Use of Cloud Computing in Tutorial Group Discussions as a Method of Teaching and its Influence in Learning: A Case of Kenyatta University

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Abstract: Cloud computing has lately been deployed in educational institutions for a range of services and applications by way of virtualization of computing resources such as processors, memory, storage and networking. This paper discusses the use of cloud computing in tutorial group discussions as a teaching pedagogy and its influence in learning. It explores the essentials in tutorial group discussions in class including the preparations, activities, processes, benefits and opportunities. The research utilized a mixed method approach including qualitative and quantitative for data collection, then both action research and agile software development to develop and test the cloud computing based tutorial management system (Tutmas). Results indicated that both students and lecturers appreciated the benefits and usefulness of regular tutorials. Further, both students and lecturers appreciated the role of the cloud based Tutmas platform in improving efficiency in the management of tutorials and enhancement of students' learning experiences and academic skills.

Keywords: Tutorials, Group Study, Cloud Computing, Collaborative Learning, Cloud Computing Architecture in Education, E-learning System

1. Introduction

Over the years there has been increasing concerns about the quality of teaching and learning within institutions of higher learning (Almarghani & Mijatovic, 2017). As a result, there are concerted efforts to improve on teaching methods and learning strategies to help students achieve their defined learning outcomes. To guide on these efforts Biggs et al. (2011) suggest two fundamental principles. First is to put in place policies and procedures that encourage teaching and assessment, then secondly is shifting the training process that focuses from teacher to learner.

Another effort to improve the quality of teaching and learning is to use methods that encourage active learning. Luís Konopka et al. (2015) observe that active learning places the learner at the center of learning which improves understanding and information retention. It engages learners in deeper thought on the subject being taught. Thus, popular active learning techniques include collaborative learning, inquiry and

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problem-based learning, use of group discussions, class workshops and tutorials. These techniques are quite effective in enhancing student participation in learning.

Tutorials in particular have been used for a long time by many top universities as a pedagogy in teaching and learning that enhances student learning experiences. For example, both Oxford and Cambridge universities in the United Kingdom (UK) have used tutorial approach for more than two decades. Some universities in East Africa such as Kenyatta University, having adopted the university education system from the British, former colonial masters, in some instances incorporated use of tutorials as a method of teaching (Bogonko, 1991; Mulinge & Arasa, 2017).

Using adaptive modern educational technologies such as institutions facilitating access to internet, encouraging learners to acquire internet-enable gadgets such as smartphones and using suitable learning management systems (LMS) has enabled use active teaching techniques that improve on students' learning experience.

Use of modern technology however has its challenges: it is expensive to install, huge financial resources are needed to buy equipment, often expert support is needed and both learners and instructors need to be continuously trained to ensure effective use.

For example, the underlying technologies to host an e-learning systems is expensive due to huge financial resources required to acquire and install both infrastructure and software. Additional funds are needed to pay the staff, support and maintain the system. Most e-learning systems are set up to operate in the institutional Intranets which are network-based and client/server browser setups. Institutions therefore must provide a reliable network with internet access at various buildings and locations. It is also important to establish computer labs to be used by students. This kind of installations are expensive right from initiation through implementation to maintenance.

Nowadays, with the widespread access to cloud computing technology, it is much cheaper to implement ICT based learning systems. Cloud technologies provision computing services including infrastructure such as computer servers, platforms to host and maintain system and software. It offers the infrastructure, platforms and software as a scalable service where institutions can hire when needed. Billing is often done as services are consumed. This enables implementation of new e-learning solutions, experimentation of innovations and effecting changes due to emerging opportunities, finances to expend are low, there is limited expertise to be assigned and infrastructure needed at the user end is modest for supporting internet service. Since internet is key to using cloud computing, institutions are obliged to provide adequate and reliable wifi and/or wired network points. Students are encouraged to use their internet enabled personal gadget such as smartphone, laptop and iPad.

1.1 Research questions

This research addresses the following research questions:

1. What are the perceived a) benefits and b) challenges in conducting tutorials?
2. How can cloud computing technology be integrated to enhance the traditional way of conducting tutorials?

3. What are the student's perceptions in use of cloud-based Tutmas platform to conduct tutorials?

In order to address the research questions various tools were used to conduct quantitative and qualitative survey which included questionnaires, observations and log analysis in the cloud-based tutorial management system.

2. Literature Review

2.1 Background to the Tutorials Pedagogy

The use of tutorials as a method of teaching and learning in universities has a long history. Its origin can be traced at Oxford and Cambridge universities, United Kingdom (UK) where it was introduced as part of teaching a few centuries ago. It was until the mid-19th century when Prof Benjamin Jowett became the Vice Chancellor at Oxford University when it was widely established (Moore, 1968; Morgan, 2013; Tapper & Palfreyman, 2011). Since then it has remained a "pedagogical gem, the jewel in Oxford's crown" to be preserved at all costs (Palfreyman et al., 2008). Both Oxford and Cambridge are often referred to as Oxbridge, a term derived from a combination of names, are top universities that use a highly personalised approach to teaching where an expert tutor in a field usually has a weekly session with one or two students for discussion. These discussion sessions are normally referred to as "tutorials" in Oxford University and "supervisions" at Cambridge University. For instance, the usual practice for tutorials at Oxbridge is to have a 1-hour session with the tutor to discuss any essay which has been researched and written by the student, the teacher will often provide feedback on the essay, challenge the learner's arguments and answers and clarify any grey areas. The discussions between the student and the tutor are very personalised, often 1:1 or 2:1 which makes these tutorials unique (University of Cambridge, 2021a). While at Cambridge University, "supervisions" are usually a small group of about 2-4 students with a specialist in the subject area or topic, often an academic or PhD student. These supervision sessions provide opportunities for students to explore their subjects more deeply, write a paper for presentation and discussion. This gives the students the opportunity to get feedback on their work or ideas and provide them with a good learning experience (University of Cambridge, 2021b).

2.2 Benefits of Tutorial Groups

Over the years, it has been observed that group tutorials not only improve the teacher-student relationship but also encourages collaboration between learners and enhances students' learning experience (Moore, 1968). The size of tutorial groups in classes can extend from an individual to over ten members; however, one to three is most desirable. Top universities that regularly use tutorial groups in teaching often have up to three members. Tutorial groups with up to five or seven members are suitable, sometimes groups can be more than seven members depending on the size of classes. However, it is important to note that as tutorial groups increase in size they become less effective.

In the last few decades' studies on group discussions have focused on aspects of the pedagogy particularly its unique learning benefits, challenges and proposals to best practices. Various writers have described group discussions using different terminologies depending on an aspect of teaching and/or learning. Most notable is collaborative learning and/or cooperative learning method (Shoval & Shulruf, 2011). Other common terminologies are class seminars, class workshops, problem based learning and the inquiry based

learning. The original terminology: 'tutorials' at Oxford University is referred to as 'supervisions' at Cambridge University. All these terms best describe aspects of group discussions. It is important to note however, that whatever the terminology or approach used, the fundamental aim for the learning institutions is to enhance student learning experience, achieve excellence in academic goals and accomplish the course outcomes sufficiently.

Most institutions of higher education do encourage active learning through various ways. A widely used approach, across many disciplines, is the small group discussions. Benefits associated with this pedagogy have been outlined as: cultivating relationship between student and lecturer; encouraging research and writing; developing collaboration and cooperative skills among students (Hammar Chiriac, 2014); improving oral and written communication; use of an active learning approach (Luís Konopka et al., 2015); providing immediate feedback; and building presentation and discussion skills.

Undoubtedly group tutorials can greatly be rewarding however there are few challenges though with group discussions. One of the major challenges is the control and management of large groups. As the group size grows there are inherent issues associated with group dynamics that affect its effectiveness (Alfares, 2017). Use of technology in virtual meeting platforms does provide for a break-away session from the main group which is an effort to address the large group issues but it introduces other issues particularly for supervisors in monitoring and scheduling such sessions.

Another challenge with group tutorials is time constraint especially where the curriculum requires having lecture time, practicals or fieldwork. Setting aside time for discussion tutorials may not be possible because it is difficult to adjust lecturer hours planned in the semester's timetable. Other challenges are associated with group dynamics for example domineering a discussion by one or just a few students, callousness by some students and lengthy discussions which often affect groups negatively.

2.3 Cloud Computing as an Emerging Educational Technology

The trends in emerging technologies is making it easier for students and trainers to access and use high end ICT facilities. The internet has dramatically changed how teachers and learners search, store and share learning resources. There are high-end cloud computing services such as provision of servers, application software and system development platforms which are provisioned online in scalable plan. A user can hire these services and be billed for what is consumed at very affordable rates. Further internet enabled gadgets has become affordable to students. All these advancements have opened opportunities to explore how cloud computing can improve learning experience and provision of better and widely accessed e-learning solutions.

2.3.1 Cloud Computing Service Levels

Cloud computing can simply be described as the delivery of computing services over the internet by a provider. Services include virtual computer servers, online data storage, networks and a variety of applications that are usually provisioned to a client almost instantly with minimal intervention by the provider (Shaw & De Sarkar, 2021; Zhang, 2020). Some of the established cloud computing service providers are Amazon Web Services (AWS), Microsoft Azure, Google Cloud and Oracle (Han, 2013; Tomer, 2017). These providers have made technologies that has been too expensive and out-of-reach to

big and small clients be available. Through the cloud computing, anyone using internet browsers can easily and cheaply implement computing services. Educational institutions therefore should take keen interest in the emerging opportunities to enrich learner's technology-enable pedagogies and also reduce budgets for automation (Ercan, 2010). The benefits have immediate impact including equitable and wide accessibility to learning resources and fast implementation. There is also a tremendous reduction in infrastructure expenses because most computing equipment is never acquired but rather provided as a service when needed and at very low cost.

The National Institute of Standards and Technology (NIST) provided a classical categorization of cloud computing models into three service levels (Mell & Grance, 2011). In spite of the tremendous growth and maturity that cloud computing has experienced in the last decade this categorization has continued to enjoy worldwide acceptance (Simmon, 2018). The first service level is referred to as infrastructure-as-a-service (IaaS) that provides computing infrastructure such as virtual computer servers, computer storage and networks.

Second service level is the platforms-as-a-service (PaaS) that is used by computer experts to create, deploy and host applications and databases; and last level is software-as-a-service (SaaS) that provides general applications needed by end users such as word processors, spreadsheet and presentation software (Buyya et al., 2014; Smoot & Tan, 2012). Additional software is installed for user specific purposes, for example the e-Learning applications, library management systems and property management software. As it has been observed by Jain & Pandey (2013), it is therefore important for clients to understand how cloud computing services are provisioned, various designs for setups and architectural models so as to adopt the best that fits well.

2.3.2 Provisioning Cloud Computing

Popularity in cloud services can be attributed to the many computing resources, availability of the service, scalability and flexibility in service provision and wide range of services it offers including huge storage, fast processing capability and high bandwidth. These services and resources are scalable and charged as they are consumed, in a plan normally referred to as pay-as-you-use. A client therefore can scale up or down the usage as demanded. The three service levels have provided the basis for cloud computing architecture models across various business setups including the education sector.

Javatpoint, a leading online training center for computer science, has provided a cloud computing architecture model that focuses more on two kinds of services: front-end and back-end services that are interlinked with the internet (JavaTpoint, 2021). The front-end service provides the client's interface that is accessed by clients using web browsers such as FireFox and Chrome. The front end hosts user interfaces and web applications that are required by clients. Web applications for the users provide interfaces with the means to access various kinds of online systems. For example, in educational systems there are learning management systems such as TalentsLMS which is a cloud based e-learning that is accessed on a web based interface. Another example is Turnitin software, which is an online application with a platform to check documents for plagiarism and text similarity. The user need not install these systems but has an opportunity to use them. Apart from the applications, the front end also provides interfaces for web mail such as Gmail, and web programming tools and interfaces such as Condenvy which is an Integrated

Development Environment (IDE) that is used by web-based system programmers. IDE interface for building new online systems, modifying or adding their functionalities and features whenever there is need.

The back-end service has the servers, databases and applications that work behind the scenes to process and deliver information to the user. It is used to manage all resources needed to provide the cloud services. Back-end services include computer data storage, installed applications, virtual servers, networking and service protocols including security management, traffic control, service models and billing system. The back end is normally used by the provider.

2.4 Cloud Computing Architecture in Education

Various writers have given cloud computing architectural models that fit well in the educational systems (Buyya et al., 2014; Mhouti et al., 2018; Zhang, 2020). Educational cloud computing architecture can be illustrated in three layers: physical layer, service layer and cloud management system layer. The physical layer includes all computing hardware such as servers, storage and processors needed to host and maintain the service. Next is the service layer that represents the virtual machines that deliver the three cloud services IaaS, PaaS and SaaS. The final layer is the physical hardware layer and it represents users' information infrastructure and all other physical resources such as CPU, storage and networks. This layer is dynamic and scalable which means the resources can be added in order to enhance computing power or scaled down to optimal level.

Cloud computing architecture in education can as well be described in service-oriented architecture with the provider on one end and the client on the other just like other business enterprises. In this kind of arrangement, the architecture can be viewed into three service components: front-end; back-end and the internet as illustrated in Figure 1. In the illustration, the internet is the medium for interconnectivity between provider based back-end services at the top and the front-end user services at the bottom. This arrangement helps in conceptualization of cloud based educational systems with the user at the ground and the provided computing services in the ‘cloud’.

Back end has all the three cloud computing services IaaS, PaaS and SaaS which are controlled and managed by the service provider. IaaS include virtual servers, memory, CPU and storage. The PaaS offers a necessary platform for deploying user applications such as learning management systems (LMS), Integrated Library Management System or a financial management system that are installed in the cloud servers. The interfaces provide a gateway platform to applications installed and all other computing resources needed by the client. Within SaaS are general applications such as word processors, spreadsheet and presentation software, and operating systems in which a client need not pay for licences.

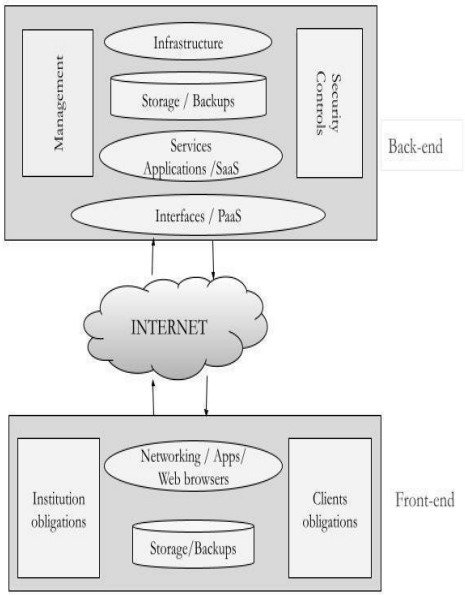

Figure 1: Educational Cloud Computing Architecture

The front-end is for clients who consume the services. The clients are the learners, instructors, researchers, administrators and all other stakeholders in the education sector. Networking is basically the institutional intranet for both Local Area Networking (LAN) and Wide Area Network (WAN). The intranet is important to enable clients to collaborate, communicate and share information within the institution. Both the clients and the institution do have their obligations to facilitate internet access: first acquire internet access gadgets such as laptops, mobile phones and computers; and ensure the internet is available and accessible.

Users in the front-end are generally not bothered with system maintenance or upgrade of infrastructure but rather ensure they have gadgets that can access the internet. An important responsibility for the institution is to ensure that subscriptions to cloud services are up-to-date, the internet is available to their users and that the institutional network is operational. This will ensure availability and continued use of the service. The provider then monitors the cloud resource utilization through a metering system (Buyya et al., 2014) and bills accordingly.

Therefore, cloud computing has enabled learning institutions to provide access to the key infrastructure (computer servers, storage and networks), platform (learning management applications) and software (operating systems) as services at relatively very low costs. Thus cloud computing services have gradually become attractive to institutions and has gained tremendous popularity in supporting online services across different types of academic applications. Institutions are able to implement high-end online systems and services which have encouraged innovation and experimentation of new systems.

Application of cloud computing in the education sector is wide. It is currently being used not only by individual researchers but also in small and large learning institutions for learning content management and delivery (Singh & Baheti, 2017). It is also being used in research, information and data storage. For

example, nowadays institutions are maintaining an online platform for content delivery, content creation, course setup, student registration, monitoring learner progress and maintaining course data for evaluation (Mhouti et al., 2018).

2.5 Benefits and Challenges of Cloud based E-Learning

Since cloud computing allows institutions to have a flexible and internet-based hosting service for the eLearning system and content, the immediate benefit is allowing students and staff to access the learning content from all locations where there is internet connection. In addition, the institution is no longer bothered too much about bandwidth limitations and regular upgrade of computer labs and servers. The user on the other hand accesses the service through the internet and with the proliferation of internet-ready mobile devices such as smart phones and laptops that are affordable by the student the access to cloud computing-based systems makes it convenient to students. Eventually there are unprecedented savings in computing infrastructure, bandwidth and maintenance for provision of e-learning.

Cloud providers normally assure clients on the security of data and do offer various plans. So depending on the security plan that an institution subscribes to, there is always an assurance of data security including regular or real time backups.

Another important benefit is that when e-learning systems are supported through the cloud it provides an environment that encourages collaborations and social interactions. "Users and experts in the field claim that some of the most promising trends of modern e-learning systems will be the Web with cloud computing. Despite the convenience of cloud computing in tackling the challenges of implementing LMS, one must be aware there are risks and concerns in this technology which should be addressed before full integration. One major concern relates to internet connectivity and thus data availability. Cloud-based e-learning systems require fast and reliable internet access therefore low bandwidth or speeds reduce its efficiency in providing services. Institutions are always concerned if users will access data from their remote locations as expected.

Another concern is security and privacy of data. Sun et al. (2014) observes that data security in the cloud is more complicated than in the traditional systems because data is scattered in different storage devices and machines including virtual servers, PCs, laptops and mobile phones. It would be important therefore to resolve to enhance confidence within the institution before implementing cloud based e-learning solutions (Avram, 2014; Zuhrieh & Abulibdeh, 2017). Lastly Jain & Pandey (2013) observes that cloud computing is generally ill understood and it is not only enough to teach about virtualization but there are a host of other tools such as architecture, design and monitoring that need to be understood before implementation can be accomplished.

3. Theoretical Framework

Activities associated with group tutorial teaching and learning pedagogy in a class not only gives the learner great learning experience but also helps the lecturer to closely interact and/or monitor them. Learners while participating in group tutorials are exposed to various learning activities that include research, collaborating, writing, presentation and sharing their academic work to class members.

Tutorials combine a number of teaching pedagogical techniques which makes it an important teaching and learning method. Its activities are group based that encourage collaboration among students, research and writing, in addition to presentation and discussions. These activities are in line with some of the leading theoretical pedagogical approaches that support excellence in teaching learning and teaching. First is collaborative learning involving learners working together in pairs or small groups on an assigned task such as solving a problem or create a product (Laal & Ghodsi, 2012). Collaborative learning generally involves three steps: first is the introduction to the topic or task, then tutorial groups engage independently on the task, and lastly debriefing where learners share their findings in class with lecturer moderating discussions and clarifying or explaining issues of concern. Collaborative learning encourages students to be active, social while working in the group, improve oral communication, research and writing, and promote student-faculty interactions. Apart from active participation within the group, collaborative learning can extend to creating a product (Smith & MacGregor, 1992). These experiences lead to deeper learning and retention. Class tutorials encourage multiple learners to work together as a group particularly when they are writing the tutorial paper. Individuals in the group contribute to the content of their paper.

Another theory is the inquiry-based that focus on researching on certain learning task or problem. Learners get provoked to undertake investigations in finding a solution. Tutorials pedagogy focus on assigning each a group a question or topic to write a paper on. In the process of writing the paper, students have the opportunity to solve the problem through research, inquiry and discussions that help them develop problem-solving abilities (Smith & MacGregor, 1992).

Tutorials teaching and learning approach is also grounded in social constructivist theory, which emphasizes that learning and knowledge construction is affected by interaction and collaboration (Vuopala et al., 2016). Learners are actively involved in the learning process particularly during tutorial presentation and discussion time. At the end, they are required to prepare a paper that will be graded by the lecturer.

4. Methodology

The aim of the study was to investigate how group tutorials are conducted in class for teaching and learning at Kenyatta University, develop a cloud based tutorial platform to enhance its management and evaluate the effectiveness of the platform. The study further investigated the perceived benefits and challenges by the students and lecturers. The study commenced with observations and interviewing lecturers to understand the class tutorials process flow, how they are planned and administered. Then questionnaires on perception, benefits and challenges in class group tutorials were administered to both students and lecturers. Lastly was design, develop, test and evaluate the cloud based tutorial management system for teaching and learning.

The study used a combination of research methods which included qualitative research, action research and agile software development (ASD). Two questionnaires to get insight on the tutorial group activities in learning and teaching and the perceived benefits and challenges were administered. It was noted that although use of the group tutorials approach is one of the recommended approaches for teaching at the university not many lecturers used the method. However, the researcher used snowballing approach to identify respondents, 31 lecturers and 234 students participated.

The researcher then embarked on the design and development of cloud based tutorial management system. Primary requirements were largely informed by the feedback form lecturers and students who participated in the survey however action research together and agile software development approach was used to improve and test the platform. At this stage web programmer and database experts were engaged who used a number of web development tools. Tools used were JavaScript for web programming, Postgres for databases and NoteJs for web IDE. The cloud computing services to host the web development platform was provided by Heroku service while Amazon Web Services (AWS) hosted the full text tutorial papers, class notes and references documents. The online platform developed was referred to as tutorial management system (Tutmas).

Final stage was a qualitative approach to evaluate the online tutorial management platform with students after the lecturers have set up class tutorial sessions. Questionnaires to evaluate the effectiveness and quality of cloud based Tutmas platform in managing class tutorial activities were administered to 45 students. This was done just before the onset of COVID-19 where the tutorial discussions and presentation were conducted in the traditional way but processes were managed using the designed cloud based tutorial platform that was to be evaluated. Later due to the COVID-19 protocols on social distancing and the introduction of blended learning in the University where student used virtual classes there was need to undertake further evaluation on virtual tutorials. A group of 15 students undertaking library attachment unit participated in the evaluation. The students, were enrolled in five groups using Tutmas platform and each assigned a different topic on library service. Presentations and discussions were done virtually with the supervising lecturer and librarians as moderators.

5. Results

This section discusses the findings of this study on use of cloud computing in tutorial group discussions as a method of teaching and its influence in teaching and learning.

5.1 Context of Tutorial Teaching and Learning at Kenyatta University

Following the responses from the lecturers who use tutorial methods in teaching and students who have learned in tutorial classes, observations made by the researcher and feedback from students, it noted that tutorials at the University were conducted in a systematic way with five key processes as illustrated in Figure 2.

Figure 2: Tutorial teaching process

The five teaching processes in tutorials begin with introductions to the course topics and provide references by the lecturer. It is followed by setting of tutorial questions where students enrol in groups. Students are then required to research on their group's topics and write a paper for presentation. This is followed by a

schedule of class presentation and discussion sessions for each group and finally assessment, grading and sharing of the tutorial papers

The tutorials teaching process present students with opportunities to enhance learning experience, they stand to benefit in both academic and social skills. However, it is also important to note their challenges as well. The following sections present findings on the opportunities, benefits and challenges.

5.2 Opportunities in Tutorial Presentations

A presentation of tutorial papers in class is probably the most critical activity that defines tutorial learning and teaching approach. Each group is given an opportunity to present their research topics in class for discussion, critiquing and defend their topics. These activities should be moderated by lecturer. The researcher sought opinions from both lecturers and students on how presentation should be conducted as summarized in Table 1 and Table 2 respectively. Table 1 presents the lecturer's opinions on tutorial presentations.

Table 1: Lecturer's opinions on tutorial presentations (N=31)

Statements	SA	A	N/O	D	S/D
A group should designate a main presenter.	51.6%	25.8%	6.5	12.9%	3.2
Presentations should be done using PowerPoint or similar software.	32.3%	51.6%	0%	16.1%	0%
Discussions should be moderated by the lecturer or his/her representative.	90.3%	9.7%	0%	0%	0%
Class members should be allowed to critique, comment or seek clarifications on the presentations.	93.5%	6.5%	0%	0%	0%
Students should be allowed to revise their tutorial papers after discussions before marking.	67.7%	16.1%	6.5%	9.7%	0%
Students should be allowed to access copies of all revised tutorial papers.	54.8%	38.7%	3.2%	0%	3.2%
Lecturer should recommend tutorial papers that can be preserved for use as supplementary study materials.	58.1%	35.5%	6.5%	0%	0%
Some select tutorial papers are of quality that can be considered for publication a journal	51.6%	45.2%	3.2%	0%	0%

It was observed that presentation and discussions should be done in class under the moderation and guidance from the lecturer. Groups should designate a main presenter: thus 51.6% of lecturers strongly agree and 25.8% agree. Assessment should be done for each group after presentation. Then groups should be allowed to correct and improve their papers which should then be marked and accessible to all groups. Table 2 presents the student's opinions on tutorial presentations.

Table 2: Student's opinions on tutorial presentations (N=234)

Statements	SA	A	N/O	D	S/D
Discussions of tutorial papers presented was very useful.	55.1%	40.2%	3.4%	1.3%	0%
Lecturer's comments on paper presentations were very essential.	55.6%	38.9%	5.1%	0.4%	0%
Students should be allowed to revise their tutorial papers before handing over for marking.	39.6%	37.6%	9.8%	2.6%	0.4%
I used my tutorial paper to revise for exam.	40.6%	46.6%	6.4%	5.6%	0.9%
All tutorial papers were useful revision materials for the exam.	35.5%	40.6%	11.5%	9.8%	2.6%
Students should be allowed to access copies of all revised tutorial papers.	53.9%	36.3%	7.2%	1.7%	0.9%
Tutorial papers should be preserved for use as supplementary study materials by future students.	45.3%	39.3%	9.0%	3.0%	3.4%
Tutorial papers can be considered as a manuscript for publication in a journal.	33.3%	49.6%	12.0%	3.0%	2.1%

Majority of students agreed that they not only used their tutorial papers to revise for exams but also papers from other groups. Thus the response to allow students to access all revised tutorial was overwhelmingly high at 53.9% (strongly agree) and 36.3% (agree). A comparable observation was made from lecturer 54.8% (strongly agree) and 38.7% (agree). Further the lecturers agree they should recommend tutorial paper that can be preserved for future use as supplementary study materials. Students do agree with this view as well. Quality of some selected papers is good and both students and lecturers agree they can be considered for publication in a manuscript or journal.

All lecturers agreed that discussions should be moderated by the lecturer, however there was a concern on the class size where majority disagree that it has no significant influence on the effectiveness of presentations.

5.3 Benefits of Tutorials

Learning through a group discussion tutorial has its benefits particularly those that enhance student overall experience. Tutorials help learners gain a number of competences and skills. Table 3 and Table 4 show responses from both lecturers and students respectively, on the extent they agree that certain skills and competences are gained.

Table 3: Opinion on skills and competences by lecturers, N=31

Skills and competencies gained through tutorials	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
Research skills.	83.9%	16.1%	0%	0%	0%
Writing skills.	74.2%	25.8%	0%	0%	0%
Information searching skills.	83.9%	12.9%	3.2%	0%	0%
Presentation skills.	87.1%	12.9%	0%	0%	0%
Referencing and citation skills.	61.3%	38.7%	0%	0%	0%
Confidence in defending research opinions.	80.6%	19.4%	0%	0%	0%
Collaboration with other students.	77.4%	22.6%	0%	0%	0%
Plagiarism awareness.	64.5%	29.0	6.5%	0%	0%

Table 4: Opinion on skills and competences by students, N=234

Skills and competencies gained through tutorials	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
Research skills.	75.6%	22.7%	1.3%	0.4%	0.0%
Writing skills.	59.8%	38.0%	0.9%	0.45	0.9%
Information searching skills.	70.1%	26.9%	2.6%	0.0%	0.4%
Presentation skills.	68.8%	27.4%	3.4%	0.4%	0.0%
Referencing and citation skills.	52.1%	40.6%	4.3%	3.0%	0.0%
Confidence in defending research opinions.	62.4%	30.8%	6.4%	0.4%	0.0%
Collaboration with other students.	57.3%	37.6%	3.9%	1.3%	0.0%
Plagiarism awareness.	43.6%	41.0%	9.8%	4.3%	1.3%

These skills include: research skills; writing skills, information searching skills; presentation skills and competences like collaborating with others and defending research opinions. Both the lecturers and student strongly agree on these benefits regarding tutorial experience. It is important to note that lecturers play the role of promoters for tutorial teaching approach while students are the beneficiaries. Responses on benefits regarding group tutorials learning and teaching approach from both lecturers and students are indeed quite comparable as much as one is the provider and the other the receiver. This is a good indicator for the effectiveness of tutorial approach in impacting these skills.

5.4 Challenges Associated with Tutorials Learning Approach

While the responses show that learning and teaching using tutorial groups has great benefits, it however important to note that there are challenges associated with tutorial teaching approach. Both the lecturers and students identified some of the challenges associated with the tutorial groups learning approach. Tables 5 and Table 6 show opinions by lecturers and students respectively, on the challenges in using tutorials as a method of teaching and learning.

Table 5: Challenges of tutorials by lecturers, N=31

Significance of Challenges/Issues	Ext Significant	Very Significant	Significant	No Opinion	Not Significant
Some students getting the opportunity to dominate on others.	32.2%	22.6%	45.2%	0%	0%
Discussions being dominated by few members.	25.8%	29.0%	38.7%	3.2%	3.2%
Tutorials encouraging laziness and aloofness among some students.	25.8%	19.4%	22.6%	9.7%	22.6%
Lack of relevant reference materials on the topics.	25.8%	16.1%	16.1%	12.9%	29.0%
Lack of skills to search for relevant and appropriate information resources.	25.8%	19.4%	29.0%	9.7%	16.1%
Lack of appropriate skills in using institution's online learning systems.	19.4%	32.3%	32.3%	0%	16.1%

Table 6: Challenges of tutorials by students, N=234

How significant do the following challenges or issues hinder the effectiveness of tutorials?	Ext Significant	Very Significant	Significant	No Opinion	Not Significant
Some students getting the opportunity to dominate on others	20.5%	28.2%	26.1%	15.1%	10.3%
Discussions being dominated by few members.	21.8%	33.8%	24.4%	11.5%	8.6%
Tutorials encouraging laziness and aloofness among some students.	20.9%	20.9%	24.4%	20.5%	13.3%
Difficulty in scheduling meetings among group members.	26.9%	27.8%	30.8%	8.6%	6.0%
Lack of relevant reference materials on the topics.	22.7%	25.2%	26.9%	13.3%	12.0%
Lack of skills to search for appropriate information resources.	25.2%	23.9%	24.8%	13.7%	12.4%

Challenges that were most significant include: some students getting the opportunity to dominate the discussions and some students demonstrating laziness. Other significant challenges were lack of relevant reference materials on the topics and lack of skills to search for relevant and appropriate information resources. These challenges were observed from both students and lecturers.

In addition, some there are difficulties in organizing discussion groups. One lecturer observed that "Tutorials demand more time, it may not be effective for big classes" and some students remarked that. "some groups face difficulty in scheduling group meetings", there is "difficulty in keeping time…" and "absenteeism" was another expressed challenge. Also noted is that there may be bias on part of the lecturers where they may not pay attention to all groups in equal measure as one lecturer commented "... it is difficult to offer equal opportunities to all groups", and a student observed there is "inadequate moderation by the tutor".

However, most students and lecturers agreed that tutorials are important and suggested every student should have an opportunity to participate in group tutorials in the course of their learning at the University. Some comments from students were: "Tutorials are effective in building scholarly ability among learners"; another was "Tutorials are good since they encourage students to do more research hence enhancing their research skills" and noted tutorial approach is "… a noble program that should be encouraged in all levels in each School".

5.5 Overall Opinions about Tutorial as Teaching Method

Both lecturers and students have a general positive opinion on tutorials as a teaching method that encourages engagement and helps student gain many educational skills. They have frequently used the words such as “useful”, “helpful”, “effective” and “important” to express their opinions. Some comments below illustrate opinions by students about tutorials.

- It is extremely important
- It is effective to enhance learning.
- Effective if presented under close supervision.
- It is effective method that enhance learning process as students gain what the lecturers could not have taught.
- This method is very important because it enhances the students understanding on certain topics. I prefer tutorials than lecture method.
- It is good teaching method. Enables a student to actively participate in the unit he/she is undertaking.
- It is a very important of making students do more research and gain more confidence while presenting.
- It can be sometime be very effective if only more resources and time can be allocated to it.
- It is the best teaching method.
- Very effective and efficient because learners tend to engage in other effective learning approaches other than lecture, question and answer.
- Tutorials are very important and should be encouraged because it increases participation and confidence in students.

6. Integrating Cloud Computing in the Management of Tutorials

Cloud computing has recently gained popularity in learning institutions for the management of ICT systems. As a critical enabler to learning and teaching, ICT, is a critical tool and it is prudent for institutions to use the most efficient solutions (Avram, 2014; Bhaumik, 2012; S. Okai et al., 2014). Cloud-based systems have tremendously saving in infrastructure, networking, applications, deployment, maintenance and support (DinCloud, 2021; Ercan, 2010; Singh & Baheti, 2017). The researcher undertook development, testing and evaluation of cloud based Tutorial management system (Tutmas) to enhance the management of tutorial learning and teaching pedagogy at Kenyatta University.

6.1 Tutorial Management System (Tutmas)

Tutmas, a cloud-based tutorial management system was designed and developed following the observations on how tutorials are conducted at the University. The development process adopted agile software development (ASD) approach from a basic online system with features for setting up classes, creating tutorial groups and assigning topics to an advanced cloud-based tutorial management system. Additional features include functionality for scheduling presentations, uploading tutorial papers for sharing, embedding link for online group meetings and tracking students tutorial group activities. During the development due consideration to ensure friendly user interface, easy deployment, conserve skills and competences associated with group discussion were not compromised but rather enhanced.

6.2 Tutmas Features and User Interface

The development also was cognizant that the current trends in LMS is shifting from locally installed solutions to cloud based LMS accessible via the public Internet using proper credentials. The resulting online system was designed to have three user operational levels that include administrator, lecturer and student. Each level had a customized user interface to access to applicable set of features as summarized in Table 7. A sample student's interface is shown in Figure 3.

6.1.1 Tutmas Features

Table 7: Features in tutorial management system

Tutmas Feature	Student	Lecturer	Administrator
Setup course units and presentation schedule		√	√
Upload unit references and resources links		√	√
Update unit/group tutorial assignments and scheduling		√	
Enroll in a class	√	√	
Join a tutorial group	√		
Participate in group chat and 'collabo'	√	√	
Access to the course references and class notes	√	√	
Post schedules for group presentations		√	√
Post grades		√	
Access to group's tutorial papers	√	√	
View groups assignments and grades	√	√	√
View groups and individual statistics/analytics	√	√	√
Post a group virtual meeting link	√	√	√

6.1.2 Tutmas Student Interface

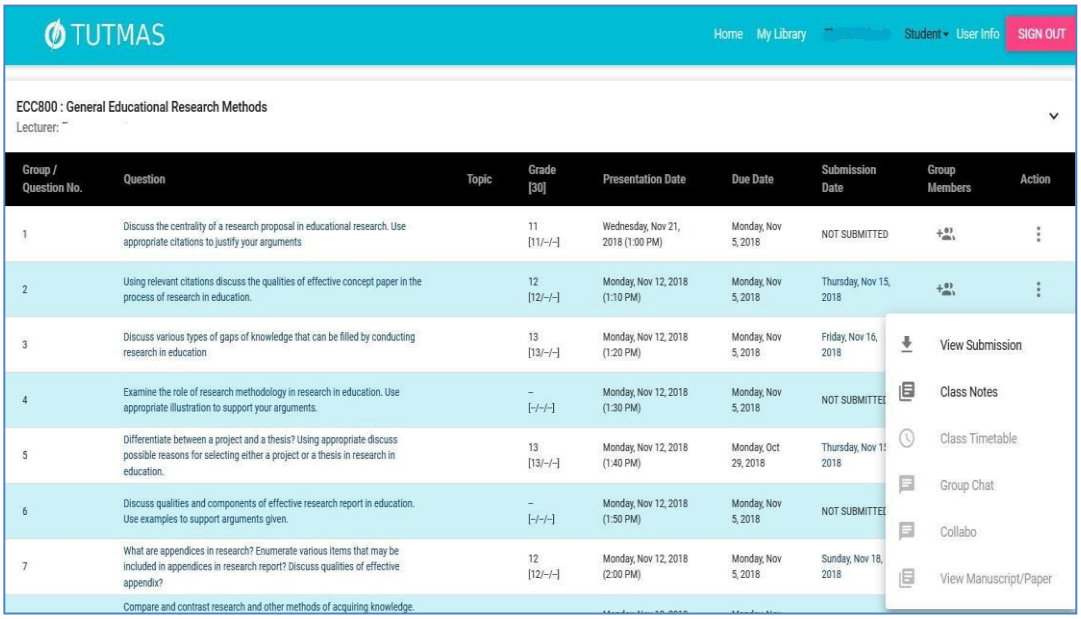

Figure 3: Student's interface

The student's interface provides the information about tutorial including unit code and title, name of lecturer, listing of all tutorial groups and topics, due date and presentation schedule. There is an icon to join, view group members or leave a group. A side menu is available to view the final submitted papers, group chats, access to class notes and 'collabo' that allow sharing tasks by group members.

6.2 Virtual Meeting Integration with Tutmas Platform

Tutmas platform integrates with virtual meeting applications such Google Meet and Zoom by updating a meeting link. Provision is given for establishing a virtual meeting link for the entire class as well as for each tutorial group. The virtual meeting link can also be shared either through the "Group Chat" or "Collabo" interface to initiate online discussions.

This feature was occasioned by the uptake of conducting online classes following the public health guidelines to protect against the COVID-19 pandemic. There has been a shift in the University to offer some lectures online to minimize contacts and adhere to social distancing. As a result, the tutorial group discussions were not done as has been the practice.

6.3 Tutmas Reports

These are reports generated from Tutmas platform that enable a lecture evaluate student's participation in tutorials as well as the fulfillment of assigned tasks. Some of these reports are class summary and statistical reports.

6.3.1 Class Summary Report

The class summary report provides information about class and tutorial group. A sample report is illustrated in Figure 4 and it can be viewed from the platform.

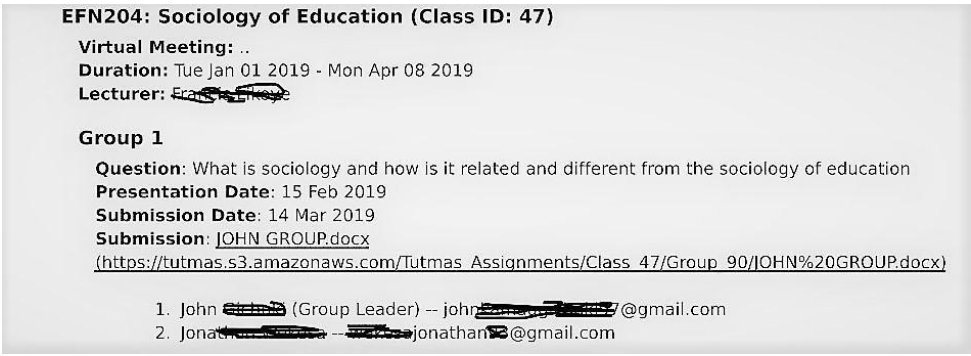

Figure 4: Class summary

The summary report gives information such as class and group members, topics to groups, member details such as names, emails and the group leader. It also gives the presentation schedule, assignment status (i.e. due, submitted or uploaded) and links to the final tutorial papers. A sample report is shown in Figure 4.

6.3.2 Tutmas Statistics and Analytics

The system maintains statistics of logs that can be analyzed to show how students have interacted with Tutmas platform and are indicators for collaboration activities within groups. Scheduling of group meetings, sharing of tasks and associated communication within the group support social interaction outside the classroom setting which is an important element for social constructivism. Important evidence is the final copy of tutorial paper uploaded by the group which is a result of inquiry by students and also a product for constructivism. Some of the statistics and logs are student enrollment in the class and groups, user logins, participation in the group's 'collabo' and chats, access to tutorial papers by class members, assessment and grading by the lecturer. These statistics are accessible online to both the lecture and students. In traditional process, without a suitable system such information can be difficult to access.

7 Students Perception in Using Tutmas

The essence of improving learning delivery systems is to enhance learner's experience, promote best teaching practices and improve access (Gan et al., 2020; Mhouti et al., 2018; Ouadoud et al., 2018). Tutmas is a tool to improve management of tutorials at the University. The researcher sought the experience of participants in terms of their learning activities, experience and skills as well as challenges.

7.1 Feedback on Using Tutmas in Tutorials

The researcher considered feedback on how students used Tutmas, a cloud based tutorial management system was used in tutorial method of learning. Since Tutmas is an online system it was important to know which devices students often use, where they often access the internet and which online channels

they use to reach out to group members. Table 8 shows the students responses in this regard while using the Tutmas platform.

Table 8: Using Tutmas platform

Description	Respondents	Percent
Device often used to access the Internet, N= 79		
Smartphone	47	59.5%
Desktop computers /PCs	17	21.5%
Laptop	12	15.2%
Ipad or Tablet	3	3.8%
Sub Total	79	100%
Where do you often access the Internet, N=77		
University Computer Labs	22	28.6%
Hotspots in the University	20	26.0%
University Library	19	24.7%
At Home	13	16.9%
Other	3	3.9%
Sub Total	77	100.0%
Channels of communication students use to reach out to group members, N=73		
Whatsapp	31	42.5%
SMS	19	26.0%
Face to face	14	19.2%
Phone call	8	10.9%
Email	1	1.4%
Sub Total	73	100.0%

As Table 8 shows, most students often 59.5% use Smartphone, another 21.5% use Desktop computers and 15.2% use laptops. Students often access the internet usually at the University's computer labs (28.6%), hotspot areas (26.0%) and the library (24.7%). A few do use Internet at home at 16.9%. WhatsApp (42.5%) and sms (26.0%) are the most popular channels student use to reach out to group members when planning on tutorial activities.

7.2 Accessing Papers by Other Groups

Tutorial discussion questions are derived from topics in the study unit, so students find it important not only to attend and participate in class presentations but also need to access final papers done by other groups. Some 76 students who used Tutmas and gave their feedback on how they accessed to papers from

other groups, 54 (71.1%) participants indicate that they downloaded from Tutmas platform, 25.3% did photocopying of the final papers, 17.1% had the presentation emailed while 6.5% used other means.

Traditionally students have often used various means to access content of presentations as shown in Table 9.

Table 9: Tutorial papers content sharing, N=234

Means of Sharing	Often Used	Occasionally Used	No Opinion	Never Used
Making photocopies of tutorial papers, i.e. Xeroxing.	49.6%	38.5%	5.1%	6.8%
Making notes during tutorial presentation.	56.8%	38.5%	3.4%	1.3%
Sharing copies of tutorial papers through emails	44.9%	30.8%	14.1%	10.3%
Sharing the papers through mobile applications such as WhatsApp	44.0%	33.8%	11.5	10.7%
Taking photos of screen shots or pages using mobile phone.	41.0%	40.2%	11.1%	7.7%
Copying files to external storage such as flash disks or CDs.	34.2%	44.0%	11.5%	10.3%

Making notes during tutorial presentation (56.8%) has often been the most popular way of accessing to the presentations, then making photocopies of tutorial papers (49.6%) and sharing papers through emails (44.9%) by students. Following the use of Tutmas platform for tutorial management it was indeed remarkable shift to sharing tutorial papers presented in class online from the traditional ways.

7.3 Virtual Tutorial Presentations

The researcher undertook further evaluation on Tutmas feature in handling virtual tutorial management with a group of 15 students of Bachelor of Library and Information Science students who were undergoing industrial attachment at the University Library. Each group selected a different tutorial topic on a service at the library and write a paper. They did the assignment in a tutorial approach and as guided in the Tutmas platform. Thus students enrolled in Tutmas platform, formed groups of 3 or 4 students and choose relating to library services as a tutorial topic, shared group tasks and were able to schedule discussion meetings. Presentations were done online as per schedule to all members including their lecturer and librarians who had supervised them at various library sections. Online discussion was done and the presentations assessed. Thereafter groups edited the papers and uploaded them for access by all participants. An evaluation on the students' experience and interactions with Tutmas was undertaken with 13 participants who completed an online questionnaire. Figure 5 gives the extent on devices used to access the platform by the participants during the virtual presentations.

All the participants (100%) had used the University's PCs to access Tutmas and 69.2% had used their mobile phone. This means that institutional facilities are important for access online platforms in addition to their mobile phones. Figure 6 shows which mode of messaging was used.

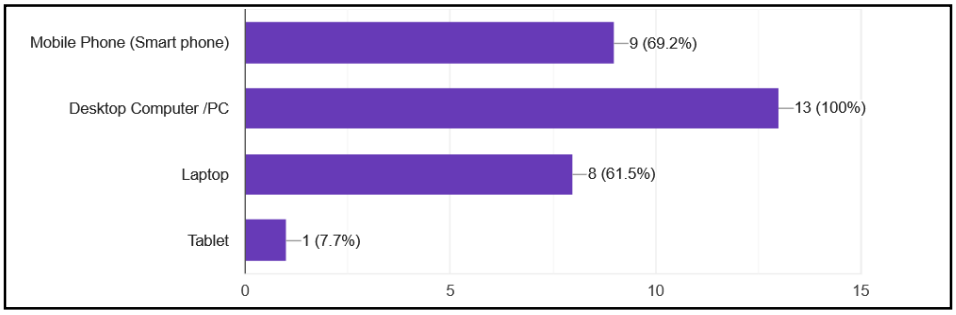

Figure 5: Device used to access platform

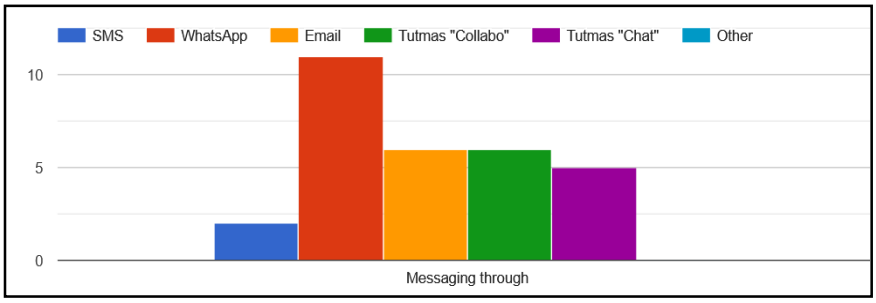

Figure 6: Mode of messaging to communicate among your group members

Regarding the mode of messaging to communication among group members during tutorials WhattApp was the most preferred with 11 (84.6%) out of 13 respondents using it followed by Tutmas' 'collabo' facility and emails.

Overall rating of the Tutmas by participants is shown in Figure 7.

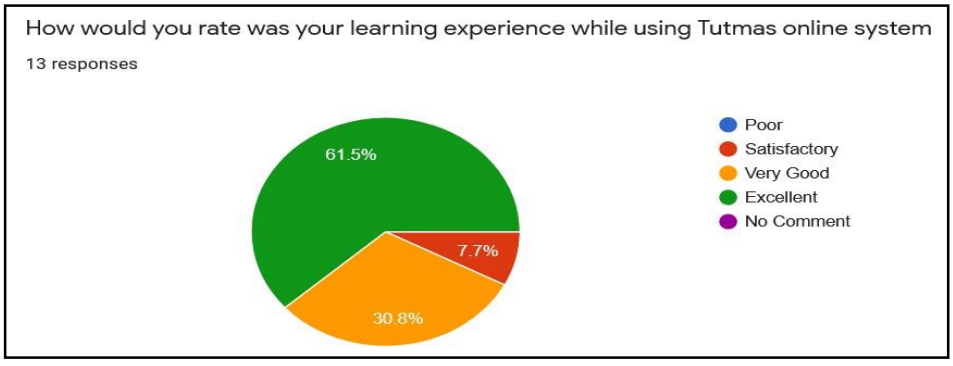

Figure 7: Overall experience and skills enhancement

Students had an excellent experience with Tutmas and which encouraged them on skills such as collaboration, communication and presentation skills. Following are some of the comments on their experience and skills gain

- Presentation skills- these are skills that one will need in future when on is infront of a panel.
- Group collaboration skills - through tutmas group members are able to collaborate their efforts.
- Communication skills. I have improved my communication skills since tutmas required time to time communication with my group members.
- Improves team work and sharing of task among members through collabo.
- Tutmas assisted us as a group in completing some activities given and also enhanced our research skills and communication skills.
- It was a good experience, making the attachment period as interactive, I got equipped with some skills such as presentation skills, which am sure will help me in future. The best part is having the papers we came up with available even for the groups in future making us fell that what we did was worthwhile.
- It improved my communication skills in the course of discussion using tutmas collabo. Tutmas is effective platform to give room for e-communication. Lastly, Tutmas improves my writing skills/typing skills when typing responses during group

7.4 Challenges with Tutmas Platform during Evaluation

During the evaluation of Tutmas the participants gave their opinions regarding challenges with the platform. The responses were summarized in three thematic areas: thirty-four, 43%, indicated Tutmas was not fast and this was mainly due to Internet issues. Another 19 (24.1%) indicated low participation by members which was attributed to lack of enough computers while 26 (32.9%) respondents said they faced no challenges.

8. Discussions and Conclusions

The paper has discussed how tutorials are conducted for teaching and learning, the perceived benefits by both students and lecturers had demonstrated how tutorials can be improved using cloud computing for better students' learning experience. It presents the design, development and testing of a cloud-based tutorial management system called Tutmas. Tutmas is a teaching and learning management system with features for lecturers to set up tutorial sessions and allow students to select tutorial questions, form discussion groups and schedule class presentations. A facility to upload final papers by groups and eventually becomes accessible to all other members of the class.

Tutorials approach in teaching naturally engages the learner during the learning period. They are engaged in research, writing and group discussion on the tutorial topic, presentation in class and compiling the tutorial paper to be shared to class members. The tutorial activities include three major elements in active learning, these are: discussions, research and writing, and teaching.

Class tutorials are principally initiated by the lecturer who identifies tutorial topics or questions from the course outline. The lecturer guides the students, gives an introduction and scope of the curriculum unit. This follows the formation of tutorial groups that picks assignment topics. Students then strategies on how to research and write on the topic then prepare a presentation to be done in class. At the end, students are required to do a final paper that is graded and made available for sharing among the other students. This is a holistic approach to active learning necessary to engage students. A worthwhile implication in this learning approach for all learning institutions is that use of class tutorial pedagogy is an important strategy as it supports major aspects that enhance student learning experience. Therefore, tutorials should be practiced, supported and encouraged in all learning programs.

In addition, tutorials are grounded in three major classical theories in education that include collaborative, constructivism and inquiry. Tutorials by design are inquiry based and takes collaborative approach when a group of students research on a topic and write for presentation in class. The process further encourages students to construct their own understanding and defend their scholarly positions. Bhaumik (2012) observes that ICT is an enabler to the process of teaching and learning and not a pedagogy. Tutmas as an ICT component enhances teaching and learning by having improved management of tutorials sessions and keeping records of tutorial activities for the instructor to inspect which encourages learners to keep on track. It is important that good learning management systems solutions should be hybridized on key learning theories, traditional pedagogy and practical activities (Abdallah et al., 2017; Ouadoud et al., 2018; Zuhrieh & Abulibdeh, 2017). An interrelationship between the learning theories that support active learning, tutorial activities and the features of Tutmas platform enhance the reasons to use tutorials.

Further, using cloud computing for learning management systems is beneficial to institutions because it offers virtualization technologies that help them break through economic and technical constraints associated with modern technology (Tomer, 2017). Cloud computing offers many benefits to learning including reduced hardware costs, inexpensive networks and centralised data (Okai et al., 2014; Shaw & De Sarkar, 2021; Thuku et al., 2019). It saves learning institutions a lot of cost overheads and relieves them “the hassle of procuring, maintaining and constantly upgrading IT hardware” (DinCloud, 2021). As observed by Okai et al., (2014) and Zuhrieh & Abulibdeh (2017) educational institutions that are prospecting about cloud based systems or need to upgrade their learning management systems should waste no time but jump ship and embrace the cloud solutions.

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