



## Implementation of Flipped Classroom as A Supportive and Alternative Approach to Traditional Learning System

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### Article Information

Article # 10038

Received: 15<sup>th</sup> May, 2024

Revision: 8<sup>th</sup> Sept. 2024

2<sup>nd</sup> Revision: 19<sup>th</sup> Sept. 2024

Acceptance 2<sup>nd</sup> Oct. 2024

Available online:

13<sup>th</sup> October, 2024.

### Key Words

A mini-Learning Management

Unified Modelling System

Flipped classroom

### Abstract

Integrating a mini-Learning Management System (MLMS) into the pedagogical structure of flipped classrooms has developed as a convincing educational strategy, designed to reshape the traditional teaching and learning models. This study developed a mini LMS platform to empower educators in managing and disseminating instructional materials to engage students before the in-class period. JavaScript, HTML, CSS and MYSQL play vital roles in the design and development mini Learning Management System (LMS) used in this study to create a functional and user-friendly platform. The integration of these technologies in the design of the mini LMS allows for the creation of a robust, operative, interactive and data-driven learning platform. JavaScript provided the dynamism of the user experience, HTML structured the content, CSS styled the interface and MySQL managed the data. Consequently, a mini Learning Management System was developed. This platform was used in implementing the flipped classroom system.

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### Introduction

There are different histories regarding the origination of flipped classrooms also called inverted classrooms or reversed classrooms with credits to Jonathan Bergmann and Aaron Sams who were chemistry teachers at a school in Colorado, where they began the use of recorded lectures in 2006 (Tucker, 2012). Outside of the class, students interact with instructional materials frequently in the form of video lectures, digital resources, reading contents and related multimedia items. Several educators in the late 90s independently attempted to find student-centred learning teaching methods; Erik (2021), known for peer instruction, is one of the earliest educators to have adapted flipped teaching.

Tomas *et al.* (2019) defined a flipped classroom as a learning approach where traditional classroom lectures are shifted outside regular class while using technology, and face-to-face class time for active learning activities. Researchers have found flipped classrooms to be of benefit, despite differing opinions from students, instructors and administrators. Flipped classrooms have allowed students to learn the basics at home while saving class time for applying concepts and developing critical thinking abilities (Gough *et al.*, 2017). Numerous studies have shown that using flipping improves students' motivation (Abeysekera & Dawson, 2015; Kim and Jang, 2017) and performance academically (Blair *et al.*, 2015; Cronhjort *et al.*, 2018; Hsieh *et al.*, 2017), which there are two essential criteria for evaluating the effectiveness of the teaching

and learning processes. Also, Onodipe *et al.* (2020) noted that in a flipped class, preclass preparation is an integral part of the course structure. The in-class component of the lesson might fail to be effective if students are not equipped with the baseline knowledge required before class. The paper further opined that a flipped classroom that incorporates self-regulated learning strategies improved students' self-efficacy and strategies for planning and management of time and effort, leading to improved student learning.

With the development of technology and shifting educational frameworks, the conventional classroom model, where instructors provide lectures during class and give homework for individual study has changed. Flipped classroom (FC) as an approach has gained popularity in recent years, where the roles and the processes of traditional in-class instructions are been flipped or reversed. Santiago and Bergman (2018) explain the use of the LMS as a cycle based on learning analytics to include: Students' use of an LMS allows effective interaction with the teacher, the optimal distribution of content, and the individualization of the assessment process; The data is collected and stored in a database, which can be used to make predictions that guide the learning process and provide feedback that guides the student towards the achievement of the objectives. Students receive digital teaching material tailored to their interests and needs; Teachers manage and develop the entire process, and are able to intervene whenever they see fit.

The mini Learning Management System (mini LMS) is a tool that has become essential to educators, as they increasingly rely on technology to support the adoption of the flipped classroom strategy. A Mini LMS is a condensed form of a standard Learning Management System (LMS), created especially to meet the special requirements of flipped classes in an institution which sought effective support for the existing educational approaches. Several studies have discussed and also discovered the effectiveness of the flipped classroom approach towards enhancing students' engagement and learning outcomes. There have been investigations on the delivery of instructional materials in the out-class method of learning through digital means. Integrating a mini

LMS into the flipped classroom has gotten so much attention, due to its process of content delivery and equal assessment prowess.

Several studies have highlighted how learning management system platforms provide a central hub for both the instructors and the students to share resources, disseminate information and facilitate interactions. These systems offer features like upload and download of study materials, quizzes and assignments submission, encouraging skill development and fostering collaborative learning and individual assessment. A summary of some closely related studies is depicted in Table 1

Table 1: Summary of Closely Related Studies

No.	Title	Author	Method	Strength	Weakness
1.	Flipped Classroom With Cloud-Based Technology	Ligi and William (2018)	The instructor prepares a video around a knowledge point with a clear subject purpose	Students are provided with the instructor practice environment to conduct experiments through the network access, and individual test status and time information will be recorded	There is time control of at most 10 minutes for each of the student's activities
2.	Flip My Class! A Faculty Development Demonstration of a Flipped-classroom.	Sharon and John (2014)	Program homework was assigned to the faculty, requiring them to watch a YouTube origami video on how to make a paper crane, construct their own crane and send the picture of it to the faculty facilitators by deadline.	The flipped classroom aids in utilizing class time for higher order complex assignments.	The YouTube video is not an already downloaded one. There might be need to subscribe to the page and or also pay for the download.
3.	The flipped classroom: Online instruction at home frees class time for learning	Tucker (2012)	Videos and interactive lessons that are supposed to used in class are allowed to be accessed at home, leaving the class to become a place to work through problems, advanced concepts and engage in collaborative learning	All aspects of instruction are taught, in order to best maximize the scarcest learning resource-time.	There is no specific model in use.

Many studies have so far discussed and reviewed flipped classrooms as an educational system, Ligi & William (2018) did a similar study however their work was not implemented. This study therefore intends to develop a mini Learning Management System (LMS)

for a flipped classroom system in order to narrow this gap.

**Materials and Methods**

Mini Learning Management System is the sole tool used in this study. It is the platform which interacts both the instructors and the students to realize the aim of achieving effective classroom flipping approach. The tool (LMS) is built around web and script languages like Javascript, HTML, CSS and MySQL ( a database management system for managing and storing of data). These languages offer powerful combination of technologies that enable the creation of dynamic, user-friendly feature-rich educational platforms. MySQL was used because of its suitability for medium-scale project. MySQL is freely available; it helps reduce the cost of the system development. Again, it contributes to the ease of use, compactness and readability of the source code. MySQL is already ported to several platforms (Saudi *et al.*, 2003).

Also, Paliwal (2024) stated that the universe of web improvement is a dynamic and steadily developing space, where innovations like html, JavaScript, and CSS structure the bedrock of computerized encounters. The study further buttressed the benefits of java scripts to include: client-side intuitiveness, making it imperative for dynamic web encounters, single-page applications, and responsive UIs. Also, its uses in Cross-program similarity and execution enhancement are fundamental contemplations. Furthermore, it highlighted the advantages of CSS to include: engagement and responsive plans across different gadgets and programs. While not an independent innovation, it is imperative related to HTML and Java Script.

Mini Learning Management System (LMS) is an educational tool used in flipped classroom method of teaching and learning, where instructors and students interact to create and facilitate smooth pedagogical process. Stated are the ways both parties (instructors and students) typically operate within the tool, Mini LMS.

The actions and components used are:

**Accessing MLMS:** Authorized instructor and student log into the mini LMS using their credentials (username and password)

**Class/Course Creation:** Classes and courses are created by the instructor/admin

**Organization and Upload of Course Material:** Instructor uploads the downloadable materials of any format.

**Communication:** Instructors send messages to individual class, student or selected classes or students; students can also in turn send messages to their instructors

**Viewing of Class:** Instructor can view his/her classes, get the list of the students in it and also prints if needed.

**Announcement/Notification:** General announcement are sent to the students here and students get notification of any message or information they have.

**Quizzes and Assignment:** Instructor organizes quiz and gives assignment to the students. Students also take their quiz and assignment here and get them submitted.

**Shared Files:** This comprises of all the files shared so far for individual classes.

**Backpack:** This is a file where all downloaded materials by students can be saved for future reference. Both instructors and students benefit from the convenience and organization that the mini LMS provides; streamlining the teaching and learning experience in a digital environment.

**System Design:** The system was designed using the unified modelling language (UML) where all the components are logically integrated to address the research problems. This outlines the architecture, interactions, steps and actions involved in the implementation of the system (Mini LMS). The unified modeling language tools used in the system are analyzed below;

i. **Use Case Diagram:** This is a modeling technique which identifies the system-user interaction and provides overview of the system's functionality. Figure 1 analyzes the specific tasks a user can perform in the system and as well the behavior of the system when the user interacts with it

ii. **Class Diagram:** This is a UML diagram used in modeling the static structure of the system. It depicts the relationships and associations existing between the classes. Figure 2 is a class diagram which analyzes how classes interact with one another in the system.

iii. **Sequence Diagram:** This is a UML diagram which visualizes the interactions and communication between the entities, objects and components of the system. Figure 3 is a sequence diagram which analyzes the step by step processes of the application.

iv. **Activity Diagram:** This is a UML diagram used for modeling the dynamic behavior and workflow of the system. Figure 4 shows how different actions are organized and performed in the system.

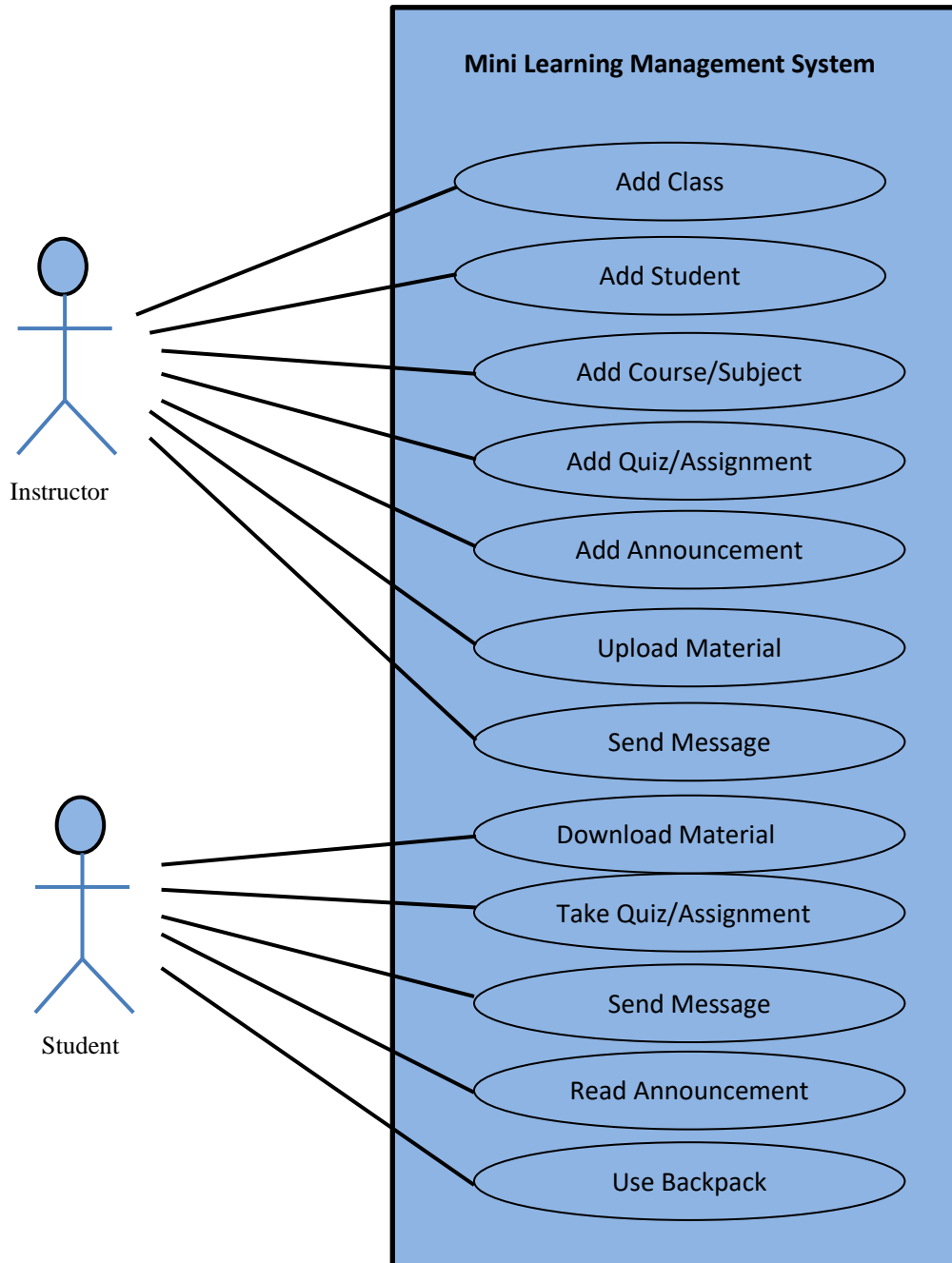


Figure 1: Use case diagram of Mini LMS

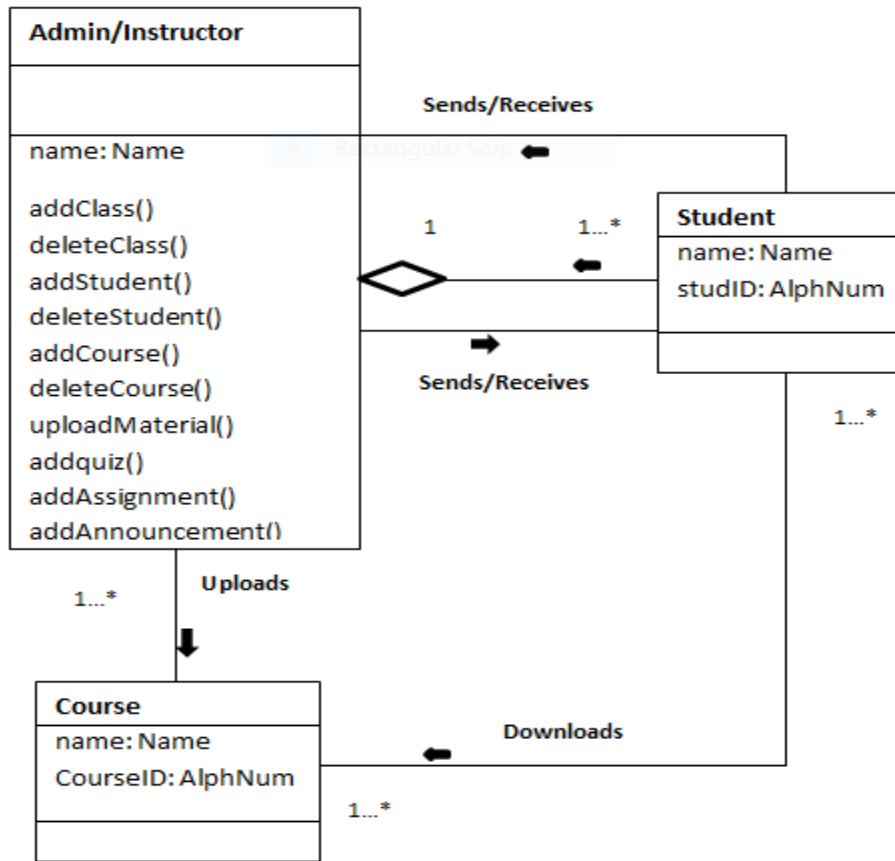


Figure 2: UML Class Diagram of Mini LMS

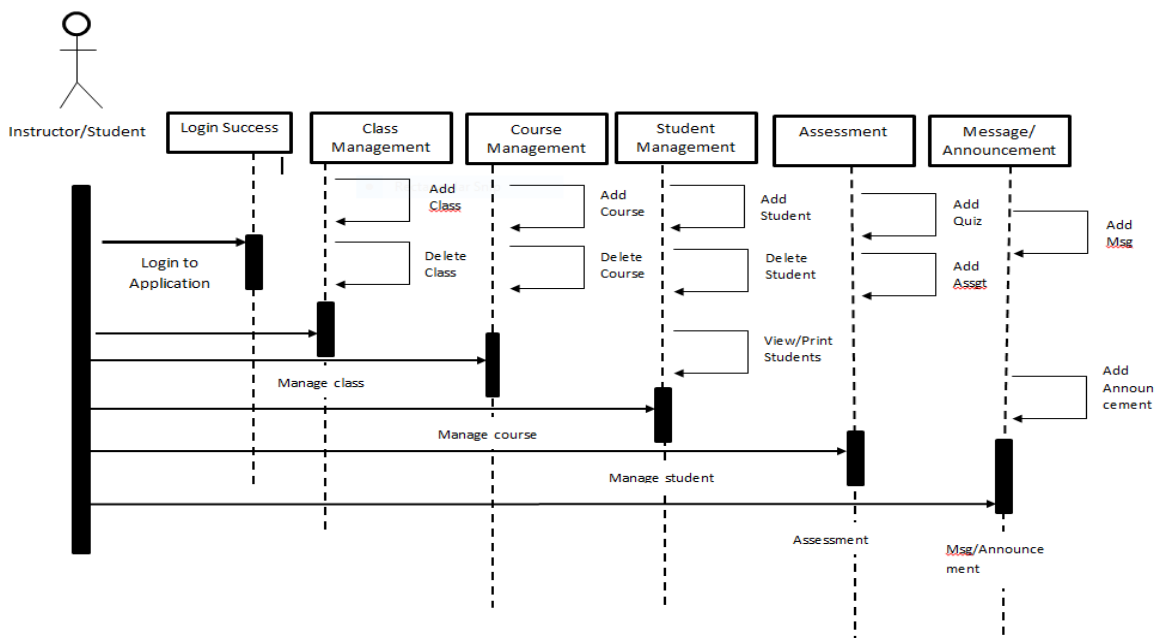


Figure 3: Sequence Diagram of Mini LMS

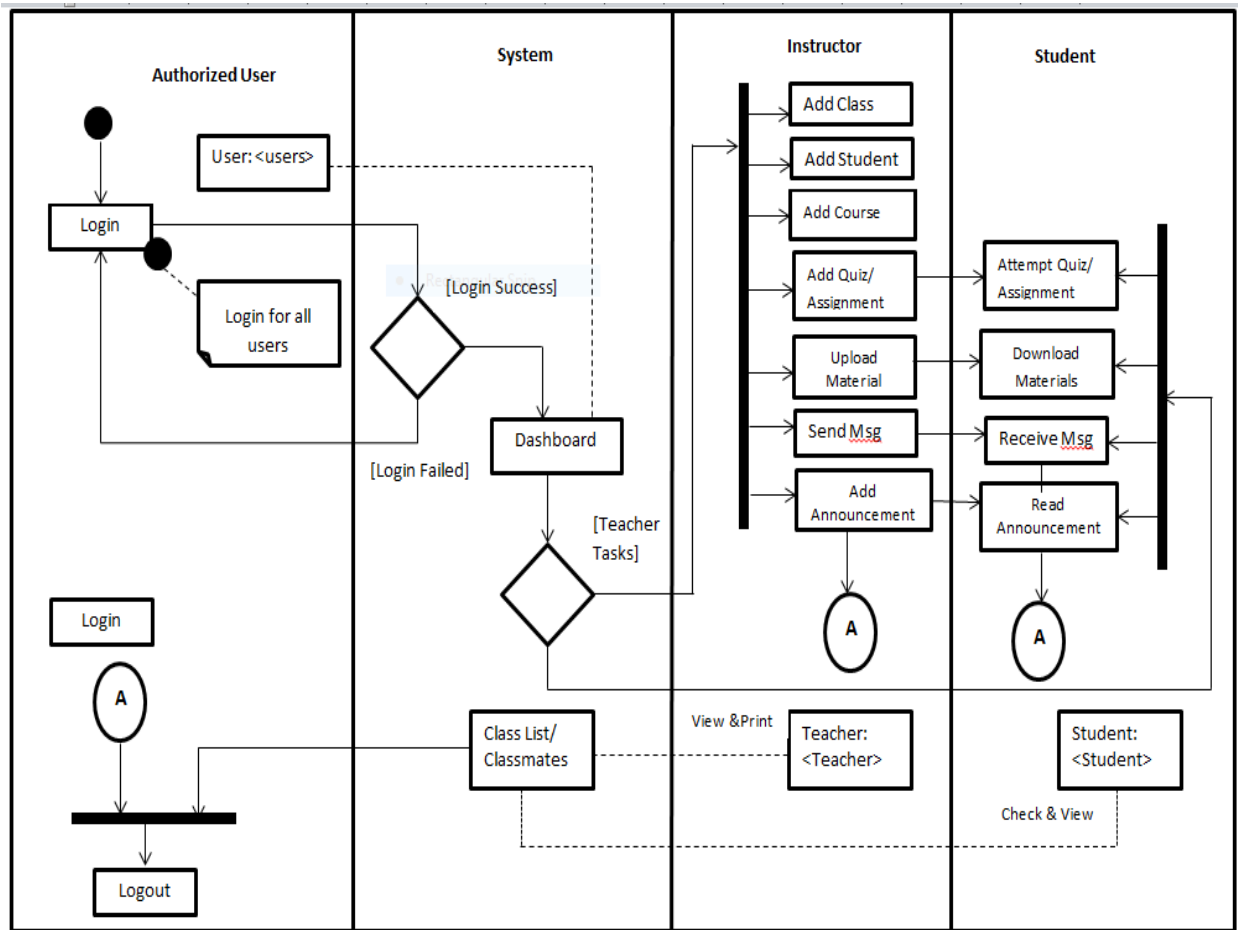


Figure 4: Activity Diagram of Mini LMS

**Results**

This produces the overall outputs of the objectives of the study, i.e. the results expected when the tool, mini LMS is implemented and the management of the flipped classroom approach. Here are few of the obtained results;

**Login Page:** Figure 5 shows the login page for instructors and students, which comprises the “Sign in” and “Sign up” for existing users and new users respectively. This is the page for accessing the content of the mini Learning Management System for the flipped classroom.

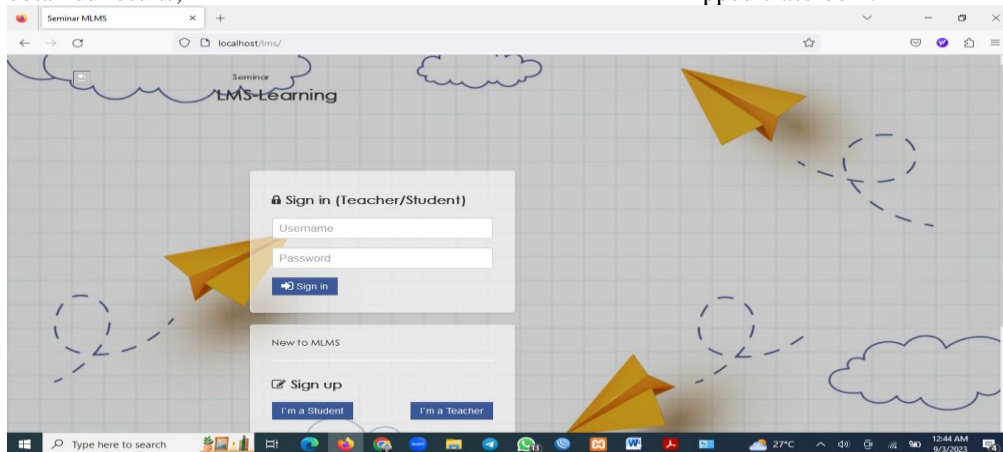


Figure 5: Login Page

**Dashboard:** Figures 6a and 6b show the dashboard for both the instructor and student respectively. This is the user interface element of the mini LMS which visualizes the menus and submenus for user's activities.

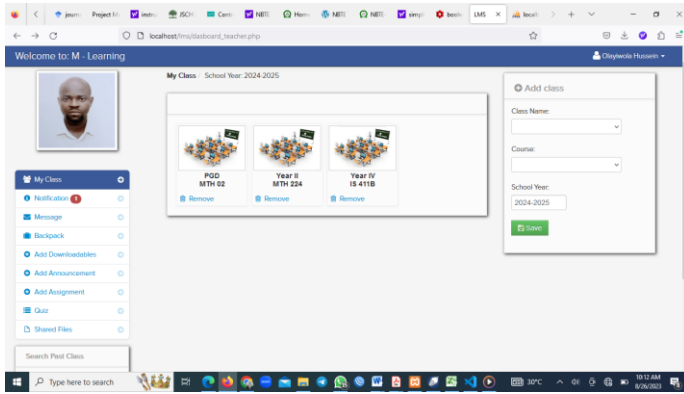


Figure 6a

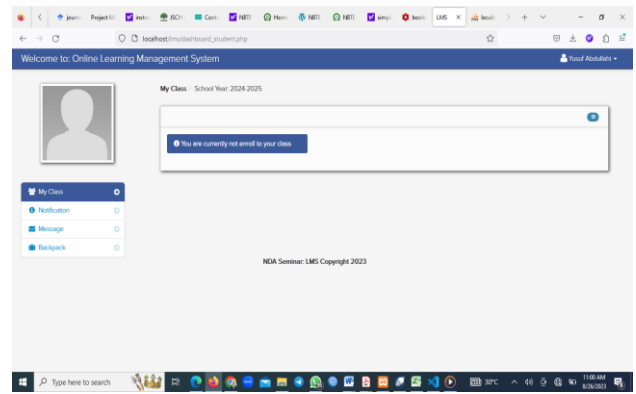


Figure 6b

**Upload /Download Study Materials:** Figures 7a and 7b show the element for upload and download of the study materials by the instructor and student respectively.

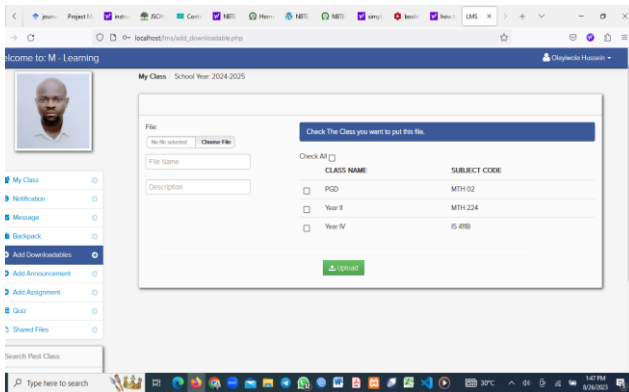


Figure 7a

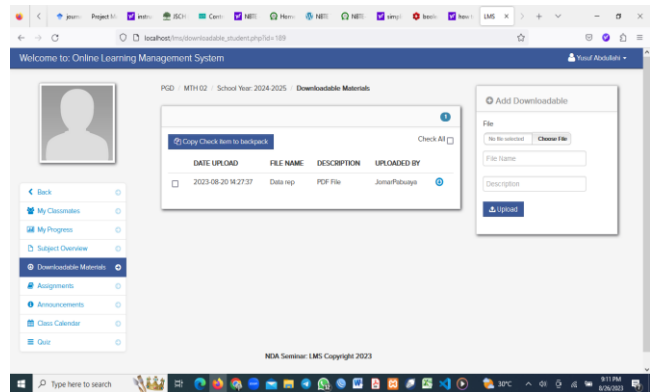


Figure 7b

**Quiz and Assignment:** Figure 8a and 8b show the element for quiz and assignment given to the student basically

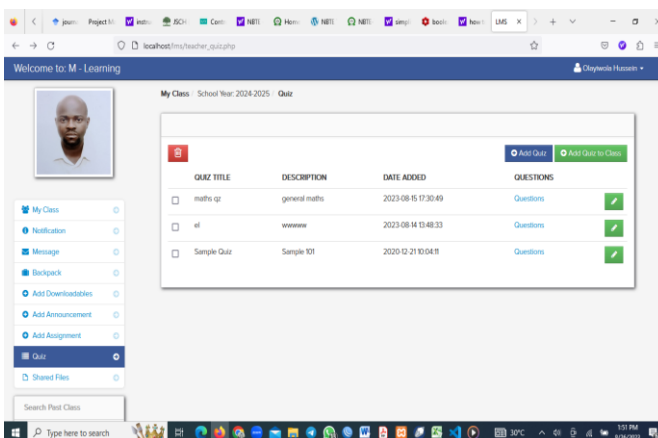


Figure 8a

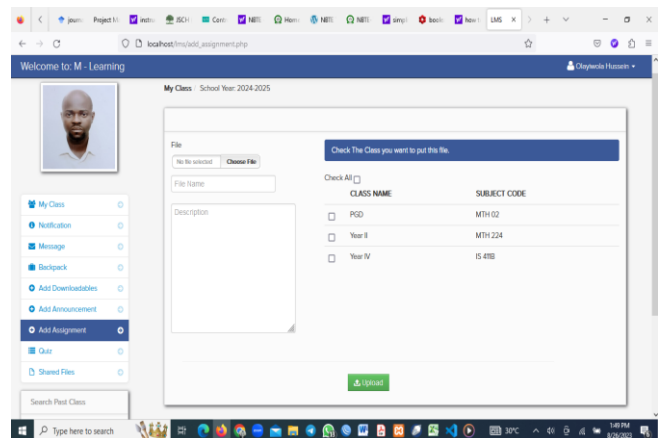


Figure 8b

**Messaging and Announcement:** Figure 9a and 9b are meant for sending/receiving message and announcement respectively. Both Instructors and students are to forward and receive information through this as necessary

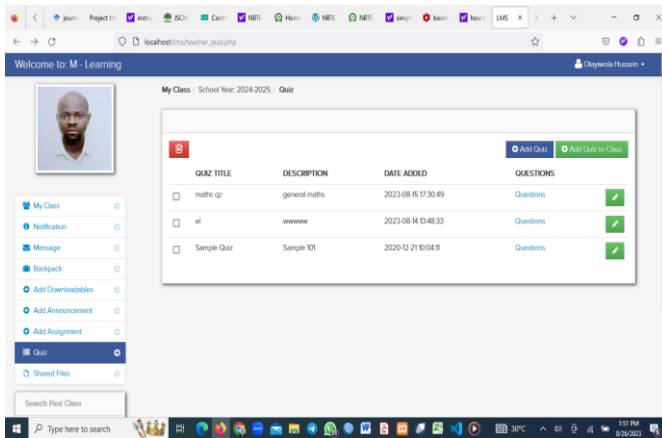


Figure 9a

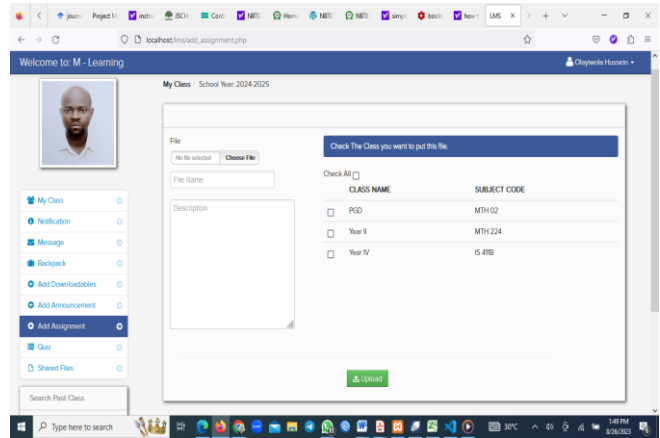


Figure 9b

**Discussion**

Flipped classroom is a pedagogical approach where the traditional teaching methods are inverted; in flipped classroom, students are introduced to the use of learning materials outside the class mostly through recorded videos, reading materials and other multimedia resources. This allows the students to have pre-knowledge and ideas of what is to be taught in the class where interaction activities, discussions and problem solving will take place. A mini Learning Management System is a platform which is used in implementing the flipped classroom system. So, both the flipped classroom and Learning Management System must be inseparable to achieve the educational purposes they are meant for, such as; Students get exposed to the foundational content of a course or subject before going to the class, enabling them to have basic understanding. Flipped classroom with LMS platform, features quizzes and assignments to assess the students’ understanding of the contents provided.

The platform also gives a sense of responsibility to the students in self-paced learning which may enhance their learning progress. The platform also enable students to access study materials from anywhere with internet connection, providing flexibility for them. Mini Learning Management System in this study also serves as a repository for study materials, which makes it easy for students to revisit and go over the materials

for review and references. Flipped classroom with mini LMS personalized learning experience to the students, where they learn on their own and at their own pace.

**Performance Evaluation of mini LMS in Flipped Classroom**

The LMS was evaluated using ten (10) year-one students in a federal institution in Kaduna State. Flipped classroom using LMS was introduced to the students to check its efficiency compared to the traditional system of learning for a period of four weeks each.

Table 2 shows the analysis of the evaluation of responses and scores/performances in quizzes and assignments attempted by the students in flipped classroom with the application of LMS; while Table 3 shows that of the same number of students using the traditional in-class learning while table 4 depicts the average performance of Flipped Classroom and Traditional Learning System.

The analysis comprising of 10 students was done in a period of 8 weeks where each system was run for 4 weeks each. The students’ responses were rated based on the questions asked in the in-class after both systems were run. Teachers’ discretions were used in rating students in each of the classes, while the scores are graded from the quizzes and assignments given.



Table 2: Flipped Classroom Learning using LMS

Students	Week 1		Week 2		Week 3		Week 4		Avg Score
	Hardware & Software (%)		Operating System (%)		Word Processing Package (%)		Spreadsheet Package (%)		
	Response	Score	Response	Score	Response	Score	Response	Score	
1.	50	60	65	65	70	45	65	65	61
2.	70	85	60	80	75	65	60	75	71
3.	55	65	70	60	60	60	65	70	63
4.	80	85	75	80	75	75	80	65	77
5.	75	90	75	80	75	70	75	70	76
6.	60	60	65	70	80	85	80	80	73
7.	55	60	70	75	55	60	60	60	62
8.	90	80	85	95	75	80	85	75	83
9.	65	65	65	70	75	75	65	80	70
10.	70	75	75	75	80	70	70	65	73

Table 3: Traditional In-class Learning

Students	Week 1		Week 2		Week 3		Week 4		Avg Score
	Hardware & Software (%)		Operating System (%)		Word Processing Package (%)		Spreadsheet Package (%)		
	Response	Score	Response	Score	Response	Score	Response	Score	
1.	60	50	55	40	60	45	55	55	53
2.	50	50	55	60	65	65	50	60	57
3.	60	60	65	60	55	70	55	50	59
4.	60	60	60	60	50	65	55	50	58
5.	45	50	55	60	55	60	70	60	57
6.	55	50	65	60	65	70	75	70	64
7.	55	55	50	55	60	60	60	70	58
8.	75	80	70	70	75	80	70	75	74
9.	60	55	50	55	50	50	55	60	54
10.	75	75	65	70	70	65	70	75	71

Table 4: Average performance of Flipped Classroom and Traditional Learning System

S/No.	Flipped Classroom	Traditional Classroom
1.	53	61
2.	57	71
3.	59	63
4.	58	77
5.	57	76
6.	64	73
7.	58	62
8.	74	83
9.	54	70
10.	71	73

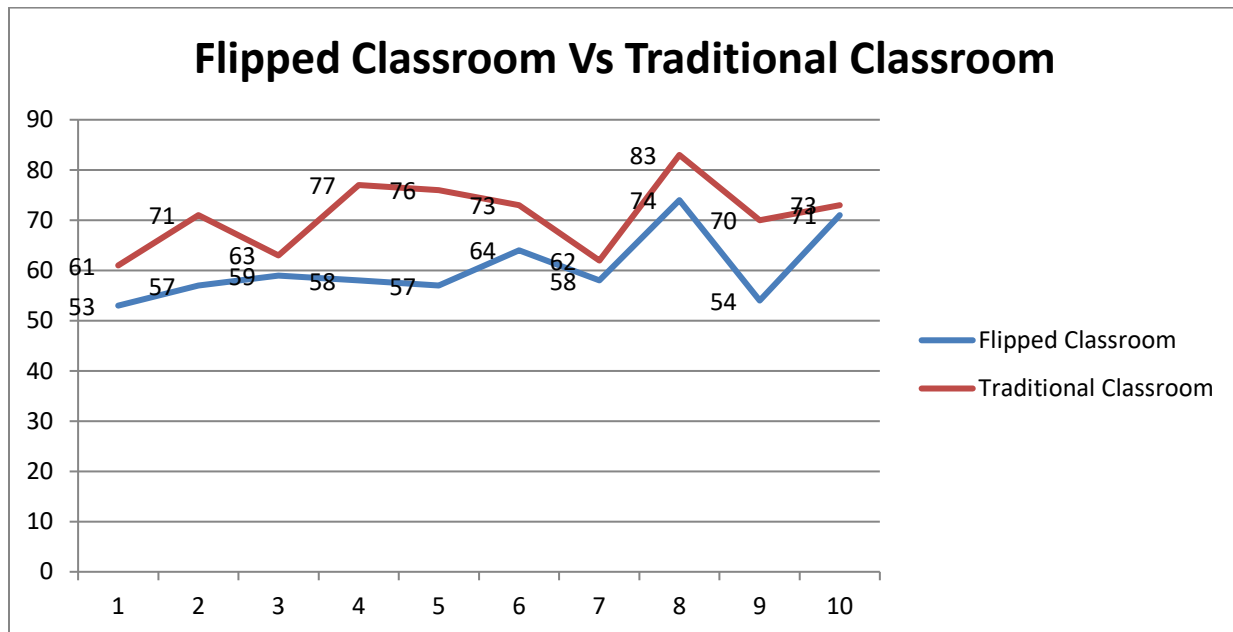


Figure 10: The result of flipped classroom and traditional in-class system of learning

At the end of the experiment, the performance recorded by the flipped classroom (pre-class exercises and engagements) learning was significant over the traditional in-class system. Therefore, the result shows that flipped classroom to an extent has a positive impact on system of learning.

### Conclusion

The integration of mini Learning Management System into the context of the flipped classroom represents an essential change in modern education practice, by reviewing the criteria for resourceful learning. This study has revealed the potentials of LMS-enabled flipped classroom model. Through in-depth study of literature, experimental proofs, and reported practical experiences, this study highlights the significant influence LMS has on the flipped classroom model, which makes it evident that mini LMS platform empowers educators to re-evaluate their teaching methods, shifting the focus from in-class delivery of content to an active and student-centered engagement. The ability to deliver study materials such as video lectures, readings and other instructional-based materials through LMS not only encourages autonomy for students, but also increases the degree of understanding and critical thinking. In conclusion, the combination of mini LMS with the flipped classroom model appears as an essential improvement in education, in which the educators, institutions and policymakers should look forward to as one of the tools for education transformation.

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