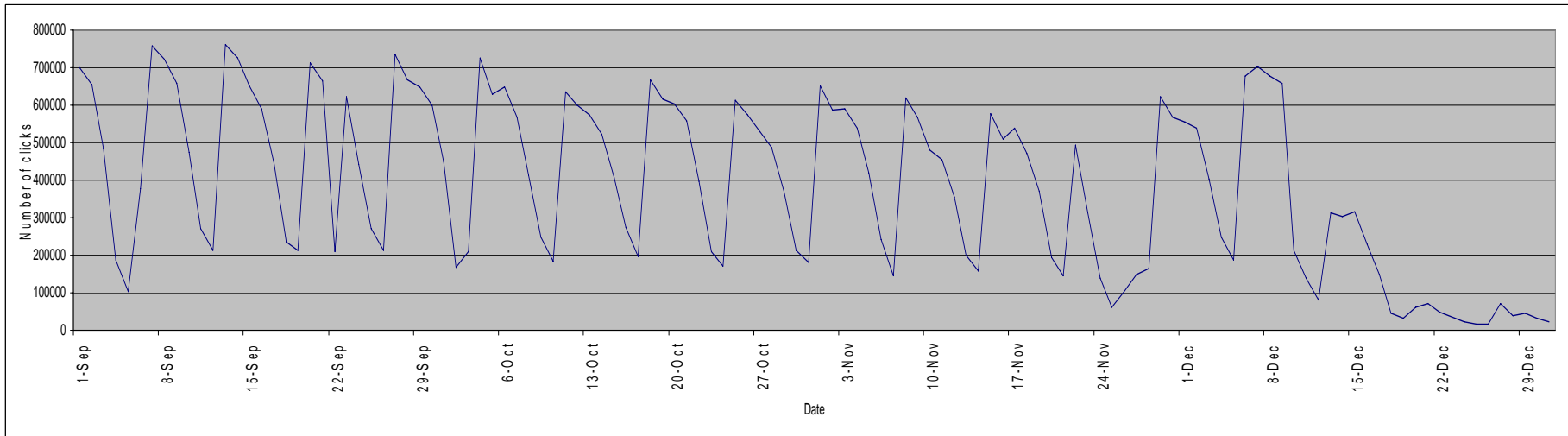


Figure 78. Fall 2004 Blackboard activity over time.

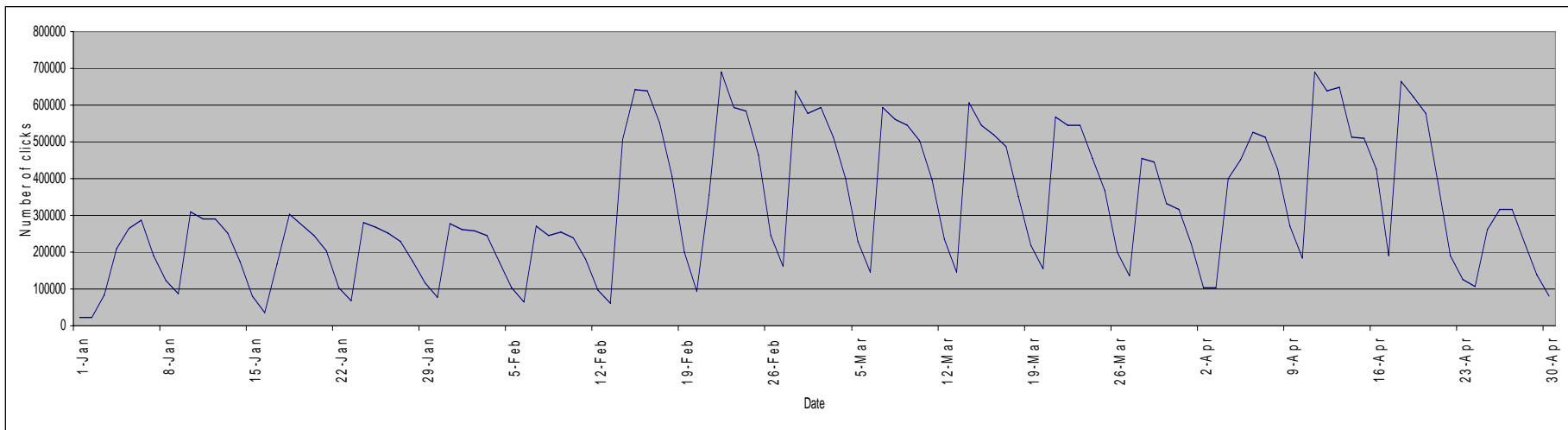


Figure 79. Winter 2005 Blackboard activity over time.

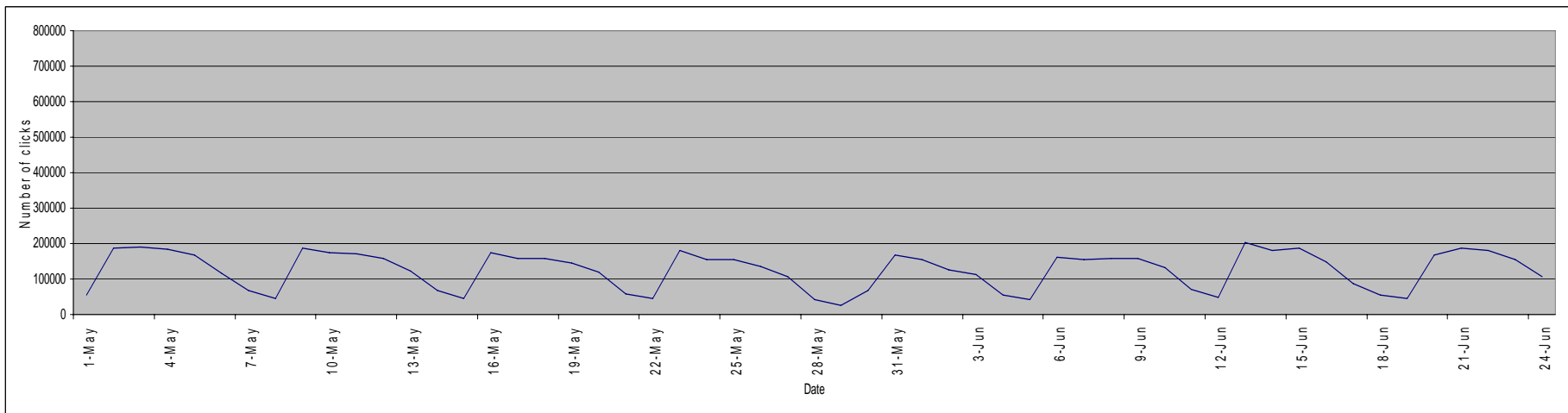


Figure 80. Spring 2005 Blackboard activity over time.

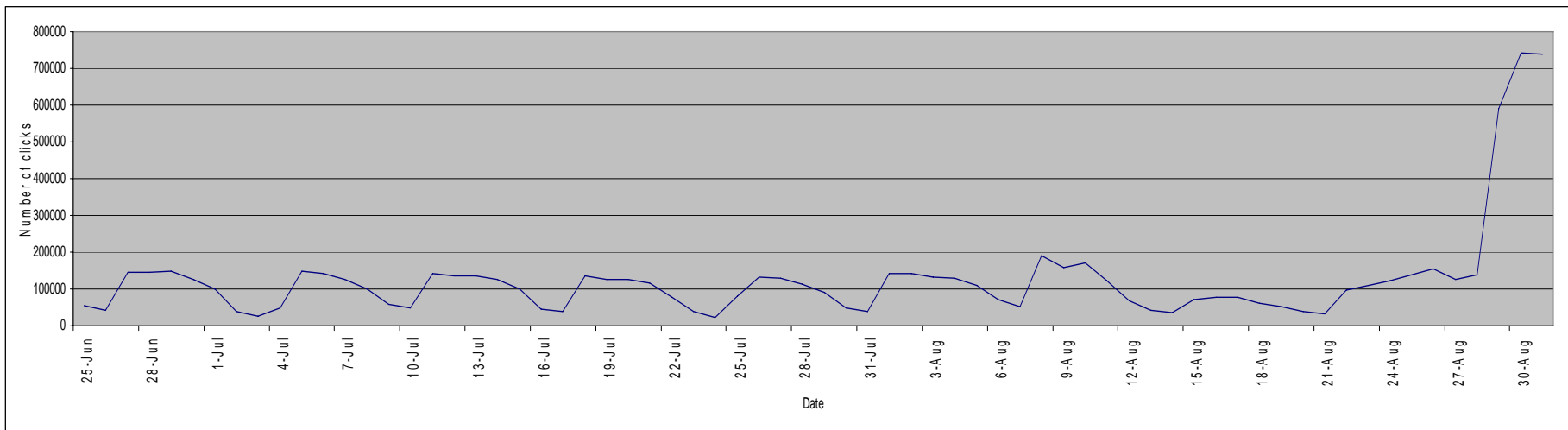


Figure 81. Summer 2005 Blackboard activity over time.

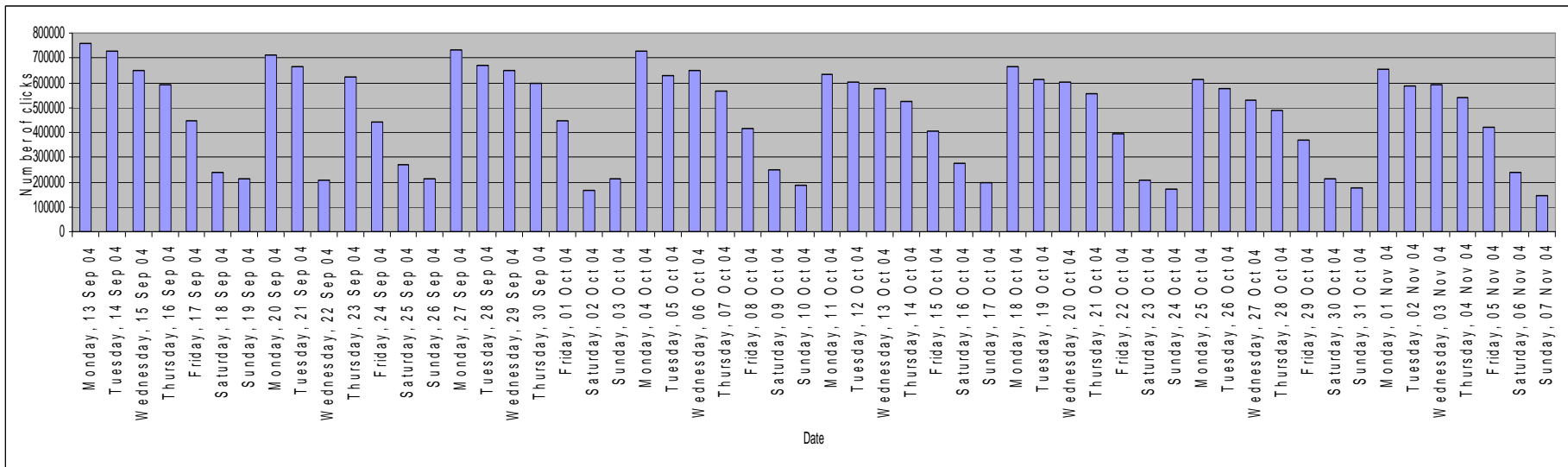


Figure 82. Two month view of timing of Blackboard activity showing weekly patterns of overall activity.

Activity in Different Class Sizes

What is the average activity of students, professors, and assistants in different class sizes?

For this study, class sizes have been summarized by being grouped by rounding to the nearest 10. Class sizes that rounded to zero were changed to 5 as there is no such thing as a class size of zero. Charts show class size groups to 300 as this represents over 98% of all course-sections and including all class size groups including the extreme outliers results in the charts being difficult to interpret.

The data shown on Figure 83 implies that on average, Student Clicks increase as class size increases. However, the average clicks for class size groups of 150 -190 appear to not fit that model. It may be a logical assumption that as the number of students increases, the reliance on technology increases as it becomes more difficult for a professor to interact with every student in a traditional manner. It may also be the case that a CMS such as Blackboard facilitates having larger classes.

The data shown on Figure 84 shows that on average, Professor Clicks increase as class size increases until class size reaches somewhere around 100, then the pattern is variable to the point that it makes interpretation difficult. This may be due to the fact that there were less course-sections to analyze as the class size increases. The interesting factor shown in Figure 84 is that the average Professor Clicks does not increase at the same rate as number of students in the course-section. For the class size group of 10, the average Professor Clicks is around 150, but for a class size group of 100 the average Professor Clicks is a little over 300. This needs a detailed study to be understood as there may be many factors that impact this data. For example, it is logical that for some features such as posting

Content and Announcements, class size makes no difference, but for others such as *Grades*, *Email/Comm*, and *Discussion Board*, they are likely to increase as number of students increases. At least up to a point, this data does imply that as number of students in a course-section increases that a professor must do more work in Blackboard.

The data shown on Figure 85 shows that on average, Assistant Clicks increase as class size increases. The dip in average Student Clicks in the class size group range of 150-190 is interesting and may warrant a deeper study as it follows a similar dip as is observed for average student and Professor Clicks. Apart from the dip, Figure 85 shows that the work that assistants do in Blackboard increases as the class size increases.

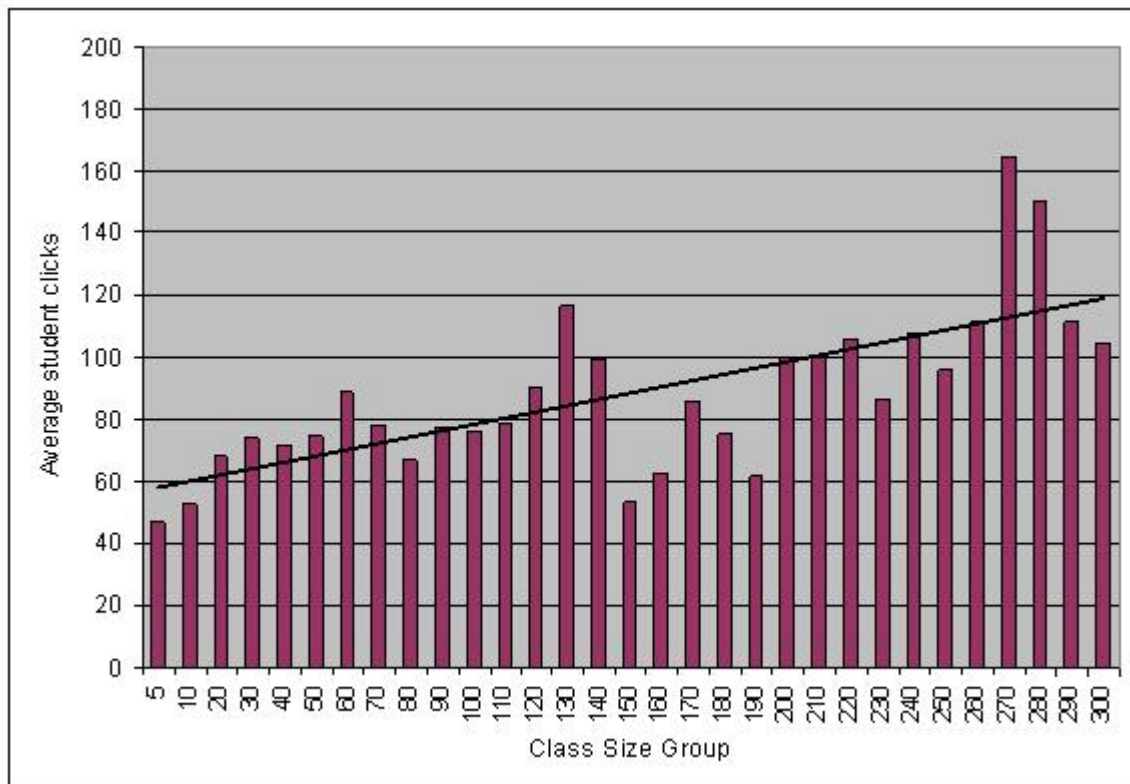


Figure 83. Average Student Clicks in different class size groups with trend line, up to class size of 300 which represents 98% of all course-sections.

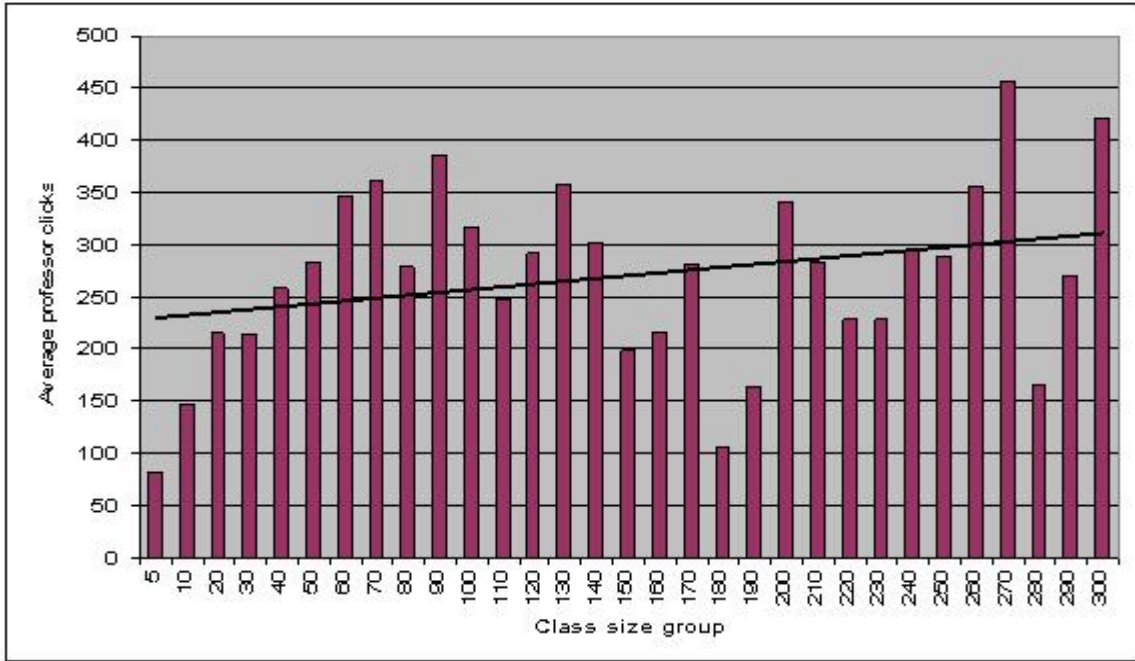


Figure 84. Average Professor Clicks in different class size groups with trend line, up to class size of 300 which represents 98% of all course-sections.

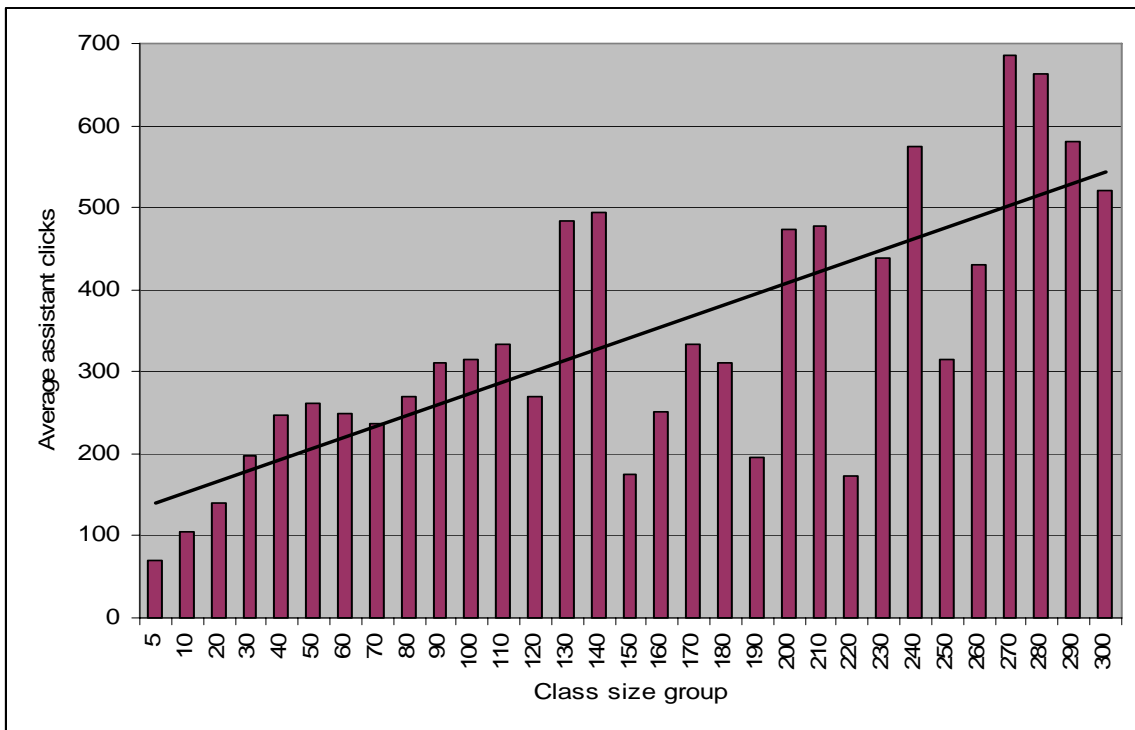


Figure 85. Average Assistant Clicks in different class size groups with trend line, up to class size of 300 which represents 98% of all course-sections.

Blackboard Feature Use by Class Size

What is the difference in feature usage of students, professors, and assistants in different class sizes?

Only class size groups up to 200 are shown as they represent over 90% of classes and the charts are difficult to read with more categories. Student usage of some of the administrative features such as *Announcements*, *Grades*, and *Comm/Email* does not appear to be correlated with class size. However, student usage of some of the pedagogical features such as *Quiz* and *Discussion Board* does seem to be correlated. Figure 86 shows that there is trend that usage of the *Quiz* feature increases as class size increases, and the use of the *Discussion Board* feature decreases as class size increases. Figure 87 shows that feature usage by professors does not seem to be related to class size. Figure 88 shows an increase in the percentage of Assistant Clicks that were performed in *Grades* as class size increases, but that all of the other features do not appear to show any obvious patterns correlating with class size except for the interesting pattern in very small class sizes (1–5 students which is the class size group 5).

Apart from a few exceptions, this section of data shows that for all features in all user categories, class size has no significant impact on the level of activity in different features. The exceptions of student activity levels in *Quiz* and *Discussion Board*, and assistant activity in *Grades* are not particularly surprising. Communicating with all students through the *Discussion Board* will obviously become more difficult and less attractive as an option to professors as the number of students increases. The effort required to create a quiz, especially one that is automatically graded, stays constant irrespective of the number of the students in the class, and this feature therefore becomes more attractive as an educational tool

as class size increases. Assistants are most used to enter grades, and therefore as class size increases the effort required to enter grades increases, and their capacity to spend time using other features decreases.

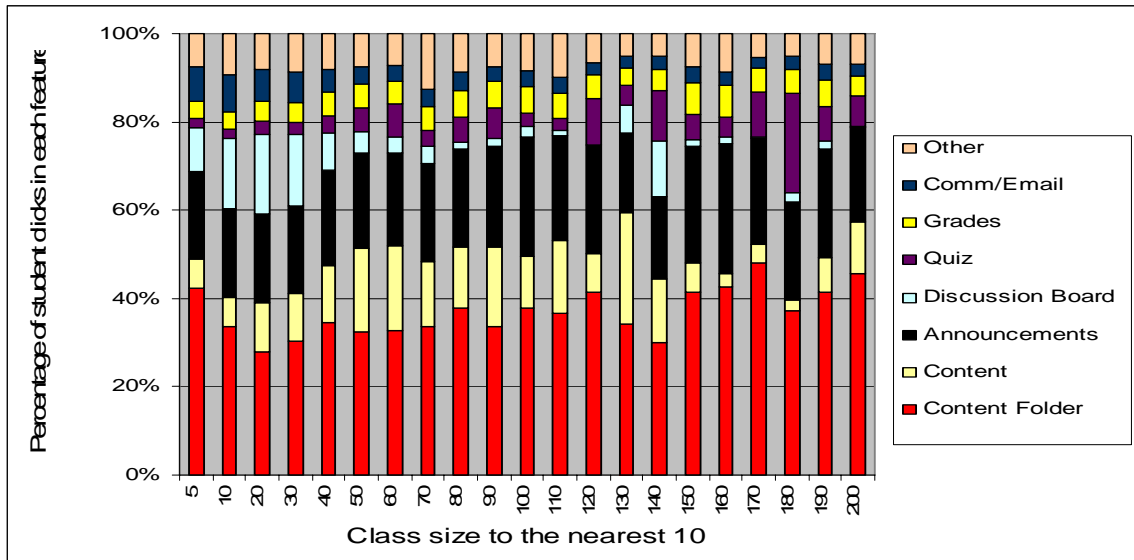


Figure 86. Percentage of Student Clicks in different features of Blackboard in different class size groups up to class size of 200 which represents 96% of all course-sections.

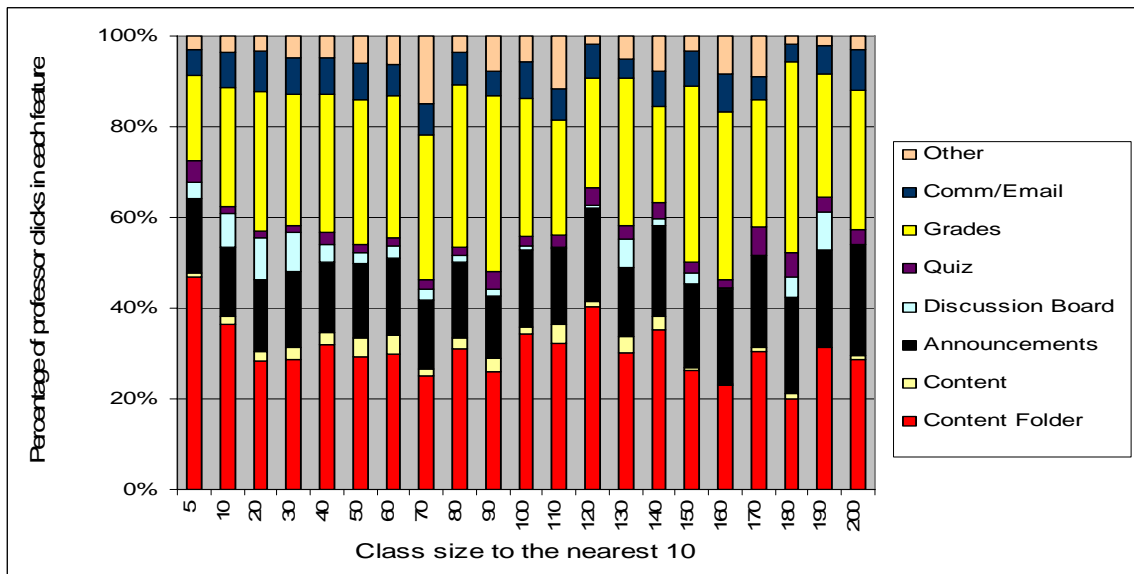


Figure 87. Percentage of Professor Clicks in different features of Blackboard in different class size groups up to class size of 200 which represents 96% of all course-sections.

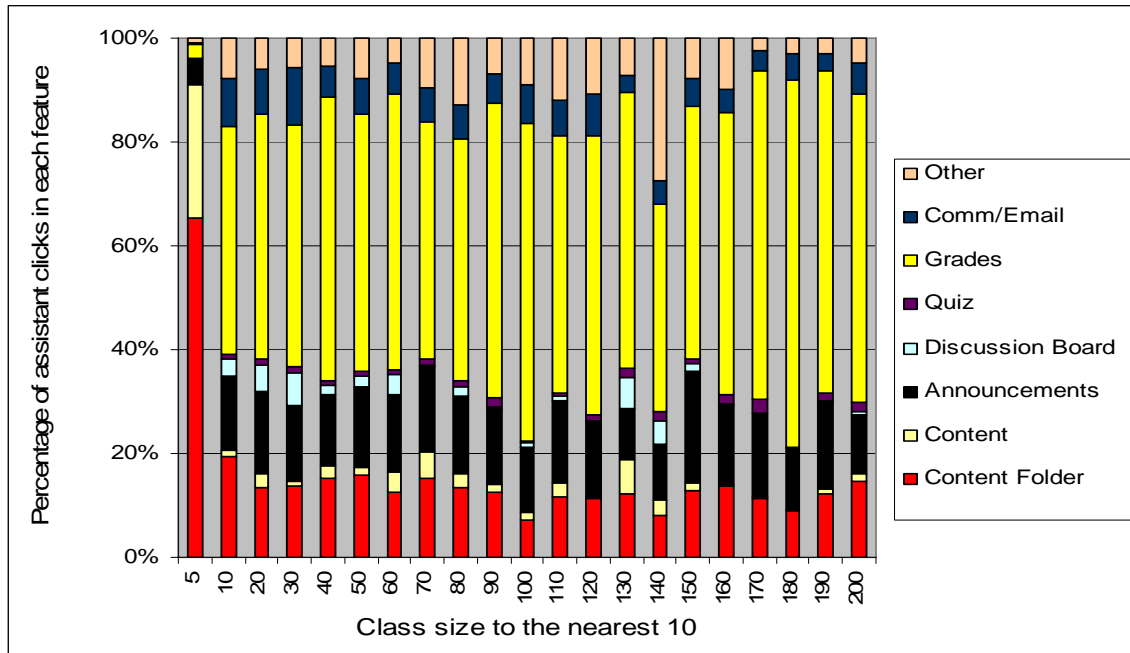


Figure 88. Percentage of Assistant Clicks in different features of Blackboard in different class size groups up to class size of 200 which represents 96% of all course-sections.

Ratio of Instructor Activity to Student Activity

What is the ratio of instructor to student activity shown by different class sizes?

The ratio of instructor to student activity is described as total professor and Assistant Clicks divided by Student Clicks in each class. This is designed to give a general idea of the energy that is put into using Blackboard per student. Figure 89 shows that the ratio for most course-sections is under 20 but there were some with exceptionally high ratios that need to be studied separately to understand the educational effect of such a high instructor activity level compared to student activity. Figure 89 appears to show a gradual upward trend in instructor to student activity ratio as class size increases. Figure 90 shows the increasing trend in more clarity than in Figure 89. As was shown for average student, professor, and Assistant Clicks, there is a steady increase until class size reached 100, and after that point the results are not so uniform. There is some seemingly interesting facet of Blackboard activity in course-

sections with more than 100 students that could be the subject of a further more detailed study. Figure 91 shows that course-sections with large student numbers have a variable pattern of instructor to student activity ratio that does not appear to correlate with class size.

From all the data in this study regarding class size, it seems that class size has some kind of formulaic impact on Blackboard activity up to a certain class size, but after a certain class size it appears that there may be something different about how Blackboard is used that makes number of students have less of an impact. In this study, there were much fewer course-sections that have very large class sizes and it therefore possible that the conclusions made about large class sizes and instructor to student energy ratios are due to a lack of sample data. Nevertheless, further studies should be conducted to understand how large classes use Blackboard to create efficiencies in education that some useful elements of which could be transferred though training and development to smaller classes.

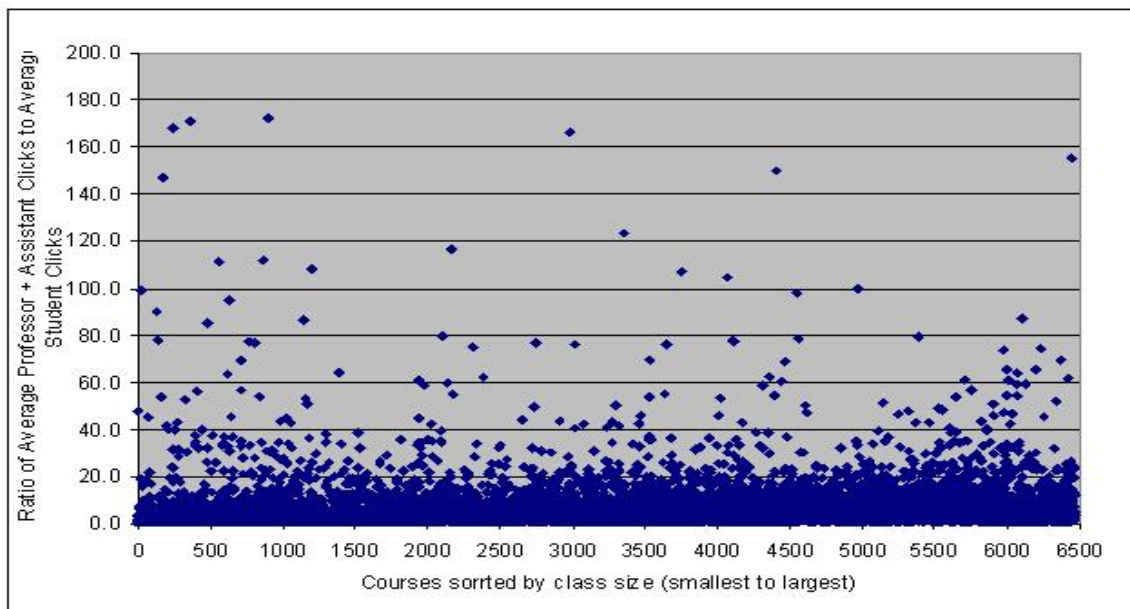


Figure 89. Scatter chart of all course-sections and their instructor to student activity ratio. Course-sections are sorted in order of class size.

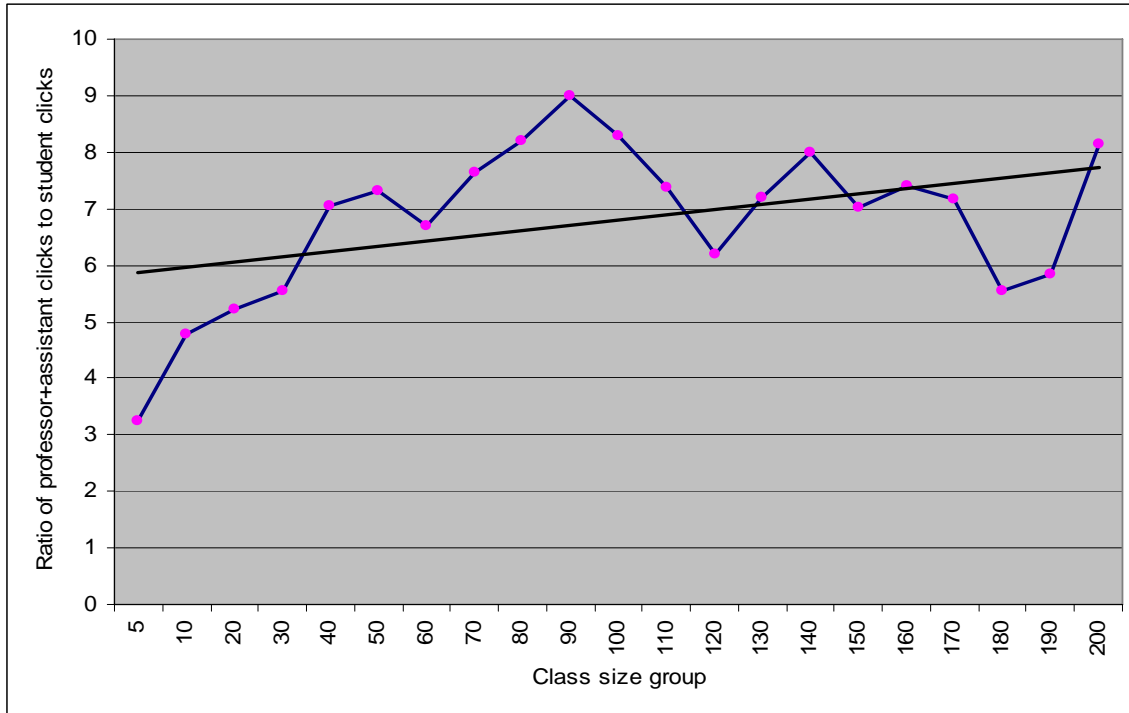


Figure 90. Line chart showing instructor to student activity ratio by class size group with trend line, up to class size of 200 which represents 96% of all course-sections.

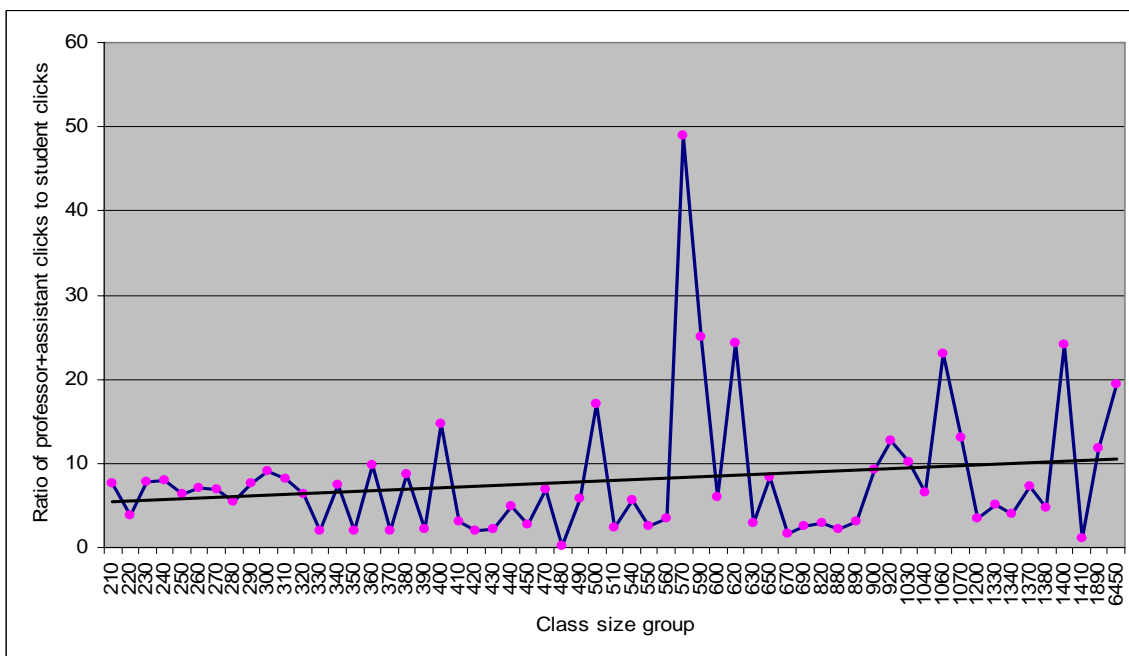


Figure 91. Line chart showing instructor to student activity ratio by class size groups over 200 which represents 4% of all course-sections.

Discussion

The results of this study have shown several interesting patterns of Blackboard activity. Each of these patterns will require an in depth study to be able to move towards an understanding of any implications to the overall education process. This section of the study summarizes some of the most interesting patterns and offers suggestions of areas that require further study. The different points of discussion resulting from interesting patterns of activity are likely to be of interest to different groups such as educators and administrators. It would be fair to state that many of the results were surprising and unexpected. The many unexpected patterns are an indicator that much of how a CMS such as Blackboard is used or could be used most effectively is not very well understood and this may have substantial implications for the kind of development and training that should be used to create the highest levels of positive educational benefits through the use of CMS.

Overall Activity

Of approximately 11,809 course-sections that could potentially use Blackboard, this study showed that there were 6,467 course-sections in the 2004-2005 academic year that had at least some student activity. In percentage terms, 55% of BYU course-sections used Blackboard to some extent in 2004-2005. Due to the lack of research covering campus-wide CMS activity, there is no standard set for usage levels of a CMS, but it is reasonable to suggest that 55% or a little over one half of course-sections is a fairly high level of course-sections that use Blackboard. This may indicate that BYU has a high level of use of this technology across the whole campus.

This conclusion is to some extent backed up by data from 2006 given by Blackboard ASP, Blackboard's hosting division, to Jon Mott, Director of the Center for Instructional

Design at BYU, which shows that BYU is one of the top 5 users of Blackboard (personal communication, April 27, 2007) which is shown on Figure 93 in Appendix A. The reasonably high level of usage of the Blackboard CMS may also be a general indicator of the overall level of technology implementation by professors at BYU.

Student, Professor, and Assistant Activity Levels

Of the 6,467 course-sections that used Blackboard, a total of 36,080,401 clicks were performed in the Blackboard system with an average of 91 clicks per user per course-section. Students performed 32,333,570 clicks with an average of 85 clicks per student per course-section. Professors performed 2,060,153 clicks with an average of 239 clicks per professor per course-section. Assistants performed 1,686,678 with an average of 257 clicks per assistant per course-section. The average of 85 clicks per student per course-section is difficult to put into any meaningful context without a more in depth study, and there is no research with which this result could be compared. There are approximately 15 weeks in a semester course which equates to 105 days from the first day of class to the last day of finals. This means that on average, a student performed less than one click per day in each course-section that used Blackboard, which does not seem to be a very high level of activity. However many course-sections had a very low use of Blackboard, and it might be argued that a very low use does not really constitute truly using the system at all. Therefore it is recommended that further and more in-depth research be performed to study the different levels of activity in Blackboard to see what different benefits students can obtain from course-sections with low average clicks and from course-sections with high average clicks.

High Levels of Student Activity

This study also revealed that there are a number of course-sections that had very high average student activity levels, for example 226 course-sections had average Student Clicks of more than 300, and 18 course-sections had average Student Clicks of more than 700. These course-sections are intriguing as to why students are spending so much effort in Blackboard and if that effort makes a significant difference to their educational experience. Research is needed to understand what makes these course-sections so different and to study the educational impact of high patterns of CMS activity.

Researching the patterns of usage and educational benefits that are gained from high usage in these classes has important implications. If it is found that the way Blackboard is used in these classes creates educational benefits for students, then this information could help shape professional development and the training of faculty in how to use Blackboard to help improve the educational experience of their students.

Between College Variance of Assistant Activity

This study showed that colleges have different patterns of activity. Student and professor activity varied between colleges, but the most variance occurred with assistant activity between colleges. Some colleges were shown to have almost all course-sections with no assistant activity (which means that there were no assistants in that course-section), and other colleges had assistant activity in almost all course-sections. Across all colleges, more than half of all course-sections had no assistant activity in Blackboard. The fact that certain colleges have a preference for using assistants while other colleges hardly use them at all is an interesting factor that could be the subject of further research.

It would be interesting to study whether high assistant activity in Blackboard has any impact on the quality or results of education in university courses.

The Most Used Features in Blackboard

The features of *Announcements, Content, Grades, Quiz, Discussion Board, and Comm/Email* constituted approximately 90% of all activity in Blackboard for the 2004-2005 academic year. The fact that the top six features account for 90% of all activity could lead to several possible conclusions and further questions. It could be that this shows that to be a successful product, a CMS only needs to incorporate these most used features. It could also be the case that some features that are not used to any substantial degree may in fact be useful, but have not yet been discovered by enough faculty members, or that training has not been given in these features, or that the feature could be useful but is too difficult to use. The many features that constitute 10% of all activity should be studied to see what potential for educational benefits exist in using these features, and what training could be given to professors for useful features that have not so far been discovered and used to any significant degree.

Administrative Versus Pedagogical Activity

Pedagogical usage for this study is defined as *Discussion Board, Group Collaboration, Quiz, Content*. Administrative usage is defined as the following Blackboard categories: *Announcements, Dropbox, Grades, Course Roster, Course Tools, Staff Info*. *Comm/Email* is separated as emails and communication could be administrative or pedagogical. Based on this categorization of administrative versus pedagogical activity, it was found that approximately 48% of all student activity was

administrative, approximately 70% of all professor activity was administrative, and approximately 81% of all assistant activity was administrative.

Roughly half of all student activity was pedagogical according to the definitions in this study. Although it is not easy to come to any firm conclusion as to the meaning of this result, data showing assessment (*Quiz*) usage levels for the top 5 users of Blackboard (personal communication, April 27, 2007) which is shown on Figure 93 in Appendix A, shows that BYU has by far the highest levels of activity for *Quiz* which is one of the pedagogical features noted in this study. It is therefore reasonable to suggest that in the context of a comparison with other high users of Blackboard, BYU has a high level of pedagogical usage by students.

Professors and assistants had a low level of activity of the pedagogical features of Blackboard. This may indicate that Blackboard is predominately used as an administrative tool that may help improve productivity rather than a pedagogical tool that impacts the nature or quality of education. However, it is difficult to make any firm conclusions for several reasons. Firstly, apart from features such as *Grades* and *Quiz* that have a distinct type of use, it is impossible to fully conclude that the some features are being used in administrative or pedagogical ways as they could be used for either. Even the meaning of the terms administrative and pedagogical activity is subjective and open to debate. Also, it may be the case that using Blackboard for administrative purposes helps to give professors more time to spend on pedagogical concerns. If this is true, then Blackboard is a tool that can be used to indirectly help to improve the quality of education. Further research is recommended to study course-sections that heavily use Blackboard for administrative purposes to study how the time that is made available to a

professor through the administrative use of Blackboard is used in those course-sections. It is also recommended that features of Blackboard that are not used to any significant degree be studied to ascertain whether there are features that could be highly beneficial to student education so that training and development can be adjusted to incorporate these features.

Blackboard Feature Usage Variance in Different Colleges

Another interesting pattern of activity relating to features was found when comparing the activity level in different features across different colleges. Features that were categorized as administrative features in this study had fairly comparable levels of activity in all colleges which suggests that there is a typical way of using those features that may not vary significantly between colleges. However, there was found to be a large variance of levels of activity between colleges for the features that were categorized as pedagogical.

It would seem that colleges have favorite educational methods that equate to certain features of Blackboard. Some colleges heavily use the *Discussion Board*, some colleges heavily use *Quiz*, and others heavily use *Content*. It may be that colleges have adapted teaching methods over time that have now translated into the way that they use Blackboard, or it may be the case that the colleges have evolved these methods through their use of Blackboard since it was implemented. Different instructional philosophies or strategies in colleges appear to be suggested by the data from Blackboard. Further research is recommended to study the relationship between activity levels of pedagogical features and the teaching methods that prevail in different colleges.

Blackboard Feature Usage Variance in Different Class Size Ranges

In a similar fashion to the study of levels of activity of features in different colleges, the results of the study of levels of activity of features in different class sizes showed a similar trend. The levels of activity for administrative features remained fairly constant in different class size ranges, but the levels of activity in *Quiz* and *Discussion Board* varied with class size. For *Quiz*, the proportional level of activity compared with the other features generally increased as class size increased, and for *Discussion Board* the proportional level of activity compared with the other features generally decreased as class size increased. This may be because the effort required for an instructor to communicate with students through the discussion board becomes too great when there are many students, but the effort required to administer a quiz through Blackboard remains constant for any number of students. Therefore a quiz in Blackboard becomes a more attractive and economical option to an instructor the greater the class size.

Instructor to Student Activity Ratio Variance in Different Class Size Ranges

Class size also showed an interesting pattern when it was used to study instructor to student activity ratio data. A sharp increase in the instructor to student activity ratio was observed up to a certain class size of approximately 90 (see Figures 83-90). Beyond the class size of 90, there was no longer an obvious rising pattern of the instructor to student activity ratio. A similar pattern was observed in the results of the analysis of average clicks in different class size ranges. For students, there is a sharp and steady rise in average clicks up to the same class size of approximately 90. After this point average activity does not show a steady pattern of any kind, although there is still a slight upward trend. For professor and assistant average clicks, there was also an upward trend as class

size increased, but there was still a point in class size around 90 where the pattern of activity changes from an obvious upward pattern. There is something interesting about the relationship between class size and both overall average activity levels and activity levels analyzed by feature type. From the results shown in this study it seems that there is a strong link between average activity levels and class size until the class size surpasses 90 or so. With classes that are larger than 90 the pattern changes and it would seem that there is something different about the nature of these large classes that needs to be studied separately to be understood and further research is recommended into the levels of average activity and feature activity in larger classes.

The Timing of Blackboard Activity

The analysis of the timing of Blackboard activity in this study revealed some interesting patterns. Firstly, the results reveal that the highest activity levels occur at the beginning of a semester and decline gradually over the semester before rising again as finals approach towards the end of a semester. Analyzed on a daily level, it was found that over a week, activity is highest on Monday and then activity declines gradually to Thursday and then there is a slightly larger level of decline on Friday and the activity then drops to its lowest levels on Saturday and Sunday. Sunday usually has lower activity levels than Saturday, but not always.

The general downward trend in Blackboard activity over the course of a semester is an interesting facet shown by this data. It may be that professors use Blackboard in such a way that the requirements on students start heavily and gradually reduce over time. It could also be that this trend is indicative of general student behaviors over the course of a semester which may correspond with a gradual reduction of enthusiasm for studying and homework

over time. Activity levels over time should be broken out by feature categories so that it can be seen whether activity levels in all features diminish over the course of a semester, or whether some decrease while others increase. The results of such a study will help further the understanding of how to use features at different times in a semester to compensate for the natural tendencies and strategies of students over time.

Conclusion

There are many more ways of analyzing the Blackboard data than was possible to include in this study and other questions of merit could be investigated with the same dataset. The research questions posed in this study have been analyzed and discussed but detailed conclusions can not be made at this high level of analysis and discussion. The patterns summarized in this study are interesting in different ways to different stakeholders and give a certain level of information from an overview perspective that can be used for high level discussion purposes, for future research recommendations, and as a baseline set of statistics that can be used to compare against future studies of this nature.

Future research that is based on patterns that are discussed in this study should be conducted at a more detailed level where student level data are available rather than course-section level data. Research of data at student level is recommended so that variances and standard deviations within course-sections can be analyzed and detailed patterns of student activity can lead to a greater understanding of student learning strategies and habits. This level of research will produce a detailed set of results that could potentially lead to the shaping of the use of Blackboard and other course management systems to maximize the educational benefits to students.

References

- Beatty, B., & Ulasewicz, C. (2006). Faculty Perspectives on Moving from Blackboard to the Moodle Learning Management System. *Linking Research & Practice to Improve Learning, TechTrends*, 50(4).
- Bell, W., & Bell, M. (2005). It's installed ... now get on with it! Looking beyond the software to the cultural change. *British Journal of Educational Technology*, 36(4), 643-656.
- Blackboard Learning Systems Manual. (2004.). Retrieved April 9, 2007, from http://library.blackboard.com/docs/r6/6_1/instructor/bbls_r6_1_instructor/
- Bonds-Raacke, J. M. (2006). Students' Attitudes Toward the Introduction of a Course Website. *Journal of Instructional Psychology*, 33(4).
- Bryans-Bongey, S., Cizadlo, G., & Kalnbach, L. (2005). Using a course management system (CMS) to meet the challenges of large lecture classes. *Campus-Wide Information Systems*, 22(5).
- Carmean, C. (2002). Mind over matter: transforming course management systems into effective learning environments. *Educause Review*, 37(6), 26-34.
- Cartwright, A. (2000). Blackboard experience of a chemistry teacher. *Journal of Chemical Education*, 77(6).
- Conn, C., & Roberts, S. (2004). *Conducting a Qualitative Return on Investment: Determining Whether to Migrate to Blackboard[TM]*. Association for Educational Communications and Technology.
- Daniels, W., Davis, B., & Servonsky, E. (2005). Evaluation of Blackboard as a Platform for Distance Education Delivery. *ABNF Journal*, 16(6), 132-135.
- Green, K. C. (2001). Campus Computing Project. Retrieved April 9, 2007, from <http://www.campuscomputing.net>
- Jones, G. H. (2005). A Comparison of Teacher and Student Attitudes Concerning Use and Effectiveness of Web-based Course Management Software. *Journal of Educational Technology & Society*, 8(2), 125-35.
- Klecker, B. M. (2002). *Evaluation of Electronic Blackboard Enhancement of a Graduate Course in School Counseling*. Paper presented at the conference for the Mid-South Educational Research Association, held at Chattanooga, TN.

- Merrill, E., Reinckens, T., Yarborough, M., & Robinson, V. (2006). Retaining and Assisting Nontraditional Nursing Students in a Baccalaureate Nursing Program Utilizing Blackboard & Tegrity Technologies. *ABNF Journal*, 17(3).
- Moersch, C. (1995). Levels of Technology Implementation (LoTi): A Framework for Measuring Classroom Technology Use. *Learning and Leading with Technology*, 23(3) p40-42.
- Mott, J., & Granata, G. (2006). The Value of Teaching and Learning Technology: Beyond ROI. *Educause Quarterly*.
- Nachmias, R., Ram, J., Mioduser, D. (2005). The study of a campus wide implementation of blended learning in Tel Aviv. In C. J. Bonk, C. R. Graham (Eds.). *The Handbook of Blended Learning: Global Perspectives, Local Designs* (pp. 374-386). San Francisco, CA: Pfeiffer.
- Olsen, F. (2004). Course Management: Colleges Push for an Open Approach. *The Chronicle of Higher Education*, 50(21).
- Teng, Y. (2005). Using Blackboard in an Educational Psychology Course to Increase Preservice Teachers' Skills and Confidence in Technology Integration. *Journal of Interactive Online Learning*, 3(4), 1-12.
- West, R., Waddoups, G., & Graham, C. (2007). Understanding the experiences of instructors as they adopt a course management system. *Education Technology Research and Development*, 55(1), 1-26.
- West, R., Graham, C., Waddoups, G., & Kennedy, M. (2007). Weighing Costs Versus Benefits: Evaluating the Impact from Implementing a Course Management System [Electronic Version]. *International Journal of Instructional Technology and Distance Learning*, 4. Retrieved April 4, 2007 from http://www.idtl.org/Journal/Feb_07/article01.htm.

Appendix A: Data showing usage of Blackboard CMS by Blackboard ASP's top 5 users

The following Figures from 2006 were obtained by the Center for Instructional Design at BYU from Blackboard ASP, Blackboard's hosting division and show comparisons of the five top users of Blackboard ASP hosting services. Figure 94 shows a comparison of overall database size. Figure 95 shows a comparison of unique sessions (connections to the database) over time. Figure 96 shows a comparison of the number of completed assessments (*Quiz*) over time.

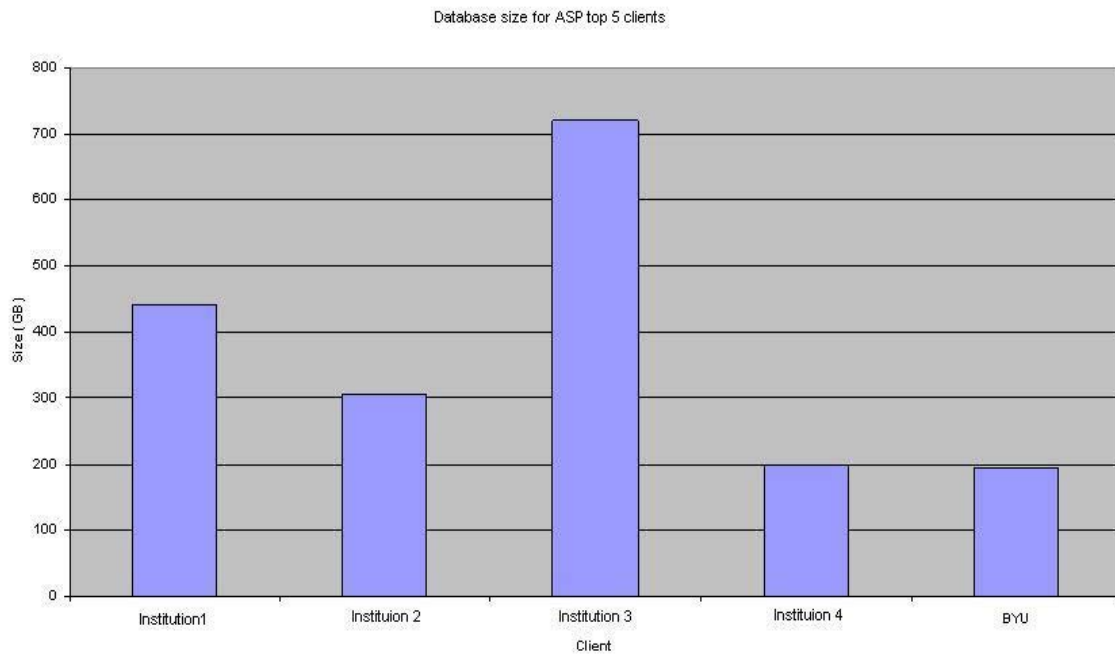


Figure 92. Database size for ASP's top 5 clients. All institution names except BYU have been removed

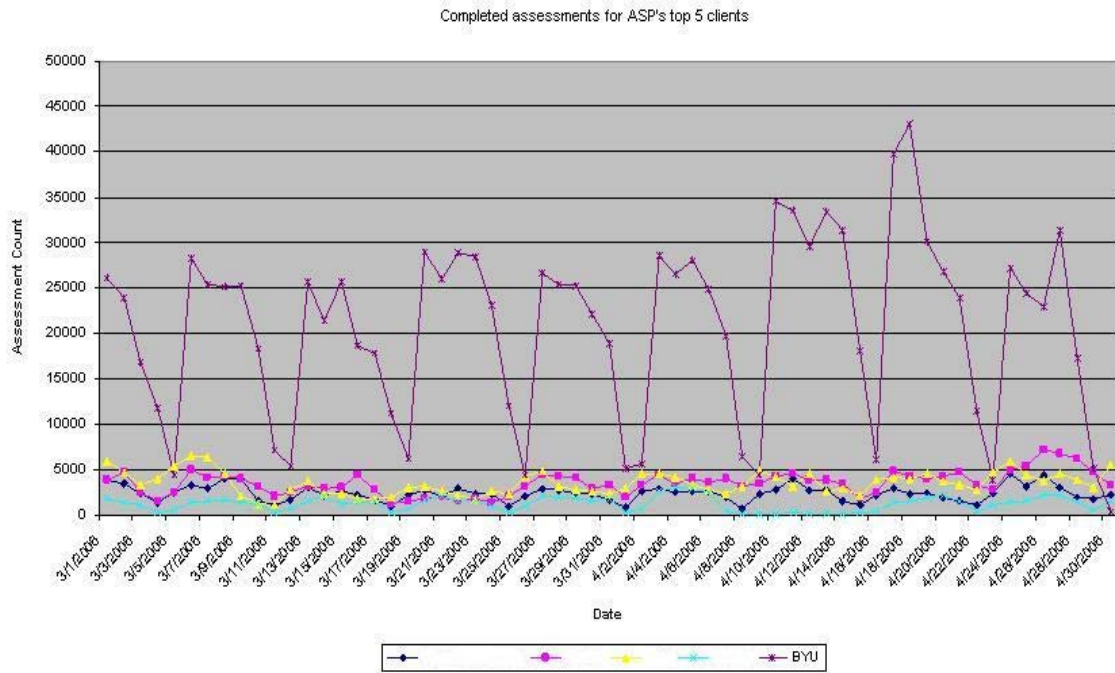


Figure 93. Completed assessments for ASP's top 5 clients. All institution names except BYU have been removed

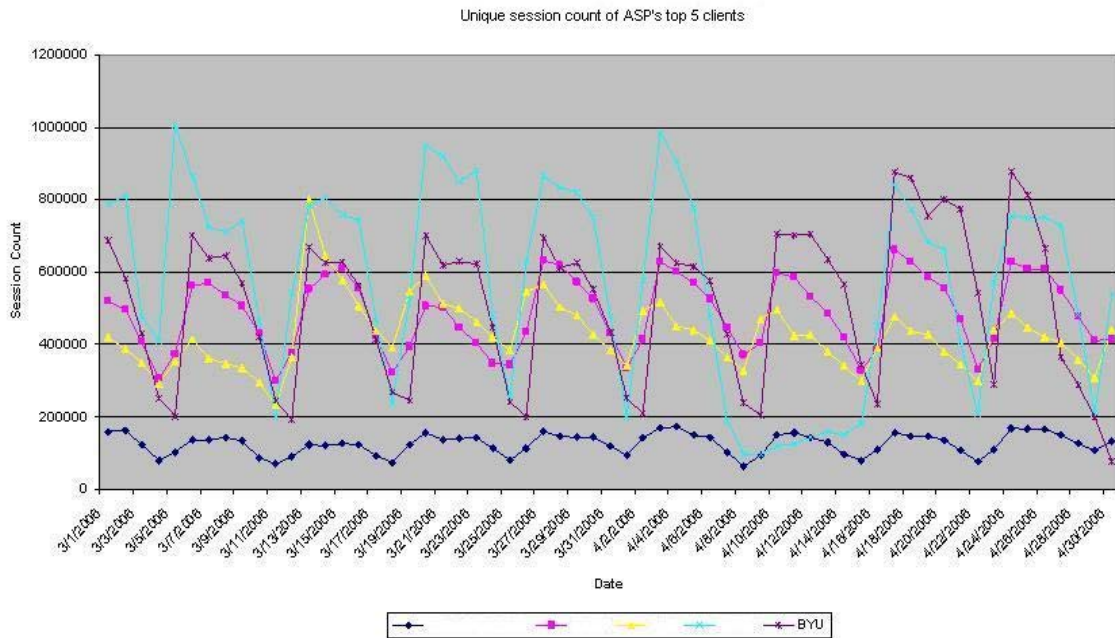


Figure 94. Unique session count of ASP's top 5 clients. All institution names except BYU have been removed

Appendix B: Detailed explanation of the Blackboard activity database

When a click is performed in Blackboard, if the software is programmed to record that particular click, then an entry is made to the `ACTIVITY_ACCUMULATOR` table. Depending on the type of click, an entry is made in one of the following fields: `INTERNAL_HANDLE`, `CONTENT_PK1`. Some records in the database do not have a value for either of these fields. Records that do not have a value in either of these fields have not been included in this study. The `INTERNAL_HANDLE` field creates a link to the `NAVIGATION_ITEM` table, and the `NAVIGATION_ITEM` table has a field called `APPLICATION` that can be used to categorize the click. The `CONTENT_PK1` field creates a link to the `COURSE_CONTENTS` table. The `COURSE_CONTENTS` table has a field called `CNTHNDLR_HANDLE` that can be used to categorize the click.

The following are the `APPLICATION` field values that are accounted for in this study: `address_book`, `announcements`, `bb_glossary`, `collaboration`, `community`, `content`, `course_communications`, `course_email`, `course_roster`, `course_tools_area`, `discussion board`, `dropbox`, `edit_homepage`, `electric_blackboard`, `groups`, `instructor_gradebook`, `jjcd_jjcdg` (the meaning of this is unknown), `messages`, `personal_info`, `resources`, `staff_information`, `student_gradebook`, `Tasks`.

The following are the `CNTHNDLR_HANDLE` field values that are accounted for in this study: `resource/x-bb-mt-survey-link`, `resource/x-bb-mt-test-link`, `resource/x-bb-assignment`, `resource/x-bb-courselink`, `resource/x-bb-document`, `resource/x-bb-externallink`, `resource/x-bb-folder`, `resource/x-bb-lesson`.

Appendix C: Code for data extraction

The challenge with downloading data from Blackboard has been due to running queries on a huge Oracle database from a remote location. Many times queries would simply die and lose the SQL connection to the Blackboard server. To overcome this Blackboard copied the BYU ASR database to another server and gave us table creation privileges. We were able to break queries down into smaller subsections by creating tables rather than trying to run the whole query together. The second challenge was to get row data into columns for our analysis purposes.

The first step was to create a table of course-sections for each semester/term that only contained course-sections from the 2004-2005 academic year. This was accomplished by the following query:

```
create table byufall04courses as (select * from byufall04xcourses where courseid like '%20045%' and trunc(timestamp)>'29-AUG-04' and trunc(timestamp)<'18-DEC-04');

create table byuwin05courses as (select * from byuwin05xcourses where courseid like '%20051%' and trunc(timestamp)>'3-JAN-05' and trunc(timestamp)<'22-APR-05');

create table byuspr05courses as (select * from byuspr05xcourses where courseid like '%20053%' and trunc(timestamp)>'25-APR-05' and trunc(timestamp)<'17-JUN-05');

create table byusum05courses as (select * from byusum05xcourses where courseid like '%20054%' and trunc(timestamp) >'19-JUN-05' and trunc(timestamp)<'12-AUG-05');
```

The next step was to create a table for each semester/term that stored all counts of students, professors, and assistants for each class. This was accomplished by the following query:

```
create table fallcounts as
(select a.courseid, b.role, count(*) as count from byufall04courses a, course_users b
where b.crsmain_pk1 = a.coursepk1 group by a.courseid,b.role);
```

```
create table wintercounts as
(select a.courseid, b.role, count(*) as count from byuwin05courses a, course_users b
where b.crsmain_pk1 = a.coursepk1 group by a.courseid,b.role);
```

```
create table springcounts as
(select a.courseid, b.role, count(*) as count from byuspr05courses a, course_users b
where b.crsmain_pk1 = a.coursepk1 group by a.courseid,b.role);
```

```
create table summercounts as
(select a.courseid, b.role, count(*) as count from byusum05courses a, course_users b
where b.crsmain_pk1 = a.coursepk1 group by a.courseid,b.role);
```

```
create table allfallcounts as
(select x.courseid,
(select a.count from fallcounts a where a.courseid= x.courseid and a.role= 'S') as scout,
(select a.count from fallcounts a where a.courseid= x.courseid and a.role= 'T') as tcount,
(select a.count from fallcounts a where a.courseid= x.courseid and a.role= 'P') as pcount
from fallcounts x);
```

```
create table allwintercounts as
(select x.courseid,
(select a.count from wintercounts a where a.courseid= x.courseid and a.role= 'S') as
scout,
(select a.count from wintercounts a where a.courseid= x.courseid and a.role= 'T') as
tcount,
(select a.count from wintercounts a where a.courseid= x.courseid and a.role= 'P') as
pcount
from wintercounts x);
```

```
create table allspringcounts as
(select x.courseid,
(select a.count from springcounts a where a.courseid= x.courseid and a.role= 'S') as
scout,
(select a.count from springcounts a where a.courseid= x.courseid and a.role= 'T') as
tcount,
(select a.count from springcounts a where a.courseid= x.courseid and a.role= 'P') as
pcount
from springcounts x);
```

```
create table allsummercounts as
(select x.courseid,
(select a.count from summercounts a where a.courseid= x.courseid and a.role= 'S') as
scout,
(select a.count from summercounts a where a.courseid= x.courseid and a.role= 'T') as
tcount,
```

```
(select a.count from summercounts a where a.courseid= x.courseid and a.role= 'P') as
pcount
from summercounts x);
```

This file was exported to a PC. This was accomplished by the following query:

```
set buffer 1000
set lin 500
spool c:\allcounts.txt
set termout off
set pagesize 999
set heading off
set feedback off
select '''||trim(COURSEID)||''','''
||trim(scount)||''',''
||trim(pcount)||''',''
||trim(tcount)
FROM allfallcounts;
select '''||trim(COURSEID)||''','''
||trim(scount)||''',''
||trim(pcount)||''',''
||trim(tcount)
FROM allwintercounts;
select '''||trim(COURSEID)||''','''
||trim(scount)||''',''
||trim(pcount)||''',''
||trim(tcount)
FROM allspringcounts;
select '''||trim(COURSEID)||''','''
||trim(scount)||''',''
||trim(pcount)||''',''
||trim(tcount)
FROM allsummercounts;
SPOOL OFF
```

The next step was to create a table for each semester/term that stored all counts of clicks by students, professors, and assistants for each feature of Blackboard (application) for each class. This was accomplished by the following query: (Query for spring term is shown, queries were actually written for each semester/term)

```
create table byuspr05applications as
(select a.course_pk1,n.application,count(*) as countapp
```

```
from activity_accumulator a, navigation_item n, byuspr05courses c
where a.internal_handle = n.internal_handle and a.course_pk1 = c.coursepk1
group by c.course_pk1,n.application);
```

The next step was to create a table for each semester/term that stored all counts of clicks by students, professors, and assistants on content links in Blackboard for each class. This was accomplished by the following query: (Query for spring term is shown, queries were actually written for each semester/term)

```
create table byuspr05contents as
(select a.course_pk1,n.CNTHNDLR_HANDLE,count(*) as countapp
from activity_accumulator a, course_contents n, byuspr05courses c
where a.content_pk1 = n.pk1 and a.course_pk1 = c.coursepk1
group by c.course_pk1,n.CNTHNDLR_HANDLE);
```

The next step was to create a table for each semester/term that for each course-section stored columns of each type of feature clicks and all each type of content clicks by students, professors, and assistants. This was accomplished by the following query: (Query for spring term is shown, queries were actually written for each semester/term, and the query took so much processing power that it was necessary to divide the features and contents into 3 tables rather than 1 otherwise it would not run)

```
Create table allcoursespring05a as
(Select courseid, coursepk1,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='S' and application = 'address_book') as SAaddress_book,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='P' and application = 'address_book') as Paddress_book,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='T' and application = 'address_book') as Taddress_book,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='S' and application = 'announcements') as Sannouncements,
```

(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='P' and application = 'announcements') as Pannouncements,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='T' and application = 'announcements') as Tannouncements,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='S' and application = 'bb_glossary') as Sbb_glossary,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='P' and application = 'bb_glossary') as Pbb_glossary,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='T' and application = 'bb_glossary') as Tbb_glossary,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='S' and application = 'collaboration') as Scollaboration,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='P' and application = 'collaboration') as Pcollaboration,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='T' and application = 'collaboration') as Tcollaboration,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='S' and application = 'community') as Scommunity,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='P' and application = 'community') as Pcommunity,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='T' and application = 'community') as Tcommunity,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='S' and application = 'content') as Scontent,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='P' and application = 'content') as Pcontent,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='T' and application = 'content') as Tcontent,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='S' and application = 'course_communications') as
Scourse_communications,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='P' and application = 'course_communications') as
Pcourse_communications,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='T' and application = 'course_communications') as
Tcourse_communications,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='S' and application = 'course_email') as Scourse_email,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='P' and application = 'course_email') as Pcourse_email,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='T' and application = 'course_email') as Tcourse_email,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='S' and application = 'course_roster') as Scourse_roster,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1

```

and role='P' and application = 'course_roster') as Pcourse_roster,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='T' and application = 'course_roster') as Tcourse_roster,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='S' and application = 'course_tools_area') as Scourse_tools_area,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='P' and application = 'course_tools_area') as Pcourse_tools_area,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='T' and application = 'course_tools_area') as Tcourse_tools_area,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='S' and application = 'discussion_board') as Sdiscussion_board,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='P' and application = 'discussion_board') as Pdiscussion_board,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='T' and application = 'discussion_board') as Tdiscussion_board,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='S' and application = 'dropbox') as Sdropbox,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='P' and application = 'dropbox') as Pdropbox,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='T' and application = 'dropbox') as Tdropbox
from byuspr05courses m);

```

Create table allcoursespring05b as

```

(Select coursename, courseid, coursepk1,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='S' and application = 'edit_homepage') as Sedit_homepage,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='P' and application = 'edit_homepage') as Pedit_homepage,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='T' and application = 'edit_homepage') as Tedit_homepage,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='S' and application = 'electric_blackboard') as
Selectric_blackboard,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='P' and application = 'electric_blackboard') as
Pelectric_blackboard,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='T' and application = 'electric_blackboard') as
Telectric_blackboard,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='S' and application = 'groups') as Sgroups,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='P' and application = 'groups') as Pgroups,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1

```


and role='T' and application = 'groups') as Tgroups,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='S' and application = 'instructor_gradebook') as
 Sinstructor_gradebook,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='P' and application = 'instructor_gradebook') as
 Pinstructor_gradebook,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='T' and application = 'instructor_gradebook') as
 Tinstructor_gradebook,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='S' and application = 'jjcd_jjcdg') as Sjjcd_jjcdg,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='P' and application = 'jjcd_jjcdg') as Pjjcd_jjcdg,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='T' and application = 'jjcd_jjcdg') as Tjjcd_jjcdg,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='S' and application = 'messages') as Smessages,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='P' and application = 'messages') as Pmessages,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='T' and application = 'messages') as Tmessages,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='S' and application = 'personal_info') as Spersonal_info,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='P' and application = 'personal_info') as Ppersonal_info,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='T' and application = 'personal_info') as Tpersonal_info,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='S' and application = 'resources') as Sresources,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='P' and application = 'resources') as Presources,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='T' and application = 'resources') as Tresources,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='S' and application = 'staff_information') as Sstaff_information,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='P' and application = 'staff_information') as Pstaff_information,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='T' and application = 'staff_information') as Tstaff_information,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='S' and application = 'student_gradebook') as Sstudent_gradebook,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='P' and application = 'student_gradebook') as Pstudent_gradebook,
 (select countapp from byuspr05applications where course_pk1 = m.coursepk1
 and role='T' and application = 'student_gradebook') as Tstudent_gradebook,

```
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='S' and application = 'tasks') as Stasks,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='P' and application = 'tasks') as Ptasks,
(select countapp from byuspr05applications where course_pk1 = m.coursepk1
and role='T' and application = 'tasks') as Ttasks
from byuspr05courses m);
```

Create table allcoursespring05c as

```
(Select coursename, courseid, coursepk1,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-asmt-survey-link' and role='S') as
Scontsurveylink,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-asmt-test-link' and role='S') as
Sconttestlink,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-assignment' and role='S') as
Scontassignment,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-courselink' and role='S') as
Scontcourselink,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-document' and role='S') as Scontdocument,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-externallink' and role='S') as
Scontexternallink,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-folder' and role='S') as Scontfolder,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-lesson' and role='S') as Scontlesson,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-asmt-survey-link' and role='P') as
Pcontsurveylink,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-asmt-test-link' and role='P') as
Pconttestlink,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-assignment' and role='P') as
Pcontassignment,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-courselink' and role='P') as
Pcontcourselink,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-document' and role='P') as Pcontdocument,
```

```

(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-externallink' and role='P') as
Pcontexternallink,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-folder' and role='P') as Pcontfolder,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-lesson' and role='P') as Pcontlesson,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-asmt-survey-link' and role='T') as
Tcontsurveylink,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-asmt-test-link' and role='T') as
Tconttestlink,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-assignment' and role='T') as
Tcontassignment,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-courselink' and role='T') as
Tcontcourselink,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-document' and role='T') as Tcontdocument,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-externallink' and role='T') as
Tcontexternallink,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-folder' and role='T') as Tcontfolder,
(select countapp from byuspr05contents where course_pk1 = m.coursepk1 and
cnthndlr_handle = 'resource/x-bb-lesson' and role='T') as Tcontlesson
from byuspr05courses m);

```

The next step was to export the contents of the 3 tables that were created above to a PC. This was accomplished by the following query: (Once the results were downloaded to a PC, the text file had to be cleaned of header and footer query information before being imported into excel spreadsheets)

```

set buffer 1000
set lin 500
spool c:\coursesSPRING05.txt
set termout off
set pagesize 999

```

```

set heading off
set feedback off
select ""||trim(A.COURSENAME)||"" , ""
||trim(A.COURSEID)||"" , ""
||trim(A.COURSEPK1)||"" , ''
||A.SAADDRESS_BOOK||', '
||A.PADDRESS_BOOK||', '
||A.TADDRESS_BOOK||', '
||A.SANNOUNCEMENTS||', '
||A.PANNOUNCEMENTS||', '
||A.TANNOUNCEMENTS||', '
||A.SBB_GLOSSARY||', '
||A.PBB_GLOSSARY||', '
||A.TBB_GLOSSARY||', '
||A.SCOLLABORATION||', '
||A.PCOLLABORATION||', '
||A.TCOLLABORATION||', '
||A.SCOMMUNITY||', '
||A.PCOMMUNITY||', '
||A.TCOMMUNITY||', '
||A.SCONTENT||', '
||A.PCONTENT||', '
||A.TCONTENT||', '
||A.SCOURSE_COMMUNICATIONS||', '
||A.PCOURSE_COMMUNICATIONS||', '
||A.TCOURSE_COMMUNICATIONS||', '
||A.SCOURSE_EMAIL||', '
||A.PCOURSE_EMAIL||', '
||A.TCOURSE_EMAIL||', '
||A.SCOURSE_ROSTER||', '
||A.PCOURSE_ROSTER||', '
||A.TCOURSE_ROSTER||', '
||A.SCOURSE_TOOLS_AREA||', '
||A.PCOURSE_TOOLS_AREA||', '
||A.TCOURSE_TOOLS_AREA||', '
||A.SDISCUSSION_BOARD||', '
||A.PDISCUSSION_BOARD||', '
||A.TDISCUSSION_BOARD||', '
||A.SDROPBOX||', '
||A.PDROPBOX||', '
||A.TDROPBOX||', '
||B.SEDIT_HOMEPAGE||', '
||B.PEDIT_HOMEPAGE||', '
||B.TEDIT_HOMEPAGE||', '
||B.SELECTRIC_BLACKBOARD||', '
||B.PELECTRIC_BLACKBOARD||', '

```

||B.TELECTRIC_BLACKBOARD||','
 ||B.SGROUPS||','
 ||B.PGROUPS||','
 ||B.TGROUPS||','
 ||B.SINSTRUCTOR_GRADEBOOK||','
 ||B.PINSTRUCTOR_GRADEBOOK||','
 ||B.TINSTRUCTOR_GRADEBOOK||','
 ||B.SJCD_JJCDG||','
 ||B.PJCD_JJCDG||','
 ||B.TJCD_JJCDG||','
 ||B.SMESSAGES||','
 ||B.PMESSAGES||','
 ||B.TMESSAGES||','
 ||B.SPERSONAL_INFO||','
 ||B.PPERSONAL_INFO||','
 ||B.TPERSONAL_INFO||','
 ||B.SRESOURCES||','
 ||B.PRESOURCES||','
 ||B.TRESOURCES||','
 ||B.SSTAFF_INFORMATION||','
 ||B.PSTAFF_INFORMATION||','
 ||B.TSTAFF_INFORMATION||','
 ||B.SSTUDENT_GRADEBOOK||','
 ||B.PSTUDENT_GRADEBOOK||','
 ||B.TSTUDENT_GRADEBOOK||','
 ||B.STASKS||','
 ||B.PTASKS||','
 ||B.TTASKS||','
 ||C.SCONTSURVEYLINK||','
 ||C.PCONTSURVEYLINK||','
 ||C.TCONTSURVEYLINK||','
 ||C.SCONTTESTLINK||','
 ||C.PCONTTESTLINK||','
 ||C.TCONTTESTLINK||','
 ||C.SCONTASSIGNMENT||','
 ||C.PCONTASSIGNMENT||','
 ||C.TCONTASSIGNMENT||','
 ||C.SCONTCOURSELINK||','
 ||C.PCONTCOURSELINK||','
 ||C.TCONTCOURSELINK||','
 ||C.SCONTDOCUMENT||','
 ||C.PCONTDOCUMENT||','
 ||C.TCONTDOCUMENT||','
 ||C.SCONTEXTERNALLINK||','
 ||C.PCONTEXTERNALLINK||','
 ||C.TCONTEXTERNALLINK||','

```

||C.SCONTFOLDER||','
||C.PCONTFOLDER||','
||C.TCONTFOLDER||','
||C.SCONTLESSON||','
||C.PCONTLESSON||','
||C.TCONTLESSON||','
||D.ENROLL||','
||D.STCLICKS||','
||D.TACLICKS||','
||D.PRCLICKS
FROM BYUSPR05COURSES AA, ALLCOURSESSPRING05A
A,ALLCOURSESSPRING05B
B,ALLCOURSESSPRING05C C, spr05xclicks D
WHERE AA.COURSEPK1 = A.COURSEPK1 AND AA.COURSEPK1 =
B.COURSEPK1 AND
AA.COURSEPK1 = C.COURSEPK1 and A.COURSEID = D.COURSEID
order by A.coursename;
SPOOL OFF

```

The next step was to export the results of a query that counted clicks on different dates. This was accomplished by the following query: (Once the results were downloaded to a PC, the text file had to be cleaned of header and footer query information before being imported into excel spreadsheets)

```

set buffer 1000
set lin 500
spool c:\datesqry.txt
set termout off
set pagesize 999
set heading off
set feedback off
select ""||trunc(timestamp,'dd')||"",""||count(1)||""
from activity_accumulator where timestamp like '%-04' or timestamp like '%-05' group
by trunc(timestamp,'dd');
set spool off

```