

On-line Course Registration Systems Usability: A Case Study of the e-Lion Course Registration System at the Pennsylvania State University

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ABSTRACT

Electronic course registration systems allow students to select courses and giving student to access course offerings through these on-line systems as well as the ability to complete various administrative functions allows for better management of curriculum decisions in the context of academic objectives. The objective of these systems is to make this process more convenient and easier to achieve which has been met with varying levels of success. This study looks closely at one particular system, the e-Lion system at the Pennsylvania State University. Data was collected using semi-structured interviews and an online survey. The findings are discussed through the lens of the Delone and McLeane (D&M) information systems success model and are of interest to business practitioners fielding on-line systems in the areas of e-commerce and e-learning as well as many others, providing considerable insight into the importance of system usability.

Keywords: Course Registration Systems, Delone-McClean Model of Information System Success, E-Learning, Online System, System Usability

INTRODUCTION

For those who can recall the time before iPod's and cell phones, the course registration process in most higher education institutions was a

challenging, often frustrating rite of passage the student must endure every semester simply to sign-up for their classes. In order to officially register for classes, each student must have filled a form out manually, taken it to the Registrar's Office; stood in a line (quite often for long periods of time without the benefits

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of the aforementioned iPod or cell phone to help pass the time) and finally gotten the form officially approved and stamped. The student went through the same tedious process to accomplish things like changing their current course schedule by dropping or adding courses (Borosan, 2003).

These challenges have prompted academic institutions to embark on school-wide electronic curriculum support mechanisms for on-campus functions such as course registration. These systems typically allow students to select courses offered for the up-coming semester or even for the up-coming academic year. The student can access the on-line system to add and drop courses as well as pay bursar fees through use of secure on-line payment systems. In addition, these registration systems allow advisors to spend less time performing the transaction oriented aspects of registration and more time helping students frame their coursework in the context of their academic objectives and understand the impact of their course selections. The course registration systems aim is to make easier, and more convenient, the class registration process.

The registration process is extremely pivotal for universities because they receive tuition and fee payments through this mechanism and students cannot receive their student aid or payment of tuition and stipends through the other various means of reimbursement until their registration has been verified. These systems fulfilling such a critical role and function make the evaluation of these sorts of registration systems an important area of study. The institutions are required to assess how effective their registration systems are and they need to understand whether the system is performing the tasks that it is designed to perform and whether it meets the needs of different stakeholders, particularly the students.

The Delone and McLeane (D&M) information systems success model contends that user satisfaction with usability of a system is "reciprocally interwoven with the ways in which the system is used" (Delone & Mclean, 2003). The Pennsylvania State University uses a course registration system called e-Lion which provides

various functions such as course registration, grade reports and transcript request, to name a few, to the university community. Extension of this model as a means of evaluating the usability of the e-Lion registration system provided us with a solid theoretical framework and model for further investigation of the e-Lion registration system's perceived usability among users.

Our research questions were threefold. They were articulated as follows: (i) what are the general perceptions of the usability of the e-Lion registration system? (ii) What is the relationship between training and understanding of the e-Lion registration system? and (iii) Do graduate and undergraduate students have different perceptions of the e-Lion registration? We used multiple data sources including semi-structured interviews and an online survey.

The rest of the paper is structured as follows: in the next section we provide background and describe the context of the study. Then we present a brief literature review on online registration information systems followed by our research epistemology and after, we discuss our analytical framework. Method and data are described following that. The data analysis and discussion are presented next and finally the conclusion.

BACKGROUND AND CONTEXT

We embarked on this study of the e-Lion registration system in response to considerable anecdotal evidence observed during encounters with students at the Pennsylvania State University. It seemed nearly every student had a story to tell regarding the e-Lion system and a failure to meet their expectations on some level; whether it was a matter of not being able to execute a given function at all or a complaint about the way a particular function worked, the common theme was that of frustration. Quotes from system users such as, "I have never had trouble getting into an empty class, but I have had trouble when the system has crashed before" and "The whole user interface could definitely be improved...I think they made it 10 years

ago, or 5 years ago, and they have not changed it since” offered some evidence from system users that significant perceptions of problems associated with the usability of the e-Lion system existed and presented an interesting topic.

With a rich pool of individual e-Lion system users readily available to us, all with a vested interest in seeing the system improved, the exploration of the system in the context of how it is used and perceptions on its overall usability made it an excellent research problem to be explored in greater detail. While a comprehensive look at the system requires examination of all aspects of the e-Lion system in context of use, the specific focus of our study was on the individual’s interaction with the system, primarily through examination of three characteristics in the D&MIS model; information quality, system quality, and service quality.

Table 1 illustrates recent enrollment statistics from the Penn State Fact Book, reflecting over 85,000 students, indicating a significant impact of the system usability in terms of sheer numbers of students affected. The systems usability also impacts student’s perceptions of the quality of the university and for The Pennsylvania State University to maintain its standing as one of the top ten public universities in the nation, it is imperative that the university field information technology solutions capable of providing students with a first class experience. For system designers to field such a system,

it’s necessary to understand the context within which the system is used.

These two reasons including the impact on the student population and the image of the university, highlight why the research is important. While these reasons are sufficiently important to the Pennsylvania State University, in broader terms the research is likely of benefit to a much wider community of information systems users in a variety of areas. System usability has become more and more important as use of on-line systems becomes more ubiquitous in everyday life, with use of everything from Automated Teller Machines to gain access to funds, to on-line reservation systems used to book airline flights, to on-line shopping for nearly anything one can think of; use of such systems is not the exception but the norm. This increasing use and subsequent reliance on information technology systems makes the understanding of user’s attitudes towards systems usability and good and bad features an exciting area of research and a fruitful one if findings offer a prescriptive solution to system designers that can provide a generalized design framework to work from when designing systems in the future.

LITERATURE REVIEW

According to Cao and Brodnick (2002) on-line registration systems have gone through many

Table 1. Fall enrollment statistics from Penn State Fact Book, <http://www.budget.psu.edu/factbook/>

	Fall to Fall Enrollment	
Year	2006	2007
University Park	43252	42914
Commonwealth Campuses	33149	31632
Great Valley	1238	1319
Dickinson School of Law - Carlisle	464	496
College of Medicine	815	791
PA College of Technology	6682	6569
Total	85600	83721

different stages of development. In the first stage, the literature was mainly concerned with experimentation and testing of the systems. During the 1970s a number of higher education institutions began to employ new technologies in administration (Hengehold, 1975; Michael, 1976; Brown, 1979). This technology use was treated primarily as a means to assist university administration. It is worth noting that the on-line registration systems of this period implemented the technologies of the time, a time when the mainframe computers were king and telephone registration systems represented the “cutting edge” of telecommunications technology.

During the next phase, on-line registration was employed by a growing number of universities across the United States. New features were developed and added to these systems in response to a more demanding generation of system users. Additionally, one could note the growing number of experiences with these systems summarized and documented within the literature (Cook & Parker, 1983; Heard, 1987). During the 1980s, most of the research reported largely positive experiences with these systems. Because of this largely positive experience reflected in the literature, on-line registration was deemed “a successful approach” to this administrative function (Cao & Brodnick, 2002).

The third stage, occurring in the 1990s and still a work in progress, is characterized by the emergence of new technologies like the World Wide Web and incorporation of the Internet into various aspects of the education process (Thomas et al., 1998). This stage suggests that on-line registration has become pervasive and well established in the academic systems, and is looking for more ways to integrate different technologies and processes. Despite these investigations, very few attempts have been made to systematically evaluate the application of these on-line registration systems and their organizational consequences in higher education institutions. The following are some descriptions of research efforts which have dealt with the evaluation of these systems pointing out deficiencies and explicating their limitations.

Ahmad et al. (2001) looked at the evolution of on-line registration systems with a particular emphasis on the processes and producers. The aim of their work was to investigate whether the new registration system has been well integrated with the old organizational processes. As a result, they looked in-depth at how the processes were being carried out before and after the implementation of the computerized registration system in an effort to determine if the implementation of the system had merely computerized a bad manual process or if it had taken advantage of the new systems capabilities that improved upon the old system rather than merely automating it.

Little et al. (2000) assessed the implementation of the student registration at the University of Newcastle. The system under study was evaluated in terms of reliability and availability, examining performance based on possible failure of certain components. As such, this research centered on the technical infrastructure and backbone of the system because the system was evaluated strictly on the grounds of availability and fault-tolerance criteria. Likewise, Galler et al. (1973) undertook a technical evaluation of a distributed learning system. They underscored some difficulties in the registration process but their consideration chiefly shed light on the technical issues that plagued the entire system. They concluded that suitable computer access and network reliability were key enablers which must be present if on-line education is to be successful. Finally, Ciebiera et al. (2004) elaborated on a new registration module which was deployed at all the facilities of Warsaw University. They focused on the design and development of the registration software, going beyond the mere technical issues and exploring other aspects of the system not taken into account.

The only study that has attempted to go beyond the technical or process-related issues is the Cao and Brodnick (2002) research. They explore how social factors influence the college students' use of an on-line registration system at a private university in Northern California.

Their findings indicate that academic and demographic factors have an important bearing on the use of on-line services. What they fail to take into account however are things like the experience of the actual system users themselves in their critique. The whole evaluation appears bound to understanding of the academic variables (i.e., major, class) and demographic ones (i.e., gender, age). What we outline here demonstrates a significant gap in the current research. Although some studies have embraced on-line registration systems and conducted appraisal of them providing a descriptive analysis, the research in this area requires a more interpretivist investigation that examines the experiences, perceptions and assumptions of the system users. This is particularly important since in addition to a demonstrated need for more technical robustness, the on-line registration system must also meet the needs of its intended users. In point of fact, the evaluation of information systems and system usability remains a difficult problem, one which we wish to evaluate through examination of the e-Lion system.

RESEARCH QUESTION AND EPISTEMOLOGY

In the design of our research questions, we first wanted to establish a firm foundation for our research effort based on sound principles of research design. We chose as our guide the writings of Mason (1996) in which she suggested five basic questions every researcher should be able to answer regarding their own research project.

The first question we answered regards the nature of the phenomenon and the social reality that we wished to investigate. We identified four strata which include technical, individual, organizational, and inter-organizational stakeholders which combine together to form the operating environment for the e-Lion system. In an effort to limit the scope of the study in a manner befitting the relatively short timeline

that was available, the individual student level stratum was chosen as the area to be investigated.

The second question examined the way knowledge is represented and the means by which the social reality could be discovered. To obtain this information, we elicited graduate and undergraduate students opinions and interpretations regarding the way in which they construct their personal perceptions of the e-Lion system and their interactions with it.

The third question dealt with the broad substantive topical area the research was concerned with which in our case was the study of the students experience with, and assessment of, the usability of the e-Lion system. Further, we wanted to pursue how the different student stakeholders contribute to produce the positive or negative perceptions of the performance of the e-Lion system.

The fourth question identified the intellectual puzzle to be resolved as well as articulating the main research questions to be answered. We believe the e-Lion system constitutes a mechanical puzzle in so far as it describes "how something works or is constituted" (Mason, 1996).

As such our research questions were as follows:

- Q1: What are the general perceptions of the usability of the e-Lion registration system?
- Q2: What is the relationship between training and understanding of the e-Lion registration system?
- Q3: Do graduate and undergraduate students have different perceptions of the e-Lion registration?

The fifth question related to the overall purpose of our research. The major purpose of our research is to better comprehend why these attitudes and beliefs regarding the usability of the e-Lion system exist among the student population using the system.

Having answered these five key questions and established a firm foundation for our research effort and design, we were then

able to reflect on our research paradigm or epistemological approach to the study of the e-Lion system. According to Mason, “Paradigms constitute a way of looking at the world, interpreting what is seen, and deciding which of the things seen by researchers is real, valid, and important” (Mason, 1996). It was thus important to select a compatible research paradigm on which to build our research design to provide us the best picture of the e-Lion system we could possibly achieve in our study. We felt the best means of doing this was through an interpretive approach, also sometimes referred to as the phenomenological or constructivist approach, given its propensity for supporting participation and interaction which we felt to be a crucial element of gaining an appropriate level of understanding. Unlike the positivist approach which assumes more of a “what you see is what you get” mentality and that the world is what it is and merely needs to be observed, using the interpretive viewpoint we wanted to take in the reality that is or what Mason alludes to as “a social construction of reality” (Mason, 1996). The meaning of this is that reality is more of a construct of what people make it out to be rather than a strictly observable, empirically verifiable entity. This interpretive viewpoint was a more effective epistemological approach in that it better allowed for the examination of the role of culture and what Mason refers to as the “situated” nature of a system and the need to examine it in the context of its environment (Mason, 1996). Given the highly diverse nature

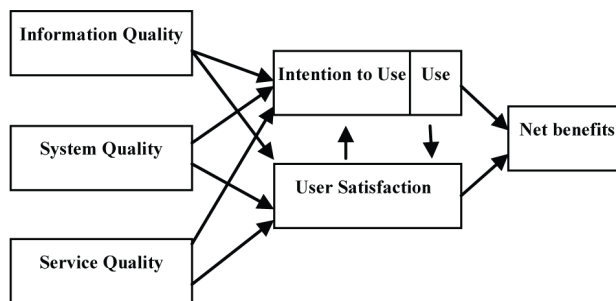
of the university community and student body, this ability to examine the e-Lion system in that context and explore the differing opinions of the student stakeholders was a much more effective approach which yielded us a far greater understanding of the system.

THEORETICAL FRAMEWORK

This section focuses on the theoretical foundation for this study. The theoretical basis for this paper is the D&M information systems success model, an outgrowth of Shannon and Weavers (1949) model that focused on the technical, semantic, and effectiveness levels of a system. In the D&M model, these three levels are reflected in information quality, system quality, and service quality as depicted in Figure 1.

Information quality is identified as belonging to the semantic level and is “concerned with content issues, with content needing to be personalized, complete, relevant, and easy to understand” (Delone & Mclean, 2003). In the case of the e-Lion registration system, things such as the users understanding of various functions intended purpose versus their actual use in a “live” setting were our prime interest. System quality falls into the technical level, referring to “desired characteristics of a system like usability, availability, reliability, adoptability, and response time” (Delone & Mclean, 2003).

Figure 1. Delone and McLeane information systems success model (adapted from Cao & Brodnick, 2002)



In the e-Lion system, this was represented in people's attitudes towards the usability of the system and the highlighting of positive and negative impacts the system had on their registration experience. Service quality has more to do with the information system functions and organizations than the applications and "is concerned with the overall support afforded by the service provider, poor service translates to poor user satisfaction" (Delone & Mclean, 2003). The systems help desk support, on-line help function, and other supporting entities such as administrative support staffs in the various colleges are what embody this element of the model in e-Lion. User satisfaction corresponds to the effectiveness level evaluations of the e-Lion system and provides "an important means to appraise the user's opinion of the system" (Delone & Mclean, 2003).

Having operationalized the terms in the IS success model, our next step in our research process was the gathering of the data to populate the various levels of the model. The models general assumption is that user satisfaction with a system is influenced by the system quality and the information quality associated with the system and that use of the system is considered to be a measure of success since the use of the system leads to a realization of system benefits. In the case of the e-Lion registration system, use has a slightly different connotation as the study that D&M (Delone & Mclean, 2003) conducted dealt with e-Commerce systems and by and large the use of those systems was completely discretionary while the use of the e-Lion system is largely mandated due to the way in which it has been integrated into the core business processes of the university's registration procedures.

RESEARCH METHODOLOGY

Our study sought to identify student perceptions of the usability of the e-Lion system. Since we elected to use the D&M model (Delone & Mclean, 2003) as our theoretical framework for our research study, our approach was largely a

deductive one in which we moved forward with an idea of the kind of data we were looking for to answer our research questions. To investigate those research questions, we chose to use qualitative research methods to find out about students perceptions of system usability that were likely to exist below the surface.

Measures

We attempted to measure the factors that influence student's intention to use the e-Lion system and the user behavior of those that use the e-Lion system. Specifically, we conducted four semi-structured interviews with the students (undergraduate and graduate; American and International students). We conducted semi-structured interviews because of the ability for a semi-structured interview to "combine the flexibility of the unstructured, open-ended interview with the directionality and agenda of the survey instrument" (DeSanctis & Poole, 1994). Since our approach was deductive, we had in mind a general line of questioning we wished to pursue to aid in determining the accuracy of anecdotal evidence regarding the e-Lion systems perceived usability. In the conduct of these semi-structured interviews, we identified several factors that appear to influence students' intention to use the e-Lion system.

Subject

Given that most of our suppositions were based largely on anecdotal responses overheard in various venues and of a predominately opinionated nature, we concluded that to design good survey questions, we needed to elicit some candid and free form responses from a small group representative of the demographic makeup of interest to us in our study.

The semi-structured interviews provided us with the ability to tailor the questions to the areas of interest in our study, thus eliminating the wide open and somewhat unfocused results likely to come from a completely open-ended interview. Specifically, we interviewed four students in the College of Information Sciences and Technology. Two were undergradu-

ate students and the other two were graduate students. Of the two undergraduate students, one was an international student and the other was an American citizen; this was also the case with the two graduate students. We chose this sample because we wanted to try our best to make our sample representative of the whole student body at Penn State. At Penn State, both undergraduate students and graduate students use the e-Lion system but they use it in different ways. Both American and international students use the e-Lion systems, but for some reason, possibly cultural differences, they appear to hold somewhat different attitudes toward the e-Lion system.

After interviewing these four students, we identified the domains that may influence students' use of the e-Lion system and gained a somewhat more detailed appreciation of the perceptions they had of the usability of the system, as well as differences that existed between the respondent groups. This led us to think about the design of a more detailed survey instrument to follow up on points of interest from the interviews and the recruiting participants for our survey. Regarding the latter topic of the recruiting of respondents for the survey, we found enough differences between the interviewees to merit the recruiting of both undergraduate students and graduate students, both American students and international students, to determine if the trend towards a difference in perceptions and attitudes between undergraduate and graduate students does exist in a broader sample or if that was unique to our small interview respondent pool. We recruited these students by using the snow-ball method, specifically we started with the students we knew and then asked them to pass our web survey link to their friends at Penn State. We chose this method because it is cost effective and we could ensure a reasonable response rate though limitations of this method existed and were recognized. First, participants in our survey were likely students from College of Information Science and Technology since (IST) all of our team members are IST students and because the typical social circle is relatively

small, it is highly possible most of the participants were IST students. While this impacted on our sample and how representative it was of the Penn State student body, we deemed it to be an influential factor on the reliability of our study but its influence on the validity of our study is judged to be minimal.

SURVEY DESIGN

The final survey instrument was designed based on the factors of use identified from the semi-structured interviews in which we identified the domains and a pilot survey administered to a small group of respondents to elicit feedback on the questions clarity, the functionality of the survey tool and to determine if the questions posed provided data meaningful to our research questions.

The survey was chosen as a data collection technique due to the ability for it to provided consistent responses from a much larger pool of survey participants, yielding a much greater pool of data from which conclusions could be drawn based on analysis of respondents answers to questions related to the use, understanding, and usability, and flexibility of the e-Lion system that the semi-structured interviews and pilot surveys indicated were appropriate follow-on questions to pursue to answer our research questions. The questions posed related directly to the information quality and system quality and user satisfaction in the D&M model and indirectly to service quality and use intentions. Table 2 provides descriptions of some of the e-Lion functions used to generate survey questions.

DISCUSSION AND ANALYSIS

The main purpose of this study was to investigate the usability of the e-Lion registration system. The survey was delivered to 150 students comprised of both undergraduate and graduate students. 50 responses were registered yielding a response rate of 33.3%. Our survey demonstrated that the overall satisfaction of the users with the system was 2.4 on a 5 point

Table 2. e-Lion function descriptions

e-Lion Function	e-Lion Function Description
e-Lion Main Menu	Main access point for accessing e-Lion
Kerberos User Authentication	User authentication system used by e-Lion
Bills/Tuition/Other	Screen used to access university billings
Bursar Account	Screen used to access bursar account
Drop/Add	Provides means to add and drop courses
Grades	Produces grade reports for each semester
Parent/Other Access	Allows granting of e-Lion access to others
Registration	Allows students to register for classes
Student Schedule	Provides students a semester schedule
Transcripts	Means for obtaining official transcripts

Likert scale which equates to a below average level of satisfaction with the system. Further, we ran one way analysis of variance to see whether there is any difference in user perception about (i) effectiveness and (ii) flexibility of the e-lion system across undergraduate and graduate students. We present (Figure 2 and Figure 3) the results of the analysis. From these results, we can see that the perception about both the effectiveness and the flexibility of the e-lion system do not vary across these two students groups with a p-value respectively of 0.889 and 0.749 at alpha = 0.05.

Findings from the interviews portray a widely divergent set of opinions from the interview respondents. Their individual opinions ranged from a general sense of satisfaction with

certain of the functions to a significant level of frustration with others. As such, the use of a feature-centric approach in our analysis seemed the logical course for purposes of analysis. According to Desanctis and Poole (1994) “A feature-centric approach seems valuable because they are the specific features in use that influence the work outcome.”

In order to understand the factors that are instrumental in shaping the users perception of the e-Lion registration system, we draw on D&M information systems success model. The framework explains how user satisfaction is influenced by the information quality, system quality, service quality and the use of the system. Our findings suggest that the general usability of the system is above average.

Figure 2. Descriptive statistics

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Effectiveness	Graduate	14	2.7619	.69711	.18631	2.3594	3.1644	1.50	4.50
	Undergraduate	31	2.7984	.85494	.15355	2.4848	3.1120	1.00	4.50
	Total	45	2.7870	.80139	.11946	2.5463	3.0278	1.00	4.50
Flexibility	Graduate	14	2.6286	.83245	.22248	2.1479	3.1092	1.20	3.70
	Undergraduate	31	2.7197	.89898	.16146	2.3900	3.0495	1.00	4.20
	Total	45	2.6914	.87039	.12975	2.4299	2.9529	1.00	4.20

Figure 3. Anova

		Sum of Squares	df	Mean Square	F	Sig.
Effectiveness	Between Groups	.013	1	.013	.020	.889
	Within Groups	28.245	43	.657		
	Total	28.258	44			
Flexibility	Between Groups	.080	1	.080	.104	.749
	Within Groups	33.254	43	.773		
	Total	33.334	44			

However, respondents also expressed a certain level of dissatisfaction with usability of some specific features. For example, one interviewee complained about the need to visit a separate web link to obtain course numbers required for registration for a specific class, expressing a desire for that information to be available via dropdown box on the same screen.

Another measure of system quality is system availability. Some of the respondents expressed their dissatisfaction with system availability, relating stories related to system downtimes during critical periods. Said one respondent, "...I have had trouble when the system has crashed before. All of the students in the honors college know when the time is. So I think freshman year in the dorms there was one time specifically where the time was at 12 am so everyone was on refreshing at 12am and everybody in the hallway. A couple people got in, a couple others got in, and then it crashed for 3 hours, and then everybody in the next day registered."

Flexibility is yet another of the elements of system quality of interest to us. Generally speaking, the data suggests that users do not consider most of the features of e-Lion to be flexible, rating them overall below 3.0 on a five point Likert scale. One good example of this lack of flexibility comes from a respondent who wished to have the ability to generate the optimal course schedule based on available choices. He expressed frustration that the system didn't provide any such mechanism for doing so. Consequently, the respondent was forced to use a third party website (lionschedules.com) to accomplish this task.

The final element of system quality considered in our study was effectiveness of some specific functions. The functions of interest were course sign-up, confirmation registration, paying tuition, and the grade report. With the exception of the grade report, all of these functions fell below 3.0 on the five point Likert scale which is an indicator of low effectiveness.

From the perspective of information quality, we were interested in the examination of understandability. In a generalized sense, respondents considered their understanding of the e-Lion system to be above average, rating consistently above 3.0 on the five point Likert scale across nearly all functions. However, the perceived understanding of the respondents, when compared to the intended functionality of the system, indicates a mismatch between the two. For instance, our data shows that respondents characterize their understanding of the grade function to be 3.75 on the five point Likert scale, yet the use of the grade function on a daily basis by some respondents indicates that they don't understand the grade function as well as their personal assessments would indicate. The grade function is only updated at the end of the semester when final course grades post.

Thus, the checking of grades daily by a subset of the respondent pool indicates a lack of understanding of the intended use of this function. Another of the problems identified by some respondents regarding understandability of the system was the confusing terminology associated with certain of the functions. Several respondents indicated they weren't able to understand the difference between certain features in the e-Lion system. For example,

the “drop/add” function garnered the following statement “I was a little bit confused about the difference between adding and dropping there”. Another respondent said “basically I think it is very complete except that there are lots of links which I do not really [understand] what they stand for.”

Another of the factors of interest related to information quality is that of integration. Several respondents indicated additional features they would like to see implemented in e-Lion that are not implemented because of a lack of integration with the other systems. Respondents expressed a consistent desire to see a more integration between the course scheduling system and e-Lion registration system. One respondent commented “It would be really nice if the e-Lion system had something where you could put in your course and could see your weekly schedule before you are actually registered.”

In the area of service quality, we concentrate on two areas. In the case of training, graduate respondents rated the effectiveness of formal training at 4.0 on a five point Likert scale which indicates an above average effectiveness rating. Conversely, undergraduate students rated formal training at 1.43 on a five point Likert scale indicating a below average effectiveness rating. This represents a significant difference between the perceptions of graduate and undergraduate students, the only area in which substantial differences in perception exist. This difference also highlights a significant inconsistency in the way that training is delivered to different groups of students, in this case international and American students. International students indicated they received formal training during a mandatory orientation session whereas American students received no such formal training.

Another factor with regard to service quality is the sources of assistance. The general perception of respondents is that the support from the university is not considered effective, with friends rated twice as effective as the help desk in providing assistance. Another finding was that academic advisors are more involved in undergraduate assistance actions than graduate students. This isn’t surprising considering

the differing maturity levels of graduate versus undergraduate students, as well as differing approval processes levied on the two groups.

The last element of the model used in our study was system use. We found a correlation between the frequency of use and the understanding of system functions, this was particularly evident in the parent/other function of e-Lion, where use was well below average among respondents and understanding of the function was rated low as well. This relationship confirms what is indicated in the D&M model in that more frequent use of the system is likely to bring about better understanding, and consequently more satisfaction, with the e-Lion registration system. Regarding net benefits, as the D&M model states “there will be a variety of system net benefits measures” (Delone & Mclean, 2003). In the case of our study, the focus is placed on user’s perceptions and their relationship to user satisfaction. Thus, user perception is regarded as the main antecedent of net benefits.

CONCLUSION

Based on our study of the e-Lion registration system, several interesting findings emerged. First, the anecdotal claims regarding the usability of the e-Lion system in large measure didn’t manifest themselves in the results of the survey of e-Lion users. While pockets of dissatisfaction with selected features were found to exist, the overall characterization of the usability and effectiveness of the system by respondents was found to reflect a general acceptance of the e-Lion system as adequate. The dissatisfaction with the usability of individual functions such as course sign-up was found to be more of a problem with the interface and what several respondents regarded as a somewhat cumbersome way in which certain features were implemented. The correspondence of the effectiveness evaluations of system users to user satisfaction, according to the D&M model, is based on both positive and negative aspects of the system when considered as a whole which

appears to explain the inconsistency between the anecdotal claims of dissatisfaction and the generally good level of satisfaction exhibited in the findings of our study.

Another interesting finding of the study was the role of training in users perceptions of the e-Lion registration systems. The D&M model attributes training to the service quality component of a system and another significant component of the users' perceptions of systems usability and their satisfaction with it. The poor ratings shown by our survey overall exhibit an area where significant opportunity exists for improving system users perceptions through more effective training on the use of the e-Lion registration. If users were better informed on what the system functions were and what their intended use was considered to be from the perspective of the system designers, the information quality component of the D&M model would also be enhanced; a practical implication of this is that a more effective training regimen could lead to a more usable system and would require little if any modification to the e-Lion system to implement.

Finally, there was an interesting difference between the undergraduate and graduate students groups regarding the perception of training on the e-Lion registration system (Figure 4). When comparing undergraduate versus graduate students, we found an interesting

trend of behavior regarding how training was administered among different groups. It was only the graduate student group that received formal training on the e-Lion system during new student orientation and further, this training was only conducted within the international graduate student group. This tendency towards training of groups in different ways appears to belie a misunderstanding of the familiarity level of differing groups of students and raises further questions regarding why this misconception exists.

Generally, the D&M model concentrates on the information quality, the system quality, and the service quality of a system. Within this framework, these components contribute to the overall satisfaction of users and provide a mechanism for measuring and evaluating the opinions of the users towards the system in question. In the case of the e-Lion registration system, these components match the structure of the system quite well; however, the D&M model does have some limitations regarding its applicability in the case of the e-Lion system. The most significant of these is the "intention to use" component of the system. We would have previously addressed this shortcomings of the model in this area however it bears repeating that the model is primarily designed to address systems whose use is of a more voluntary and elective nature and the more or less

Figure 4. Effectiveness of training



“mandated use” nature of e-Lion raises some questions, most especially in the arena of generalizability of the findings to other systems. This raises interesting questions for future research into these types of systems regarding how the mandated or voluntary use of a system impacts user’s perceptions of the system. In the case of our research, this remains an open question as our focus was more on the usability aspects and didn’t delve into issues related to the mandated use of the system. Another of the limitations of our study was the limited time available to conduct as thorough an investigation of the use of the system in what we referred to as a “live setting.” In our study, the ability to obtain access to the respondents and perform sufficient interviews and observations was hampered by our timeline and as such, we were forced to abstain from observations of users actually using the e-Lion system.

This limitation leads us to our final comments regarding what we’d have done differently if we had another opportunity at doing this study. First and foremost, we’d have worked the coordination of the respondents much earlier in the process. Access to the respondents and the data they had to offer in the form of interviews, surveys, and observations was an absolute necessity and we found considerable difficulty in obtaining unrestricted access to these groups. Securing access to the data and developing relationships with those acting in the role of gatekeeper to these rich pools of data is something we’d have begun work on much earlier in the process had we known what a challenge gaining this access would become. Another thing we’d have changed was the addition of observations to our data collection plan to better capture how the system was actually used by e-Lion system users. We encountered several instances of reports by users on their perceived understanding of the e-Lion system that didn’t appear to match and believe there may have been some level of difficulty introduced into our study through our dependence on self-reporting. This is an area we could have better addressed had we conducted system user

observations where we would have been better able to evaluate what the users were doing and draw our own conclusions regarding their perceived understanding of the system directly from their actions. Through the data collected in our study and implementation of these additional refinements, we felt we could derive some valuable implications capable of better informing the development of similar systems; the true value of the outcomes of our study of the e-Lion registration system.

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