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An Adaptive Framework for Applying Cloud Computing In Virtual Learning Environment at Education a Case Study of “AASTMT”

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Abstract

This study aims to provide a Cloud Computing (CC) proposed framework using Application programming interface (API's) to deliver connectivity and interaction of Software as a Service (SaaS) in Virtual Learning Environment (VLE) system at higher education institute. The framework is adopted and implemented to enhance the existing VLE to meet the incremental increasing of users' needs and expectations. Different research's methodologies and techniques are used to measure the students and instructors satisfaction, and to measure the impact of the adoption of CC on business value for VLE as well. In addition, the study identifies and explores the idea of covering the gap between the advance of adopting CC as a new technology and the benefits of implementing cloud techniques in education. The findings of implementing the adopted framework equate the study expectations, where the user's satisfaction significantly increased compared with the existing system. The users found that the system performance and response to their tasks are improved. Meanwhile, the users found that the new adopted system make it easier for them to achieve their academic activities and goals.

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1. Introduction

Cloud Computing (CC) began to be deeply involved in educational sector globally, educational institutions adopt CC models in their virtual learning systems not only to take advantage of CC cost effective, CC make it easy for adopters to enhance their educational experience through the deployment of a lot of services that can be accessed anytime, anywhere with no worries about how the cloud and its services works, or where they are located. As well it helps the user to get rid of periodic maintenance operations to be handled by the service provider⁷.

In general, CC have three main deployment models public cloud, private cloud, and hybrid cloud, each model has its characteristics, as public cloud is available for open use by the general public¹. One of public cloud benefits is that, it can be larger than a private cloud, and all the risks removed from customer shoulder to providers. One of cons of the public cloud is the security and privacy issues, which is resolved in private cloud; the main purpose of the private cloud is giving the institution more control over resources, their data and security¹, in this model the cloud infrastructure can be owned and managed by the institution, a third party or combination of them. The hybrid model simply is a combination of different private and public clouds, some resources provided in-house and others provided through third parties.

As well, CC has three main services models Infrastructure as a service (IaaS), Platform as a service (PaaS), Software as a service (SaaS). IaaS provide on-demand, pay-as-you-use access to infrastructure resources, including servers, storage or network devices². PaaS besides infrastructure it provides operating system for developers (e.g., windows Azure). SaaS provides a software's that is provided from a vendor and made it available for public use (e.g., Gmail, and Hotmail), is usually provided through a public cloud provider.

The study survey of the current system found that there are some problems facing the existing VLE such, difficulty to respond to user needs, lack of timely, adequate information about user needs, lack of user involvement, lack of continuous communication among users.

The aim of this study is to present a CC based APIs to provide SaaS integration with the current virtual learning environment system to combine a range of services that helps improve the VLE experience to meet users' needs. The rest of this paper organized as follows: Section 2 gives an overview of API and briefly describes virtual learning environment. Section 3 presents some related work. Section 4 presents the proposed cloud-based framework and the methodology. Section 5 presents the experimental study and work results Finally, Section 6 ends this paper with conclusion and future work.

2. Background and fundamentals

This section will briefly illustrate the application programming interface and virtual learning environment.

2.1. Application Programming Interface

API stands for, a mechanism for code reuse⁶. Code reuse allows extend functionality of software and mashup services together that build on top of the work, rather than starting from scratch with every software⁶. API generally work as a software to software interface that can allow communication and interoperate in a secure way, with the same or other applications on different platforms or written in different languages, without the need to understand, modify the provider code. The main purpose of integrating APIs is to enhance the functionality of the intended system.

Web services API's development is usually done using Representational State Transfer (REST) and Simple Object Access protocol (SOAP)⁸.

2.2. Virtual Learning Environment

Virtual Learning Environment (VLE) it can also called "learning platforms" It is a set of teaching and learning tools designed to enhance a student's learning experience by including computers and the Internet in the learning process³, including web based access to class content, grades, assessments, and other class tools.

Many university campuses around the world have adopted VLEs to create a virtual classroom where students and teachers share information. However, VLE can offer similar teaching opportunities to traditional ones, which can be used to make more productive, enhance, facilitate, support traditional teaching methods¹², but there will always be the need for human interaction. So VLEs should not be seen as a full substitution for physical presence teaching. VLE systems facilitates some educational processes for the teachers and student in university (e.g., content management, communication, collaboration, administration, syllabus planning).

3. Related work

This research field has a lot of related contributions Al-Zoube⁴ Presented web-based virtual and personal learning environment solution based on Cloud Computing which combines a wide range of services that create an interactive tool for education based on services available in the cloud.

Sultan⁵ provide Google Apps (Education Edition) solution at the University of Westminster as Cloud Computing platform service instead of the old used email system, cloud services helped to fix two problems, that the forwarded emails by the university to the students personal emails was treated as spam and were being blocked on many occasions, storage issues google provide them with 7 Gigabyte of free storage to each user, and Another issue that made the university to adopt this solution is the economic reasons, the cost of using Google Mail was literally zero.

Sclater⁹ compared between the services provided by some of VLE systems, as mentioned Sclater illustrate that Moodle system provide majority of the functions of a VLE but it will be weaker if educational institutions does not take advantage of the cloud free services provided from (e.g., google apps for education).

Khedr¹⁰ used a case study to explore the impact of the adaption of the three dimensional analyses model: (Student – Staff – University) on e-learning implementation and evaluation. The study found that e-learning can be cost effective solution, and provide better opportunities for self-study.

Barker and Gossman¹¹ investigate by their survey the impact of using Moodle VLE system on learning, based on three questions, if the use of a VLE has a positive impact on student learning; and whether the use of a VLE increases students' motivation to learn. The statistically significant findings report that the use of Moodle produces improvement in learning and motivation to learn as reported by the student participants.

4. Research Methodology

An adaptive framework is applied to meet the study aim, and descriptive statistics is used as a statistical technique. In addition a structured questionnaire is used as a tool for collecting primary data to analyze the quantitative data of the research and results is analyzed through SPSS statistical software.

The main objective of statistical analysis part is to investigate students' and faculty members' satisfaction regarding the existing Moodle VLE and after the new added features. Base on this objective, the sample was selected to represent the target population. The students' sample represented 1/5 of students' body in business department in Arab Academy for Science and Technology and Maritime Transport (AASTMT) Dokki branch, while the sample size of the faculty members represented almost half of the faculty in the department.

The sample was not a probability sample however, the researcher attempted to represent all the segments in the target population and the data have been weighted to reflect the actual size of each segment within the targeted population. Segments were defined in terms of the academic year and gender for the students and in terms of academic position (instructors, teaching assistant and professors) and gender.

Assessment of students and faculty opinion was carried out by undertaking two surveys. In the first, namely the pilot study survey, a sample of students and faculty were asked about the degree of satisfaction regarding the actual features of the old system. The second survey was carried out after explaining and introducing the main new features of the new system which included social Media activities (Facebook-Twitter), Google drive (docs, sheets, presentations), YouTube video streaming (e.g., lectures, content, experts, etc.), Web-Based Videoconferencing (Skype), Audio Media (Sound Cloud). Besides satisfaction was measured by means of 5 dimensions, that is, ease of use, accessibility, usability, awareness, and technical. Users are asked the same questions before and after the implementation to compare between the answer by mean of satisfaction.

This study applied the public cloud model and SaaS service model to integrate some new services to enhance current VLE system to increase user's satisfaction. Meanwhile this can't be called a hybrid model, because the current VLE system is already deployed in servers that is not applying CC concept on it.

this study used for experimental study Moodle version 2.7, the API's created using PHP scripting language, Apache HTTP Server which is used to run the web server under Windows environment to make a local host to test the functionality of the new system, and MySQL to deal with the database

The study adapted the Moodle as one of the most known and used VLE systems in universities, It is the place where lecturers upload learning materials (e.g., lecture slides, quizzes, hand-outs, assignments, reading links, audio and video) each lecturer assigning features and items according to what is most appropriate to the course needs. In addition, the students involved in the activities, only students registered and enrolled on a specific module are able to access the available course materials, they can asked to (e.g., submitting assignments, participating in discussions, contributing to wiki's or blog).

5. Proposed framework

The proposed system is designed and implemented to serve the educational process in a cost efficient way, through integrating new useful services with the current system to make users more attached, and to finish their tasks in less time and more professional way that fulfil their needs. Accordingly this study mashup some useful software's APIs to enhance the learning experience for both teachers and students, likewise can be accessed anytime at anywhere table 1 shows new services of the proposed system.

In the proposed solution social media API's (Facebook, Google+ and twitter) has been added to allow users to access the system by their social media user profile information, to personalize their Moodle experience. Once the API is successfully authorized the user, the system will be able to publish users activities to the news feed and profile pages of Facebook subject to users permission. Likewise users can add posts, comments, and likes to Moodle pages. To authenticate users access Facebook and twitter uses OAuth to provide authorized access to its API.

The course contents and other materials can be uploaded to the traditional system servers or, uploaded and hosted in Google Drive that have a lot of productive tools (e.g., docs, sheets, presentation) this study chosen google drive API to be integrated to the current system, which will let users use those productive tools inside the system pages, and likewise will reduce the amount of storage used to keep users files of users in the servers hosting the current system, as well will reduce the amount of upload traffic to the servers and switch it to the google drive cloud servers, which will help increasing the performance of the system. Another advantage for users is keeping their files for a longer period with using such service compared with the traditional one. Listed below some other applied services.

- YouTube API, used to play learning videos, instructor's tutorials, and also students can record or make their own videos and publish it into the Moodle context.
- Sound cloud API, is used for playing the audio media files, instructors could use it for voice announcements.
- Skype API is used for video calls between the users.

Table 1: Features of the proposed system

Feature	API	Provider
Sign up, login	Facebook app – Twitter – Google+	Facebook – Twitter - Google
Comments on topics	Facebook (comment, like, and share)	Facebook
Storage	Drive	Google
Productive tools	docs, sheets, slides (Drive)	Google
Video Media(record and upload)	YouTube	Google
Video Calls	Skype	Skype
Audio Media	Sound Cloud API	Sound cloud

Integrating the Cloud Computing techniques for delivering such services to enhance current VLE system will give more flexibility and functionality which solves some of the technical issues addition to increasing the user satisfaction. There are main components in proposed architecture as shown in figure 1.

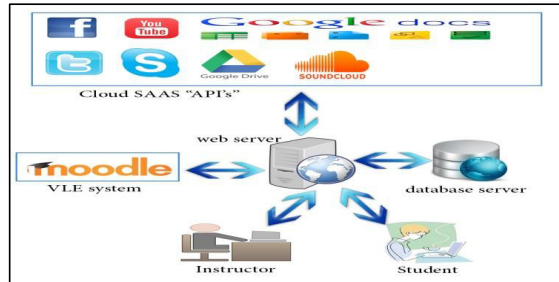


Fig. 1: General overview of the proposed framework components

The proposed architecture is composed of the following components:

- **Users:** represents the academy faculty members and students that use Virtual Learning system content.
- **VLE:** represent the current Moodle system, which contains a Service catalogue: contains different types of services with detailed information about the additional access information, such as where the service is located and who can access this specific service. Likewise Monitoring: monitor user activity through the system services, works as event viewer, filter, and sort data.
- **Service provider:** represents the public cloud providers that deliver their SaaS to public use.
- **Public Cloud - SaaS "API's":** Each API function as a gateway that provides access to hosted services or tools on the public cloud and is generally based mainly on the REST and SOAP needed for the current system enhancement,;
- **Database server:** it contains the academy confidential data that requires more control and likewise need to be secured by the academy, without having to give them to a third-party cloud provider to be under his control.
- **Web server:** serve the primary web interface of the system and works as a middle tier, accesses the database server using the language of the database (MySQL) to retrieve and deliver the necessary content to the web server then sends this information to users via HTTP using HTML.

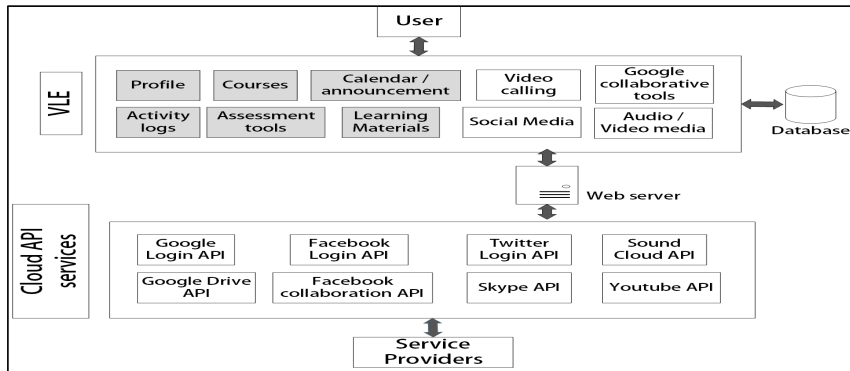


Fig. 2: Proposed framework architecture

6. Experimental study

This section is divided into two subsections, the first section describes the proposed system implementation, and the second section illustrates the questionnaire results.

6.1. Cloud-based VLE system

As mentioned early this study mashup some cloud services to current VLE system, some screenshots of the implemented system shown in the next following figures.

The below Fig.4 represent a file picker for (e.g., discussion blogs, assignment delivery) and as well can be used across the system pages, as shown at the left user can use the available services, besides the traditional system server files, there are new integrated SaaS (e.g., Google Drive, Sound Cloud, and YouTube videos) that need users login information to access his desired files.

After the user successfully login the provider servers ask the user if he approved the integration with the desirable system, if the user accept to allow the system to view his files and documents in (e.g., Google Drive), according to OAuth security to provide authorized access to its API. The user will be able to use his files from Google drive inside the system pages.

Another new added feature, the faculty member or the students, can record, upload, or present through the YouTube record API, inside the system pages without the need to go to YouTube page and then return to the system to use the link. That will reduce the steps used to use such service, and make the users focus in their core tasks.

6.2. Questionnaire results

The following Figures and explanation show a sample of the result of evaluation completed during the fall semester of the academic year 2014-2015.

Figure 3 shows the comparisons between the before and after opinion regarding the different current features of the system. And its indicates that there are a significant increase in satisfaction for both students and faculty members in using the discussion board after adding the new features, as mentioned the number of students and faculty members that never used the discussion board in order decreased by 15 %, and 10.8 %, the satisfaction increased by 29 %, and 24.2%, the one's how neutrally responded decreased by 2.1 %, and 2.3 %, finally the dissatisfaction decreased by 11.1 %, and 11.1 % , that means that most of users that turned to be satisfied are the dissatisfied users , cause the percentage of users answered neutrally almost the same.

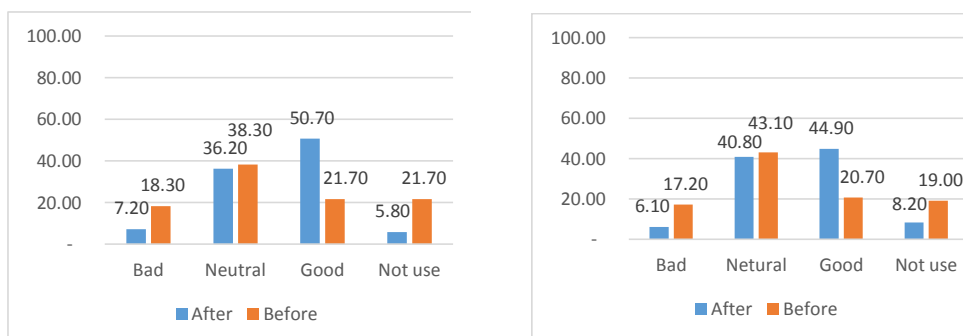


Fig. 3: (a) Students opinion asynchronous discussion forums; (b) Faculty member opinion asynchronous discussion forums.

This part contains questions about the new added services (Social Media activities (Facebook-Twitter), Google Drive (docs, sheets, and presentations), YouTube video streaming (e.g., lectures, content, experts, etc.), Sound Cloud (Audio Media), and Skype Web-Based videoconferencing). The following figures show the rating of these features by students and faculty members.

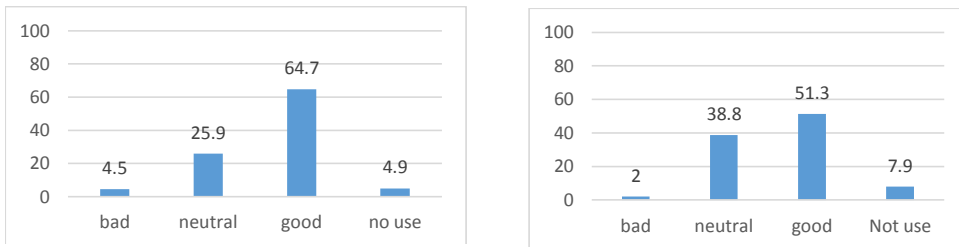


Fig. 4: (a) Students opinion social media activities; (b) Faculty member opinion social media activities.

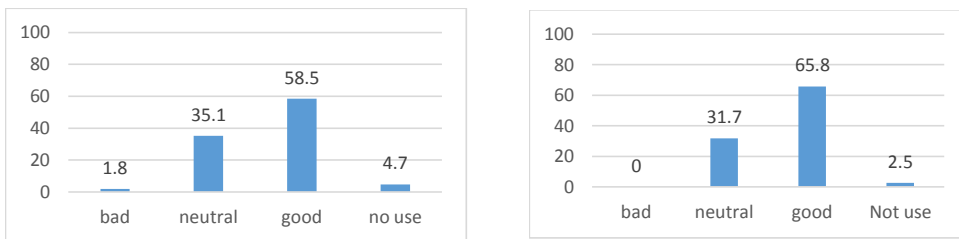


Fig. 5: (a) Students opinion Google Drive (docs, sheets, presentation); (b) Faculty member opinion Google Drive (docs, sheets, presentation).

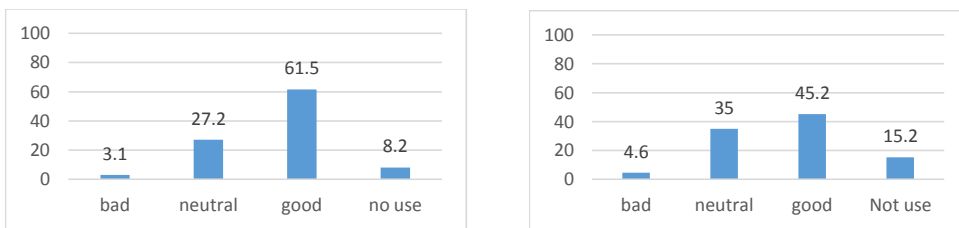


Fig. 6: (a) Students opinion YouTube (e.g. Lectures, content); (b) Faculty member opinion YouTube (e.g. Lectures, content)

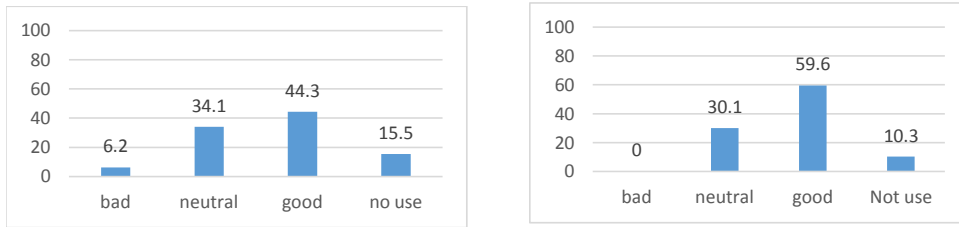


Fig. 7: (a) Students opinion Sound Cloud audio media; (b) Faculty member opinion Sound Cloud audio media

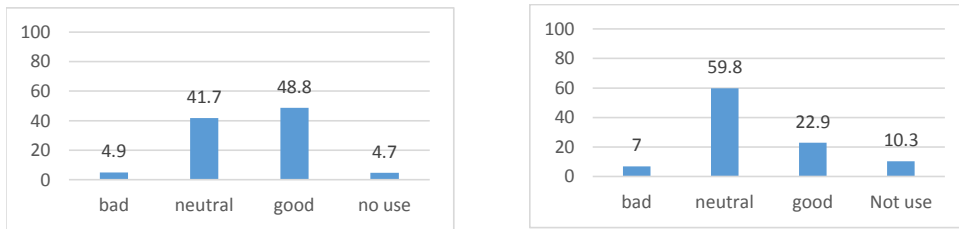


Fig. 8: (a) Students opinion Skype Videoconferencing (b) Faculty member opinion Skype Videoconferencing

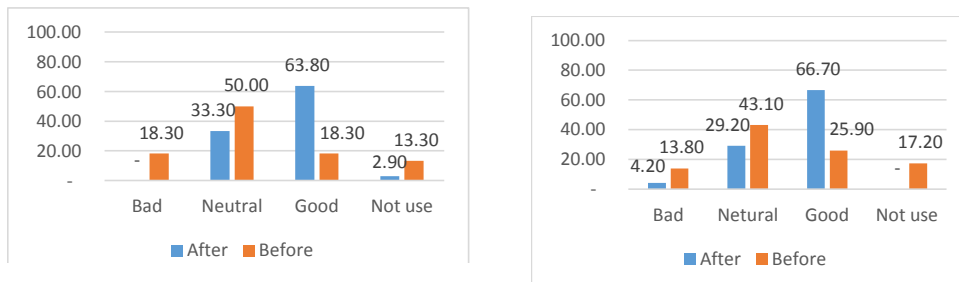


Fig. 9: (a) Students opinion overall VLE system experience (b) Faculty member opinion overall VLE system experience

7. Findings analysis and discussion

The findings of implementing the adopted new features equate the study expectations; the findings show that there is a significant increase in satisfaction in the comparison of before and after implementation of the new features. The percentages of students who are satisfied with the overall adapted VLE are increased. The range of increment mounted from 40 % to 71 %. As well as, the significant decline in the level of dissatisfaction is ranged

from 10 % to 2.9 %. So, we can conclude that most of the study sample test is satisfied of the whole features provided by the adapted AASTMT system.

8. Conclusion

This study is attempting to apply a new proposed cloud-based framework to enhance AASTMT VLE system. The findings of this research found that the number of users that uses the VLE system is low, as well the communication between the students and faculty member by mean of technology is likewise low and is not motivated by the actual facilities used by users in their daily life, and users expectations compared to the real deal don't reach the actual users' needs. The research used an experiment through the implementation of the new system and used the sampling test, it is a reliable tool to examine and measure user satisfaction.

To conclude, the overall finding shows that the satisfaction is significantly increased toward both segments of the targeted sample (faculty members and students). Therefore, it can be concluded that the implementation of the cloud computing SaaS in VLE is expected to enhance the system functionality besides meeting the increasing needs of user's, and maximize the benefits they gain through their online educational experience.

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