Assessing Implementation of blended Learning in Constrained Low Bandwidth Environment

Nazir Ahmad Suhail

In order to meet the exponentially growing demand of higher education, implementation of e-learning is an ideal choice for the universities. And the introduction of the concept of blended learning model is a natural start for the implementation of e-learning solutions for the universities in developing countries which is pursued by many organizations in rich economies. When organizations are in the process of implementation of new type learning, a number of factors come into play. Some factors are about the technology, others about the prospective users, still others about the local context of use and the associated costs [Wilson et al. 2002]. This paper sought to study the readiness of organizations seeking to implement blended learning in constrained low bandwidth environment with an emphasis on university settings and proposes an e-readiness model. The study employed three types of instruments; Institutional Readiness Questionnaire, Lecturers’ Perception Questionnaire, and Students’ Perception Questionnaire.

1. Introduction

In order to meet the exponentially growing demand [Goddard 1998] of higher education, implementation of e-learning is an ideal choice for the universities. And the introduction of the concept of blended learning model is a natural start for the implementation of e-learning solutions for the universities in developing countries which is pursued by many organizations in rich economies. Blended learning model combines best experiences in face–to-face learning and e-learning thoughtfully to optimize the learning process. Blended learning has been successful due to combining successful elements of both traditional and technology-enhanced learning and that it enhances the learners’ performance over single-delivery mode [Zenger and Uehlein 2001; Barbian 2002].

Least Developed Countries (LDCs) fall under the category of constrained low bandwidth environment. Constrained low bandwidth environment includes: insufficient bandwidth, inadequate telecommunication infrastructure, irregular power supply, high cost of technology, among others. The bandwidth available to a user in LDCs is much lower than that in developed world [aidworld 2006]. An average university in LDCs pays 50 times more for their bandwidth than a typical university in other parts of the world [Steiner et al. 2005].
The issue of low bandwidth can be addressed through bandwidth optimization. This approach puts emphasis on how to explore ways to control and manage many bandwidth hungry Internet applications that consume this institutional resource [infobrief 2003]. Universities can use the available conserved institutional bandwidth to optimize the media performance.

However, addressing only the issue of low bandwidth environment doesn’t suffice to complete of the complex process of blended learning implementation composed of many inter-related factors. According to Wilson et al. [2000], “Some factors are about the technology, others about the prospective users, still others about the local context of use and the associated costs”. To address the issues of complexities that abound during the implementation process of blended learning, researchers have called for the need of a framework to guide the practicing managers. For example, Bates [2000] argues that an over reaching framework is needed to ensure that the use of all technology needs are embedded within a framework. Others researchers [Hadjerrouit 2007; Uys et al. 2004] support the idea of Bates and suggest that blended learning needs to be implemented within a clear and strategically developed framework in order to have the desired impact.

But prior to the development of the framework, it is imperative to assess the preparedness of the organizations planning to adopt blended learning strategy for their course delivery. This in turn would lead to the successful design of a strategy based on the realities, opportunities and constraints identified in the e-readiness model [e-readiness Guide 2002]. E-Readiness as defined by Borotis and Poulomenakou [2004] is “the mental or physical preparedness of an organization for some e-learning experience or action”. Also it is equally important that various stakeholders; students, lecturers and administrative staff [Sorenson and Reiner 2003] are “e-ready so that a coherent achievable strategy, tailored to meet their needs, may be implemented” [infodev 2001; Sife et al. 2007].

Based on this background, this paper sought to study the readiness of organizations seeking to implement blended learning in constrained low bandwidth environment. And assess the awareness and perceptions of academic staff and students with an emphasis on university settings and proposes an e-readiness model.

2. Methodology

By using multiple case study approach this study developed three survey questionnaires; Institutional Readiness Questionnaire, Lecturers’ Perception Questionnaire, and Students’ Perception Questionnaire to explore factors relating to e-readiness in constrained low bandwidth environment.
3. Research Design

Figure 1 below shows the research design for the study

**Fig. 1: Research design framework**

![Research Design Diagram](image)

4. Participants

For the survey we selected one public and two private universities, namely; Makerere University, Kampala University and Kampala International University all located in Kampala, Uganda. The reason for selecting Makerere University is that this is the most popular Government funded University in Uganda with a population of about 30,000 students which would provide better understanding of the context. Other two universities are private but they have upcountry branches. Hence these three universities make a good representative sample of Ugandan universities.

5. Data Collection Instruments

A combination of three data collection instruments; Institutional Readiness Questionnaire, Lecturers’ Perception Questionnaire, and Students’ Perception Questionnaire were designed for the study after identifying three key stakeholders; institutions, lecturers, and students. The questionnaires contained open ended and
closed ended questions. Mukazi [2005] argues that identification of stakeholders and to secure their support is key to the success for any technology enhanced initiative in an organization in the context of LDCs.

6. Procedures

After having the survey instruments ready which were paper based, researchers distributed 10 Institutional Readiness (survey) Questionnaire to various Deans/ Heads of department in three Universities in Kampala, Uganda. A total of 12 Lecturers Perception (survey) Questionnaires were also distributed to lecturers by the researchers. In addition to that 47 Students Perception (survey) Questionnaires were distributed among students in two universities. We distributed the instrument to the students belonging to Faculties of Computing and Information Technology in two universities at the time when they were sitting free in their lecture rooms. While for other Faculties questionnaires were distributed and collected through the lecturers of the respective faculties.

The study took place during the period November 2007 –January 2008.

7. Data Analysis and Results

7.1 Institutional Readiness Questionnaire (IRQ)

The provision of appropriate technological infrastructure, administrative, technical, and logistic support is crucial for the successful implementation of blended learning in an organization. Out of 10 IRQs which we distributed to various Dean/Head of departments of various universities, only 8 responded. The universities include; Makerere university, Kampala university, and Kampala International university in Uganda.

The Institutional Readiness Questionnaire was synthesized from Badri 2002. The main areas covered were on Infrastructure, Human resource, National policy and Implementation of blended learning initiatives as shown in Tables I, II, and III.

Table I. Statistics for the items related to Technological Infrastructure

<table>
<thead>
<tr>
<th>Item</th>
<th>Human resources</th>
<th>No. of Respondents</th>
<th>Percentage of respondents’ choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q.9</td>
<td>How is the availability of IT professionals for E-transactions in your department?</td>
<td>8</td>
<td>Good 75%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bad 25%</td>
</tr>
<tr>
<td>Q.10</td>
<td>What is the level of computer literacy in your department?</td>
<td>8</td>
<td>High 25%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Low 75%</td>
</tr>
</tbody>
</table>
Q.11 Is there any ICT training facility in your department or university?  
Yes 100%  
No 0.00%

Q.12, 13 What is the attitude of the academic staff, and students towards blended learning implementation in your department?  
Positive 75%  
Not known or not good 25%

Table 10. Statistics for the items relating to National policy & blended learning implementation initiative

<table>
<thead>
<tr>
<th>Item</th>
<th>National policy &amp; blended learning implementation initiative</th>
<th>No. of Respondents</th>
<th>Percentage of respondents’ choice</th>
</tr>
</thead>
</table>
| Q.15 | Is there any Government authority in-charge of ICT in the country? | 8 | Yes 100%  
No 0.00%  |
| Q.16 | Is implementation of blended learning readiness a national priority? | 8 | Yes 62.5%  
Don’t Know 37.5%  |
| Q17  | Is there any partnership between NGOs and Government that exist in the country to improve ICT readiness? | 8 | Yes 100%  
Don’t know 0.00%  |

7.2 Lecturers’ Perception Questionnaire (LPQ)

Lecturers’ Perception Questionnaires were distributed to lecturers in various faculties in two universities, namely, Makerere University and Kampala University in Kampala, Uganda. The Questionnaire was [synthesized from Kamsin 2005] and had two sections; Background Information of respondents, and their Perception to assess their self-reported readiness for blended learning.

7.2.1 Background Information

The survey included 4 (33.33%) female, and 8 (66.66%) male lecturers. The majority of the lecturers are above 30 years of age as shown in Table IV. The survey reveal that most lecturers have high level of teaching experience; 5 (41.7%) of them have teaching experience ranging from 1-5 years, 2 (16.6%) have 5-10 years while 5 (41.7%) have teaching experience more than 10 years.
Table 11. The respondents’ age distribution

<table>
<thead>
<tr>
<th>Age range</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-30 years</td>
<td>4</td>
<td>33.33%</td>
</tr>
<tr>
<td>30-40 years</td>
<td>4</td>
<td>33.33%</td>
</tr>
<tr>
<td>40 years and above</td>
<td>4</td>
<td>33.33%</td>
</tr>
</tbody>
</table>

7.2.2 Lecturers’ perception to assess their self reported readiness for blended learning

This section concerned how the participant lecturers perceived their readiness for blended learning. Table V illustrates the survey results.

Table 12. Statistics of the items related to Lecturers’ perception

<table>
<thead>
<tr>
<th>Item</th>
<th>Lecturers’ perception</th>
<th>No. of Respondents</th>
<th>Percentage of respondents’ choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q.7</td>
<td>Where do you access a computer &amp; Internet when necessary?</td>
<td>8</td>
<td>Office / Faculty 33.33% Internet Cafè 33.33% Home (Computer only) 33.33%</td>
</tr>
<tr>
<td>Q.8</td>
<td>Do you have basic computer skills?</td>
<td>8</td>
<td>Yes 100% No 0.00%</td>
</tr>
<tr>
<td>Q.9</td>
<td>What technical problem do you face when accessing the Internet?</td>
<td>8</td>
<td>Low speed 90% Unreliable Internet service 10%</td>
</tr>
<tr>
<td>Q.10</td>
<td>How is power supply in your department?</td>
<td>8</td>
<td>Fair 66.33% Irregular 33.33%</td>
</tr>
<tr>
<td>Q.11</td>
<td>Do you have blended learning teaching experience? If yes state the number of years</td>
<td>8</td>
<td>1-10 years 33.33% &lt; 1 year 33.33% No 33.33%</td>
</tr>
<tr>
<td>Q.12</td>
<td>What type of Instructional mode do you prefer?</td>
<td>8</td>
<td>Traditional face - to - face learning 0.00% Fully online learning 0.00% Blended learning 100%</td>
</tr>
<tr>
<td>Q.13</td>
<td>Do you think implementation of blended learning can enhance learning skills?</td>
<td>8</td>
<td>Yes 100% No 0.00%</td>
</tr>
<tr>
<td>Q.14</td>
<td>Do you think that blended learning embraces numerous benefits such as; Cost effectiveness, Quality, Interactivity, and Flexibility?</td>
<td>8</td>
<td>Yes 100% No 0.00%</td>
</tr>
<tr>
<td>Q.15</td>
<td>Can implementation of blended learning make any contribution to education system of Uganda and LDcs at large?</td>
<td>8</td>
<td>Yes 100% No 0.00%</td>
</tr>
</tbody>
</table>
7.3 Students' Perception Questionnaire (SPQ)

Students' Perception Questionnaire was also [synthesized from Kamsin 2005]. Our survey included the students from various universities belonging to the following faculties: Faculty of Computer Science and Information Technology, School of Education, Faculty of Arts, Faculty of Social Sciences, Faculty of Business Management, Faculty of Art and Interior Designing, which made up the largest number of students being surveyed. More samples had been taken from the Faculty of Computer Science and Information Technology because assumptions are made that their degree is more related to the e-learning system [Kamsin 2005]. The Questionnaire also had two sections like Lecturers’ perception Questionnaire.

7.3.1 Background Information

As revealed by the survey shown in table VI majority of the students were in the age range of 20-30 years. The respondents include; 15 (32.60%) females and 32 (67.40%) males offering courses from Certificate to Doctorate degree. However, there was no student in the sample from Masters Program.

Table 13. Students’ age range

<table>
<thead>
<tr>
<th>Age range</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20 years</td>
<td>10</td>
<td>21.28%</td>
</tr>
<tr>
<td>20-30 years</td>
<td>34</td>
<td>72.34%</td>
</tr>
<tr>
<td>&gt; 30 years</td>
<td>3</td>
<td>6.38%</td>
</tr>
</tbody>
</table>

7.3.2 Students perception to assess their self reported readiness for blended learning

This section describes the students’ perception to assess their readiness for blended learning. The survey results are shown in Table14.

Table 14. Statistics for the items relating to students’ perception

<table>
<thead>
<tr>
<th>Item</th>
<th>Students’ perception</th>
<th>No. of respondents</th>
<th>Percentage of respondents’ choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q7</td>
<td>Do you have enough knowledge to use a computer?</td>
<td>47</td>
<td>Yes 23.40%</td>
</tr>
<tr>
<td>Q8</td>
<td>Do you have enough knowledge as how to use Internet?</td>
<td>47</td>
<td>Yes 29.79%</td>
</tr>
<tr>
<td>Q9</td>
<td>Do you like to undergo some formal training in computer applications?</td>
<td>47</td>
<td>Yes 91.49%</td>
</tr>
<tr>
<td>Q.10</td>
<td>Do you have some idea about e-learning or blended learning?</td>
<td>47</td>
<td>Yes</td>
</tr>
<tr>
<td>Q.11</td>
<td>Do you have any experience of using e-learning or blended learning?</td>
<td>47</td>
<td>Used many times</td>
</tr>
<tr>
<td>Q.12</td>
<td>Do you think Implementation of blended learning can enhance learning skills?</td>
<td>47</td>
<td>Yes</td>
</tr>
<tr>
<td>Q.13</td>
<td>Do you have access to your own personal computer and Internet connection?</td>
<td>47</td>
<td>PC &amp; Internet</td>
</tr>
<tr>
<td>Q.14</td>
<td>What type of learning mode do you support?</td>
<td>47</td>
<td>Traditional face-to-face learning</td>
</tr>
<tr>
<td>Q.15</td>
<td>Do you have uninterrupted power supply in your computer lab at the university?</td>
<td>47</td>
<td>Yes</td>
</tr>
<tr>
<td>Q.16</td>
<td>Do you have uninterrupted power supply at your residence?</td>
<td>47</td>
<td>Yes</td>
</tr>
<tr>
<td>Q17</td>
<td>Can implementation of blended learning make any contribution to education system of Uganda and least developed countries at large?</td>
<td>47</td>
<td>Yes</td>
</tr>
</tbody>
</table>

8. Discussion

8.1 Institutional Readiness Questionnaire

In Institutional Readiness Questionnaire the major focus was on areas such as; Infrastructure, Human resource, National policy, and Implementation of blended learning initiatives.

Availability of necessary technological infrastructure is the basic requirement for the implementation of blended learning strategy in any organization, among others. The access to an adequate network infrastructure includes: speed (bandwidth) of Internet, service and support, reliable and affordable Internet connection, hardware and software [Canaria report 2002].
We found that many of blended learning advantages such as to acquire knowledge just-in-time, anytime and anywhere are not guaranteed in developing countries. Most of the students do not have access to Internet and personal computers due to prevailing economic conditions and are thus restricted to come to the lab which could be far away from their homes or workplaces for access to a computer. We also found that it is difficult to attain real-time communication with our students due to insufficient bandwidth and irregular power supply.

It is also confirmed that many faculties and departments either do not have computers, or have very few as compared to the student population, except some faculties such as Faculties of Computing and Faculties of Science. According to survey results, Technical support is non existent in some faculties but fair in some faculties. Regarding students computer literacy rate, we found that it is fair only among students offering computer science related courses but very low among students in other faculties. Survey results show that attitude towards implementation of blended learning is positive in most of the faculties; even some faculties’ say they are eagerly waiting to use it when implemented.

National policy or Institutional policy plays an important role to introduce e-learning. Policy is meant to create an enabling environment and culture at institutional levels through: telecommunications regulations, ethics, mandatory courses and increasing access [Canaria report 2002]. Survey results confirm that there is a Government Ministry responsible for all matters relating ICT in the country and some partnership exists between Government of Uganda and other foreign organizations.

8.2 Lecturers’ Perception Questionnaire

As revealed by the results, one third of the lecturers were females and two third were males. Similarly we found that one third of the lecturers were in the age range of 20-30 and two third were of 30 years and above. All the lecturers have a high level of teaching experience and many of them have taught for more than ten years. In addition to that many lecturers stated that they have experience in teaching online courses.

Regarding the respondents basic computer knowledge, the findings were quite encouraging. All the respondents have indicated that they have basic computer knowledge and they access computers and Internet from their office or faculty or Internet café, when necessary. But none have computer with Internet connection at home, although very few have PCs at home. Low speed Internet and unreliable Internet services are among the main technical problems revealed by the lecturers. Non existence of power supply is another technical problem some faculties are facing as revealed by the survey.

All the lecturers prefer blended learning over traditional face-to-face learning or fully online learning and agreed that blended learning can enhance the learning skills. Following benefits of blended learning are agreed by the respondents: Cost effectiveness, Quality, Interactivity, Flexibility, More direct control, Ease of
use, Self paced, Time saving, and High level of participation and engagement. All lecturers agree that implementation of blended learning will contribute to education system of Uganda.

8.3 Students’ Perception Questionnaire

Survey results indicate that majority of the respondents fall in the age range of 20-30 years, offering Certificate, Diploma, Degree, and PhD programs. One third of the students were female in the sample. A smaller percentage of students have computer skills and Internet knowledge, majority has very little knowledge and about one quarter doesn’t have any knowledge. It is interesting to note a bigger percentage of students have shown interest to go for computer training. Although some say it is expensive and time consuming.

The survey results show that idea of blended learning or e-learning is new for most of the students. But majority of the respondents prefer blended learning method over face-to-face or fully online learning and agreed that blended learning mode can hence the learning skills and can make contributions to the education system in Uganda and LDCs at large.

Survey results also reveal that majority of the students do not have access to PCs and Internet connection, neither had they capacity to purchase it. Although a smaller percentage has access to PCs. Irregular power supply is another technical problem revealed by the students’ survey.

9. E-readiness Model

Machado [2007] argues that e-readiness formula for an organization may be achieved by “equation of ICTs plus e-skilled people”. Carlos further explains that e-readiness is conceptualized by two factors; ‘the ability of Higher Education Institutions and the capacity of stakeholders (Lecturers and students). Figure 2 below provides the e-readiness Model for this study and shows the relationship among three constituent parts of the model; Administration, lecturers and students.
10. Conclusion

By utilizing bended learning solutions effectively and thoughtfully, universities ability to transfer knowledge to the potential learners can be enhanced in developing countries. Before that, it is necessary to understand the issues that may confront during the complex process of integrating blended learning with multimedia tools, as blended learning relies heavily on technologies. Also, collaboration with other government and organization is important to overcome the high cost of technology. Technical support in form of experienced personnel with technical skill is also needed to implement blended learning in an institution.

However, according to survey, the implementation of blended learning is tough in the universities in LDCs as they are facing a number of challenges such as; low bandwidth environment, irregular power supply, inadequate telecommunication infrastructure, high cost of technology, and accessibility. This study has provided the researcher an opportunity to understand the concern of stakeholders which in turn will lead to successful design of blended implementation framework adaptable
in constrained low bandwidth environment. And the framework will be based upon realities and constraints that abound the context.

Currently, most universities in constrained low bandwidth environment have not strategically implemented online learning or blended learning in their programme offerings and therefore this study, besides the scientific, has its highly pragmatic justification [Begićević, et al. 2006]. This study made a significant contribution theoretically and practically to the existing literature on blended learning in general and its implementation in constrained low bandwidth environment in particular.

The study is based on realistic and idealistic grounds and addresses questions of practicality which leads to instrumental consequences and increased usefulness of knowledge created [JMPE 2004]. The research will offer particular value when the organizations are considering larger change management initiatives within an organization to be addressed through a combination of training using a variety of modalities and media [Shaw et al. 2006]. It is important to understand the concern of stakeholders when designing

The study has served to confirm that ‘ability’, and ‘capacity’ are key factors for the successful implementation of an e-readiness measurement tool [Machado 2007] for HEIs in constrained low bandwidth environment. The ability and capacity are measured through assessing ‘Institutional Readiness’ and ‘Perceptions of Lecturers and Students, respectively.

**Acknowledgments**

This research was conducted in collaboration with three universities in Uganda; Makerere University, Kampala University, and Kampala International University. Many thanks to the administrators, academic staff, and students of these institutions who contributed to this research by providing useful information.

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