Journal of Universal Computer Science, vol. 25, no. 5 (2019), 515-540
submitted: 1/10/18, accepted: 20/5/19, appeared: 28/5/19 © J.UCS

Students' Perception of a Blended Learning Approach in an African Higher Institution

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Abstract: This research examined the students' perception of blended learning pedagogy in an African higher institution. The research was aimed at introducing a better and a qualitative teaching and learning approach which can accommodate the overpopulated classes in African institutions. A mixed research method was implemented in gathering and analyzing the data obtained from the study. A mixed learning experiment was conducted with some students from an African higher institution. One hundred and twenty-five students taking a JAVA programming course participated in the experiment. Focus team, semi-structured interview, and questionnaires were employed during the experiment. The findings argue that the new learning approach (blended learning) may motivate and enhance the students' learning efficiency. In conclusion, a framework or a guideline has been suggested for the possible implementation of blended learning in African higher education institutions amidst their limited resources, and educational institutions in developing countries at large.

Keywords: African institutions, approach to learning, blended learning, face-to-face learning, students' perception
Categories: L.2.3, L.3.4, L.3.6

1 Introduction

Advanced education institutions, especially in West-African countries, are struggling to deliver an effective learning pedagogy in addressing the needs of their overcrowded learners [Jaffer et al., 2007]. Massive Open Online Courses (MOOCs) are intended to be self-centered online courses, free, open to everyone having the capability of internet connection, their introduction to the higher institutions and the subsequent use of learning technologies provide educators with opportunities in choosing the most suitable learning styles for their learners. Many of the African higher institutions lack the adequate technology infrastructure for the proper MOOCs implementation [Oyo and Kalema, 2014]. Considering the limited information and communication technology (ICT) infrastructure in Africa, full-scale online programs are not feasible, even though they are the best pedagogically [Boitshwarelo, 2009]. With the introduction of the mobile internet and the smartphones in Africa, the recent generation of African students becomes sensitive to technology by displaying

technology influence attitudes [Donner, et al., 2011]. These students have a keen interest in using technology to achieve their learning objectives and request the use of technology to supplement their learning pedagogy.

With respect to African higher institutions, using technology in complimenting the traditional teaching methods becomes inevitable. The application of ICT in producing and distributing learning in higher institutions remains the only alternative [Nneka, 2010]. Several African universities move to address the agitation by introducing the e-learning project. Although, e-learning projects have their positive impacts but are not sufficient to meet the requirements, for the fact that, the attribute tend to depict modern technologies are missing in the African institutions [Boitshwarelo, 2009]. Limited availability and low-quality service characterize the ICT infrastructure all over the African continent, which includes poor telephone connections, frequent power-outage, and low internet bandwidth [Isaac et al., 2013].

Isaac et al. [2013] stated that the student-centered learning environment becomes the most popular pedagogy in developed communities. Amidst scarce resources, the African higher institutions are forced to utilize innovative ideas in their education delivery and approaches [Howitt and Pegrum, 2015]. Uwin [2005] suggested that the most common trend for mass enrichment and qualitative education in African institutions is blended learning (BL) approach [Uwin, et al., 2010]. Instructor-to-student (single-direction) learning approach known as the traditional teaching method is the most popular strategy in Africa. [Flumerfelt and Green, 2003, Sahin et al., 2015].

Looking at the higher population of students in African higher institutions, and the inactive nature of their teaching strategy, it gets very difficult for the instructors to attend to students with different learning background. According to Goodwin and Miller [2013] combining the traditional classroom with online platforms (videos) would shift the passive nature of the classes to a student-centered learning approach. The student-centered learning method encourages students' preparation before the class, which improves the learning process during the class. [Goodwin and Miller, 2013]. According to Bergmann and Sams, [2012], Chen and Chen, [2015] this learning style enables the students to associate among themselves and develop advanced cognitive skills.

Java Programming constitutes an important subject in the field of computer science. Usually, Java programming is relatively difficult for African students, particularly when the traditional teaching method was applied. Effective learning about Java programming requires the understanding of some basic programming concepts, including rigorous hands-on practices. Based on their experience, the programming instructors indicated that many African students are uninterested and detached from the programming courses and believed that the courses are hard to learn or apply in a real-life situation. [Lahtinen et al., 2005].

2 Challenges facing African Higher Institutions

Many of the African higher institutions suffer a dedicated instruction system as well as a deficiency of personal interaction between the students and the instructors. The assessment methods applied by those institutions are usually outdated and cannot

measure the learning goals adequately, this provides the student with a very little opportunity of utilizing their knowledge to solve real-life problems [Bora and Zoukemefa, 2011]. Students from a privileged educational background, as well as the student from disadvantaged educational backgrounds, usually enter higher educational institutions with differences in the skills and knowledge required for studying different disciplines [Jaffer et al., 2007, Howie and Pietersen, 2001]. The issue of the educational background gaps rendered the school leaving-certificates as an unreliable measure of students' potentials for gaining the admission into the higher institutions. The academic performance of the students in higher institutions has had no correlations with their school leaving-certificate [Jaffer et al, 2007]. The potential students' success in gaining the admission into higher institutions increases importance, by adding an alternative placement test in conjunction with the school-leaving certificate.

The rapid growth of higher education has made an outsized classroom, the pervasive feature of many courses at African higher institutions. Outsized classroom makes it tedious for instructors to adopt interactive teaching strategies, as such, they cannot be familiar with the challenges faced by their students [Nicol and Boyle, 2003]. Enormous classes generally hinder students' performance but highly affected less-prepared students. Those contexts cause useful opportunities for educational technologies.

This research scrutinized the students' perception of a BL method so as to facilitate their performance, skills and the understanding of programming in Java. The research design applied BL method as the instructional pedagogy and Java programming course as the instructional course. From the instructors' perspectives, this research proposed an innovative teaching model for African students to acquire specialized skills, competencies, and knowledge. This teaching approach is an added advantage to both the African students and the instructors: the instructors' teaching effectiveness improved by encouraging their students to use the knowledge learned properly, and the students would understand the advantages of using Java programming in software development. The research questions are;

1. In which ways do the students' perception of a BL strategy support their intellectual, emotional, and communicative learning domains?
2. What influence does the perception of the combined classroom experience have on the African students?

3 Literature Review

BL is regarded as a learning approach beyond the boundaries of Traditional classrooms [Tshabalala et al., 2014]. The term BL lacks uniquely accepted definition, but practitioners accepted their definitions based on the need for their context of practice [Lim et al., 2007]. According to Smith and Cardaciotto [2012], BL refers to the assimilation of predictable and non-predictable aspects of learning to facilitate communication between the students and their teachers with or without technology. Lim et al., [2007] refer to BL as a technique of applying several instructional materials, combined with the classroom teaching to achieve learning objectives. Waha and Davis [2014] argue that any kind of mixed learning that cannot leverage the

strength of both the predictable and non-predictable method of teaching to enhance achieving the learning outcome, cannot be regarded as BL. Akhtar [2015] stated that, if students lack schedule flexibility, instructors' availability, and vast interaction in a particular leaning system, it cannot be regarded as a BL. BL is any mixed learning with the increase in quality and the number of interactions between the teacher and the students [Alammary et al., 2014]. Learning can be regarded as blended when the learners have frequent access to their instructors, both online and physically [Pento de Moura et al., 2010]. BL is any method of learning that uses technology to bridge the gaps between students and instructors [Sife et al., 2007].

The quality, frequency, and the quantity of communication between the instructors and students alone are not enough in BL, but refining the learning experience of the student [Harding et al., 2012]. Lenchus et al. [2011] cautioned against the instructional materials used for BL indicating that providing BL through a variety of instructional materials is seriously hard, and it is not worth the effort. Oliver et al., [2005] also argued that any learning strategy, which cannot incorporate the perspective of both instructors and the learners, is not a blended learning. Even though there are various contradicting statements about the BL as well as the possible challenges involved in its implementation, African institutions are left with no option than BL amidst their limited resources [Frehywot et al. 2013]. Any approach that utilized the mixture of technology and the traditional method of teaching to improve pedagogical practices, can be called BL [Garrison and Kanuka, 2004]. The most common problem faced by African institutions in adopting the BL is the inadequate computer skills for the instructors and students [Beetham and Sharpe, 2013].

Some of the major challenges hindering the application of technology in Africa include; students' restricted access to technological resources, and lack of innovative teaching methods from instructors [Brown, 2003]. Integrating online materials with the traditional classroom provides a positive effect on students' performance, enhances a flexible learning atmosphere, and ensures student autonomy [Lopez-Perez et al., 2011]. The absence of a unified definition of BL allows the African institutions to utilize the concept according to their environment.

4 Principles for the Designing of BL Courses in Higher Institutions

BL provides great opportunities for review and refining the ideas of higher education activities [Garrison and Vaughan, 2008]. The stakeholders in education recognized the potentialities of transforming higher education for better through the convergence of ICT and the traditional classroom [Bonk and Graham, 2012]. The Role-based, Incident-based, Rule-based, and strategy-based are the magnitude considered while designing BL classes including the ten designing principles from the framework for learning design topology [Adeyeye et al., 2013].

Principles	**Description**
Focus on the Outcomes	Stands [2002] explains that the perception of course planning is: what do you want the student to be able to do at the end of the session. Meaning, the goals, and objectives should lead the designing of the courses instead of technology [Aycoc et al., 2002]. This would help in avoiding a counterproductive focus on technology. (Limited technology in Africa)
Interaction	Creating activities that require focusing on interactions rather than the delivery mode of the course that is a higher rate of student-to-student and instructor-to-student interactions [Aycock et al., 2002].
Redesign	An integration between online materials and the traditional classroom. For instance, allow the student to learn online and apply the knowledge in the classroom.
Integration	Avoid too much integration, don't give when the integration fails [Futch, 2005, Aycock et al., 2002]
Keep it Simple starting	Use simple and few technology tools, avoid creating extra work for the learners [Stands, 2002, Aycock et al., 2002]
Allocate sufficient time,	Take an appropriate time for the redesigning of the blended courses, at least six months
The collegial process	Liaise with experience blended faculties and staff willing to share their experience.
Organization	Make sure that all the activities are well organized sequentially and consistently [Simmons College, 2011]
Student expectations	**Blended concepts:** explain clearly the rationale for the course design and the relationship of the components, because students don't always understand the relationship between the online component and the classroom. **Active learning:** you need to educate the student about their responsibilities as many students are not matured enough to understand their responsibilities in active-learning strategies. **Time management:** students need help with time management before they can be able to build the skills**.** **Classrooms versus home:** the student need to be educated on "reduced seat time". Time spent outside the classroom should be less and they should work much at home.
Convenience	Engineer the design to help the teacher and the student enjoy the flexibility of working from home or in the computer laboratory rather than in the classrooms.

Table 1: The principles of the BL model [Clark and Mayer, 2016]

The research adopted the BL model proposed by Clark and Mayer [2016], conforming to the principles of BL strategy discussed in table 1, the model concentrated on integration, redesign, focus on the outcomes, interaction, keep it simple (KISS), the collegial process, allocate sufficient time, organization, convenience, and students' expectations. The empirical research result, conducted by Beetham and Sharpe [2013] has proven that the BL model is very effective, students exercise more effort in learning and they are usually satisfied with the pedagogy considering the increase in attendance rate. This research maintained the ten precepts of the models but built a little alteration to the substance of each principle to reflect and suit the available resources in African higher institutions. The model is shown in the table 1 above.

5 Methodology

5.1 Participants

A number of 125 students out of over 400 second-year students in computer science education participated in the experiment. The population was drawn from the Federal College of Education, Katsina in the Northern part of Nigeria using the snowballing technique. The sample includes 72 male and 53 female students who are usually from a privileged background. The population was restricted to the only computer sciences' student because of the involvement of Java programming course during the experiment. The age of the participants ranges between 17 to 20 years, and are generally passive in learning and have a lower academic achievement compared to the student of the Federal University in Dutsinma. One of the researchers taught in both the College and the University. Federal College was the site chosen for the conduct of this research due to the diversity of her students.

5.1.1 The design

This study applied mixed research techniques to examine the students' perception of BL experiment [Kim et al., 2014]. Due to the novelty of the instructional strategy used in conducting this experiment, it can be investigated using multiple facets of the students' perceptions. To properly manage the disadvantages of both the quantitative and qualitative research techniques, a mixed research method was applied to the data analysis. The advantages of both the quantitative and the qualitative research approaches are the complementation and cross-validation of research processes. Regarding an embedded experiment, the process of intervention may be examined by embedding the qualitative data [Creswell and Plano, 2011].

Methods of data collection that involved gathering the data before the experiment, during the experiment, and after the experiment become the basic techniques for designing an embedded experimental mixed method [Creswell and Plano, 2011]. At the beginning of this research, an interview was conducted with some investigators or experts who have the experience of blended learning pedagogy. The information gathered helped the researchers in designing the proper BL activities that are capable of providing the participants' needs in conducting the experiment. While conducting the experiment, discussion notes, and online responses totaling to 57 was collected from the

respondents. This enables the researchers to understand if the experiment is capable of achieving the required result and also to find out if the participants become familiar with the system. Interviews were conducted during the experiment, each at the last day of every unit. After experimenting, purposive sampling was employed in selecting 15 participants for a comprehensive interview. For the sake of increasing the validity of the analysis, the interview result and the platform data were compared for triangulation. A research team was created by inviting two experts from the research field (Blended Learning) who reviewed the outcome of research to avoid deviating from the objectives of the research.

6 BL Model

According to Yang et al., [2016], a BL model is classified into four categories; (a) flex (b) rotational (c) enriched virtual and (d) self-blended. This is the most widely accepted model [Yang et al., 2016], it enables a perfect blend of the traditional classroom with online materials. Figure 1 illustrates the models and their relationships.

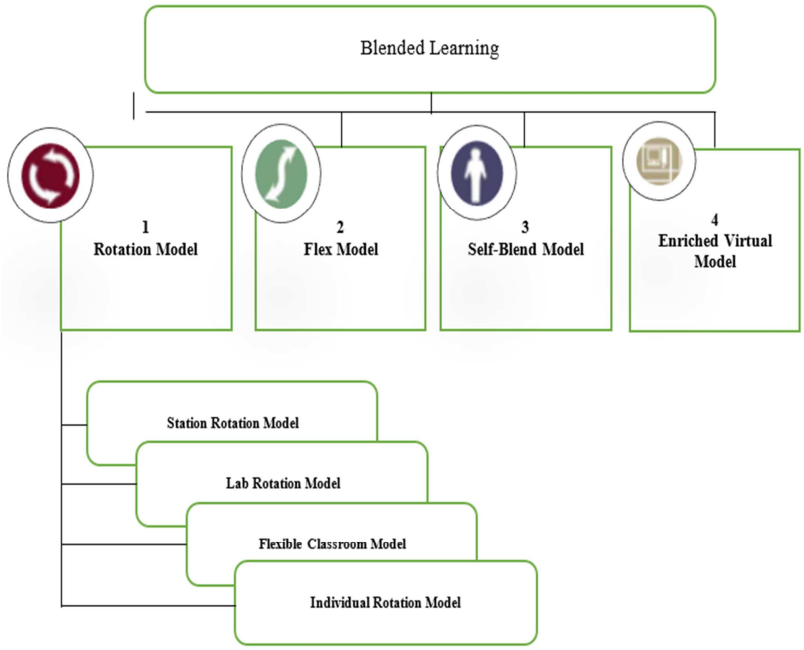

Figure 1: BL models [Staker and Horn, 2012]

The rotation BL was further categorized into four according to staker and Horn [2012] the flipped-rotation model, the lab-rotation model, the individual rotation model, and the station-rotation model. [Yang, et al., 2016, Lugovtsova and Mylinikova 2007, Schecter et al., 2017] explain the individual rotation model as a

customized activity based on individual needs and specifications. Station rotation refers to a delivery of the students' experience via a complete rotation of all students in the entire available station. The lab-rotation involved the physical rotation of a space by the students within the laboratory to complete various activities. While the flipped involved the participating of the individual learners in an off-site online study for creating more time for practice outside the classroom.

The flex model involved the strategy of teaching, in which the learners are physically provided with course materials and receive the instructions online. The flexibility of the model permits the learners to manipulate their learning schedules and includes offline activities. The self-blended models involved the simultaneous running of traditional classrooms and online instructions. The learners choose a fully online course meant for supplementing their traditional courses with an alternative to study in school or at home. The enriched-virtual blended model seems to be of double edge, half self-paced and half face-to-face in which the entire study time is measured based on the time spent on both the paces. The learners' experience is divided between the time for attending traditional classrooms and online learning.

7 The model for the Java programming experiment

Among the blended model shown in figure 1, a flexible classroom model was chosen to guide the designing of the BL experiment used in this research. Considering the principles for the designing of BL discussed earlier on, the design focused on three dimensions of the model: 1. Content which includes Gann chart drawing, questionnaire design, sampling techniques, data collection, statistical analysis, validation, and reliability. 2. Blended processes which include the students' ability in knowledge integration, teamwork skills, problem-solving, IT skills, communication skills, and critical thinking. 3. Blended classroom activities which focused on the concepts and methods of teaching Java programming course online and in the classroom [Bove and Davies, 2009, Makienko and Bernard, 2012].

A focus group of 5-7 members was formed among the participants. The groups were expected to enhance the students' capacity in teamwork and group discussion. The Java programming course was also divided into eight units. The experiment is complete when all the groups completed the units. The experiment required the students to organize teamwork, following the course topic by topic, hands-on practices, and complete the assignments therein.

Regarding the dimension of online activities, this research combined various learning by doing activities with participatory learning activities, which includes presentations, free-associating, the contest, information sharing, deliberations, and applied works. The design of these activities conforms to the principles of the BL models discussed earlier on. The study designs the blended activities into a. pre-class learning activity, b. In-class learning activities, and c. post-class learning activities [Kong, 2015, Kong, 2014], and each of the steps was also divided into three as illustrated in figure 2.

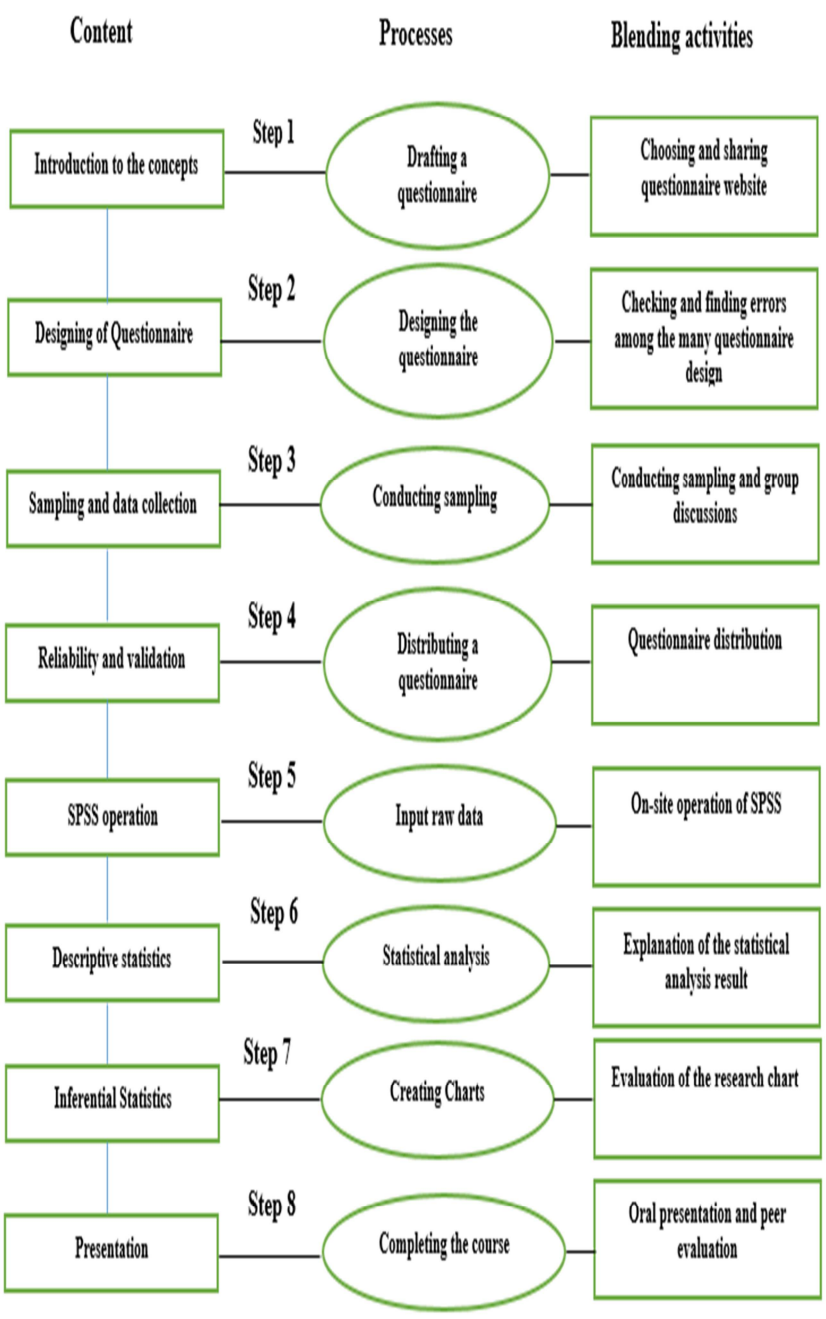

Figure 2: The teaching stages (Strategy) applied to the Java programming model

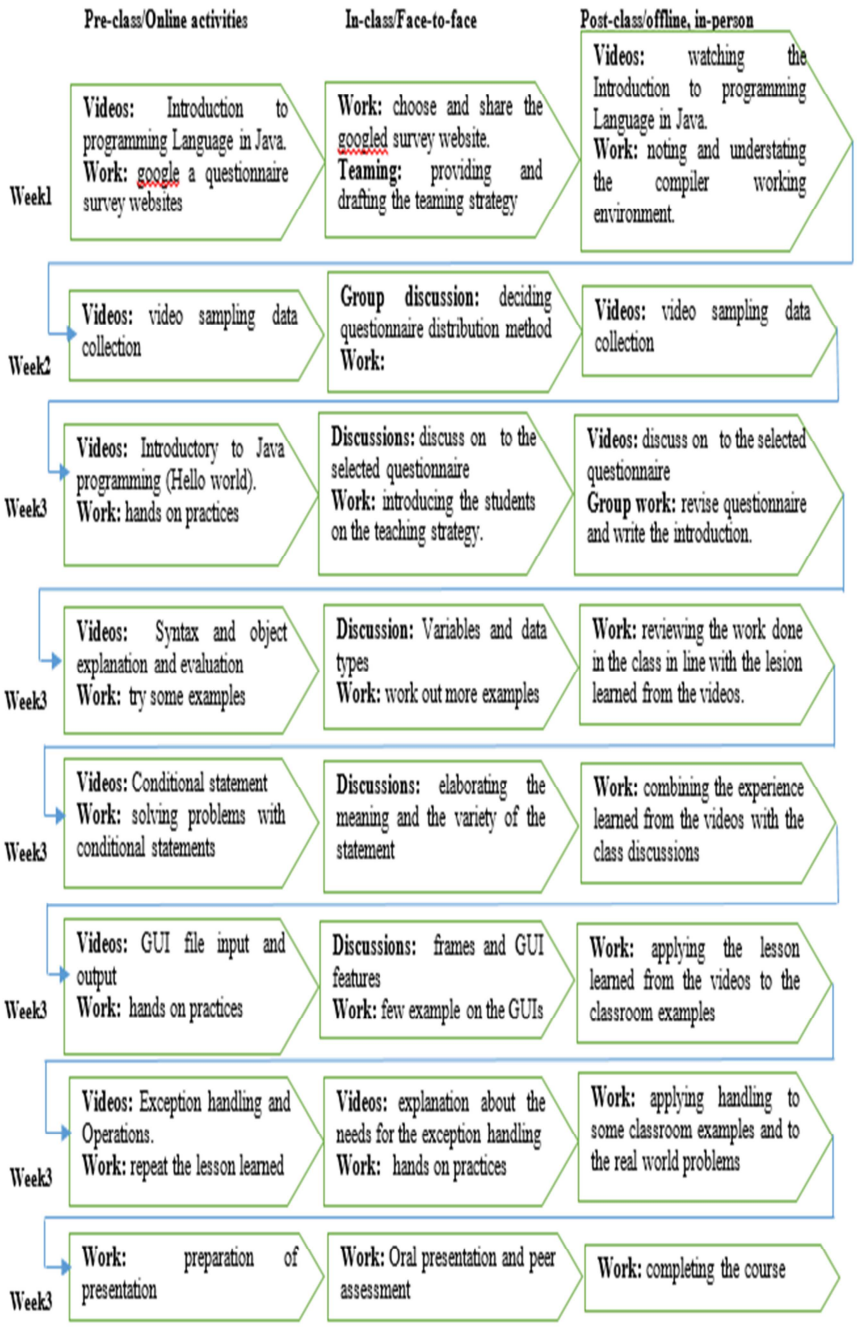

Figure 3: Pre-class, in-class, and post-class activities in each unit of the BL

For pre-class learning activities, students are to be involved in self-learning, they were required to use the online learning materials for conducting the assignment in each unit, and to enhance the understanding of the programming concepts. Participatory learning took place during the in-class activities between the students and their instructors. Considering the course content, the experiment was designed to accommodate different kinds of participatory learning activities so as to help the students responding to the programming requirements. The **s**tudents engaged in reviews so as to consolidate the various learning outcome, during the post class learning activities

8 The Research Instruments

8.1 The Questionnaire

The questionnaire used in this research emulates the questionnaire designed by Warter-Perez and Dong [2012] with some little modifications in order to agree with the learning activities planned in this study.

The dimensions	**Subscales**	**Number of items**	**Reliability**
Affection	Learning motivation	5	.93
	Learning interest	5	.83
Skill	Enhancement of the varied skills	6	.81
	Expedition of teamwork	4	.82
Cognition	Learning the effectiveness	5	.91
Total scale		25	.91

Table 2: The Outcome of the Learning Scales (Cronbach's A Coefficients)

The following scales were used for content validity: 1. Learning motivation, 2. Learning effectiveness, 3. Enhancement of diversified skills, and 4. Learning interests. Bloom et al., [1956], proposed a domain of learning which classified the learning outcomes into: Affection, Skills, and Cognition. Concerning the reliability, 0.91 was the Cronbach's α for the entire scale and the Cronbach's for the respective subscales is between .81 - .93, which is within the accepted reliability range. This is indicated in table 2. A Likert scale of strongly agree, agree, neutral, disagree, and strongly disagree with the corresponding figures of 5, 4, 3, 2, and 1 respectively was applied.

8.2 The Semi-structured interview

A semi-structured interview is usually the most suitable technique of data collection that has open-ended questions for the interviewees to freely and fully express themselves. The researchers carefully tailored the questions to avoid imposing or leading the interviewee on what to say during the interview. The design also provides the interviewees with a relaxed environment by asking simple and straightforward questions to enable them to provide a proper response. For the purpose of validity and reliability, the scheme for the BL pedagogy was applied while designing the semi-structured interview. The questions were as follows: (a). what is your experience about the BL activities for every unit? (b). what is your experience about the pre-class learning activities? (c). what is your opinion about the post-class learning activity? (d). what is your experience generally about the diversified nature of the study?

9 The online learning environment

The online learning activities include announcements, storage of the learning material, course description, forums, group areas, notes, assignments, questionnaire surveys, and attendance rates.

10 Data Analysis

Percentages, means, standard deviation, and related statistical methods were applied to the quantitative data analyses. For the qualitative data analyses, 15 students interviewed were coded Int-1 to Int-15. Online notes and online discussion were coded N-1 to N-n and D-1 to D-n respectively.

11 Results

11.1 The students' perception of BL in cognitive dimension

Table 3 below illustrates the outcome of the students' perception of BL in cognitive dimension.

Item	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	M
Google search practice can improve learning effectiveness	11 (17.5%)	28 (44.4%)	21 (33.3%)	3 (4.8%)	0 (0%)	3.73
Achieving the desired coding outcome can improve learning effectiveness	13 (20.6%)	38 (60.3%)	11 (17.5%)	1 (1.6%)	0 (0%)	4.01
Decision making skills can improve learning effectiveness	16 (25.4%)	35 (55.6%)	16 (25.4%)	0 (0%)	1 (1.6%)	4.02
Using computers for practice can improve learning effectiveness	15 (23.8%)	31 (49.2%)	15 (23.8%)	1 (1.6%)	1 (1.6%)	3.92
Testing learning competency can improve learning effectiveness	15 (23.8%)	34 (54.0%)	12 (19.0%)	1 (1.6%)	1 (1.6%)	3.79

Table 3: The outcome of the "learning effectiveness"

Based on the outcome of the "learning effectiveness" facet, "decision making skills can improve learning effectiveness" had (M= 4.02) with the highest agreement of 81%, followed by "achieving the desired coding outcome" having (M = 4.01), "using computer for practice" with (M = 3.92), "test of learning competency" (M = 3.79) and "Google search practice" (M = 3.73) as indicated in Table 3.

11.2 The students' perception of BL in the affective dimension

The outcome indicated that the students' perception of BL regarding affective dimension had an average agreement for all the item as indicated in Table 4.

Items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	M
Google search practice can improve learning motivation	10 (15.9%)	33 (52.4%)	19 (30.2%)	1 (1.6%)	0 (0%)	3.84
Achieving the desired coding outcome can improve learning motivation	20 (31.7%)	24 (38.1%)	17 (27.0%)	2 (3.2%)	0 (0%)	3.99
Decision making skills can improve can improve learning motivation	12 (19.0%)	31 (49.2%)	17 (27.0%)	2 (3.2%)	1 (1.6%)	3.82
Using computers for practice can improve learning motivation	11 (17.5%)	30 (47.6%)	20 (31.7%)	1 (1.6%)	1 (1.6%)	3.78
Testing learning competency can improve learning motivation	13 (20.6%)	32 (50.8%)	12 (19.0%)	3 (4.8%)	1 (1.6%)	3.96

Table 4: The outcomes of the "learning motivation"

Students perceived that BL might improve learning motivation. The agreement for "testing the learning competency" had a 70.4% agreement (M = 3.96), which is the highest. Followed by "achieving the desired coding outcome" (M = 3.99), "Google search practice" (M = 3.84), "decision making skills" (M = 3.82) and "computer for practice" (M = 378).

Item	**M**	**SD**
BL can increase class interest	3.68	.64
BL can increase interest in knowledge construction	4.07	.85
BL can be the best instruction strategy	3.85	.68
BL can increase programming interest	3.74	.81
BL can increase the interest in topics exploration	3.81	.74

Table 5: The outcome of the "learning interest"

Considering the learning interest shown in Table 5, the item with the highest score of agreement from the students is "BL can increase interest in knowledge construction" having (M = 4.07), followed by "BL can be the best instruction strategy" with (M = 3.85), "increase interests in topics exploration" had (M = 3.81), "increase programming interest" (M = 3.74), and finally "increase class interest" with (M = 3.68).

11.3 The students' perception of BL in the skills perspective.

The outcome of students' perception of utilising BL to develop various skills is shown in table 6.

The option with the highest students' agreement is "BL can develop programming skills" having (M = 4.20), and then "problem-solving skills" with (M = 4.09), followed by "information technology skills" with (M= 4.04), "knowledge integration skills" had (M = 4.01), "self-regulation skills" had (M = 3.95), and "critical thinking skills" with (M = 3.78). Concerning the perception of facilitating teamwork, "improve cooperative abilities" had the highest (M = 4.06), accompanied by "BL can enhance interaction skills" (M = 4.02), "developed teamwork spirit" had (M = 3.98), and "completing software project" with (M = 3.70).

Cultivation of skills			Improvement of Teamwork		
Item	**M**	**SD**	**Item**	**M**	**SD**
BL can develop problem-solving skills	4.09	.81	BL can develop teamwork spirit	3.99	.56
BL can develop information technology skills	4.04	.84	BL can improve interaction skills	4.02	.78
BL can develop self-regulation skills	3.95	.69	BL enables students to complete software project	3.69	.89
BL can develop critical thinking skills	3.78	.77	BL can improve cooperative abilities	4.06	.79
BL can develop programming skills	4.20	.46			
BL can develop knowledge integration skills	4.01	.71			

Table 6: The outcome of the skills dimensions.

11.4 Students' perception of the mixed learning experience.

The overall perception of the combined learning method was discussed based on the outline of the flexible classroom model. The blended model proposed by Clark and Mayer [2016] was adopted in this study, which includes; flexible environment, learner-center approach, intentional content, the learning networking activities, diversified seamless learning environment, and engaging an effective learning experience.

11.5 Learning with diversified technology (Flexible environment)

The model engaged students in learning processes that involved the utilization of various online platforms in both the pre and post classroom planning. The online platforms include network-based and mobile-based environments. The instructors employed the online platforms to configure students' centered-learning and utilized the traditional classroom management to monitor students' teamwork, participatory activities, and group discussion. This increased the opportunity for learning-by-doing and help the researchers in getting the responses from the participants as stated below; *"At the beginning, the class seems to be boring, but the amazing teaching technique for the blending makes it very interesting. It was more engaging than traditional*

classes. The classes become more interesting and we interact more but took our time to prepare for the class at home by watching videos. (Int-1)"
"My learning ability improved via the online mobile platforms, watching the videos before class enhances the understanding of the topic during the classes. (N-1)."

11.6 The formation of active learning (Learner-center approach)

The instructors designed various teaching activities during the experiment, which enables the students to construct knowledge and improve their learning opportunities. The activities include a free-associating (brainstorming), group discussion, competitions, demonstration, mini-projects, and presentations. Every student must participate in each of the listed activities in order to develop some learning skills. The expected skills include knowledge integration, problem-solving, teamwork, and critical thinking. Some of the students' responses include:
"Even though the learning activities are too tight, I learned a lot from working as a team, peer observation, and presentations. (N2)"
"This learning strategy was a bit exhaustive, we had undergone a lot of activities, however, the final outcomes are amazing and it even boosts my senses of achievement. (Int-2)"
"I was not interested in programming courses, but in a later time I discovered that the course was highly organized, and the hands-on (learning-by-doing) practices are more efficient than lectures (Int-3)"
"The discussions, assignment, and the hands-on practices change the way I see things, I usually learn a lot in the laboratory, class, or during the discussions (Int-4)"

11.7 Classification of teaching materials: in-class and out-class (intentional content).

The general content intended for the experiment was at the beginning placed on the learning platform for further review by the students after classes. The in-class lecture consists of elaborating the contents, guiding the students on how to navigate the platform, and responses to students' questions. Subsequently, the students complained of too much learning material, for that reason, some of the materials were extracted out for use after classes and the remaining materials were taught in the class.
"Due to the vast nature of the online learning document and the difficulties involved in navigating through, I sometimes feel reluctant to prepare for class (D-1)"
"The huge nature of the learning material and the hierarchy of the content lower students' willing to read. (D-2)".

11.8 Observation, evaluation, and feedback (Professional educators)

Researchers in this study perform the activities of evaluation, observation and a feedback for achieving the teaching effectiveness and learning objectives. The instructors also serve as professional educators on the students' team cooperation and inquiries. The outcomes of the interview indicate that the method of traditional lectures made students passive learners. The students who failed to preview the learning materials before the class asked questions that force the instructor to clarify the content during the class, which contravenes the effect of the BL strategy. To properly achieve the blended activities, the student must develop the habit of

previewing the materials before the classroom (self-study). In this respect, the instructors improved their effort in changing the attitude of the student from passive to active learners. Even though, the instructors experience a lot of difficulties in changing the students' attitude.

"Honestly, almost all the students are passive in nature, they only become committed to the online materials when the test is fast approaching. (Int-5)"

"Actually, I sometimes fail to finish learning the out-of-the- class materials, which makes me avoid interaction with the instructors or the peers for discussions (N-3)"

"Learning how to undertake a mini- project, execute the codes and display the outcome on windows is a good experience, even though, a lot of us are shy in presenting their ideas due to the passive nature of the entire learning strategy in our institutions. (D-3)"

During the experiment, the students' groups discover their individual difference such as weakness and strengths, and they collaborate perfectly, although there were few problems regarding the collaboration. The instructors usually deal with the collaboration issues to assist the student to progress.

"The success of the BL activities solemnly depend on how perfect the student cooperates. The system would fail when the student refuses to pair well (Int-6)"

"I understand that students who get along do not necessarily make a good team. I learned how to quickly handle a situation where group members fail to cooperate well (N-4)"

"Teamwork has its potentialities and shortcoming, it can increase interaction among classmates, but some students are selfish and leave the work to others. (N-5)"

"We sometimes encounter conflicts during the teamwork, but it teaches me to accept the opinion of others (N-6)"

11.9 Advanced learning networking activities (knowledge sharing).

In this research, group discussions and knowledge sharing among the students was achieved using networking activities. The integration of practice and the theoretical aspect of learning in this study was achieved as a result of participatory activities designed during the experiment. For the purpose of motivating peer interaction, the participants were divided into groups.

"Division of labor or sharing work among the group members is a great experience I never had before (D-4)"

"Due to the networking nature of this learning method, I become very familiar with programming techniques through group discussions with the classmates. (D-5)"

"The students discovered various talent hiding within themselves unknowingly as a result of focus groups. The students realized that they can make a good team because some are good at coding while some have the design talent. (Int-6)"

"The most amazing thing about the presentations is the showcasing of talent by various groups, in my group we were a bit relieved by not presenting earlier but it is also nerve-racking. We were able to see the other groups' mistakes and learned from them to improve our presentation. (D-6)"

11.10 Devising a creative learning attitude and a conducive atmosphere

The instructors in their effort to support learning applied various teaching techniques such as learning-by-doing, experiential learning, and hands-on-practice for individual learning and discussion, problem-solving, homework and undertaking assignments for group learning.

"I learn a new experience by having the output of my program on windows, I developed a courage to imitate some software on my own. (N- 7)"

"We become committed to this course more than any other in this semester, It gives us a lot of experience and taught us to compete with peers and the teachers' positive comments on the result was satisfying (N-8)".

To help the students in improving their learning experience, the researcher involved the processes of data analysis, the interview outcome indicated that the participants find it difficult to use the knowledge learned in the class to solve their homework. Students operate the compilers in a computer laboratory, and the instructors helped to guide them through for debugging. Some of the responses include

"We used to find out whether the problem-solving techniques applied in solving a particular problem are correct or not. In which the instructors' help in pinpointing the gray area and that activity facilitate learning. (Int-9)"

"The competition during the presentation of the mini-projects was interesting and seriously motivating. The activity helped us to identify what could be improved. (Int-10)"

"I am in love with this teaching strategy, it energizes me and busts my learning skills (D-6)"

11.11 The expanded and unified learning platform

The platform used for online learning provides the advanced and basic learning materials for learners having a different level of learning background. The platform also provides communicative and interactive functions to facilitate group learning. However, the finding of this research indicates that the traditional learning method has minimal influence on students' learning interest. Watching videos and short films attract their interest the most.

"Learning becomes easier with the online platform since the materials have been categorized into advanced and fundamental levels (D-7)"

"Hands-on clips (videos) are interesting and motivating, they aid my understanding more than the classroom lectures. (N-7)"

12 Discussion

12.1 Students' perception of the cognitive dimension

Based on the students' perception of the cognitive aspect, BL has the potential of enhancing their learning effectiveness. The outcome of this research is in line with the finding of Roach [2014]. While conducting the experiment, course completion was

separated into eight portions to be completed one after the other. More so, students were grouped to encourage peer interaction and inspiration for proper learning effectiveness. The students were allowed to conduct peer assessment during each step of the experiment. This peer assessment enables the students to work harder to complete their tasks and also provide them with new skills. The students' perception of instruction activities showed 'achieving the desired coding outcome' had the highest students' agreement (M = 4.02) having 81%. This indicates that the students become convinced that learning is effective by developing their decision-making skills. Followed by 'testing the learning competency' (M = 3.99) having 77.8% of the students' agreement. The students believed that if the system can provide them with the ability to test their coding skills, they become very curious about learning, as a result, that may enhance learning effectiveness. The 'using of a computer for practices' (M= 3.78) with 73% agreement from the students indicates that the student believed that programming skills can only be achieved by hands-on practice. They perceived that learning is effective when there is proper hands-on practice. The 'Google search practice' (M = 3.84) had the students' agreement of 68.3%. The outcome indicates that the students enjoyed the practice for the fact that, they learned the power of discovering various information within a limited time.

12.2 The students' perception of the effective dimension

The outcome of the students' perception regarding the effective measurement showed that BL may increase learning interest and motivation, the results were related to the outcome of the research carried out by [Butt, 2014]. The involvement of hands-on activities during the learning process remains the main reason for enhancing the learning interest and motivation. 'Testing the learning competency' highly motivated learning (M = 3.96), by engaging the students into various interesting activities such as breaking down the problem into a number of stages (algorithms), representing those stages into a flowchart, and coding the stages. The students learn independently, compete against each other by comparing their results and work together in finding their differences and similarities. Identifying the variables and the data-types first, seriously motivated the students to work hard in coding and concentrate more on learning new skills. 'Achieving the desired coding outcome' (M = 3.99) also had a very high agreement from the students with 69.8%. This means learning to identify and debug the semantic errors motivates learning. Followed by 'Google search' (M = 3.84) having a 68.3% students' agreement. The students become highly motivated learning through the Google search, the term 'ask it to Google' become their slogan whenever they encounter an issue. 'Decision making skills' (M = 3.82; 68.2%) also motivate learning. Students enjoy testing their decision-making skills by engaging in coding the problems that require the use of nested loops and control structures. 'Using the computer for practice' with least numbers of agreement from the students (M =3.78; 65.1%) also motivate learning. This item had a high number of student with a neutral view. The students believe that using the computer to practice motivate learning even though some believe that some hand-held devices used cannot be regarded as a computer, this may explain the reason why many students are neutral.

12.3 Students' perception of BL of skills dimension

The entire student body has the perception that BL has the ability to develop various learning skills. The students agree that their programming skills having been developed due to their participation in this BL activities. The students have the ability to identify, creating and declaring the variables required in solving a particular programming question. Their skills of decision making have also been developed. The participants perceived that multiple learning opportunities for developing various learning skills have been acquired through BL. Some of these skills include information technology, knowledge integration, self-centered learning, team-work and division of labor. The students believed that implementing BL activities would shift their learning behavior from passive to active

12.4 Students' perception of the mixed learning experience.

Lecture method is the most popular teaching strategy in many of the African higher institutions. The students attend classes unprepared and passively wait for their instructors to deliver. Students end up with little or no skills required to handle programming courses. The students express their appreciation of the learning-by-doing approach used in this research, they perceived that implementing the BL pedagogy is the best way of handling any technical course. The instructors are required to use various strategy in convincing and changing the students' attitude toward the mixed learning approach. The students find it difficult to change their usual learning style in which they relate the problem to excessive credit hours (many courses) [Findlay-Thompson and Mombourquette, 2014].

Learning with diversified learning gadget provides the students with the greater opportunity of learning anywhere any time. The students perceived that using the mobile technology may widen their approach to learning. This research discovers that some students are not very active during the in-class activity and the students' response to researchers' inquiry indicates that the students are lacking the necessary skills to utilize the online platform and some complain of not having the mobile gadget. Though, the learning with diversified technology offers greater advantages to the students, some few students complain of faced when tarrying to consolidate the learning between various environments.

Online discussion enables the students to voice out their opinions, difficulties and learning experience. It also enables the instructors to figure out the general problem concerning learning activities. The students also have the opportunity of working together during the hands-on activities. While organizing online materials and the implementation of the BL pedagogy, the students' skills, learning style, interest, and behavior has to be considered for proper learning achievements [Butt, 2014].

13 Conclusion and Suggestion

This study applied a mixed research method (qualitative and quantitative analyses) to scrutinize the effectiveness and the African students' perception of BL from the effective, cognitive, and skills dimension. Conclusions and recommendations are outlined based on the outcomes of this research.

From the general point of view, BL has already been a commodity in communities where the knowledge of ICT and the required resources are no longer an issue. However, this is not the case in Africa, some of the African higher institutions are reluctant in adopting the internationally accepted designed ICT solution on paper because, it usually performs badly in the realities of their countries [Kisubi, 2014]. There exist a wider gap in the literature about BL in African institutions [Kisubi, 2014]. Many African students lack the required ICT knowledge to undertake BL. These may explain the reason why this research opted for snowballing technique in sampling the respondents instead of random sampling. The outcome of this research seriously improved the performance of the participants and educate them on how to make the best use of technology to achieve leaning.

The students' perception based on the cognitive dimension is that BL improved their effectiveness. Each group learned to deal with their assignment and even know how to present the result orally. The learning interest and motivation of the students was enhanced based on the effective dimension. The learning pedagogy motivated the students to enhanced knowledge integration, and also increases there motivation in programming courses. Thus, BL turns out to be a suitable teaching method in the African higher institution and the developing nations at large. Diversified skills may be cultivated from the BL such as knowledge integration, problem-solving, ICT skills, and critical thinking. Teamwork spirit, knowledge of peer review and cooperative abilities of the students may also be encouraged through the blended strategy. These may finally help the African institution to overcome their shortfalls and encourage their students to benefit and learn effectively despite a large number of their classes.

At the end of the study, the researchers proposed some suggestions on the best way of achieving the BL pedagogy as follows: (1). The online platform: due to the nature of the African students of different backgrounds, the instructional materials should be categorized into advanced and basic materials [Chen et al., 2015, Montgomery et al., 2015]. (2). Encouragement: teachers should encourage the students to prepare before coming to class by means of incentives and allow the students to respond to many questions asked by their associates. Such students' questions answered by a fellow student will help the lecturers understand the kinds of problems the students faced and enable them to provide detailed explanations during the classroom activities.

For in-class activities, it is suggested that (1). Influential assessment: the lecturers should examine the effectiveness of the self-study because, in the beginning, the student may not be familiar with the online platform and many other study gadgets. (2). Proper in-class activities: in-class activities are the vital catalyst for achieving the success of the whole concept. (3) Encourage social learning: allow the peers to explain during the in-class activities since many students do usually understand their peers better than lecturers.

For post-class learning, the followings are some of the suggestions made. (1). Lecturers may encourage, respond, and provide an opinion on students' learning notes. The lectures should also try some kind of physical interaction with students even if in batches so that they feel the lecturers concerned.

Several recommendations are proposed for future research on BL pedagogy. To enhance the effectiveness of BL in higher institutions, the learning materials should refine future studies so as to attract the attention of the students. The learning

materials should be classified according to the students' abilities. Future research should examine the effect of the adaptive material on BL on students' learning outcomes. Another important aspect is to investigate the best way of motivating the African students as well as instructors to change their ways of thinking about teaching and learning.

In the effort of developing higher-order thinking skills, instructors may raise questions and provide the student with the clue. Engaging in peer interaction can also enhance instructors and the students' skills. The success of the whole concept depends largely on the synergy between instructors and the students and necessitates guidance, and encouragement constantly. The African students should be encouraged to actively participate in their classes so as to eradicate their passive learning habit.

References

[Adeyeye, 13] Adeyeye, M. O., Musa, A. G., Botha, A.: Problem with multi-video format m-learning applications. J.-E. Pelet, E-Learning, 2(0), 294-330.

[Akhtar, 15] Akhtar, S. A.: Developing predictive analytics to enhance learning and teaching in lab-based courses (Doctoral dissertation, University of Surrey).

[Alammary, 14] Alammary, A., Sheard, J., Carbone, A.: Blended learning in higher education: Three different design approaches. Australasian Journal of Educational Technology, 30(4).

[Baepler, 14] Baepler, P., Walker, J. D., & Driessen, M: It's not about seat time: Blending, flipping, and efficiency in active learning classrooms. Computers & Education, 78, 227-236.

[Baro, 11] Baro, E. E., & Zuokemefa, T.: Information literacy programmes in Nigeria: a survey of 36 university libraries. New Library World, 112(11/12), 549-565.

[Beetham, 13] Beetham, H., Sharpe, R. (Eds.): Rethinking pedagogy for a digital age: Designing for 21st-century learning. routledge.

[Bergmann, 12] Bergmann, J., Sams, A.: Flip your classroom: Reach every student in every class every day. International Society for Technology in Education.

[Bloom, 56] Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., Krathwohl, D. R.: Taxonomy of educational objectives: the classification of educational goals: Handbook I: cognitive domain (No. 373.19 C734t). New York, US: D. Mckay.

[Boitshwarelo, 09] Boitshwarelo, B.: Exploring blended learning for science teacher professional development in an African context. The International Review of Research in Open and Distributed Learning, 10(4).

[Bonk, 12] Bonk, C. J., Graham, C. R.: The handbook of blended learning: Global perspectives, local designs. John Wiley & Sons.

[Bove, 09] Bove, L. L., Davies, W. M.: A case study of teaching marketing research using client-sponsored projects: Method, challenges, and benefits. Journal of Marketing Education, 31(3), 230-239.

[Brown, 03] Brown, T. H.: The role of m-learning in the future of e-learning in Africa. In 21st ICDE World Conference (Vol. 110, pp. 122-137).

[Butt, 14] Butt, A.: Student views on the use of a flipped classroom approach: Evidence from Australia. Business Education & Accreditation, 6(1), 33.

[Chen, 15] Chen, L., Chen, T. L., Chen, N. S.: Students' perspectives on using cooperative learning in a flipped statistics classroom. Australasian Journal of Educational Technology, 31(6).

[Clark, 16] Clark, R. C., Mayer, R. E.: E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning. John Wiley & Sons.

[Creswell, 11] Creswell, J. W., Plano Clark, V. L.: Choosing a mixed methods design. Designing and conducting mixed methods research, 53-106.

[Donner, 11] Donner, J., Gitau, S., & Marsden, G.: Exploring mobile-only Internet use: Results of a training study in urban South Africa. International Journal of Communication, 5, 24.

[Findlay-Thompson, 14] Findlay-Thompson, S., Mombourquette, P.: Evaluation of a flipped classroom in an undergraduate business course.

[Flumerfelt, 13] Flumerfelt, S., Green, G.: Using lean in the flipped classroom for at-risk students. Journal of Educational Technology & Society, 16(1), 356.

[Frehywot, 13] Frehywot, S., Vovides, Y., Talib, Z., Mikhail, N., Ross, H., Wohltjen, H. Scott, J.: E-learning in medical education in resource-constrained low-and middle-income countries. Human resources for health, 11(1), 4.

[Garrison, 04] Garrison, D. R., Kanuka, H.: Blended learning: Uncovering its transformative potential in higher education. The internet and higher education, 7(2), 95-105.

[Garrison, 08] Garrison, D. R., Vaughan, N. D.: Blended learning in higher education: Framework, principles, and guidelines. John Wiley & Sons.

[Goodwin, 13] Goodwin, B., Miller, K.: Evidence on flipped classrooms is still coming in. Educational Leadership, 70(6), 78-80.

[Harding, 12] Harding, A., Kaczynski, D., Wood, L.: Evaluation of blended learning: analysis of qualitative data. In Proceedings of The Australian Conference on Science and Mathematics Education (formerly UniServe Science Conference) (Vol. 11).

[Howie, 01] Howie, S. J., Pietersen, J. J.: Mathematics literacy of final year students: South African realities. Studies in Educational Evaluation, 27(1), 7-25.

[Howitt, 15] Howitt, C., Pegrum, M.: Implementing a flipped classroom approach in postgraduate education: An unexpected journey into the pedagogical redesign. Australasian Journal of Educational Technology, 31(4).

[Isaacs, 13] Isaacs, S., Hollow, D., Akoh, B., Harper-Merrett, T.: Findings from the eLearning Africa Survey 2013. The eLearning Africa report. Berlin: ICWE.

[Jaffer, 07] Jaffer, S., Ng'ambi, D., Czerniewicz, L.: The role of ICTs in higher education in South Africa: One strategy for addressing teaching and learning challenges. International Journal of Education and Development using ICT, 3(4).

[Kim, 14] Kim, M. K., Kim, S. M., Khera, O., Getman, J.: The experience of three flipped classrooms in an urban university: an exploration of design principles. The Internet and Higher Education, 22, 37-50.

[Kisubi, 14] Kisubi, A. T.: A Critical Perspective on the Challenges for Blended Learning and Teaching in Africa's Higher Education. In *Cross-Cultural Interaction: Concepts, Methodologies, Tools, and Applications*. IGI Global.1043-1066

[Kong, 14] Kong, S. C.: Developing information literacy and critical thinking skills through domain knowledge learning in digital classrooms: An experience of practicing flipped classroom strategy. Computers & Education, 78, 160-173.

[Kong, 15] Kong, S. C.: An experience of a three-year study on the development of critical thinking skills in flipped secondary classrooms with pedagogical and technological support. Computers & Education, 89, 16-31.

[Lahtinen, 05] Lahtinen, E., Ala-Mutka, K., Järvinen, H. M.: A study of the difficulties of novice programmers. In Acm Sigcse Bulletin (Vol. 37, No. 3, pp. 14-18). ACM.

[Lenchus, 11] Lenchus, J., Issenberg, S. B., Murphy, D., Everett-Thomas, R., Erben, L., Arheart, K., Birnbach, D. J.: A blended approach to invasive bedside procedural instruction. Medical Teacher, 33(2), 116-123.

[Lim, 07] Lim, D. H., Morris, M. L., Kupritz, V. W.: Online vs. blended learning: Differences in instructional outcomes and learner satisfaction. Journal of Asynchronous Learning Networks, 11(2), 27-42.

[López-Pérez, 11] López-Pérez, M. V., Pérez-López, M. C., Rodríguez-Ariza, L.: Blended learning in higher education: Students' perceptions and their relation to outcomes. Computers & Education, 56(3), 818-826.

[Lugovtsova, 07] Lugovtsova, Y.D., and Mylnikova, T.S.: Challenges of Blended-Learning. Информационные технологии, (11),pp.22-28.

[Makienko, 12] Makienko, I., Bernard, E. K.: Teaching applied value of marketing research: A questionnaire design project. The International Journal of Management Education, 10(2), 139-145.

[Montgomery, 15] Montgomery, A. P., Hayward, D. V., Dunn, W., Carbonaro, M., Amrhein, C. G.: Blending for student engagement: Lessons learned for MOOCs and beyond. Australasian Journal of Educational Technology, 31(6).

[Nicol, 03] Nicol, D. J., & Boyle, J. T. (2003). Peer instruction versus class-wide discussion in large classes: a comparison of two interaction methods in the wired classroom. Studies in Higher Education, 28(4), 457-473.

[Nneka Eke, 10] Nneka Eke, H.: The perspective of e-learning and libraries in Africa: challenges and opportunities. Library Review, 59(4), 274-290.

[Olivier, 05] Olivier, B., Roberts, T., Blinco, K.: The e-Framework for Education and Research: An Overview.

[Oyo, 14] Oyo, B., & Kalema, B. M.: Massive open online courses for Africa by Africa. The International Review of Research in Open and Distributed Learning, 15(6).

[Roach, 14] Roach, T.: Student perceptions toward flipped learning: New methods to increase interaction and active learning in economics. International Review of Economics Education, 17, 74-84.

[Sahin, 15] Sahin, A., Cavlazoglu, B., Zeytuncu, Y. E.: Flipping a college calculus course: A Case study. Journal of Educational Technology & Society, 18(3), 142.

[Sife, 07] Sife, A., Lwoga, E., Sanga, C.: New technologies for teaching and learning: Challenges for higher learning institutions in developing countries. International journal of education and development using ICT, 3(2).

[Smith, 12] Smith, C. V., Cardaciotto, L.: Is active learning like broccoli? Student perceptions of active learning in large lecture classes. Journal of the Scholarship of Teaching and Learning, 11(1), 53-61.

[Staker, 12] Staker, H., Horn, M. B.: Classifying K-12 blended learning. Innosight Institute.

[Tshabalala, 14] Tshabalala, M., Ndeya-Ndereya, C., van der Merwe, T.: Implementing Blended Learning at a Developing University: Obstacles in the Way. Electronic Journal of e-Learning, 12(1), 101-110.

[Unwin, 10] Unwin, T., Kleessen, B., Hollow, D., Williams, J. B., Oloo, L. M., Alwala, J., Muianga, X.: Digital learning management systems in Africa: myths and realities. Open Learning: The Journal of Open, Distance and e-Learning, 25(1), 5-23.

[Unwin*, 05] Unwin*, T.: Towards a framework for the use of ICT in teacher training in Africa. Open Learning: The Journal of Open, Distance and e-Learning, 20(2), 113-129.

[Waha, 14] Waha, B., Davis, K.: University students' perspective on blended learning. Journal of Higher Education Policy and Management, 36(2), 172-182.

[Warter-Perez, 12] Warter-Perez, N., Dong, J.: Flipping the classroom: How to embed inquiry and design projects into a digital engineering lecture. In Proceedings of the 2012 ASEE PSW Section Conference. Washington, DC: American Society for Engineering Education.

[Yang, 16] Yang, H. H., Zhu, S., MacLeod, J.: Collaborative Teaching Approaches: Extending Current Blended Learning Models. In International Conference on Blending Learning (pp. 49-59). Springer, Cham.