

Interaction Design Principles in Virtual Learning Tool

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ABSTRACT

As e-learning methods in Universities continue to grow, it becomes significant to recognize the usability challenges that are linked with the tools like Blackboard. Blackboard is being used in Botho University, so it is essential that the usability of its user-interface is assessed. This paper presents the outcome of assessment towards adherence of Design Principles in Blackboard from the student user perspective at Botho University, Botswana. As the University is shifting from conventional teaching mode to the contemporary blended mode a slow progress in using Blackboard is observed among the learners. It is critical to increase the usability by addressing imbalances, that are observed during this study. The challenges and frustration that these user groups experience when using the Blackboard system for learning purpose cannot be ignored as it has a severe impact on the usability and user experience. Addressing this issue to have an increased effective usage can be seen as main agenda in the Learning, Teaching & Assessment Strategy (LTA) of Botho University. For this, gathering the learners' opinion is critical to this agenda, who learn, a specific module under a programme that could be offered under any of the Faculties. The study used Blackboard as a VLE tool to get the participants' opinion in terms of their ability to acclimatize various components in Blackboard that is related to the design principles. The study is performed by using evaluation questionnaires collected from students, who are the users of Blackboard. It is found that users are more satisfied with some more expectations concerning the tool's usage. The study identified issue of low internet bandwidth as a primary hinderance to use Blackboard and the need for more trainings and this has been recommended to increase and enhance the accessibility and usability of the software.

Keywords

Blackboard; Interaction Design; Design Principles; E-Learning.

1. INTRODUCTION

Computers have now become indispensable gadgets available to everyone who can afford them irrespective of any social differences and is available in almost parts of the world [1]. In Botswana, there has been a significant adaptation of computers and computing systems that has resulted in having more interactive systems in education and training. Students at Botho University have been using Blackboard for self-learning purposes. It also helps them to respond to formative assignments that would provide an evaluation on their performance during the course of study. The notion that such a tool can be used only for distance learners has been disproved and all students of different learning modes use the Blackboard platform at Botho University. Apart from downloading learning materials, the students also use the

discussion forum where they share and learn with their peers. Several reasons could influence the usability and the user experience of Blackboard. In this study, the design principles for Interaction Design are examined and each of them is evaluated to see the extent to which the existing design principles are working and where there are challenges. This research project primarily intends to explore and examine user experience and usability factors when it comes to the relationship between a computing system(Blackboard) and humans (students).

2. RESEARCH AIMS

2.1 Problem Statement

Blackboard in Botho University has been deployed for inculcating independent learning amongst students. Before the deployment of Blackboard, the lecturers relied on email to share the learning materials. The study guides and assignments were also posted in File Transfer Protocol (FTP) server. However, as more programmes were introduced, many learners had to be given different privileges to access the modules that were registered by them. Hence there was a need to deploy a better learners management system. Botho University believed that there will be a better learner experience thus improvising the student performance. However, the users at Botho University often do not explore the features to the full and this is evident from the usage report dated 19 February 2018 shown in table 1. The user activity overview for the days between 5 February and 19 February clearly indicates that the "Average Login Time Per User Per Day in Hours" was 0.10 hours and the "Average Logins" was 6.47 while the total number registered users were 5105 and the total number of modules were 627. The design principles [2] play a critical role in achieving the usability and user experience goals and hence a thorough evaluation of Blackboard by using these principles will help us to measure the effectiveness to a certain extent. Understanding any software application and its features by the users relies on the design of the application's interface. Blackboard, a tool that is primarily used by teachers and students has been consistently recording less usage at Botho University. It is anticipated that evaluation of Blackboard on the aspect of design principle will help the University to alleviate this issue.

Table 1. Blackboard Usage report Source: System Usage Activity Blackboard

User Activity Overview	
Course	All Available Courses
Availability	
Nodes	All Nodes
Terms	All Terms
Number of Courses	627
Number of Users	5105
Date Range	02/05/2018 - 02/19/2018

Activity is shown for enrolled users only.

User Activity by Day	
02/05/2018 - 02/19/2018	
Average Login Time Per User Per Day in Hours	0.10 Hours
Average Logins	6.47

2.2 Research Objectives & Questions

The evaluation of a virtual learning system like the Blackboard is an important exercise to recognize the requirements of the learner; the challenges faced by different user groups and thus provide ways of improved usage. As such, the aim of the study is to assess the current level of usability of Blackboard at Botho University among various student groups. The main objectives of this study are, to:

- i) Explore the heuristic design principles of the Blackboard platform at Botho University.
- ii) Investigate the perceptions of different user groups on the effectiveness of Blackboard design principles being used.
- iii) Identify the challenges faced by different users arising from the design principles and recommend ways to achieve greater satisfaction of learning.

Following from the stated objectives, the research questions for this study are:

- a) What are the heuristic design principles used on the Blackboard platform at Botho University?
- b) What key challenges do users face resulting from the heuristic design principles?
- c) How can the heuristic design principles be improved upon to achieve greater effectiveness, efficiency and satisfaction in learning?

3. LITERATURE REVIEW

3.1 Background

Interaction Design is the discipline that helps the application developers to plan the interface as per the behavior of human-computer systems like the Blackboard Learners Management system. The official ISO 9241-11 [3] definition of usability is “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use” [4]. Interaction design also focuses on improving User-experience goals [2] by developing interactive products that are “satisfying, enjoyable, fun, entertaining, helpful, motivating, aesthetically pleasing, supportive of creativity, rewarding and emotionally fulfilling” and these are equally important as efficiency and productivity at work.

3.2 Design Principles of the Blackboard

Design principles framed by Norman provide heuristic guideline that are relevant in designing any interactive product. The design principles that are relevant for Blackboard are visibility, feedback, constraints, mapping and consistency. Each of the principles are defined in the section that follow. The adherence of those principles in Blackboard is also explained along with the challenges identified.

3.2.1 Visibility

Visibility is the rudimentary principle emphasizing that more noticeable an element is in the interface, the more probable the users will be aware of them and how to use them.

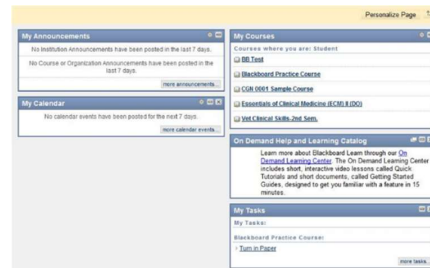


Figure 1. Blackboard Visibility

In Figure 1, the Blackboard provides good visibility of all the required components. The ability to apply this principle is realizing that not everything can be made visible, because it'll ultimately clutter the interface but instead need to rank the interface elements in terms of relevance and place them.

3.2.2 Feedback

Feedback is one of the design principle of making it understandable to the user on what action has been taken and what actions have been achieved and this could be an error message or simple label that guides the user to accomplish a task in Blackboard such as assignment creation, submission, grading of marks.

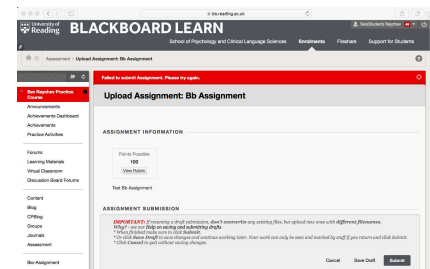


Figure 2. Blackboard Feedback

Figure 2 shows the error messages and pop up dialogs that guides the user on how to proceed further. The key challenge while adhering to this principle is that the lecturers sometimes may not use appropriate settings that could validate the actions of their learners and this eventually leaves the user assuming on what action they have taken and the repercussion of doing so ensuing in user frustration.

3.2.3 Constraints

Constraints is one of the design principles that puts an emphasis on restricting the range of options to interact for the user that simplifies the interface and direct the user to the relevant subsequent actions. Blackboard provides the feature to set various constraints by the instructional designers for their respective batch of students as shown in Figure 3. The adaptive release feature provides the facility of setting various constraints to the student groups.

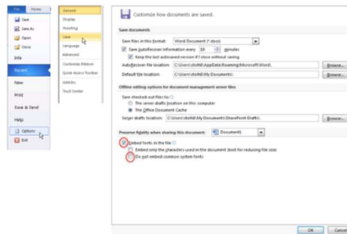


Figure 3. Blackboard Setting Constraints

3.2.4 Mapping

The design principle mapping defines on having a clear association between controls and the outcome they have on the real world. Blackboard uses sets of known icons and controls that enables the users to have easy navigation.

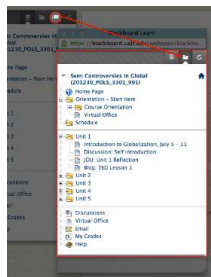


Figure 4. Blackboard Mapping

3.2.5 Consistency

The design principle consistency states the emphasis on evenness in having comparable operations and comparable elements for achieving similar tasks. An instructional designer, by providing consistent elements all over the interface, will make the learners' experience far easier to use. Blackboard interface provides similar elements for all the users in order to make it easily usable in their respective domains. The key elements that are available for ease of access are illustrated in the figure 5. Element A marked in figure 5 is "My Blackboard" and the user menu that are available everywhere in Blackboard Learn and gives the users a personalized view of the online environment. Element B displays relevant course data from all of the users'. Element C shows all the Modules on the "My Institution" stub and this controls which modules to appear on student page. Element D is the "Add Module" that is used to see the list of modules offered in a semester. Element E is the "Personalize Page" that enables the users to customize their page by allowing them to change the color scheme of the page and this provides an instructional designer to have good designs. It is often observed that both interface design of the blackboard and the instructional design plays a critical role to empower the students and facilitating learning.

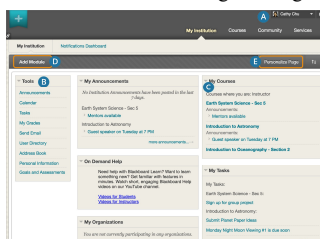


Figure 5. Blackboard Consistency

3.3 Student Attitudes about Technology

Applying technology in academia becomes effective only after an active usage by the students. The present generation of students use social networking sites with utmost convenience and that would certainly support the students to appreciate and apply the online educational tools for their learning process. Despite this fact, the assessments regarding the appreciation of students to apply educational technologies and the evaluation pertaining to the usability and user experience for VLEs like Blackboard are still under research in Botswana [5] and this is similar in other parts of the world [6]. One of the studies[5], elucidate that many learners could use Blackboard effectively when they were given clear guidance. Young university Batswana graduates who have easy access to internet are often unenthusiastic to use the educational tools. It is important to note that "Digital Competence is both a requirement and a right of citizens, if they are to be functional in today's society[7]." The current issues that prevail could challenge the usage of Blackboard discussion forums and the effective usage of VLE at Botho University.

3.4 Interaction Design & Evaluation

A main aim of interaction design to redress the gap between the interactive products which was engineered as a system which perform a set of functions and how the system was used by the real people by bringing usability into the design process. Virtual teaching tools such as the Blackboard and most of the learning activities in electronic mode necessitates familiarization of the interface of the application and its navigability and the scholars who may not have acceptable computing skills could become unwilling to learn using these web tools [8]. Heuristic evaluation is a usability review procedure initially created and established by Jakob Nielsen and team [9][10], where the design professionals, directed by a collection of usability principles known as heuristic, assess if the design interface components, such as dialog boxes, menus, navigability features, online help etc., confirm the required norms. The above theory of heuristic evaluation is carried out, to understand the successful implementation of heuristic principles with the main focus on the Blackboard users who may knew the benefits of Blackboard system and yet struggle to use due to unforeseen issues in interactivity [11].

4. RESEARCH METHODOLOGY

4.1 Research Methods

The research method used for conducting this study was the survey of students who use the Blackboard at Botho University that was carried out through the use of questionnaires. A comparison was also made between various groups of users. This data collected and analysis done were based on the questionnaires filled.

4.2 Population and sample selection

The study was conducted in all the Faculties of Botho University, namely the Faculty of Computing(FOC), Faculty of Business and Accounting(FBA), Faculty of Health & Education (FHE), Faculty of Engineering & Applied Sciences(FEAS) and Faculty of Hospitality & Sustainable Tourism (FHST). A target population describes a group of individuals, objects and aspects that may contribute through the amount of valid information they could provide (Kahane, 1992). The target population for this research study were those who are using Blackboard at Botho University for learning purposes. The population for the study consisted of around 1000 students who enrolled with "active" status in Botho University and a number of registered users of Blackboard VLE,

for the modules taught from June 2015 onwards June 2018. As per the Blackboard usage report generated on 19-Feb-2018, there were typically 418 Module Batches that use Blackboard for instruction. For this study, the total number of student participants were 136 valid responses.

4.3 Methods of data collection

For the survey, Evaluation of Blackboard Design Principles for Students Questionnaire (EBDPSTUQ) for students was developed. The questionnaires were created using Google forms and copies were distributed to all the users through email with a brief description of the study and clear instructions on how to fill them. The procedure then required the completion and signing of a waiver and ethical clearing documents, the participants were allowed to respond to the questionnaire. The questionnaires were structured in a way to enable the participants to respond to each question based on their own experience with Blackboard and the impact of the usability and user experience as a barrier to use Blackboard. The questionnaires also had sections that allowed for descriptive comments. Closed-ended questions were included and structured in a manner that participants could only respond them in a pre-defined section or by choosing from the predefined options. These were typically entry level questions which do not require long descriptive answers. The questionnaire was pilot tested before the actual data collection process by sending it to a small group of students. The feedback received from the group was used to rephrase the questions to avoid anomalies. Google forms also had the feature to download real-time questionnaire responses in multiple formats (e.g. excel) which was then coded and analyzed using SPSS. The 'analysis' feature in SPSS allowed the researcher to perform reliability testing including the missing data by applying the Cronbach Alpha to measure the internal consistency and further analysis was done only after verifying if the acceptable reliability value was close to 0.6.

4.4 Ethical Considerations

In any research project and particularly where humans are invited to participate, there should be procedural means to guard those who actively participate and the information they may divulge (Broome 1984). All the ethical considerations that is required to conduct this study was adhered to and as a first step, an application to the research permit was made to the Department of Research, Science and Technology, Botswana and the permit was received on June 14, 2018 and this enabled the researcher to proceed with administering the questionnaires. The researcher disclosed his full identification to the participants before starting the data collection process. The consent forms had been signed by participants and each participant had received an electronic copy of the statement of interest from the researcher. The form was designed in a way that if a potential member failed to complete and sign the consent form, the questionnaire will not proceed to the next section and hence data will not be collected.

5. Discussion, Interpretation of Results and Recommendations

5.1 Interpretation

The interpretations of the outcome of the survey are discussed in relation to the research questions, as set out in section 2.3. Table 2 shows the percentage of student participation from various programmes. Students pursuing Bachelors programme had the highest participation with 61%, followed by students pursuing Masters programme with 21.3%. The remaining contribution were from students pursuing Professional Diploma with 10.3%,

Diploma with 2.2 %, post graduate certificate with 1.5% and post graduate diploma with 3.7%.

Table 2. Programme Level Participation of Students

	Frequency	Percent	Valid Percent	Cumulative Percent
Bachelors	83	61.0	61.0	61.0
Masters	29	21.3	21.3	82.4
Professional Diploma	14	10.3	10.3	92.6
Valid Diploma	3	2.2	2.2	94.9
Post Graduate Certificate	2	1.5	1.5	96.3
Post Graduate Diploma	5	3.7	3.7	100.0
Total	136	100.0	100.0	

5.1.1 What are the heuristic design principles used on the Blackboard platform at Botho University?

The first and foremost research question for this study was to determine the design principles that are being adhered in Blackboard being used by students at Botho University. Evidence from this study suggests that students have a positive opinion on the adherence of design principles in Blackboard. From table 3, it is observed that 91.1% of student participants felt that Blackboard interface adhered to the 'Visibility' Design principle and 8.8% of the participants rated moderate for this statement. For the design principle 'Feedback', 87.5% of student participants had rated as 'good' while 12.5% rated it as moderate.

Table 3. Adherence of DP in Blackboard

Adherence of Visibility in BB				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Moderate	12	8.8	8.8	8.8
Valid Good	92	67.6	67.6	76.3
Valid Very Good	32	23.5	23.5	100.0
Total	136	100.0	100.0	

Adherence of Feedback in BB				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Moderate	17	12.5	12.5	12.5
Valid Good	119	87.5	87.5	100.0
Total	136	100.0	100.0	

Adherence of Constraints in BB				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Moderate	60	58.8	58.8	58.8
Valid Good	66	41.2	41.2	100.0
Total	136	100.0	100.0	

Adherence of Mapping in BB				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Moderate	58	42.6	42.6	42.6
Valid Good	78	57.4	57.4	100.0
Total	136	100.0	100.0	

Adherence of Consistency in BB				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Very bad	6	4.4	4.4	4.4
Valid Moderate	43	31.6	31.6	36.0
Valid Good	84	61.8	61.8	67.6
Valid Very Good	3	2.2	2.2	100.0
Total	136	100.0	100.0	

For adherence of the 'Constraints' design principle, 41.2% rated as good and 58.8% rated as moderate. For the design principle 'Mapping', 57.4% of student participants had rated as 'good' while 42.6% rated it as moderate. For adherence of the 'Consistency' design principle, 64% rated as good or very good, 31.6% rated as moderate and 4.4% rated as bad. It is observed that the student participants felt that the adherence to all design principles except 'Consistency' were rated as either moderate or good. However, for consistency, few (4.4%) felt that this design principle was not adhered to. The reason could be perhaps, a student might be doing various modules in a semester, and each instructional design might vary as per the nature of the module and hence an inconsistency could have been observed by the participants. Other than this principle, the students rated towards positive range. It is also important to note that a significant percentage of student respondents have opted for "moderate" responses in this section and this indicates that students could not clearly express if that specific design principle is adopted in

Blackboard. The other point of significance which is worthwhile to record is that the students at Botho University from various Faculties were learning through blended mode, that is, mix of both face-to-face classes (guided learning) and independent learning through Blackboard and the lecturers may have instructed students in class on how to use Blackboard that could have led towards this positive rating.

5.1.2 What key challenges do users face resulting from the heuristic design principles?

For the questions pertaining to 'identifying the completion of task like uploading assignment' and 'achieving the objective when participating in discussion forums' in Blackboard, 30.9% and 42.6% of students indicated 'easy' respectively. When the students were asked to list one positive aspect that they liked the most, 44.9% of them stated that Blackboard is user friendly and 22.5% of them responded that it is simple. It can be observed that only 6.6% have appreciated the discussion forums. When the students were asked to list the negative aspect of Blackboard from their experience that could hinder them to use blackboard, 33.8% of students expressed that 'face to face' teaching is better when compared to the online discussions and 27.2% of them claimed that internet bandwidth is not adequate to use it effectively.

5.1.3 How can the heuristic design principles be improved upon to achieve greater effectiveness, efficiency and satisfaction in learning?

The student participation from various Faculty groups in Botho University, the Faculty of Computing shows a high percentage of participation with 50.7% followed by 41.9% from Faculty of Health and Education. The remaining percentage of student participation was from Faculty of Engineering & Applied Sciences and Faculty of Business and Accounting with 2.9% each, with the Faculty of Hospitality and Sustainable Tourism having 1.5%. The results might vary if other Faculties contributed equally as that of the students from the Faculty of computing as they have good appreciation of software tools and this could have influenced the rating. However, with the collected data, it is clear that the users from all groups must come forward to use the tool, so as to achieve greater effectiveness, efficiency and satisfaction in learning.

6. CONCLUSION

From the view of students, Blackboard allows peer learning, independent learning and easy uploading of assignments and hence found it to be useful tool. With the overall rating being above average, the following recommendations that are based on the inferences were derived. Though the issue of the internet is not related to the design principles, the researcher appreciates the need for good bandwidth to reduce user frustration when using Blackboard and thus recommends that the Blackboard Administration Team should resolve this issue at the earliest possible time. The Blackboard Administration team must provide extensive training to both students and staff in terms of usage. Also, a specific training on achieving consistency through instructional design must be conducted for the staff on a regular basis. An extensive study to compare various tools that are being used at different institutions in Botswana will be useful as Botswana Government is moving towards new regulations and outcome-based education, and it is believed that such research would certainly emphasize the shift of teaching and learning practice from user-centered design to learner-centered design.

7. ACKNOWLEDGEMENTS

My sincere thanks to the Ministry of Education and Skills Development, Botswana for permitting to undertake this study and to the management, colleagues and friends at Botho University who gave me the support to carry out this study.

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