BLENDING THE TRADITIONAL FACE-TO-FACE LEARNING WITH INSTRUCTIONAL TECHNOLOGY

By

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A Thesis submitted to the Department of Computer Engineering, Kwame Nkrumah University of Science and Technology in partial fulfillment of the requirements for the degree

of

MASTER OF PHILOSOPHY

Department of Computer Engineering, College of Engineering

June, 2011

ABSTRACT

Emerging technologies offer alternative ways to conceptualize and deliver education in pursuit of promoting learning. One of the many ways is Blended Learning (BL). This blend of conventional Face-to-Face (F2F) instruction and Web-based distance learning has a potential to create an improved learning experience for the student. In this thesis work, BL models were studied and the pertinent ones were adopted and modified for application in a case study involving the handling of two courses—Computer Literacy at Sunyani Polytechnic and Computer Networking at Kwame Nkrumah University of Science and Technology (KNUST) all in Ghana. In the models, students' performance in terms of their end-ofsemester examination results, were used as the output. The experimental results revealed that employing instructional technology promises great successes when adequate preparation is made. This was evident in the outcome of the application of the BLM at KNUST which showed an average improvement of 61% in the performance of students. The outcome of the case study at Sunyani Polytechnic showed that, the introduction technology in the learning process notwithstanding, if preparations are woefully inadequate, results can be worse than that of the traditional F2F approach. Here, the first semester results showed an average decline of 15% in the performance of students.

DECLARATION

I hereby declare that this submission is my own work and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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DEDICATION

This work is dedicated to the Almighty God for his sustenance and bounteous blessings and to my younger sister, Priscilla Sarpong.

ACKNOWLEDGEMENT

I wish to express my profound and sincere gratitude to my supervisor, Dr. K. O. Boateng for supervising my project from the beginning to the end and imparting knowledge to me.

My warmest gratitude also goes to Prof. K. Nsiah-Gyabaah, former Rector of Sunyani Polytechnic for embracing this project and supporting it financially.

I will also like to express my sincere appreciation to my family for their support during my period of study and all persons who in diverse ways have contributed to the success of this project.

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CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND INFORMATION

The widespread adoption and availability of digital learning technologies has led to increase levels of integration of computer-mediated instructional elements into the traditional Face-toFace (F2F) learning experience [3]. Blended Learning (BL) is learning that is facilitated by the effective combination of different modes of delivery, models of teaching and styles of learning, and founded on transparent communication amongst all parties involved with a course [8]. BL focuses on optimizing achievement of learning objectives by applying the "right" learning technologies to match the "right" personal learning style to transfer the "right" skills to the "right" person at the "right" time. BL programs may include several forms of learning tools, such as real-time virtual/ collaboration software, self-paced Webbased courses, Electronic Performance Support Systems (EPSS) embedded within the jobtask environment, and knowledge management systems. BL mixes various event-based activities, including F2F classrooms, live e-learning, and self-paced learning. BL often is a mix of traditional instructor-led training, synchronous online conferencing or training, asynchronous self-paced study, and structured on the-job training from an experienced worker or mentor. Synchronous training involves interacting with a faculty member and other learners via the Web in real time using technologies such as virtual classrooms and/or chat rooms. On the other hand, asynchronous enables learners to interact with their colleagues and faculty member at their own convenience; such as interacting through email [22].

In expanding and enriching 21st century learning opportunities for students, offering teachers new techniques for personalizing instruction, delivering more effective forms of professional development, to transforming credit recovery, acceleration and other special academic programs, BL has become an acceptable and effective learning model. BL gives institutions a strategy for overcoming the barriers presented by limited resources, time constraints, and

budget pressures. It also gives educators a new range of options to craft updated curriculum that meets the needs and preferences of digital natives to learn more successfully in their technology-infused environment.

This platform can be used in Ghana to assist in solving the numerous problems facing her educational sector. With limited number of tertiary educational institutions, a large number of senior high school graduates are refused access to tertiary education due to limited infrastructure. An implementation of a BL platform will enable the country train her human resource without necessarily increasing physical infrastructure. Also, her citizens working at various organizations can also have access to further education without going back to the classroom and leaving their post. This in return will help the country reduce the illiteracy levels while increasing productivity. On the other hand, physical infrastructure can be improved in terms of computer networks with access to internet so that it can cater for the large demand of tertiary education with geographically dispersed students.

While there are a variety of BL models, there is no single best approach. The best model is the one that works best for students and teachers in their particular environment and that addresses their specific needs at the time. The models for BL are flexible and expansive enough to accommodate a wide range of learning needs and opportunities. Different institutions implement BL in different ways. The online component of a course replaces a portion of F2F instruction with Web components allowing for the flexibility of utilizing Web resources to reduce the on-campus time, yet allowing F2F interaction as well. Even though it is not clear as to how much or how little Online Learning (OL) is inherent to BL, it is important to ensure that the effective integration of the two main components (F2F and Internet technology) takes place. Therefore, the online component should not just be an addon to the existing dominant approach or method [16]. The mix is influenced by many factors including the course instructional goals,

student characteristics, instructor experience and teaching style, discipline, developmental level and online resources [29]. Consequently, no two BL designs are identical.

1.1.1 Benefits of Instructional Technology

There are many reasons that an instructor, trainer, or learner might pick BL over other learning options. Osguthorpe and Graham [29] identified six reasons that one might choose to design or use a BL system:

- ❖ Pedagogical richness,
- ❖ Access to knowledge,
- ❖ Social interaction,
- ❖ Personal agency,
- ❖ Cost-effectiveness and ❖ Ease of revision.

In BL literature, the most common reason provided is that BL combines the best of OL and F2F. While this is true to some extent, it is rarely acknowledged that a BL environment can also mix the least effective elements of OL and F2F if it is not designed well. Overwhelmingly, people choose BL for three reasons: improved pedagogy, increased access and flexibility, and increased cost-effectiveness [18].

1.2 LEARNING ENVIRONMENTS

Information and Communication Technology (ICT) in education brings to bear various forms of learning environments which includes e-learning, BL and open/distance learning. Elearning encompasses learning at all levels, both formal and non-formal, that uses an information network—the internet, intranet (LAN) or extranet (WAN)—whether wholly or in part, for course delivery, interaction and/or facilitation as shown in Figure 1.1 [38]. Elearning has some varieties which include:

- **The virtual classroom:** The virtual classroom model of eLearning continues to be the most familiar analogue for building eLearning programs. The intention of virtual classrooms is to extend the structure and services that accompany formal education programs from the campus or learning center to learners wherever they are located. The virtual classroom is for learners who may be pursuing a distance education degree made up entirely of online lessons, and it may include campus-based courses, where students partake from a variety of on- and off campus locations—in a real-time class session via the Internet. The virtual classroom model includes places for posting papers for review and comment, and for completing tutorials and distributing class assignments for team review before posting the secured PDF file containing multimedia assets and for breaking into study sections dealing with shared interest using web conferencing tools.
- **Online learning:** This model of eLearning revolves around its dependence on courseware, delivered over the internet to learners at a variety of locations where the primary interaction between the learner and the experiences of their learning occur via networked computer technology. Increasingly, learning management systems are serving as the basis for building online programs where the education experience is entirely meditated through a digital interface.
- **Mobile learning:** Mobile learning builds on the availability of ubiquitous networks and portable digital devices, including laptop computers, PDAs, game consoles, MP3 players, and mobile phones, and it takes advantage of place-independent flexibility that comes from working away from the desktop. Mobile learning provides the opportunity to connect informal learning experiences that occur naturally throughout the day with formal learning experiences, such as those encountered in the virtual classroom model, sing games or in OL implementations [41].

Combining the traditional classroom practice with e-learning solutions can also be termed as BL [8].

1.2.1 FORMS OF LEARNING

The three basic forms of learning include self-paced, F2F and online collaborative learning. Self paced learning provides the flexibility to learn according to the availability of learners' own time and pace, it occurs in a variety of ways such as: reading specific chapters from text book, studying course material presented through web-based or CD-based course, attending pre-recorded classes or sessions, reading articles referred by faculty member, working on assignments & projects, and searching & browsing the internet [30].

F2F learning refers to learning that occurs in a traditional classroom setting where a faculty member delivers instruction to a group of learners. This could include lectures, workshops, presentations, tutoring, conference and much more [23].

Online collaboration involves interaction between learners and faculty members through the web; this interaction can occur in one of the following modes: synchronous interaction and asynchronous interaction. Synchronous, means "at the same time", it involves interacting with a faculty member and other learners via the Web in real time using technologies such as virtual classrooms and/or chat rooms. On the other hand, Asynchronous means "not at the same time"; it enables learners to interact with their colleagues and faculty member at their own convenience; such as interacting through email [22].

The various forms of learning available through ICT have different levels of combination of these forms. For example, e-learning is a combination of some aspects of selfpaced learning and online collaborative learning (Figure 1.1) while BL combines F2F learning, self-paced and online collaborative learning platforms (Figure 1.2).

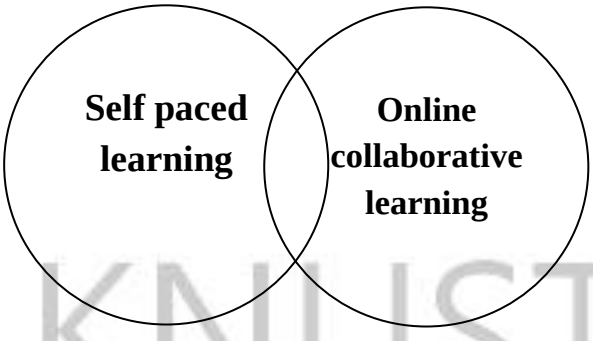


Figure 3.1: E-learning

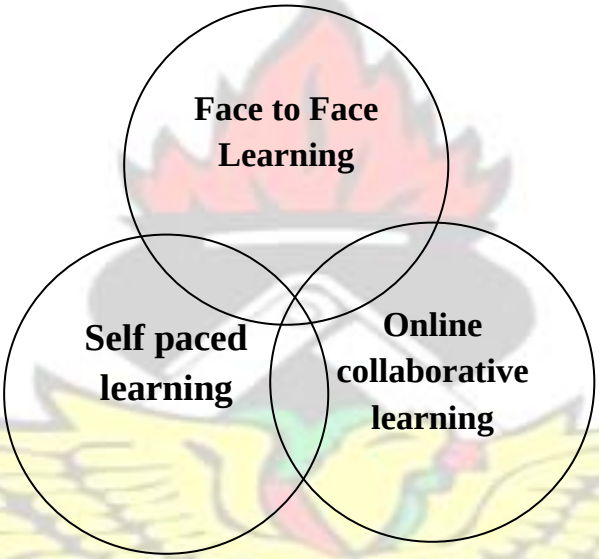


Figure 1.4: BL

1.3 PROBLEM STATEMENT

Employing ICTs in the teaching and learning process promises great rewards. However, the degree of such successes is usually unknown. This research seeks to assess the impact of integrating ICT into the teaching and learning process and also to measure the degree of success that can be achieved when adequate infrastructure is availability and accessible.

1.4 PURPOSE OF STUDY

Advances in digital technology and a rapidly evolving media landscape continue to dramatically change teaching and learning. Among these changes is the emergence of

multimedia teaching and learning tools, online degree programs, and hybrid classes that blend traditional and digital content delivery [17].

However, teaching and learning in the traditional classroom setting where the instructor and the student have to be at the same place is still predominant. Knowing very well that students come from different backgrounds and have different learning styles, it is evident that the learning occurs differently for a group of students. This research intends to demonstrate that a Blended Learning Model (BLM) can provide an effective method for addressing some of the concerns noted above. To achieve this, a BLM was developed and used for a required first year Computer Literacy course for EEE (Electrical/Electronic Engineering), HCIM (Hotel, Catering and Institutional Management) and BT (Building Technology) students at Sunyani Polytechnic. The BLM was also used for a final year course; Computer Networking for BSc.
Computer Engineering (both regular and distance learning), BSc. Electrical/Electronic Engineering and BSc. Telecommunications Engineering students at the Kwame Nkrumah University of Science and Technology (KNUST).

1.5 OBJECTIVE

In this thesis, the main objective is to measure the degree of success that can be achieved when instructional technology is blended with the traditional F2F instruction in the teaching and learning process. To achieve this, the specific objectives include

1. To develop a BLM
2. To implement the BLM in the teaching and learning of two courses at two higher learning institutions in Ghana and
3. To analyze the impact of the BLM using students' performance in semester examinations and students' responses to questionnaires from conducted surveys.

We expect to obtain results to help various institutions to realize the following.

1. The benefits derived from blending courses

2. What to consider when preparing to blend courses and
3. The need to be adequately prepared before employing instructional technology in the teaching and learning process.

1.6 JUSTIFICATION

The advent of ICTs has brought to bear different delivery modes into the educational sector to enhance the teaching and learning experience for both lecturers and students. However, the degree to which these delivery modes are adapted leaves much to be desired. This has affected students, lecturers, educational institutions and the nation as a whole since this leaves a gap in the training of human resource for the development of our nation, Ghana. Additionally, access to education by qualified applicants has also being limited due to inadequate infrastructural resources. ICTs indeed hold promising results when used. However, it is often assumed that such successes are automatic once one utilizes the technology irrespective of which tools were used and what constituted the implementation process. This research seeks to prove otherwise by assessing the impact of integrating ICT into the teaching and learning process by selecting the right tools that best suites the purpose of application and also to measure the degree of success that is achievable when requisite infrastructure is available and accessible.

1.7 SCOPE OF STUDY

The general aim of the study was to develop, apply and assess the impact of BLMs in the teaching and learning process of courses at learning institutions in Ghana. The readiness and maturity of students was a key component which was considered. The application of the developed BLMs was therefore restricted to institutions of higher learning in Ghana. The results of the study can be used as a guide for higher learning institutions in developing BLMs for various courses at their campuses.

1.8 THESIS ORGANIZATION

The layout of thesis is organized as follows: the first chapter is devoted to the introduction and objectives. Chapter two tackles the previous related works on BL platforms being implemented at various educational institutions, their successes and challenges; and the facilities which were used for implementation. In chapter three, the method employed in this research is described. Chapter four presents the analysis of data collected during the evaluation stage of this model. Chapter five presents conclusion and exhibits eventual recommendation which can lead to further researches.

CHAPTER TWO: LITERATURE REVIEW

2.1 KHAN'S OCTAGONAL FRAMEWORK

A variety of factors need to be addressed in order to create a meaningful learning environment. Many of these factors are interrelated and interdependent. A systemic understanding of these factors can enable designers to create meaningful distributed learning environments. An example of such a factor is the Octagonal Framework. The framework has eight dimensions: **institutional, pedagogical, technological, interface design, evaluation, management, resource support, and ethical** (see Figure 2.1). Each dimension in the framework represents a category of issues that need to be addressed. These issues help organize thinking, and ensure that the resulting learning program creates a meaningful learning experience.

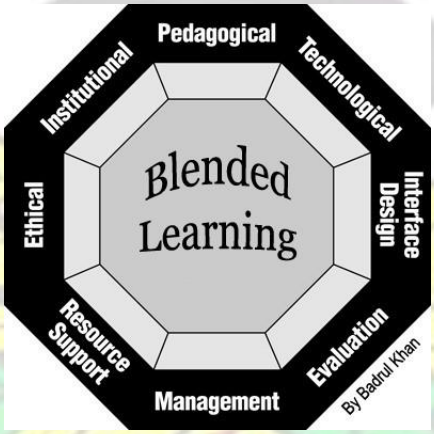


Figure 2.1: Khan's Octagonal Framework

2.1.1 Elements of the Blended Learning

The **Institutional** dimension addresses issues concerning organizational, administrative, academic affairs, and student services. Personnel involved in the planning of a learning program could ask questions related to the preparedness of the organization, availability of content and infrastructure, and learners' needs. It is also concerned with the combination of content that has to be delivered (content analysis), the learner needs (audience analysis), learning objectives (goal analysis), and the design and strategy aspect of e-learning. This

dimension addresses a scenario where all learning goals in a given program are listed and then the most appropriate delivery method is chosen. Once we have identified the delivery methods that are going to be a part of the blend, the **Technology** issues need to be addressed. Issues include creating a learning environment and the tools to deliver the learning program.

This dimension addresses the need for the most suitable Learning Management System (LMS) that would manage multiple delivery types and a Learning Content Management System (LCMS) that catalogs the actual content (online content modules) for the learning program. **Technical** requirements, such as the server that supports the learning program, access to the server, bandwidth and accessibility, security, and other hardware, software, and infrastructure issues are addressed. The **Interface Design** dimension addresses factors related to the user interface of each element in the BL program. The interface has to be sophisticated enough to integrate the different elements of the blend. This will enable the learner to use each delivery type and switch between the different types. The usability of the user interface will need to be analyzed and issues like content structure, navigation, graphics, and *help* also can be addressed in this dimension. The **Evaluation** dimension is concerned with the usability of a BL program. The program should have the capability to evaluate how effective a learning program has been as well as evaluating the performance of each learner. In a BL program, the appropriate evaluation method should be used for each delivery type. The **Management** dimension deals with issues related to the management of a BL program, such as infrastructure and logistics to manage multiple delivery types. The management dimension also addresses issues like registration and notification, and scheduling of the different elements of the blend. The **Resource Support** dimension deals with making different types of resources (offline and online) available for learners as well as organizing them. Resource support could also be a counsellor/tutor always available in person, via e-mail, or on a chat system. The **Ethical** dimension identifies the ethical issues that need to be addressed when developing a BL

program. Issues such as equal opportunity, cultural diversity, and nationality should be addressed [34].

2.2 CASES OF BL MODELS

2.2.1 A Blended Language Learning (BLL) environment

Blended Language Learning (BLL) environments, defined as teaching and learning environments in which technology plays a role. The pedagogical rationale behind BLL is the desire to allow for a higher degree of learner independence in the teaching and learning of second/foreign languages. This research describes the experiences of both learners and teachers in a particular BLL environment; namely within a European (German) higher education context. In this example of BLL, the components consisted of learners' independent self-study phases at a computer (with a CD-ROM) and traditional F2F classroom learning. Two computer programmes; *Think and talk* and *Learn to speak* were used in this project. Both programmes are for beginners, written for self-study purposes, and present the material in a structured way. The computer basically plays the role of tutor in delivering materials to the learner. Both CD-ROMS are early CALL software reflecting a behaviouristic approach to language learning. In a third step, extrapolating from the research base at the German university, the research offers a list of pragmatic points to consider when working in a BLL environment. Although the degree to which technology is being used in the societal and educational context of each reader will differ, this list provides a quick, valuable reference for anyone interested in (better) implementing technology in their particular context and aiming for a higher degree of learner independence [37].

2.2.2 The SCHOLAR Model

A BL program, SCHOLAR, was designed to "support pupils in the post-compulsory years of schooling in Scotland studying for national examinations (Higher and Advanced Higher) in the key areas of science, mathematics and computing studies in Scotland. It consists of text

booklets complemented by online resources which are the electronic versions of the texts with additional animations and simulations, short assessment exercises, revision materials, a notice board and a discussion forum. Although this program was strongly promoted by the local authorities, the teachers involved were resistant. They felt that the OL programs and independent study do not cater for learners' diverse learning abilities. Some of them stated that students need to be self-motivated and mature enough to learn in this mode. They also stated that teaching using a blended mode required new pedagogic skills. Indeed, the evaluation of SCHOLAR revealed that some teachers were reluctant to adopt the new technology because they were uncomfortable in trying out new approaches which might have a negative impact on examination results. Zuckerman-Parker and others [45] describe a research based educational intervention designed to support participants in the United States with "lifelines" using BL so they could further their education and enter the biotechnology workforce. This holistic educational approach focuses on individualized learning using technology to foster personal skill development and mentoring from industry professionals. Technology also provided a safe haven for participants to express themselves, a medium to reduce and mediate stress. Guy and Wishart [19] adopted different teaching approaches for students who took online courses in the United States who were mainly blacks. They changed the teaching strategy for the e-learning class from student-centered to instructor-centered to even more instructor-centered for the three years. Students' grades of F2F and online courses were compared but it was found that neither the strategy nor the delivery method had any impact on student performances. The interesting results are rather different from other research findings [12].

2.2.2.1 Participants

The participants were 14 undergraduate final year students (MAIE students) who took a fouryear joint-program by the Hong Kong University of Science and Technology (HKUST) and a one-year professional teacher education provided by the Hong Kong Institute of Education (HKIEd) and 14 undergraduate second year students (BEd students) studying

Bachelor of Education at HKIEd. The MAIE students were studying both mathematics and information technology at HKUST while completing education and teaching methods modules at HKIEd. The MAIE participants took "Supporting Information Technology in Schools" whilst BEd students attended a module called Information Technology Supported Learning Environment (ITSLE) during the same semester with the author. The medium of instructions for the MAIE class was Chinese whilst the BEd class was in English. Since both languages are official languages of the Hong Kong Special Administrative Region, all university students are competent in both languages.

2.2.2.2 Activities

F2F interaction included standard lectures and other classroom activities, whereas online activities included facilitating online discussion and online debate so that student teachers could experience the advantages and disadvantages of using a BL approach. Student-centered online activities were organized with the believe that learning was an active social process in which learners construct new ideas of concepts based on current knowledge. Furthermore, "as far as possible, teachers could promote students' reasoning and critical thinking rather than fostering the belief that teachers are authorities of knowledge and students should merely memorize the knowledge transmitted in class".

2.2.2.3 Online Discussion

Since BEd class had higher class participation assessment weighting, they were asked to facilitate online discussion on various topics as an ongoing activity. Groups of students had to assume the role as expert in their chosen topic. Both MAIE and BEd classes were asked to answer the questions posted by the facilitators who had to facilitate the follow-up discussion online by giving feedback to their peers.

2.2.2.4 Debates

There were three debates between the two classes; one was an online debate whilst the other two debates were F2F. Since both classes had the same number of students, they were randomly

assigned to each group as long as each group consisted of students from the two classes. Each team came up with different topics of interests to debate. The first debate topic was "will using information technology reduce the importance of teachers", the second debate was "the more we use information technology, the more distance we feel" and the last topic was "using information technology to teach is more effective than not using it". They drew lots to decide if they would join the "for" or "against" group. For the face-to-face debate, two classes sat together in the same classroom. As for the online debate, each team was stationed in one classroom which was just next door. They had to decide on the sequence of the speaking and how to proceed in the debate. Each class watched the other debate team members on the screen in the classrooms. Other classmates were also encouraged to put down their opinions in the pertinent discussion forums.

2.2.3 Adem and Aysan's Blended Computer Literacy Course

2.2.3.1 Participants

The participants of this study consisted of students in Uludag University's Faculty of Education. A total of 179 students were chosen for the sample. The participants consisted of 59 students from the Department of Educational Science, 34 students from the Department of Turkish Education and 86 students from the Department of Primary Education. The students were assigned to the control group and the experimental group purposefully in order to achieve group equivalency based on test scores examining their prior knowledge about computer literacy and attitudes towards computers. Equal representation in terms of students' prior knowledge and initial attitudes towards computers was achieved for both groups [39].

2.2.3.2 Treatments

In this study, a new instructional design based on Dick and Carey's Instructional Design Model [7] was utilized for both the experimental and the control groups. Dick and Carey's Instructional Design Model was selected because it has been one of the most widely used models around the world, and it is a systematic model that defines each step in details for the

instructors. Dick and Carey [7] stated that learning is a systematic process in which every component is crucial to successful learning. Components such as instructor, learners, materials, instructional activities, delivery system and learning and performance environments interact with each other to bring about the desired student learning outcomes. A needs analysis questionnaire embedding the teaching environment, teaching methods and the content for the computer literacy course was administered to the students of both the experimental and control groups at the beginning of the experimentation. In addition to the needs analysis questionnaire, Grasha-Riechmann Learning Style Inventory was applied to both groups in order to analyze the learners' characteristics. According to the data collected from this questionnaire and the inventory, performance objectives were written, assessment instruments were developed, instructional strategies was selected, and instructional materials were developed. After these steps, the newly designed instructional course was given to the experimental and control groups. The FTF group took the course traditionally (two hours of theoretical material in the classroom and two hours of applied material in laboratory). The theoretical part of lectures was supported by PowerPoint presentations, books, lecture notes and tutorials. Classroom discussions and question and answer techniques were used in teacher-student interactions. Teamwork, classroom discussions and projects were used in order to provide opportunities for collaborative learning. Classroom meetings for the blended group were two hours each. In addition to these classroom meetings, the blended group used a website that was developed for the course. Additional learning materials consisted of online lecture notes and multimedia-rich components such as screen captures, assessment simulations and online tutorials. One of the examples of screen captures and assessment simulations can be seen in Figure 2.2 and 2.3 [39].

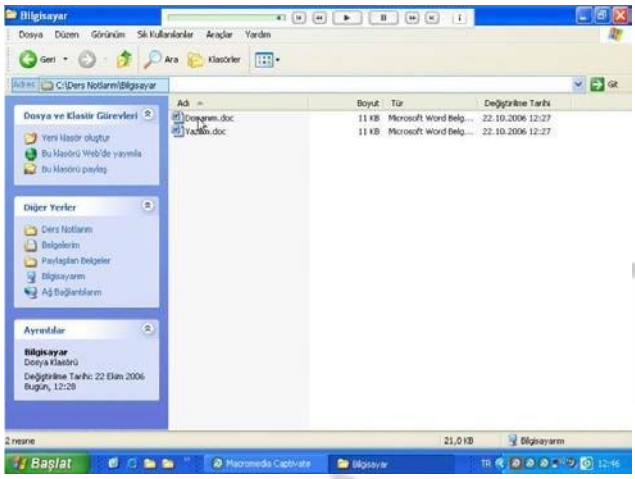


Figure 2.2: A screenshot of a screen capture developed in Macromedia Captivate

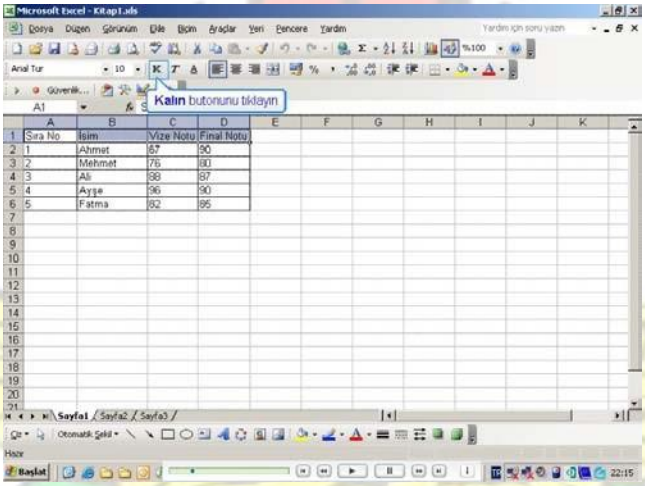


Figure 2.3: A screenshot of an assessment simulation developed in Macromedia Captivate

The screen captures and assessment simulations were prepared with Macromedia Captivate. There were totally fifteen flash files prepared for the course and their durations were between three and six minutes. The students in blended group were able to access these learning materials through the web site. Questions, e-mail and web announcements were used as means of student-teacher interaction. Teamwork, classroom discussions and e-mail were used in order to enhance students' collaborative learning experiences. The website, which included the learning materials, was developed in ASP .NET 2.0 and SQL Server 2005. Macromedia Captivate was used for screen captures and assessment simulations. The website was developed

like a small model of a LMS. Students in the blended group could log in to this web site with their passwords reaching the systematically structured learning materials [39].

2.2.4 The BLM for a Collaborative Project-Based Course in Experimental Physics

The evolution of this course occurred in two phases: the first one, started in 2004, was characterized by the progressive introduction of e-learning for asynchronous and synchronous activities, i.e. interactive Learning Units, tests and quizzes for self-assessment, online sessions for collaborative problem-solving. In this phase the pedagogical approach was mainly objectivist, with a first effort to avoid behaviourism in lab activities. In the second phase, implemented since the academic year 2007/2008, we made an effort to reinforce constructivist learning, restructuring the course around collaborative real-life projects and enriching the online environment through Java simulations and web forums. The Applied Optics is a compulsory course for students of the of the second cycle (according to the European Union Bologna system) leading to the Master's degrees in Physics Engineering, Biomedical Engineering and Teaching of Physics and Chemistry. It is also an optional course for the students of the Master degree in Electrotechnical and Computer Engineering. The transition from the traditional F2F teaching-learning system to the web enhanced solution was introduced in order to reach different goals. For what concerns students these goals are:

- To foster individual study and self-assessment as prerequisites for a more constructivist approach to laboratory activities;
- To encourage them to become responsible for their own learning;
- To offer the opportunity to engage in online activities, synchronous and asynchronous, acquiring experience in the use of different software tools;
- To offer them the opportunity to work collaboratively online, experiencing situations similar to what they will probably meet in their future work;

- To facilitate meaningful learning through an improved graphical interface and interactive learning units.

From the institutional and teacher perspective the goals are also:

- To test the efficiency and performance of the available e-learning tools in view of further development of new online courses;
- To introduce progressively ICT tools in traditional courses, avoiding quality gaps in the learning-teaching process of different academic years [24].

2.2.4.1 The Applied Optics Course between 2004 and 2007

The Applied Optics course, attended on average by 50 students, lasts 14 weeks, i.e. 70 hours, plus individual study and lab reporting. The class meets twice a week, with two-hour sessions of in-class lecturing and two-hour sessions of collaborative laboratory activities or online synchronous problem-solving. Since the academic year 2004/2005 the whole course has been supported by the LMS Blackboard-Horizon Wimba that allows synchronous and asynchronous activities, and where students find a variety of learning resources. Learners are invited to read the interactive theoretical Learning Units (LUs) available in the LMS before classes. As prerequisite to the lab activities they have to explore the preparatory Experimental Learning Units (ELUs), which describe the objectives of the lab activities, as well as experimental equipment and the tools. Students have to pass an automated assessment test in order to be allowed to access the lab. More importantly, they can use the ELUs as a guide to set up the experimental protocols. Lab protocols, in fact, are not pre-constructed by the teachers, in order to discourage behaviourism. With the help of the LUs and ELUs students have to search for theoretical laws, as well as for different methods and procedures, and then link all the elements, "constructing" and taking responsibility for their own protocol. Two problem-solving sessions are generally run in the last weeks of the course. They are performed online using the Horizon Wimba "Live classroom", which allows students and teachers to share screen and applications,

i.e. text editors and mathematical tools like MathCad, and to communicate via written chat and audio. The instructor acts as a moderator. In addition, participants can share and operate on drawings through the e-board and the teacher can browse the Internet showing useful resources to the students. This learning architecture, progressively implemented between 2004 and 2007, represents the first phase of the Applied Optics course in the BL format (Figure 2.4) [24].

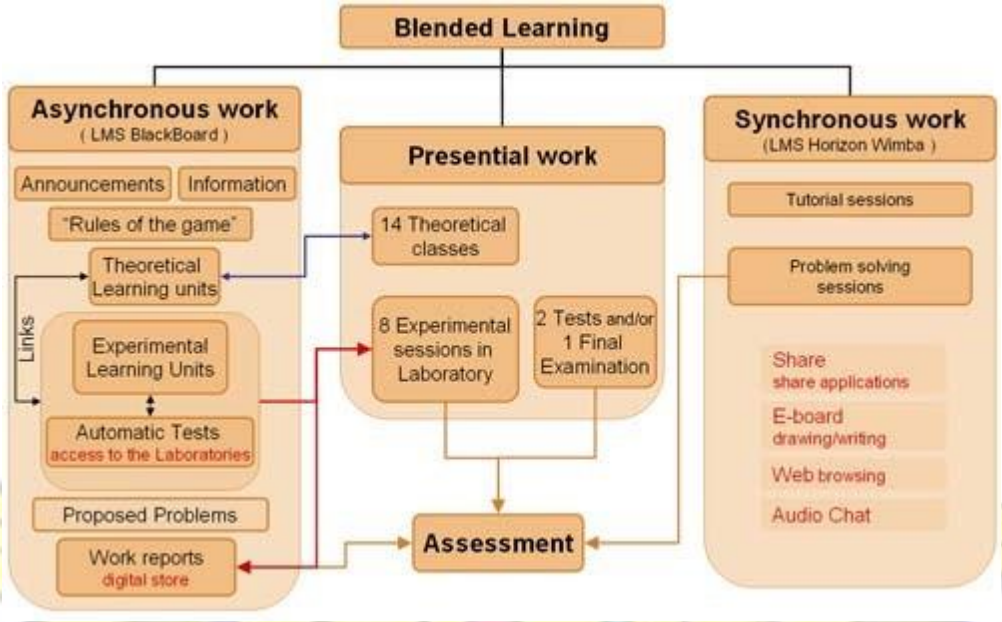


Figure 2.4: Representation of the BL solution implemented between 2004 and 2007

2.2.4.2 Web Forums

In order to promote alternative ways of communication among learners and between learners and professors we decided to start to use web forums. We assumed that they would help to enhance interaction among students and teachers, and would contribute to the creation of oneto-one communication, which is normally scarce in traditional courses. Furthermore, one of our objectives was to set up asynchronous online activities (e-tivities) that are supposed to offer students the possibility to explore information at their own pace and react to it before hearing the views and interpretations of others. As the course has about 50 students and two teachers (one professor and one assistant professor), we thought that we could create two parallel forums

with each professor moderating a group of 25. Two web forums were designed: one called "Forum for doubts", was devoted to students' questions regarding any issue related to the course. It was presented as a supporting service, substituting the traditional office time for one-to-one explanations, but also as a community space, where students were invited to help each other in a sort of peer tutoring. Of course, it is very common for students to study in pairs or groups, comparing notes, "repeating" lessons, solving problems and trying to answer doubts. Through the forum we wanted to encourage this practice and increase the number of beneficiaries of any question/answer exchange. Furthermore, as stated in the introduction, we thought that the use of a variety of online communication tools would be an asset by itself, because it helps students to become confident with a medium that they could use in future courses, namely post-graduation, and in future jobs. This forum was also supposed to be used to introduce students to a communication system that many of them still did not know, so they would be confident enough with it by the time the discussion forum would be introduced.

The second forum was devoted to an e-tivity connected to the simulation. It was introduced by a short text written in informal style, which invited students to take part into the e-tivity, paying attention to their colleagues' answer and to all the comments posted by professors. The invitation stressed the advantages of participating in the forum to learn from others' ideas and to gain "bonus" grades and the formative nature of this activity. The description of the etivity was introduced by an intriguing question and then instructions were detailed; some organizational tips were also reported, and the formative nature of the activity was stressed once again, inviting students to report to the instructor for any question concerning both the problem and the underlying physical and geometrical concepts [24].

2.2.5 A BLM for Business School Students of University of Hertfordshire

This case study reflects on the developmental process followed to produce a range of tools both inside and outside the classroom to support student learning through BL techniques developed through the University of Hertfordshire's Managed Learning Environment, Studynet. The

concept behind the approach adopted considered the range of tools readily and easily available to less technologically minded staff and the comparative ease of use and additional workload. This approach was piloted in a one semester Tourism law module taught to Business School students and following evaluation, further developed in the following academic year in a Public Law module in the School of Law. The author took over responsibility for the Tourism Law module at short notice and was the only tutor on the module and thus able to experiment in a variety of ways throughout the duration of the module and gain feedback from all students. In the Public Law module the teaching team comprised two tutors and the second tutor used some, but not all, of the "tools". The student response to the contrasting styles was evaluated at the end of the module [43].

2.2.5.1 The Toolkit:

Each session aimed to provide a well rounded session to each topic undertaken through the module. Most of the activities were used in each session; video and formative assessment strategies were used as appropriate throughout the module.

Techniques used:

Detailed module materials with lecture notes and seminar activities

- Power point slides uploaded well before the lecture
- An introductory short podcast to each lecture – 4-5 minutes identifying key issues again uploaded before the lecture
- A longer podcast against the Power point slides, either in or out of the lecture
- Hypertext links into key materials, both within the lecture notes and the reading lists
- The use of an electronic voting system (EVS) in each lecture and seminar session to check understanding
- The translation of the EVS questions subsequently into multiple choice quizzes (MCQs) available online
- A reflective podcast on key issues from the classroom following delivery of the session

- The use of a tablet PC in class to annotate already uploaded materials and thus provides outline answers as discussed to questions raised and seminar activities
- A limited use of video e.g. a class role play then played back to the class with EVS to identify the legal issues, then posted on the MLE with MCQs
- Formative assessment strategies: in class and online activities – review and "mark" past student work against marking criteria and outline answer; write an introduction – peer review; collaborative work on seminar activities – group presentations, debates, role plays; analysis of previous examination questions and answers

The techniques used are all aimed to engage students in active learning. Active learning is seen as the key to successful student motivation. The use of a set of BL tools through a managed learning environment provides further opportunities for student interaction with the materials in a structured format with feedback outside the classroom [43].

2.2.5.2 Evaluation:

The author evaluated the student experience during the course of the modules and upon its conclusion. Observation was made of the use of materials on the managed learning environment through the staff monitoring facility; attendance records in class were kept and students were encouraged to "vote" in class using EVS on their responses to the approaches adopted. Additionally students completed an end of module evaluation and were encouraged to provide qualitative comments. Students were asked to rank their preference of the different learning objects using a numerical scale of 1-5 with 1 being the highest score. This exercise was undertaken three times during the semester, at 4 weeks, 8 weeks and 12 weeks using anonymous EVS in class. The learning activities were divided into two categories: in class activities and BL resources available through Studynet. The results from these questions in relation to BL resources were also correlated with the monitoring process of the use of the electronically available materials. The monitoring of Studynet resources was conducted on a weekly basis. The most frequently accessed resources were the multiple choice quizzes (some

students repeated these several times until they had answered all the questions correctly), the short podcasts (before and after), and the seminar answers. Extensive use was made of hyperlinked materials in preparation for coursework. All students downloaded the module materials and the vast majority also downloaded the weekly power point slides. Extensive use was made of past examination questions with answers [43].

2.3 CONCLUSION

BL courses mostly consist of two components, F2F interactions and online sessions. A review of related works shows that components may vary depending on the course objectives. Also, what part of the course is done through F2F and which part goes online is not very clear and calls for further research. A recount of the reviewed works shows varying degrees of blending of several components all in the bid to make the learning experience a rewarding one for the learner. The components which were blended includes self-study phases with CDROMS; online sessions providing notice boards, revision materials, short assessment exercises and discussion forums and F2F with support for team work, classroom discussion and project by providing lecture notes, tutorials and PowerPoint presentations. A major finding was the fact that these blended courses were all adopted to suit a particular environment and the choice of components to blend will always depend on the environment in which the BLM will be used.

CHAPTER THREE: METHODOLOGY

3.1 Designing a BL Course

As discussed in Chapter 1, designing a BL program requires thoughtful integration of F2F experiences with online learning experiences" [16]. While it is appealing to consider the benefits of integrating the strengths of F2F instruction with online learning activities, there is also considerable complexity. The combinations yield virtually limitless design possibilities [16].

3.2 CASE STUDY ENVIRONMENTS

3.2.1 Sunyani Polytechnic: Original Case Study Environment

Like many other Polytechnics, Sunyani Polytechnic has large enrolment courses offered on its campus. Sunyani Polytechnic is a Technical Institution of excellence and a Polytechnic of choice, which offers a diverse and flexible range of Higher National Diploma (HND), Bachelor of Technology (B-Tech) and other Professional programmes in Science and Technology Education. It is located in Sunyani the capital town of Brong Ahafo Region in Ghana. The school has 4 computer laboratories; one used by the Commercial Studies Department, one used by the Liberal and General Studies Department, another by the Carpentry and Joinery Section and the other one used by the Electrical Engineering Department. The computer laboratory used by the Liberal Studies Department is the only laboratory that caters for all first year HND students taking the Computer Literacy course except students enrolled for HND Secretaryship and Management Studies. Some students taking non-tertiary courses such as Carpentry and Joinery, Construction Technician Course, Furniture Craft and Motor Vehicle Technician also use this laboratory for the Computer Literacy course. The classes include Accountancy, Marketing, Human Resource Management, Sales and Marketing, Travel and Tourism, Agriculture, HCIM (Hotel, Catering and Institutional Management), Electrical/ Electronic Engineering and Building Technology.

The total number of students using the laboratory for the Computer Literacy course is 2,340 out of a total of 2,437 students. Due to the large number of students, there is no period where students who do not have lectures can come to the laboratory for practice sessions. Consequently, practice sessions are not usually adequate. To enhance the learning process for students, creation of a BL classroom was embarked upon for the following classes: HND. Electrical/Electronic Engineering, HND. HCIM (Hotel, Catering and Institutional Management), HND. Building Technology, MVT (Motor Vehicle Technicians) Part III, Carpentry and Joinery (C & J), and CTC (Construction Technician Course) of which over 70% did not have personal computers. There was also limited access to the school's ICT Centre which has 100 workstations.

Computer Literacy is a core course taken by all first year HND students of Sunyani Polytechnic. It is a one year course with two parts spread over two semesters. The course covers topics in these areas: Introduction to Computers, Introduction to Operating Systems (Windows and DOS), Internet and the Web, and Introduction to the Microsoft Office Suite (Word, Excel, Access and PowerPoint).

3.2.2 KNUST: Test Case Environment

Kwame Nkrumah University of Science and Technology is a public university in Ghana. It has six colleges with several departments. The Departments of Electrical/Electronic, Computer and Telecommunications Engineering which are under the College of Engineering are the focus of this research. KNUST as a university has a 200-seater ICT Centre equipped with 200 workstations. Additionally, the Department of Computer Engineering that run the course has a 40-seater computer laboratory. All these facilities form part of the university's LAN (Local Area Network) and are provided with access to the internet. The university also provides wireless internet facilities for students. About 80% of students in the departments under study have personal computers. Students in the departments under study take several courses

throughout their four-year programme and there are some courses that are common to all Departments. One of the common courses is Computer Networking (COE 475).

Computer Networking is a final year first semester course. The course teaches students how to design, build, troubleshoot, and secure computer networks. It is an online course with provision for interactive tools and hands-on learning activities to help individuals prepare for networking careers. Students are engaged in hands-on learning activities and network simulations to develop practical skills that will help them fill a growing need for networking professionals.

3.3 The BLM

The model implemented in this instance involves recorded lecture videos, a course self tutor, and F2F interactions. Presentation graphics software, Classroom Presenter is used in the preparation of lecture notes and also for F2F interaction with students. With Classroom Presenter, presentations can be prepared using images or files created from Microsoft Office PowerPoint 2003 or 2007 versions. One peculiar advantage of this software is that it comes with inking capability which allows the instructor to create an electronic board and marker scenario with the help of a tablet pc. This can be done by creating a whiteboard deck where the instructor can write with the stylus of the tablet just like writing on a physical whiteboard with a marker. It allows the instructor to make a lot of illustrations in class. The software also allows the instructor to write directly on a slide during presentation to draw students attention to what is being talked about currently.

Lecture sessions are recorded with a laptop's video camera and illustrations made with the Classroom Presenter software can also be saved just as it had been written. This allows students to pay particular attention to the instructor and not bother about losing important points mentioned in class since all will be made available in the form of videos and annotated

presentations. At the end of every lecture session, the recorded video is made available to students.

For the test case environment at KNUST, the BLM involved traditional F2F sessions and online learning sessions. F2F interactions were made with students as it is done in the traditional classroom setting. However, online sessions were also made available to students for further studies. These two platforms were run concurrently. The course was supported by classroom instruction, hands-on learning activities, and online assessments that provide personalized feedback. The instructor had received extensive training on the learning system used. Technical support was provided to help ensure reliability by assisting students in dealing with problems faced when using the online facility.

3.3.1 Classroom Presenter

This was used in the preparation and presentation of lectures. This software was designed by the University of Washington; Department of Computer Science. Classroom Presenter is a Tablet-PC based interaction system that supports the sharing of digital ink on slides between instructors and students. When used as a presentation tool, Classroom Presenter allows the integration of digital ink and electronically prepared slides, making it possible to combine the advantages of the whiteboard style and slide based presentation. The ability to link the instructor and student devices and to send information back and forth provides a mechanism for introducing active learning into the classroom and creates additional feedback channels. The system has a more robust implementation of networking, making it easier to use as the basis of an interactive classroom. The real time inking provides a smooth rendition of digital ink, with very little delay between the instructor and the public display.

There are two different instructor set-up options: stationary and mobile. For a stationary presentation you will need a Tablet PC running Windows XP or Vista connected directly to a

data projector. For a mobile presentation you will need two machines: you will be able to move freely about the classroom with your Tablet PC, but you will need a second computer (does not have to be a tablet, but a tablet will work) in the *Public role* that should be connected directly to the projector. This set up is enough if you only want to take advantage of instructor inking on slides.

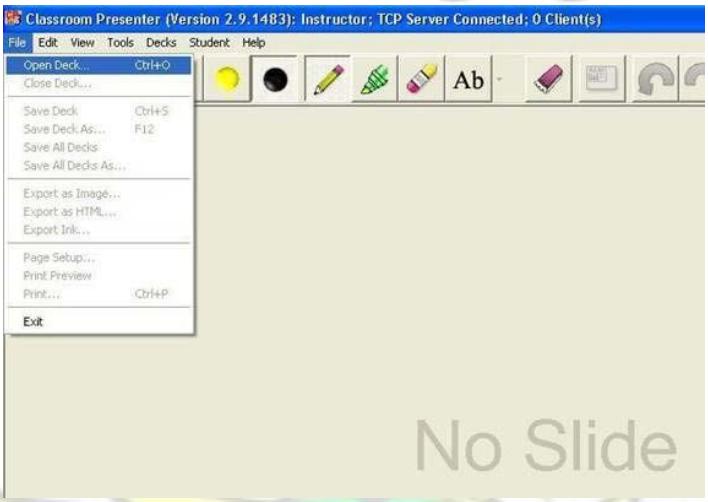


Figure 3.1: Classroom Presenter Interface

3.3.2 Tablet PC

This was used with the Classroom Presenter program in the bit of taking advantage of the inking capabilities of the Classroom Presenter program. It also helps in creating the electronic whiteboard and marker scenario. It has a digital pen, a mouse and a writing pad. With the digital pen, you can write on the writing pad just like it is when writing on a blackboard with a chalk or whiteboard with a marker.

Figure 3.2: Tablet PC

3.3.3 Video Camera

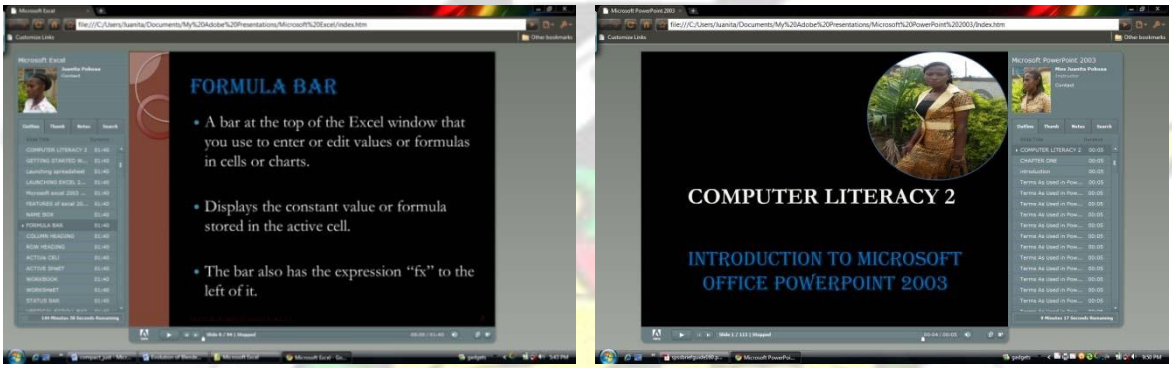
An integrated camera (webcam) of a laptop was used as the video camera in taking coverage of the lecture sessions.

3.3.4 Data Projector

This was used in projecting presentations on large screens during lecture sessions.

3.4 The Course Self Tutor

The course self tutor is a soft copy of the course material. It runs within a browser, can be used without access to the Internet. This motivates students to learn at their own pace and convenience even if they lack Internet connection. A sample interface of the self tutor is as shown in Figure 3.3.



(a) (b)

Figure 3.3: Sample interfaces of the course self tutor

3.5 Recorded Lecture Sessions

Video coverage was taken during some lectures sessions and below is snapshots of some of the videos.

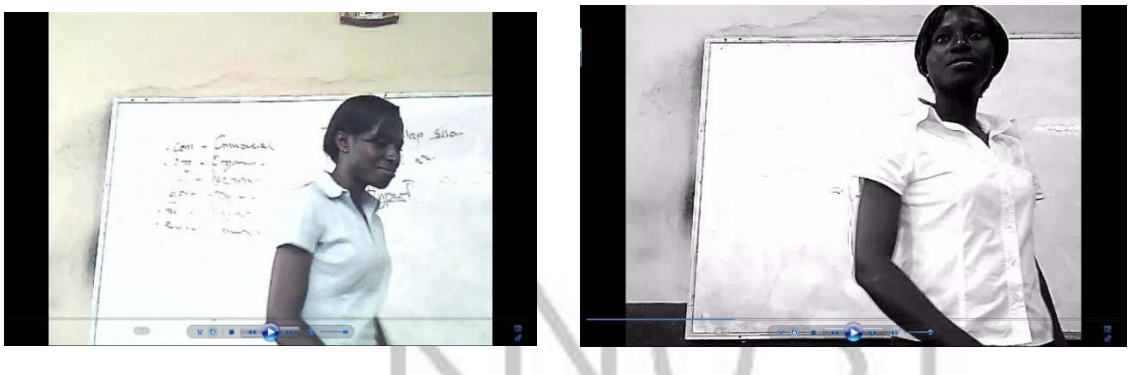


Figure 3.4: Snapshots from a video clip of a recorded lecture

3.6 Evaluation Process

The BL model has been employed for two semesters in the teaching of Computer Literacy at Sunyani Polytechnic; the original case study environment and in the teaching of Computer Networking for one semester at Kwame Nkrumah University of Science and Technology; as a test case environment. To evaluate the progress of applying this model in the teaching and learning process, questionnaires were prepared and administered to coordinate students' response to this model of learning at the original case study environment as well as analyze students' performance using their end of semester examination results to ascertain the impact of the model. The examination results of students at the test case environment were also analyzed to measure the impact of the model. Microsoft Office Excel was used as the statistical tool in analysing the data collected.

CHAPTER FOUR: RESULTS AND ANALYSIS

4.1 Analysis of Results from Questionnaires

The evaluation conducted with the questionnaires placed emphasis on the inclusion of multimedia in course delivery. Students were therefore allowed to assess the following areas:

- The content of the multimedia provided
- The usefulness of the multimedia made available

- ❖ Whether multimedia improved understanding of course concepts discussed
- ❖ Whether the provision of multimedia made the course easier and interesting
- ❖ The role it played in encouraging students to spend more time on the course and
- ❖ Whether multimedia enhanced the ability of students to appreciate the course concepts.

Students' response to questions takes the following forms; strongly disagree, disagree, agree and strongly agree.

Table 4.2: Impact of Multimedia inclusions in course delivery for the first semester of implementation (2008/2009 academic year)

		Materials are of the right content	Availability of videos proved useful	Improved understanding of course concepts	Learning the course has become interesting	Synchronizing concepts discussed with course content	Spent more time learning the course
STRONGLY AGREE	**Number of Students**	25	29	40	35	31	33
	Percentage of Students	21	24	33	29	26	28
AGREE	**Number of Students**	75	76	67	72	77	75
	Percentage of Students	62	63	56	60	64	62
DISAGREE	**Number of Students**	9	10	10	7	8	8
	Percentage of Students	8	9	9	6	7	7
STRONGLY DISAGREE	**Number of Students**	11	5	3	6	4	4

	Percentage of Students	9	4	2	5	3	3

Out of 225 students in the class for the first semester of implementation, 120 responded to questionnaires. Table 4.1 shows the numbers and Figure 4.1 shows a graphical representation of the outcome. Analysis revealed that, 56-64% of the students were in agreement to the assertions that multimedia inclusion was playing a vital role in assisting students appreciate the course concepts, 21-33% of students strongly indicated that the inclusion of multimedia was very useful and 3-9% were strongly in disagreement of these assertions. However, there was a general acceptance of multimedia inclusion in the course delivery.

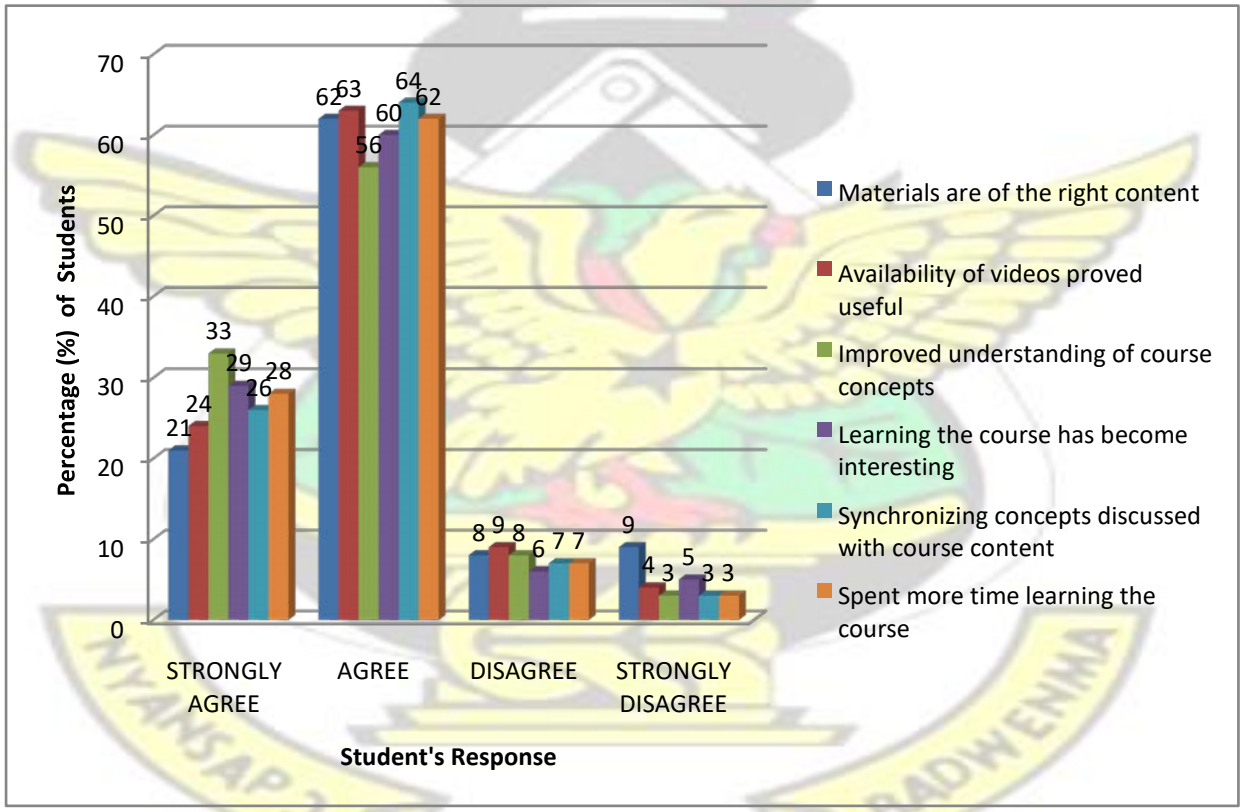


Figure 4.1: Chart showing details of multimedia inclusion in course delivery for the first semester of implementation (2008/2009 academic year)

Table 4.2: Impact of Multimedia inclusions in course delivery for the second semester of implementation (2009/2010 academic)

		Right amount of multimedia content	Availability of videos proved very useful	Videos made learning much easier and interesting	Introduction of videos encouraged learning
STRONGLY AGREE	Number of Students	87	89	96	111
	Percentage of Students	27	28	30	34
AGREE	Number of Students	135	156	145	137
	Percentage of Students	42	48	45	42
DISAGREE	Number of Students	65	48	48	45
	Percentage of Students	20	15	15	14
STRONGLY DISAGREE	Number of Students	36	30	34	30
	Percentage of Students	11	9	10	9

For the second semester of implementation, 323 out of 500 students took part in the survey. Table 4.2 shows the numbers and Figure 4.2 shows a graphical representation of the outcome. From the responses gathered, 27-34% of students gave strong indications that the inclusion of multimedia was playing a vital role when it comes the study of the course, 42-48% were also in agreement of the inclusion. Notwithstanding, 9-11% of the students strongly indicated their disagreement to the inclusion but on the whole, the appreciation of the course due to the

multimedia inclusion gradually gaining grounds and students are becoming more interested in the course.

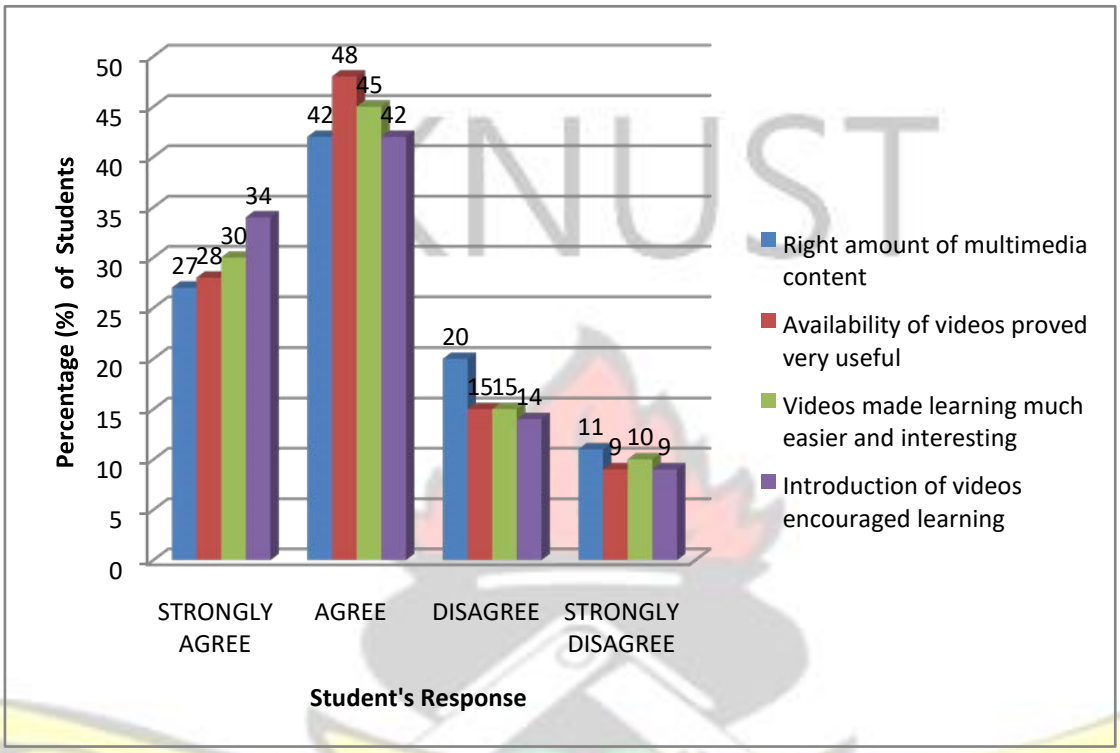


Figure 4.2: Chart showing details of multimedia inclusion in course delivery for the second semester of implementation (2009/2010 academic)

4.3 Analysis of Results from Original Case Study Environment

The end of semester results for the students under study for the 2008/2009 and 2009/2010 academic years was studied. For the purpose of this research, the first semester of the 2008/2009 academic year employing traditional F2F instruction was compared with the second semester of the 2008/2009 academic year utilizing the BLM. A similar comparison was made for the first semester of the 2008/2009 academic year and first semester of the 2009/2010 academic year employing traditional F2F and the BLM respectively. The following pages show the analysis of the data in tables and figures.

Table 4.3: HND. Electrical/Electronic Engineering First and Second Semester Examination Results for Computer Literacy

Grade	Number of Students		Percentage of Students	
	2008/2009 Semester 1	**2008/2009 Semester 2**	**2008/2009 Semester 1**	**2008/2009 Semester 2**
A+	8	1	7	1
A	11	3	10	3
B+	13	10	12	9
B	18	6	17	6
C+	13	15	12	14
C	17	13	16	12
D+	9	18	8	17
D	14	37	3	35
F	4	3	4	3

Table 4.3 shows HND. Electrical/Electronic Engineering first and second semester examination results for Computer Literacy for the 2008/2009 academic year. The mode of instruction for the first semester was purely F2F while the BLM was adopted for the second semester. Analysis of results revealed that performance of students was worse for the period of application of the BLM because the number of students who had lower grades increased compared to that of the previous semester. For instance, the number of students who had grade D increased from 3% to 35% for the F2F instruction and BL instruction respectively showing 32% increase margin. In the same way, the number of students who had D+ increased from 8% to 17% for the F2F instruction and BL instruction respectively showing an increase margin of 9%. Moreover, the number of students who had C+ also increased from 12% to 14% for the F2F instruction and BL instruction respectively showing an increase margin of 2%. Figure 4.3 shows a graphical display of the analysis.

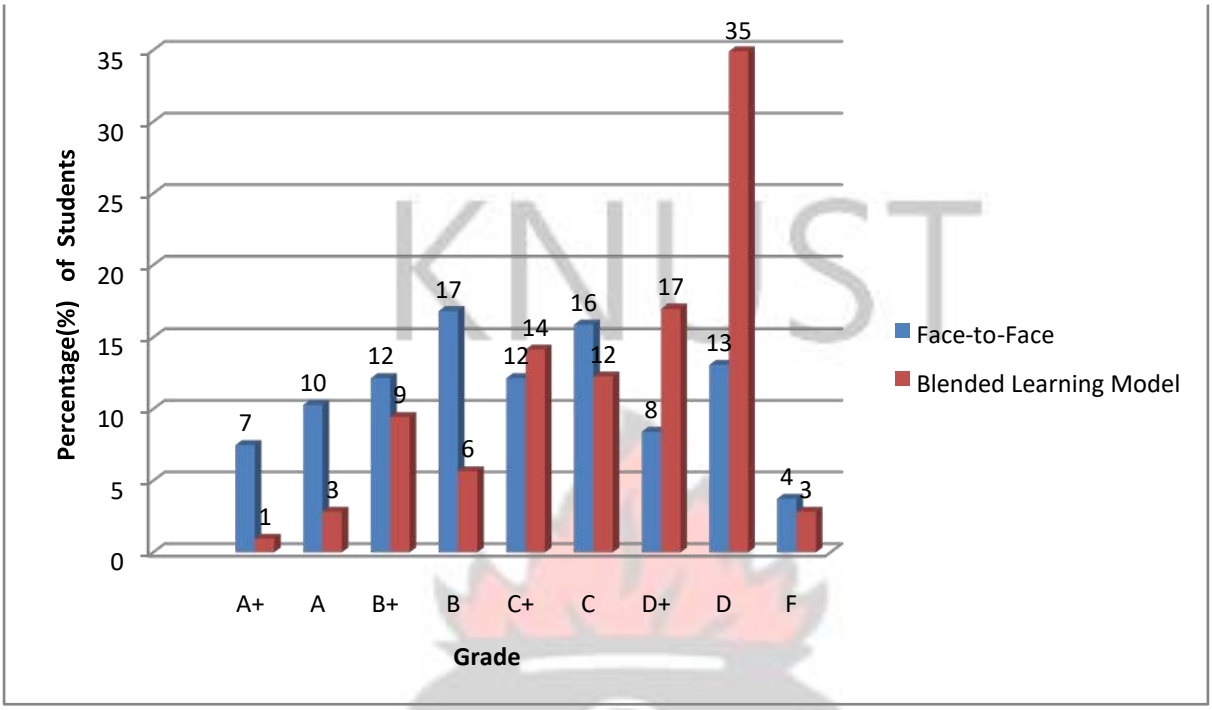


Figure 4.3: Chart showing HND. Electrical/Electronic Engineering first and second semester results for Computer Literacy (2008/2009 academic year)

Table 4.4: HND. Building Technology First and Second Semester Examination Results for Computer Literacy

Grade	Number of Students		Percentage of Students	
	2008/2009 Semester 1	2008/2009 Semester 2	2008/2009 Semester 1	2008/2009 Semester 2
A+	5	0	6	0
A	6	0	7	0
B+	8	0	10	0
B	13	5	16	5
C+	19	10	23	11
C	12	18	15	20
D+	11	15	13	16
D	8	31	10	34

F	0	13	0	14

Table 4.4 shows HND. Building Technology first and second semester examination results for Computer Literacy for the 2008/2009 academic year. The mode of instruction for the first semester was purely F2F while the BLM was adopted for the second semester. Analysis of results revealed that performance of students was worse for the period of application of the BLM because the number of students who had lower grades increased compared to that of the previous semester. For instance, the number of students who had grade D increased from 10% to 34% for the F2F instruction and BL instruction respectively showing 24% increase margin. In the same way, the number of students who had D+ increased from 13% to 16% for the F2F instruction and BL instruction respectively showing an increase margin of 3%. Moreover, the number of students who had C also increased from 15% to 20% for the F2F instruction and BL instruction respectively showing an increase margin of 5%. Furthermore, the number of students who failed increased from 0% to 14% for the F2F instruction and BL instruction respectively showing an increase margin of 14%. Figure 4.4 shows a graphical display of the analysis.

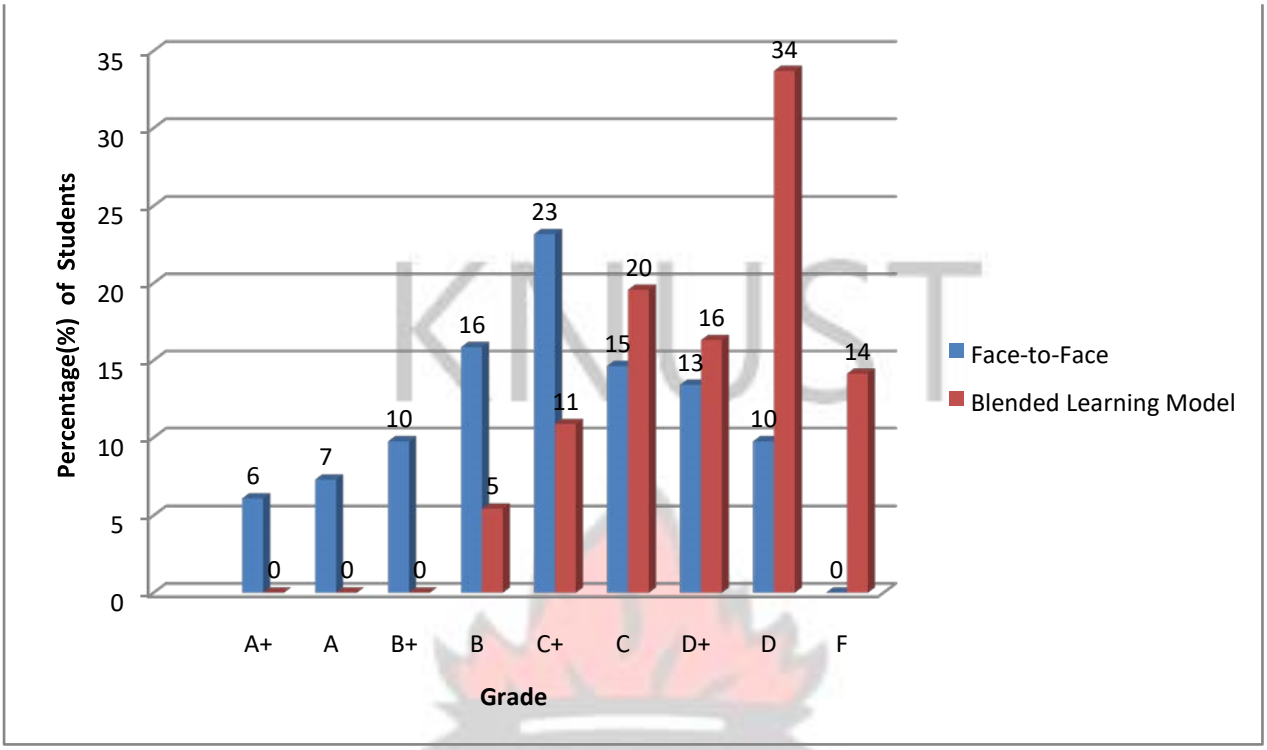


Figure 4.4: Chart showing HND. Building Technology first and second semester results for Computer Literacy (2008/2009 academic year)

Table 4.5: HND. HCIM First and Second Semester Examination Results for Computer Literacy

Grade	Number of Students		Percentage of Students	
	2008/2009 Semester 1	2008/2009 Semester 2	2008/2009 Semester 1	2008/2009 Semester 2
A+	0	0	0	0
A	2	0	5	0
B+	5	0	13	0
B	12	1	31	3
C+	12	2	31	5

C	2	5	5	13
D+	5	7	13	18
D	1	22	3	55
F	0	3	0	8

Table 4.5 shows HND. HCIM first and second semester examination results for Computer Literacy for the 2008/2009 academic year. The mode of instruction for the first semester was purely F2F while the BLM was adopted for the second semester. Analysis of results revealed that students' performance was worse for the period of application of the BLM because the number of students who had lower grades increased compared to that of the previous semester. For instance, the number of students who had grade D increased from 3% to 55% for the F2F instruction and BL instruction respectively showing 52% increase margin. In the same way, the number of students who had D+ increased from 13% to 18% for the F2F instruction and BL instruction respectively showing an increase margin of 5%. Moreover, the number of students who had grade C also increased from 5% to 13% for the F2F instruction and BL instruction respectively showing an increase margin of 8%. Furthermore, the number of students who failed increased from 0% to 8% for the F2F instruction and BL instruction respectively showing an increase margin of 8%. Figure 4.5 shows a graphical display of the analysis.

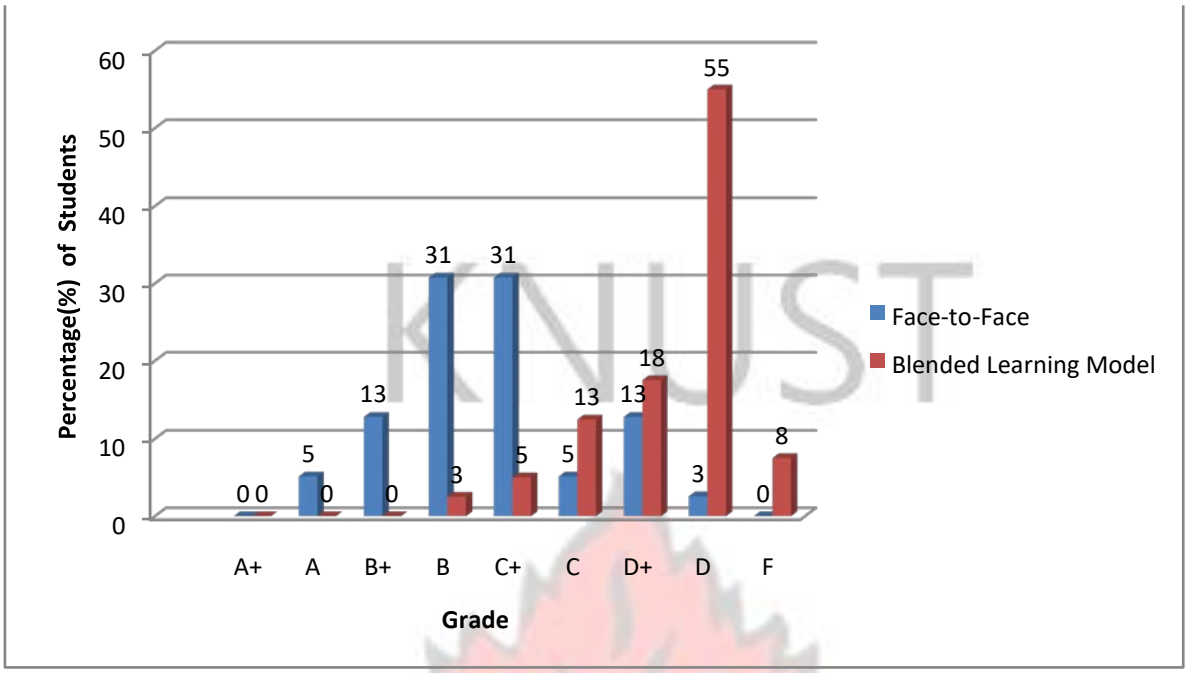


Figure 4.5: Chart showing HND. HCIM first and second semester results for Computer Literacy (2008/2009 academic year)

Table 4.6: HND. Electrical/Electronic Engineering First Semester Examination Results for Computer Literacy

Grade	Number of Students		Percentage of Students	
	2008/2009 Semester 1	2009/2010 Semester 1	2008/2009 Semester 1	2009/2010 Semester 1
A+	8	9	7	5
A	11	7	10	4
B+	13	20	12	11
B	18	22	17	13
C+	13	18	12	10
C	17	22	16	13
D+	9	17	8	10
D	14	58	13	33
F	4	3	4	2

Table 4.6 shows HND. Electrical/Electronic Engineering first semester examination results for Computer Literacy for the 2008/2009 and 2009/2010 academic years respectively. The mode of instruction for the first semester of the 2008/2009 academic year was purely F2F while the BLM was adopted for the first semester of the 2009/2010 academic year. Analysis of results revealed that students' performance was worse for the period of application of the BLM because the number of students who had lower grades increased compared to that of the previous semester. For instance, the number of students who had grade D increased from 13% to 33% for the F2F instruction and BL instruction respectively showing 20% increase margin. In the same way, the number of students who had D+ increased from 8% to 10% for the F2F instruction and BL instruction respectively showing an increase margin of 2%.

Figure 4.6 shows a graphical display of the analysis.

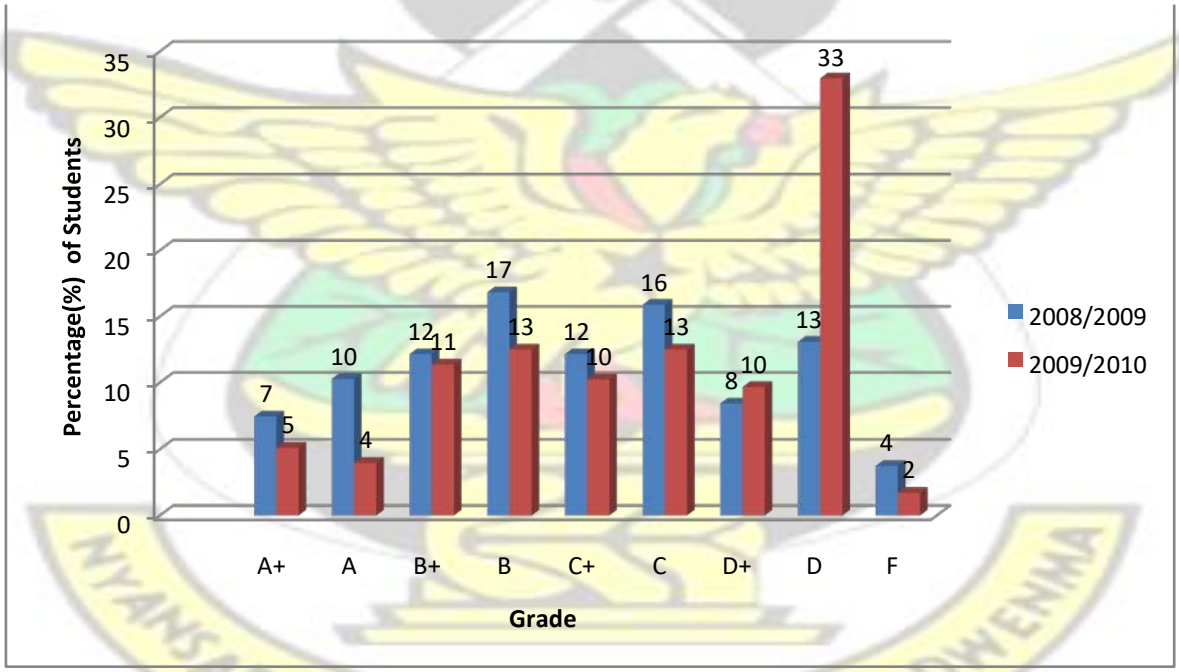


Figure 4.6: Chart showing HND. Electrical/Electronic Engineering first semester results for Computer Literacy (2008/2009 and 2009/2010 academic years)

Table 4.7: HND. Building Technology First Semester Examination Results for Computer Literacy

Grade	Number of Students		Percentage of Students	
	2008/2009 Semester 1	**2009/2010 Semester 1**	**2008/2009 Semester 1**	**2009/2010 Semester 1**
A+	5	11	6	7
A	6	10	7	7
B+	8	11	10	7
B	13	19	16	13
C+	19	24	23	16
C	12	19	15	13
D+	11	19	13	13
D	8	34	10	23
F	0	3	0	2

Table 4.7 shows HND Building Technology first semester examination results for Computer Literacy; for the 2008/2009 and 2009/2010 academic years respectively. The mode of instruction for the first semester of the 2008/2009 academic year was purely F2F while the BLM was adopted for the first semester of the 2009/2010 academic year. Analysis of results revealed that students' performance was still worse for the period of application of the BLM because the number of students who had lower grades increased compared to that of the previous semester. For instance, the number of students who had grade D increased from 10% to 23% for the F2F instruction and BL instruction respectively showing 13% increase margin. Notwithstanding, a 1% performance was seen as the number of students who had A+ increased from 6% to 7% for the F2F instruction and BL instruction respectively. Figure 4.7 shows a graphical display of the analysis.

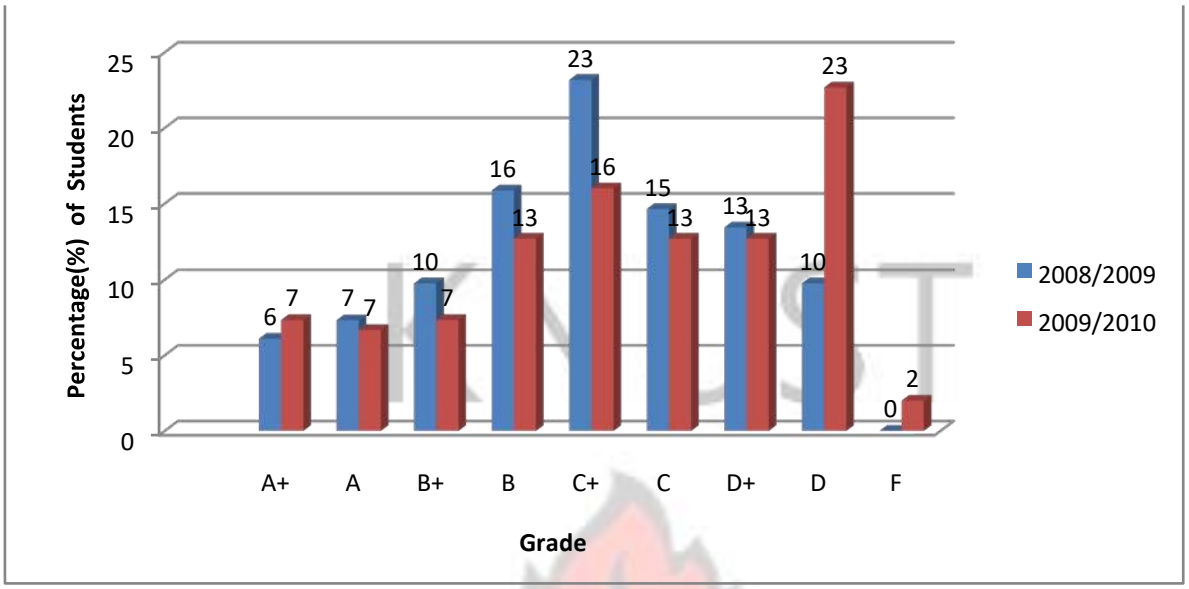


Figure 4.7: Chart showing HND. Building Technology first semester results for Computer Literacy (2008/2009 and 2009/2010 academic years)

Table 4.8: HND. HCIM First Semester Examination Results for Computer Literacy

Grade	Number of Students		Percentage of Students	
	2008/2009 Semester 1	**2009/2010 Semester 1**	**2008/2009 Semester 1**	**2009/2010 Semester 1**
A+	0	5	0	4
A	2	18	5	15
B+	5	11	13	9
B	12	15	31	13
C+	12	20	31	17
C	2	27	5	23
D+	5	3	13	3
D	1	17	3	14
F	0	3	0	3

Table 4.8 shows HND. HCIM first semester examination results for Computer Literacy for the 2008/2009 and 2009/2010 academic years respectively. The mode of instruction for the first semester of the 2008/2009 academic year was purely F2F while the BLM was adopted for the first semester of the 2009/2010 academic year. Analysis of results revealed that students' performance was still worse for the period of application of the BLM because the number of students who had lower grades increased compared to that of the previous semester. For instance, the number of students who had grade D increased from 3% to 14% for the F2F instruction and BL instruction respectively showing 11% increase margin. In the same way, the number of students who had C increased from 5% to 23% for the F2F instruction and BL instruction respectively showing an increase margin of 18%. Moreover, the number of students who failed also increased from 0% to 3% for the F2F instruction and BL instruction respectively showing an increase margin of 3%. Notwithstanding, analysis of results also

revealed a marginal improvement in students' performance. For instance, the number of students who had grade A increased from 5% to 15% for the F2F instruction and BL instruction respectively showing an increase margin of 10%. The number of students who had A+ also increased from 0% to 4% during F2F instruction and the BL instruction respectively showing an increase margin of 4%. Figure 4.8 shows a graphical display of the analysis.

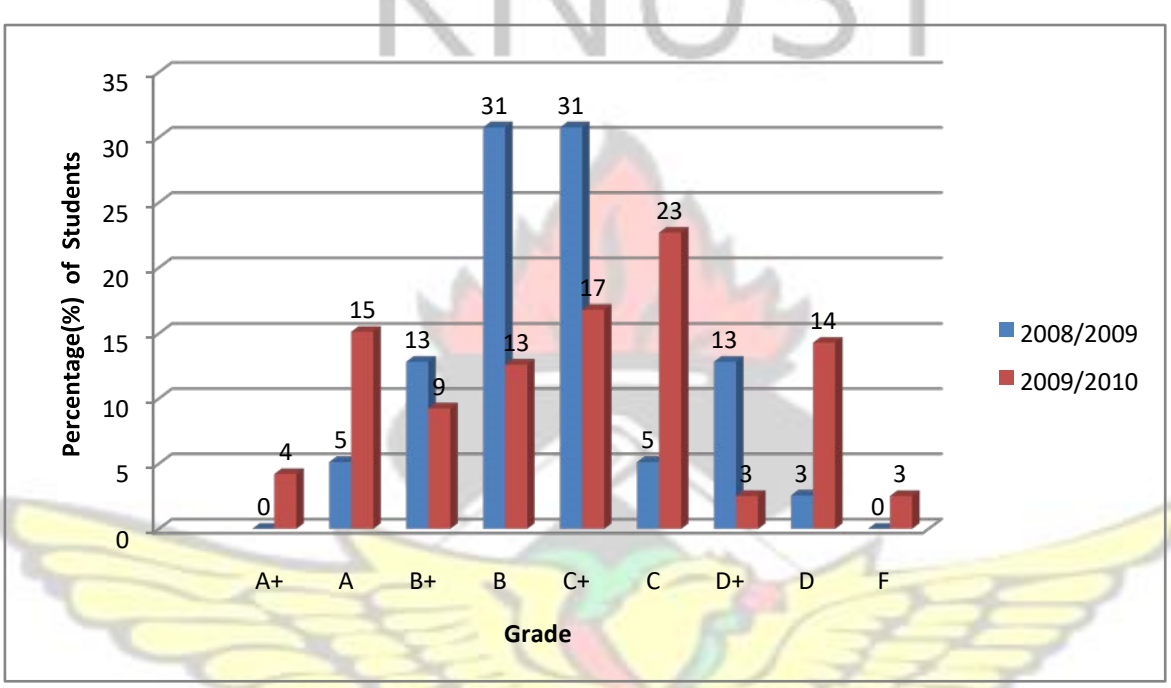


Figure 4.8: Chart showing HND. HCIM first semester results for Computer Literacy (2008/2009 and 2009/2010 academic years)

The performance of students during the first semester of implementation of the BLM was worse due to the following reasons:

- Preparation for the implementation was not adequate
- Awareness creation of the platform and help tips in using it was not readily available
- Feedback systems monitoring the progress of students' utilization of the platform were not present.

However, for the second semester of implementation of the BLM; performance of students improved. The improvement of performance were as a result of

- Creating the awareness and giving students help tips to make the use of the platform easier
- Putting in place feedback mechanisms that assist students in dealing with the problems faced when using the platform
- Adequate preparation for the implementation of the platform and
- Students' rising interest in acquiring the skills needed for the usage of the platform

4.4 Analysis of Results from Test Case Environment

The end of semester results for the students under study was studied. For the purpose of this research, the 2009/2010 and the 2010/2011 academic year was considered with emphasis on traditional F2F instruction and the use of the BLM respectively in the teaching and learning process of the course under study. The following pages show the analysis of the data in tables and figures.

Table 4.9: BSc. Computer Engineering First Semester Examination Results for Computer Networking

Grade	**Number of Students**		**Percentage of Students**	
	2009/2010 Semester 1	**2010/2011 Semester 1**	**2009/2010 Semester 1**	**2010/2011 Semester 1**
A	6	39	11	72
B	12	12	23	22
C	14	2	26	4
D	18	1	34	2
F	3	0	6	0

Table 4.9 shows BSc. Computer Engineering first semester examination results for Computer Networking for the 2009/2010 and 2010/2011 academic years respectively. The mode of instruction for the first semester of the 2009/2010 academic year was purely F2F while the

BLM was adopted for the first semester of the 2010/2011 academic year. Analysis of results revealed a massive improvement in students' performance because the number of students who scored higher grades the previous academic year increased during the period of application of the BLM. For instance, the number of students who had grade A increased from 11% to 72% for the F2F instruction and BL instruction respectively showing 61% increase margin. Figure 4.9 shows a graphical display of the analysis.

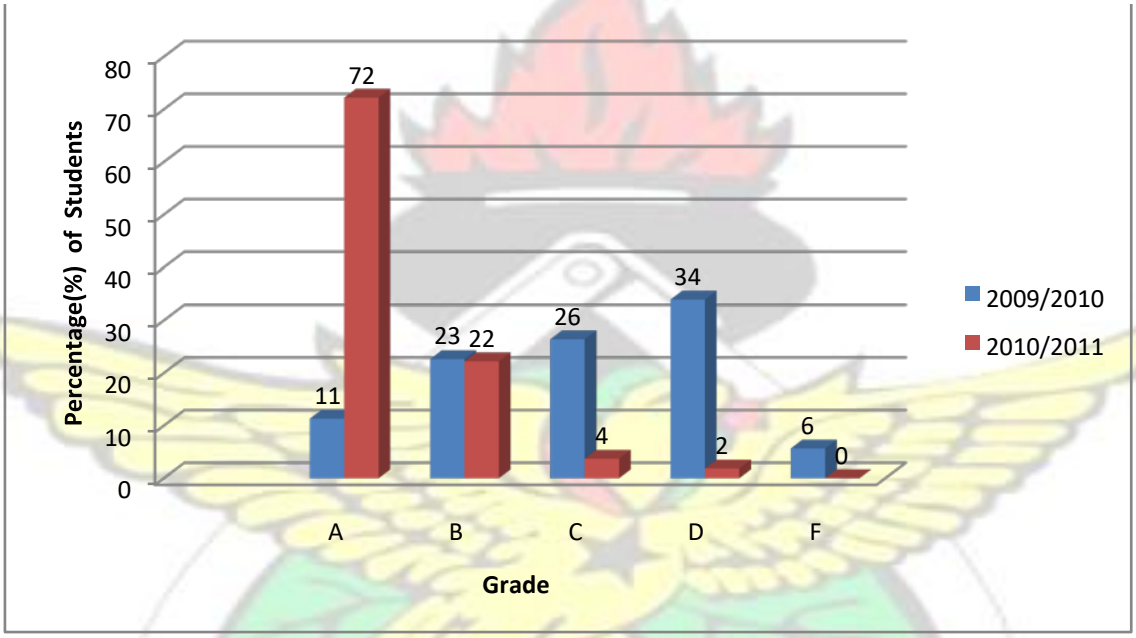


Figure 4.9: Chart showing BSc. Computer Engineering first semester results for Computer Networking (2009/2010 and 2010/2011 academic years)

Table 4.10: BSc. Computer Engineering (Distance Learning) First Semester Examination Results for Computer Networking

Grade	Number of Students		Percentage of Students	
	2009/2010 Semester 1	2010/2011 Semester 1	2009/2010 Semester 1	2010/2011 Semester 1
A	9	28	33	80

B	17	5	63	14
C	0	2	0	6
D	1	0	4	0
F	0	0	0	0

Table 4.10 shows BSc. Computer Engineering (Distance Learning) first semester examination results for Computer Networking for the 2009/2010 and 2010/2011 academic years respectively. The mode of instruction for the first semester of the 2009/2010 academic year was purely F2F while the BLM was adopted for the first semester of the 2010/2011 academic year. Analysis of results revealed a massive improvement in students' performance because the number of students who scored higher grades the previous academic year increased during the period of application of the BLM. For instance, the number of students who had grade A increased from 33% to 80% for the F2F instruction and BL instruction respectively showing 47% increase margin. In the same way, the number of students who had grade C increased from 0% to 6% for the F2F instruction and BL instruction respectively showing 6% increase margin. Figure 4.10 shows a graphical display of the analysis.

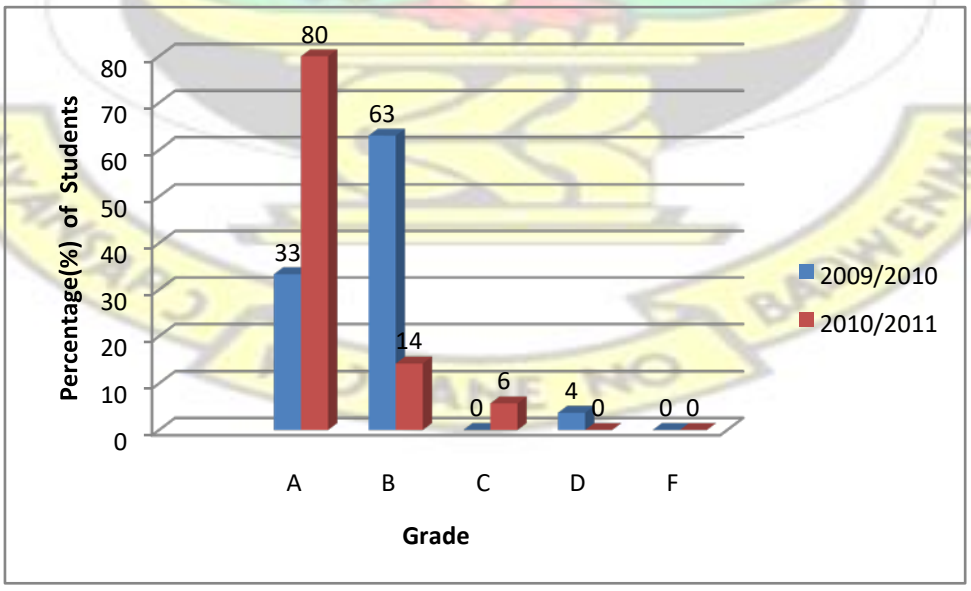


Figure 4.10: Chart showing BSc. Computer Engineering (Distance Learning) first semester results for Computer Networking (2009/2010 and 2010/2011 academic years)

Table 4.11: BSc. Electrical/Electronic Engineering First Semester Examination Results for Computer Networking

Grade	**Number of Students**		**Percentage of Students**	
	2009/2010 Semester 1	**2010/2011 Semester 1**	**2009/2010 Semester 1**	**2010/2011 Semester 1**
A	12	76	10	78
B	34	10	28	10
C	31	8	26	8
D	33	3	27	3
F	11	1	9	1

Table 4.11 shows BSc. Electrical/Electronic Engineering first semester examination results for Computer Networking for the 2009/2010 and 2010/2011 academic years respectively. The mode of instruction for the first semester of the 2009/2010 academic year was purely F2F while the BLM was implemented for the first semester of the 2010/2011 academic year. Analysis of results revealed a massive improvement in students' performance because the number of students who scored higher grades the previous academic year increased during the period of application of the BLM. For instance, the number of students who had grade A increased from 10% to 78% for the F2F instruction and BL instruction respectively showing 68% increase margin. In the same way, the number of students who failed reduced from 9% to 1% for the F2F instruction and BL instruction respectively showing 8% decrease margin.

Figure 4.11 shows a graphical display of the analysis.

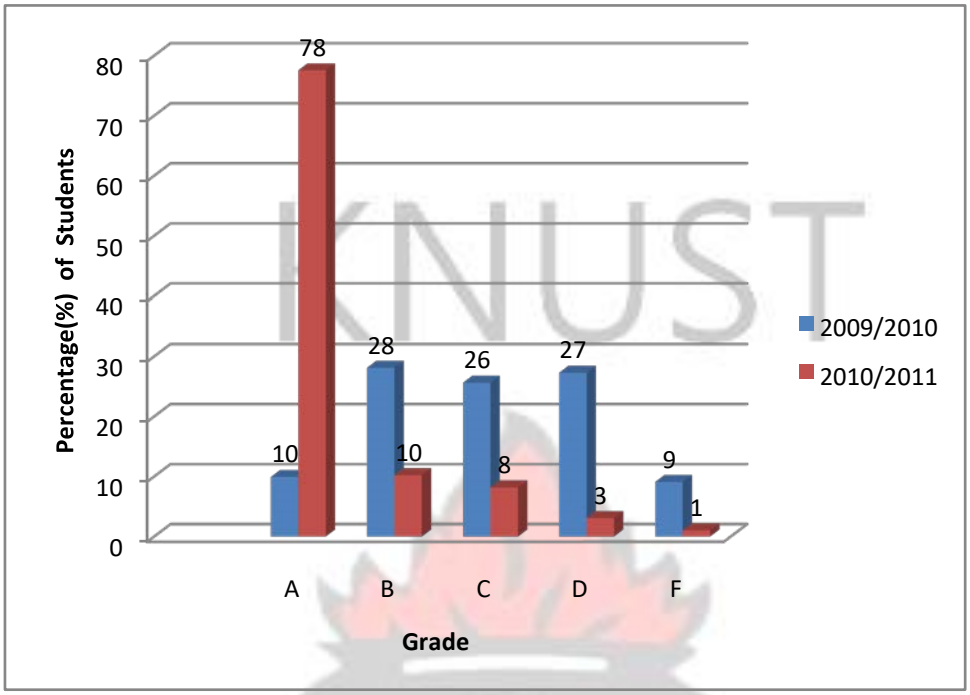


Figure 4.11: Chart showing BSc. Electrical/Electronic Engineering first semester results for Computer Networking (2009/2010 and 2010/2011 academic years)

Table 4.12: BSc. Telecommunications Engineering First Semester Examination Results for Computer Networking

Grade	Number of Students		Percentage of Students	
	2009/2010 Semester 1	**2010/2011 Semester 1**	**2009/2010 Semester 1**	**2010/2011 Semester 1**
A	6	20	15	83
B	5	2	12	8
C	6	2	15	8
D	19	0	46	0
F	5	0	12	0

Table 4.12 displays BSc. Telecommunications Engineering first semester examination results for Computer Networking for the 2009/2010 and 2010/2011 academic years respectively. The mode of instruction for the first semester of the 2009/2010 academic year was purely F2F while the BLM was implemented for the first semester of the 2010/2011 academic year. Analysis of results revealed a massive improvement in students' performance because the number of students who scored higher grades the previous academic year increased during the period of application of the BLM. For instance, the number of students who had grade A increased from 15% to 83% for the F2F instruction and BL instruction respectively showing 68% increase margin. Figure 4.12 shows a graphical display of the analysis.

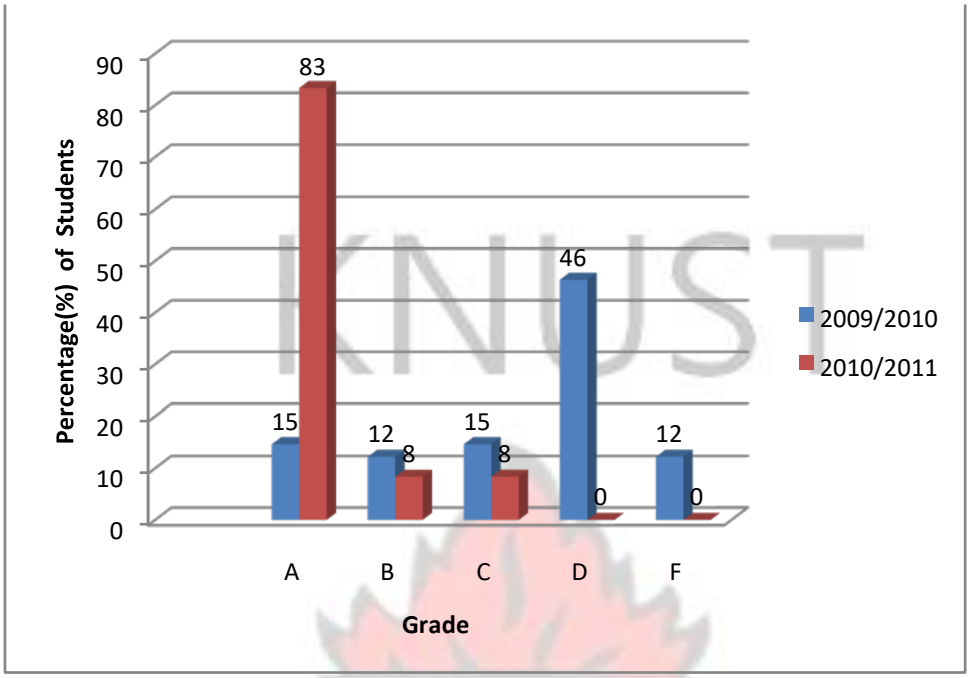


Figure 4.12: Chart showing BSc. Telecommunications Engineering first semester results for Computer Networking (2009/2010 and 2010/2011 academic years)

The performance of students at the test case environment showed a dramatic improvement due to the following reasons:

- ❖ Adequate preparation before the implementation of the platform
- ❖ Students having the skills required to use the platform
- ❖ Availability of a 24/7 internet access and
- ❖ Provision of feedback systems to monitor student's progress

4.5 Systematic Transition from F2F to BL

Before attempting to integrate ICTs into the teaching and learning process, it is essential for Colleges and Universities to have adequate support and solid infrastructure. For a particular case where there is limited access to the internet, a 30-seater computer laboratory serving over thousand (1000) students and over 70% of students new to the world of computers; it is

imperative to identify the specific needs of the students first. This involves putting in place a computer network with access to the internet and also providing a 100-seater computer laboratory as well as a 200-seater ICT centre for students.

A capable Information Technology (IT) group must then be employed to configure and manage the infrastructure. While this was a huge problem a few years ago, it may not be so in today's highly-wired environment, but it must be considered during the planning phase of the transition. Prior to enrolling in online coursework, lecturers as well as students must be made aware of the computer and technology requirements, especially with regards to operating systems, web browsers, required software and tools, and connectivity speeds. If the required software is not provided by the university, the students may be required to purchase it, and this may be very expensive for a typical student's budget. To avoid problems, schools can provide lecturers and students with properly equipped laptops that contain all supported software, such as word processing, presentation, spreadsheets, communications, electronic mail, and department-specific tools; and make arrangements for students to pay during the course of their study. For a Business department, the set of tools may include spreadsheets, statistical analysis tools, presentation software, and the like. For a Computer Science department, the tools may require operating systems, compilers, debugging tools, and similar applications. Regardless of student's major, typical requirements may include operating system, anti-virus software, web browser, word processing software, spreadsheet, graphics tools, email, and communications software [4]. Support systems must be provided to assist lecturers and students deal with difficulties that arise when using the system. To sustain the efficient and effective running of the system, scheduled evaluation should be conducted and results published to ensure regular improvements in the system's performance.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

BL which has become an established, proven and effective way to deliver quality instruction gives educators and students a technology-based on-ramp to student achievement and richer, more rewarding learning experiences. While there are a variety of BLMs, there is not a single best approach. The mix may be influenced by many factors including the course instructional goals, student characteristics, instructor experience and teaching style, discipline, developmental level and online resources [29].

In this work a BLM was developed at the Sunyani Polytechnic campus. The model involved the blending of instructional technology and traditional F2F instruction in the teaching and learning process and it involves recorded lecture videos, a course self tutor, online sessions and face-to-face interactions. The model was applied in the teaching and learning process of two courses in two Ghanaian institutions of higher learning—Sunyani Polytechnic and KNUST.

Analysis of results revealed that employing instructional technology promises great successes when adequate preparation is made. This was evident in the outcome of the application of the BLM in the test case environment (KNUST) which showed an average improvement of 61% in the performance of students. Notwithstanding, if the application is done without adequate preparation, it can result in worse outcomes contrary to the notion of automatic success when instructional technology is used. This was also evident in the outcome of the original case study environment (Sunyani Polytechnic) during the first semester of implementation of the BLM which showed an average decline of 15% in the performance of students.

Although, there are numerous accounts of reported application of instructional technology resulting in tremendous successes, availability of adequate infrastructure and access to available resources by students and adequate preparation is the key. Consequently, no two

BLMs are identical. The best model is the one that works best for students and teachers in their particular environment and that addresses their specific needs at the time.

5.2 Recommendations

BL literature is dominated by insider accounts of its introduction in campus-based courses, generally using an LMS and often including online discussions. These reports are often highly descriptive and factors that might promote successful BL are often hidden in the form of concluding observations, and recommendations and rarely identified more explicitly. The recommendations that follow have been developed based on the empirical results obtained from conducting this research, where there is an overall emphasis on pedagogic factors.

- There are several BLMs being used at different institutions of higher learning in and outside Ghana. The BLM to be used should be developed to respond to local, community or institutional needs rather than using a generic approach taking into account the learners' needs.
- Students' learning maturity and readiness for BL with its demands for independent learning must be considered.
- Student expectations, especially their ideas that fewer face-to-face classes mean less work and the need to develop more responsibility for their learning and time management skills must be taken into account.
- Consistent and transparent communication around the new expectations is needed in order to help students understand the BL process [36].
- Careful consideration of the role of the teacher in the blended model to be implemented should also be given a critical look.

- It is also important that the institutional building blocks are in place including institutional readiness, sufficient technical resources; and good communication and feedback channels with students.
- Regular evaluations and publicizing of results should also be done to ascertain the performance of the blended model being implemented [36].

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APPENDIX A: EVALUATION FORMS

SUNYANI POLYTECHNIC DEPARTMENT OF LIBERAL AND GENERAL STUDIES EVALUATION FORM COURSE: COMPUTER LITERACY 2
SEMESTER: 2 CLASS: _____ GENDER: _____ Course Orientation

1. Has the "course material" been useful?
   a. Yes b. No

Expectations, Goals and Objectives

2. Course content was consistent with the course objectives.
   a. Strongly disagree b. Disagree d. Agree e. Strongly agree 3.

What were your expectations for this class and how effectively have they been met?

_____
_____
_____
_____
_____

4. How would you rate your previous experience with the Internet, MS Office PowerPoint and Excel concepts before taking this course?

a. Highly confident b. Confident d. Less confident e. Not confident

Instructor Evaluation

5. Instructor's knowledge of subject matter was
   a. Excellent b. Very good c. Good d. Poor e. Very poor

6. The instructor returned examinations and papers in a timely fashion.
   a. Strongly disagree b. Disagree d. Agree e. Strongly agree

7. The instructor provided feedback regarding completed course assignments.
   a. Strongly disagree b. Disagree d. Agree e. Strongly agree

8. Considering the size of the class, the instructor's responsiveness to student questions and use of class participation was satisfactory.
   a. Strongly disagree b. Disagree d. Agree e. Strongly agree

9. The instructor's presentations positively impacted on my understanding of material.
   a. Strongly disagree b. Disagree d. Agree e. Strongly agree

10. The instructor's ability to communicate the subject to the student was very good.
    a. Strongly disagree b. Disagree d. Agree e. Strongly agree

11. Ability of instructors to relate to students' interests and needs. Availability of instructor (office hours and telephone calls).
    a. Excellent b. Very good c. Good d. Poor e. Very poor

12. The instructor's enthusiasm in talking about course material.
    a. Excellent b. Very good c. Good d. Poor e. Very poor

13. The instructor's interest in teaching.
    a. Excellent b. Very good c. Good d. Poor e. Very poor

14. The instructor's use of examples or personal experience to help get points across.
    a. Excellent b. Very good c. Good d. Poor e. Very poor

15. The instructor's ability to relate the course concepts in a systematic manner.
    a. Excellent b. Very good c. Good d. Poor e. Very poor

Course lectures (content, delivery style, and pace)

16. The appropriateness of the amount of material the course attempted to cover.
    a. Excellent b. Very good c. Good d. Poor e. Very poor

17. The pace at which course material was covered was satisfactory.
    a. Strongly disagree b. Disagree d. Agree e. Strongly agree

18. The content is arranged in a clear, logical and orderly manner.
    a. Strongly disagree b. Disagree d. Agree e. Strongly agree

19. The content covers most of the topics you expected to find.
    a. Strongly disagree b. Disagree d. Agree e. Strongly agree

20. The content explains the knowledge and concepts well.
    a. Strongly disagree b. Disagree d. Agree e. Strongly agree

21. The examples shown are good.
    a. Strongly disagree b. Disagree d. Agree e. Strongly agree

22. The course has made me feel more confident in the subject.
    a. Strongly disagree b. Disagree d. Agree e. Strongly agree

Rating Course Components

Please rate the following exercises and elements according to how helpful they were to your learning experience

23. Group presentations
    a. Very helpful b. Helpful d. Not helpful

24. Quizzes and assignments
    a. Very helpful b. Helpful d. Not helpful

25. Class lectures
    a. Very helpful b. Helpful d. Not helpful

Multimedia

26. The multimedia (lecture videos) materials in the module are of the right amount.
    a. Strongly disagree b. Disagree d. Agree e. Strongly agree

27. The availability of videos for the various topics handled in the course proved very useful.
    a. Strongly disagree b. Disagree d. Agree e. Strongly agree

28. The videos helped to improve my understanding of the concepts discussed in class.

a. Strongly disagree b. Disagree d. Agree e. Strongly agree

29. Learning the course has become much easier and interesting with the videos.
    a. Strongly disagree b. Disagree d. Agree e. Strongly agree

30. The videos have helped me in synchronizing the concepts discussed in class with the information provided in the course material.
    a. Strongly disagree b. Disagree d. Agree e. Strongly agree

31. The introduction of the lecture videos has encouraged me to spend more time learning this course and have greatly appreciated this course as a result.
    a. Strongly disagree b. Disagree d. Agree e. Strongly agree

32. Any other comments, suggestions, observations, etc

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SUNYANI POLYTECHNIC

DEPARTMENT OF LIBERAL AND GENERAL STUDIES EVALUATION FORM
COURSE: COMPUTER LITERACY 1 SEMESTER: 1

CLASS: _____ GENDER:_____

Course Orientation

1. Has the "course material" been useful?
   a. Yes b. No

Expectations, Goals and Objectives

2. Course content was consistent with the course objectives.
   a. Strongly disagree b. Disagree d. Agree e. Strongly agree 3.

What were your expectations for this class and how effectively have they been met?

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_____

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_____

Kindly tick the box to indicate your chosen answer to the corresponding question

	Strongly Agree	**Agree**	**Disagree**	**Strongly Disagree**

4. Instructor's knowledge of subject matter was good.				
5. The instructor returned examinations and papers in a timely fashion.				
6. The instructor provided feedback regarding completed course assignments.				
7. Considering the size of the class, the instructor's responsiveness to student questions and use of class participation was satisfactory.				
8. The instructor's presentations positively impacted on my understanding of material.				
9. The instructor's ability to communicate the subject to the student was very good.				
10. Ability of instructors to relate to students' interests and needs. Availability of instructor (office hours and telephone calls).				
11. The appropriateness of the amount of material the course attempted to cover was very good.				
12. The pace at which course material was covered was satisfactory.				
13. The content is arranged in a clear, logical and orderly manner.				
14. The content explains the knowledge and concepts well.				
15. The examples shown are good.				
16. Quizzes and assignments were extremely helpful.				
17. Class lectures went a long way to help me appreciate the course.				
18. The multimedia (lecture videos) materials in the module are of the right amount.				
19. The availability of videos for the various topics handled in the course proved very useful.				
20. Learning the course has become much easier and interesting with the videos.				
21. The introduction of the lecture videos has encouraged me to spend more time learning this course and have greatly appreciated this course as a result.				

22. Any other comments, suggestions, observations, etc

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