Musings on LMS, HCI, Clients and Native Programs

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Abstract

This paper is an essay on some of the latest developments and fads in education. It considers some of the disadvantages of a Learning Management System's gradebook compared to a simple spreadsheet.

1 Introduction

Unlike many papers, this one starts with a story. One of the our former students now works for Technology Services on our campus. In discussing with him some of problems in maintaining author's web site, he made the challenge to abandon this author's practice of keeping important, but not sensitive, information on a publicly available web site. He insisted that the better way was to store everything on a Learning Management System, in this case BlackBoard$^©$. He cited several excellent and valid reasons for doing so. These included: better support for mobile devices, much more frequent backups, better security due to student logins and ease of use. What he did not say was that this approach would be easier for himself and his colleagues in Technology Services. Like many faculty members the author is used to doing things a particular way, which is usually based on personal history and skills. The whole suggestion was a challenge as to whether the standard approach was superior to the alternatives.

Indeed, a Learning Management System (LMS) does have many advantages, but ease of use is not necessarily one of them. In the above conversation it was mentioned that using BlackBoard was slower than programs running on a local machine. At the time of the conversation this worker demonstrated the apparent speed of that service. However, his client machine was scarcely five meters from the server. In a one-click test, the difference is insignificant. The question then arises how significant are the response time differences? An experiment was conducted comparing times in the task of entering student scores. The authors are at opposite extremes in service at an institution of higer education. The second author is in hisr first year of teaching and the first is in his last teaching decade, so they have a somewhat different viewpoint. The elder of the two has been of the habit of storing scores in a spreadsheet. It should be of little surprise that the spreadsheet approach is generally quicker.

The speed of entry is not the only issue. The ordinary LMS uses a web browser as a client. This has tremendous advantages in the area of platform independence. Faculty member on our campus have a variety of platforms on which they work. These include Windows based laptops and desktops, Apple MacIntosh laptops and tablets. These are completely different platforms, yet they may all access BlackBoard easily. These platforms have little in common with regards to application programs.

Alas, this platform independence also comes with a cost. One of the casualties of this approach is good Human Computer Interface (HCI). Entering a single score into the BlackBoard gradebook is a process with few options, while the corresponding process in a spreadsheet is much less restrictive. Adding a new column to the BlackBoard© gradebook is much harder than the corresponding Excel© operation. The problem may reduce to what a developer may accomplish in a web page with Javascript compared with what a developer may accomplish in a program with Java or C++. Said another way, the user interface in a mature program such as Microsoft Excel far exceeds what we can expect in a web page generated by an LMS. The BlackBoard LMS is by no means the only offender in this regard. The web browser is now perceived as the universal client and this has the same platform independence and the same degradation of HCI.

2 Experiment

In this experiment a series of measurements were made concerning the time required to enter data into BlackBoard© and Microsoft Excel 2013©. All of the measurements were made on an HP Desktop connected to the network via 100MB Ethernet.

The process performed may be of interest. The two sets of scores were entered one after another. The input form varied. In the case of program scores, the name and points were written on paper during the grading process. Only when all the scores were assembled did the entry begin. If the assignment was on paper, the papers were graded and the papers were the source of input. If the scores were from a test, then the test form was the source. The scores or papers were not sorted by student name. The times for entering the grades from a test or paper include the times for shuffling the paper to find the scores. In some cases, such as tests, the paper shuffling may exceed the entry time. Yet both were handled consistently.

There are two different timings that should be considered. The first is the time it takes for the program to start and be ready to accept the scores. BlackBoard is at an inherent disadvantage in this case, since a login is required. However, one login may enter any number of scores. The process is then start or be in a browser, choose a single link to get into the LMS, login to the LMS with a name and password, choose the correct class, select the gradebook and then scroll right to the correct column. The Excel situation is simpler but related: start the program, select the spreadsheet and scroll to the correct column. In both cases once the program is started any number of scores may be entered. The Table 1 shows the results for average time in seconds to start and become ready and is derived from 14 separate invocations of each:

Microsoft Excel	BlackBoard
10.9	32.4

Table 1: Average start time per program.

In Table 2, we report the average time to record an individual score, based on 14 separte tests. However, in each test the total number of scores to be entered was different, because different classes have different number of students, a student may have turned in an assignment at a later time, etc. However, Table 2 shows only the average time to enter a score for all scores:

Count of scores	Excel	BlackBoard
179	4.9	7.2

Table 2: Average entry time per score.

As can be seen from Table 1 and Table 2, the differences between the two applications are significant. Excel is clearly faster compared with BlackBoard in the manipulation of data.

Most, but not all of the time, Excel was entered first and then BlackBoard. This was seen as not completely fair, since the second time through the scores, less time is needed to find the score on the paper. This should have given some advantage to the second program but it appears to be less than the inherent time needed.

Occasionally, errors were noted, such as points going into the wrong cell. It seems that this happens more frequently in BlackBoard, but was not considered germane to the experiment. When such errors were found the timer stopped, errors corrected and timing resumed. This may have been to the benefit of BlackBoard. However, there is another error that is considered important. In Excel, when a value is entered into a cell, the entry may be concluded by hitting the enter key, a tab or any cursor key. BlackBoard is much more finicky, only an enter key strike will suffice. Any other key will generate a dialog box pointing out the error.

3 Human Computer Interface

Does the comparison of Excel and BlackBoard seem to be fair? It is in some ways and is not in others. The comparison is fair in the sense of what the programs were designed to do. Excel is a generalized super calculator, each cell representing virtually anything that can be done with a hand calculator. In contrast is the BlackBoard LMS which is designed specifically to be used in education. Generally speaking we would expect the specialized tool to do a better job than the general tool.

This last statement does not quite cover the full range though. Excel was patterned after Lotus 1-2-3, among others, and so has calculator, charting and database features. BlackBoard covers many more features that are of general interest within education. It may contain content material; it supports internal and external email; it provides discussion boards and other features as well. All of these are besides the gradebook that has been the focus up until now. If we tally up the features the two are certainly not in competition with one another across each one's range of features.

Another area where the comparison is particularly not fair is in distribution. Excel is a classic mass-market program. It is estimated that there are in excess of 750 million users worldwide[1]. Of course, the BlackBoard LMS is restricted to education. Excel has crushed its competition over the years so that excellent programs such as Lotus 1-2-3 are only memories. Clearly competition has made it so that Microsoft as refined the program in countless ways. In contrast to Excel's market would be the limited number of potential customers for any LMS.

A for profit corporation always has limited resources to improve a program. Generally these resources are based upon the number of sales or potential sales of a program and the profit on each sale. The vast market of Excel has funded considerable development in all aspects, which BlackBoard has not. A good example of the differences in Human

Computer Interface was previously mentioned. This was the issue of how a cell may be exited after entering a value.

It is clear that Microsoft has altered and can be expected to continue altering the user interface of its programs, including Excel. This can be frustrating, but the behavior of cells and the process of entering data have been very stable for a decade or more. They have instead experimented with how the menus and other aspects have worked. In the same way BlackBoard has also experimented with their approach.

This plethora of features may be part of the problem. It is also typical that a program with too many features is unable to do them all well. BlackBoard is attempting to provide many features that users have asked for or the company has thought necessary. This has spread their developer's time thin and we see this in the less developed human interface. In that regards the comparison between the two programs is not fair.

Another, more serious issue must also be considered. This is the form of implementation. Excel is a native program on the machine, wheras BlackBoard must use the paradigm of client and server architecture over HTTP. This places the data in a single location, which may be properly secured, regularly backed up and made available widely through the network. We cannot assert that Microsoft developers are superior to those of BlackBoard for the differences in paradigm produces a large difference in performance, not to mention the ease of implementation.

BlackBoard© has chosen to use a web browser as its client. This is a decision with consequences. The positive consequence is that the client becomes largely platform independent. Although web browsers are not completely interchangeable in their features, the differences are manageable. Microsoft must make a separate executable for the MacIntosh platform than it does for a Windows platform, even if they are running on the same CPU. Whereas the same page is generated from BlackBoard for both platforms and others as well.

Negative consequences of this decision also exist. Every piece of information that is entered may require a server response and such responses are slow compared with the type of actions that a native program would carry out. This also means that the server needs to be able to carry out all of the calculations of an entire educational community. Each operation is not necessarily intense, this is not scientific processing, but even simple processing carried out by large numbers of users may bog down a single server.

The partial answer to this problem is scripting languages. Using scripts in the web pages offloads computing from the server to the client, that is, the web browser. This is a popular practice at this time for a variety of reasons. However, scripting languages, most notably JavaScript, are both the problem and solution.

JavaScript is present in BlackBoard web pages. JavaScript is generally interpreted rather than compiled and typically is a factor of ten slower in its execution than native languages. However, its ability to minimize the number of network accesses by doing simple checking of values and simple calculations will still improve performance and

diminish server load. However, the more that is offloaded onto the client, the longer the delay of the web page loading. Thus, there is a limit to what can be accomplished with scripting.

Web clients are versatile, ubiquitous and quite attractive, but there performance may leave their users wanting something else[2]. This seems to be the source of the performance differences that were cited in the earlier parts of this paper.

4 Summary

 Learning Management Systems do offer considerable advantages to faculty. Yet they have their disadvantages as well e.g. speed and availability to name just two. To state that they are clearly superior is to exaggerate the truth.

Many new faculty members have been advised to learn the institution's LMS and use it for every function that it offers and which they require. This is an excellent piece of advice, for it will certainly have a positive effect on administration's view of the mentioned faculty. Such a positive effect will translate into easing the path to promotion and tenure. However, to make the claim that this one-size-fits-all approach is best for everyone is leaves much to be desired.

References

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