The use of Software as a Service by Students in Higher Education Institutions
A Systematic Literature Review

Akinlolu Olumide Akande
Department of Information Systems
University of Cape Town
Cape Town, South Africa
+27723135908
Akinlolu.Akande@uct.ac.za

Jean-Paul Van Belle
Department of Information Systems
University of Cape Town
Cape Town, South Africa
+27216504256
Jean-Paul.Vanbelle@uct.ac.za

ABSTRACT
In this paper, we provide an overview of the concepts and structure of cloud computing and then focus on Software as a Service (SaaS) because it is the most common cloud computing service model adopted by higher education institutions (HEIs) [29]. SaaS is a service model of cloud computing that has the potential to provide students with improved academic experience by providing them with anytime anywhere access to learning, communication and collaboration materials [28]. It has the potential to turn around the delivery and support of educational services [26]. In this paper, we review the literature on the use of SaaS by students in HEIs. A total of ninety eight recent articles on cloud computing/ SaaS in Higher Education were reviewed and twenty six of the articles were found to be relevant to this paper. This research used a systematic literature review by ensuring that the search terms included all the concerned areas of using cloud computing/ SaaS in HEIs. The contents of online electronic databases including Google Scholar, Elsevier Science direct, Springer Link and IEEE were searched for recent articles and a content analysis of all the identified papers was conducted. The aim was to identify the current state of student’s use of SaaS in HEIs. To achieve this, the researchers conducted a systematic review of the relevant papers. This paper also explains SaaS in details and identified the benefits of SaaS as well as the perceived obstacles to student’s use of SaaS in HEIs.

CCS Concepts
• Networks ~ Cloud computing • Applied computing ~ Education

Keywords
Software as a Service; SaaS; students; higher education; higher education institutions; academic environment; improve.

1. INTRODUCTION
The financial crisis, high cost of upgrading existing licensed software, high cost of software licensing and the increase in the number of students [26] [28] has led Higher education institutions (HEIs) to look for cheaper alternatives to provide their students with software and applications needed to create a conducive academic environment [19].

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ICCE ‘16, August 17 - 19, 2016, Suwon, Republic of Korea
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ACM 978-1-4503-4222-3/16/08...$15.00
DOI: http://dx.doi.org/10.1145/2971603.2971604

As a result, HEIs are increasingly adopting SaaS because it provides mobility, scalability, interoperability, accessibility and user satisfaction while using software and applications [17]. SaaS creates the opportunity to improve educational services [26].

It is important to note that the use of SaaS does not automatically translate to development of a conducive academic environment but the activities performed with SaaS such as collaboration, interaction, monitoring the progress of students, downloading as well as uploading of academic materials etc. [21] will lead to an improved academic environment and consequently improve the performance of students.

For students to do well in their academic activities, effective learning is important. Nowadays, information and communication technologies (ICTs) are important tools that aid student’s effective learning. Effective learning encourages reflection, allows dialogue, promotes collaboration, applies the theory learned into practice, creates a community of peers, allows creativity, and motivates students [15]. SaaS has the potential to provide students with all these features of effective learning and can therefore lead to the creation of a conducive academic environment for students.

One of the most significant benefits of SaaS for students is the improved access to software and applications since students can now access software and applications via several devices including their mobile phones. Students are now able to access, share and synchronize learning materials that are stored in the cloud at anytime from anywhere [6] [11] [15].

This research is intended to help HEIs understand the benefits and limitations of SaaS and to provide them with knowledge on what kind of SaaS offerings are available to assist students in their everyday learning. This paper has the potential of motivating students to be actively involved in the use of SaaS for academic purposes. It also has the potential of encouraging HEIs to provide students with resources needed to access SaaS. This paper has the potential to change the way students in HEIs view SaaS as it sheds light on the benefits of SaaS as well as its limitations. This will assist students and HEIs in finding ways to maximize the benefits and minimize the limitations to effectively use SaaS and create a conducive learning environment.

2. CLOUD COMPUTING
Cloud Computing has found its way into HEIs and there is no doubt that it is here to stay because of the positive impact it is making in contributing to the improvement of academic environments for students. Cloud Computing is provision of computing resources like software, applications, hardware, platforms and infrastructure to users on a pay as you go basis over
the internet [29]. There are four deployment models of cloud computing. These are private cloud, public cloud, community cloud and hybrid cloud.

### 2.1 Private Cloud
In a private cloud, a higher education institution (HEI) would own the infrastructure and either manage it themselves or let a service provider manage it for them. This kind of cloud deployment model gives the HEI more control over their infrastructure and data because the infrastructure is dedicated to them [29].

### 2.2 Public Cloud
In a public cloud, the infrastructure is made available by the service provider to the general public and anyone who wishes to make use of the infrastructure could contact the service provider to subscribe. It could be an individual, organization, government, HEI etc. The user has less control over the infrastructure and data because the infrastructure is owned and managed by the service provider [29].

### 2.3 Community Cloud
A community cloud on the other hand is a type of cloud in which two or more organizations with the same goals have a shared infrastructure. For example, all the HEIs in South Africa can share a dedicated infrastructure and it could be managed by the HEIs for they can appoint a service provider to manage it for them [29].

### 2.4 Hybrid Cloud
A hybrid cloud is a combination of two or more deployment models. For example, a HEI may decide to use private cloud for sensitive information like student details and records and use a public cloud for less sensitive information like email communications [29].

## 3. CLOUD COMPUTING SERVICE MODELS

Cloud computing has three main service models which are Software as a Service (SaaS), Infrastructure as a Service (IaaS) and Platform as a Service (PaaS). With SaaS, students would be able to access software, applications and course materials from any place at any time over any internet enables device including their cell phones. IaaS will make computing resources such as storage, processing and networks available to students over the internet. PaaS will allow students to develop and deploy their own applications giving them control over such applications [29].

Collaboration, storage of data, messaging, improvement of processing power and library science repositories are among the early uses of cloud computing in HEIs [13]. Among the different service models, SaaS is the most commonly used model in HEIs [29]. As a result, the focus of this paper is on SaaS and its usage by students in HEIs.

## 4. SOFTWARE AS A SERVICE

SaaS is a form of cloud service [3]. It is made up of systems that can receive, process, and deliver software and applications over a network. Examples include email systems, learning management systems (LMS), customer relationship management (CRM) systems and enterprise resource planning (ERP) systems [4][8]. SaaS can provide students with software and applications for writing documents, analyzing and collecting data, formatting and organizing references, communication etc. [5]. Google docs, dropbox and office 365 are popular SaaS offerings used by students in HEIs [18]. Other SaaS offerings are Petrosoft, Onlive, GT Nexus, Marketo, Trade Card, Rally Software, Salesforce and Callidus Cloud [23].

## 5. HIGHER EDUCATION INSTITUTIONS

A HEI refers to institutions of learning that offer education beyond the secondary level [25]. This includes universities, technikons, colleges, polytechnics etc. HEIs have connections with government and business organizations [2] and play a vital role in building the society [19]. In order to continuously contribute towards the development of societies, HEIs have consistently looked for ways to provide education to their students at low costs. SaaS is one of the technologies currently being used by HEIs to achieve these goals.

### 5.1 Software as a Service in Higher Education Institutions

Many HEIs have adopted SaaS because of its promises such as cost reduction, scalability, flexibility, pay per use model, accessibility etc. Software and applications available through SaaS are being used by students in HEIs mainly for collaboration, content delivery, communication and accessing learning materials [13]. The economic advantages, speed, agility, flexibility as well as infinite elasticity of SaaS which leads to improved educational services [26] for students is one of the main reasons why HEIs are increasingly adopting SaaS.

### 5.2 How students can benefit from Software as a Service

SaaS makes it easy for students in HEIs to access software and application from anywhere at any time without having to install the software or applications on their computers. This will save them time because the time needed for the installations and maintenance of the software could be used for other academic activities. Software such as Google docs, Drop box and YouTube are available for free [14] [22] to students in HEIs to access study materials such as lecture notes, video, articles, eBooks etc.

In cases where the software is not available for free, the pay as you go pricing model of SaaS allows students to only pay for the software whenever they use it. This assists the students in maximizing the utilization of the software and saving on cost as they only pay for what they use. Research has shown that SaaS has the capability of helping the users save a lot on cost. The University of Westminster in UK saved one million pounds in purchasing and maintenance costs by using Google docs and Google apps (at no cost) for productivity and collaboration [4] [22]. Students can also save time needed for upgrades as the SaaS is automatically upgraded by the service provider.

SaaS helps to improve the course delivery by making course materials available to students and lecturers anytime, anywhere [6] [11] [15]. It also ensures that students submit assignments on time as it keeps records of the time the assignment was submitted and allows the lecturer to identify late submissions and penalize the students that did not submit at the stipulated time. Learning management systems, library management systems and document creation systems are other SaaS offerings that support learning process [16]. SaaS allows students to easily share software and other learning materials with students from their institutions as well as students from other institutions. This improves collaboration among students. Another very important benefit of SaaS for students is backup and recovery. This is because the risk of data loss is minimized should there be any problem with the student’s device since the data is stored in the cloud [11] [12].
With SaaS, students are not restricted to be physically present in the classroom for lectures. Institutions should avoid replacing face to face interactions with the use of technologies [9]. They can participate in live tutorials and discussion forums. They can also download assignments and other course materials as well as view their course grades at anytime from anywhere [23]. Figure 1 is conceptual framework of the benefits of SaaS to students in Higher Education (HE).

SaaS also facilitates the creation of personal learning environment for students [2]. SaaS improves the accessibility of education to students. Students can access, edit and share learning materials through various devices such as computers, ipads, laptops or their cell phones [10]. The quality of teaching and learning in academic environments is also improved through the use of SaaS [2]. Figure 1 is a conceptual framework of the benefits of SaaS to students in HEIs.

5.3 Perceived obstacles to students use of Software as a Service

Students need to have internet connection in order to access SaaS. The cost of internet connection could therefore be one of the obstacles students would face to access a software or an application via SaaS. Poor connection speed and bandwidth may also affect student’s ability to access software and applications via SaaS. The free SaaS offerings also present students with unsolicited advertising which can be a source of distraction for students. As with other cloud computing offerings, security and privacy issues such as loss of control over data, interruption to services, and infringement of personal privacy are possible obstacles to the use of SaaS [16] [20] [27] [28].

The availability of lectures in the form of video via SaaS is believed to affect student’s attendance in class as students are expected to avoid classes because they can watch the video at a later stage via SaaS. Contrary to that believe is a surprising finding by [9] who found that the availability of class videos does not affect student’s attendance in lectures. Another perceived obstacle that students may face is that some applications may not run on the cloud. Managing of accounts could also be a problem for students. For example, if a student loose his or her access details like password, other students may have access to the students account and may copy things like answers to assignments which may lead to plagiarism. Students will also have limited control over data as the data will be controlled by the service provider. If the students feel uncomfortable with SaaS because of lack of confidence, it may affect their ability to use SaaS effectively. There may be possible interruption to cloud services for several reasons such as problem with internet services, poor bandwidth, upgrade interruption etc. This may affect students negatively as they might have a deadline to submit an assignment. There is also a possibility of infringement of personal privacy. Another possible obstacle is that students may be unwilling to learn new skills needed to effectively use SaaS. This would mean that they are not able to use SaaS effectively to achieve their academic goals. Figure 2 is a conceptual framework of the Limitations of SaaS to students in HEIs.

Figure 1: Conceptual framework of the benefits of SaaS to students in Higher Education

Figure 2: Conceptual framework of the Limitations of SaaS to students in Higher Education
6. THE MOST COMMONLY USED SOFTWARE AS A SERVICE OFFERING BY STUDENTS IN HEIs
The most commonly used SaaS offering by students in HEIs is Gmail which is used for communication [16]. This may be as a result of the security and privacy issues with SaaS.

7. STUDENTS INVOLVEMENT THEORY
HEIs are beginning to realize the importance of student’s involvement in all the activities on campus. As a result there is a focus on how students can be fully involved and contribute to the advancement and wellbeing of their institution [1].

Involvement is the amount of energy both physical and psychological that a student spends on achieving academic excellence [24]. Students need to be actively involved in their surroundings to be able to learn and grow [7]. A student who is highly involved is a student that spends considerable amount of time on campus interacting with fellow students and faculty members, is an active member of student organizations, and spends time and energy on his or her studies [24]. The theory of student involvement suggests that educators should focus more on what the students do rather than on what the educators do as the level of student’s motivation and the amount of time and energy the student spends on the process of learning plays an important role in the learning outcome [24].

SaaS plays a vital role in improving student’s involvement. With SaaS, students are able to interact with one another using their cell phones and other internet enabled devices such as ipads, laptops and PDAs. Students are also able to share information that contributes to the improvement of academic environments. Interaction with faculty members is also improved through the use of SaaS.

SaaS also improves student’s participation in student organizations and students are able to participate in activities like campaigning, voting, making suggestions, sharing information and knowledge which contributes to effective student governance and improved academic environment. Students also use SaaS for social activities such as networking and events organizing. SaaS therefore offers students the opportunity of enjoying a balanced life on campus. This gives students a feeling of self-belonging and gives them a positive experience and academic engagement, intellectual achievement, motivation and good health [1].

Apart from being able to communicate effectively with fellow students, faculty members and participating in student organizations, SaaS also supports students in their studies. Students are able to manage their time effectively using SaaS applications. They are also able to view and submit their assignments and other study materials. They are also able to view the course grades timeously using SaaS.

Because SaaS offers all the avenues for students to be highly involved on campus both academically and socially, we suggest that HEIs should come up with ways such as organizing training for students on how to effectively use SaaS so as to motivate students and increase their confidence in SaaS. This will also encourage them to use SaaS for activities that will contribute towards making the academic environment more conducive for learning and in turn lead to increased academic performance of students. HEIs should also assess whether the students are effectively using SaaS from time to time in order to ensure that SaaS is being put to effective use because all of the benefits of SaaS would not be realized if the students are not making use of it effectively.

8. EFFECTS OF SOFTWARE AS A SERVICE ON STUDENTS LEARNING PERFORMANCE, COMMUNICATION, COOPERATION AND SUSTAINABILITY OF HIGHER EDUCATION
SaaS has the potential to influence student learning performance positively. The anytime anywhere access to SaaS via any internet enabled device can encourage students to develop a culture of anytime anywhere learning which can positively affect their learning performance. The fact that there is no need for installation, upgrade and maintenance by students also mean that students can spend more time on important academic activities. This can also improve their learning performance significantly. Communication and collaborations among students and faculties would also be improved as materials can easily be shared from anywhere at any time. This will also improve students learning performance. Although SaaS has the potential to provide students with several benefits and improve their learning performance, students should bear in mind that SaaS also have limitations which can affect their learning performance negatively. To avoid negative impacts of SaaS on students learning performance and to maximize the benefits of SaaS, it is important for students to find ways to minimize the limitations. For example, poor bandwidth and reliance on the internet could affect students learning performance as access to SaaS would be disrupted by poor bandwidth and poor internet access. This would also affect communication and cooperation among students and faculties as internet access and good bandwidth are essential for communication and cooperation among students and faculties. In this open education era, uninterrupted internet access and good bandwidth are also important for the sustainability of higher education as they contribute to improved access to educational materials. They also help to improve communication and collaborations among students and faculties of HEIs.

Unsolicited advertising may also affect students learning performance as they may be tempted to spend time looking at the contents of the advertisement and this may lead to loss of valuable time needed to do academic work. Students may also miss classes intentionally due to the availability of class videos through SaaS. This may also have a negative effect on learning performance because students who are not present in class may not have the opportunity to ask important questions on the topic that was thought in class as the class video is not live.

Data protection and security issue is another factor that may affect students learning performance as there could be infringement of personal privacy leading to unwanted access of another party to the student’s personal data. This research found that some students do not have confidence in SaaS due to the fear of losing personal data to unwanted person. Some students are also unwilling to use SaaS because of their lack of confidence with ICTs due to lack of prior experience with ICTs.

9. CONCLUSION AND RECOMMENDATIONS
This research found that SaaS is common amongst HEIs. The researchers also found that students are willing to use SaaS but the effective use of SaaS is affected by student’s background and prior experience with technologies. Students who had access to
computers, internet, mobile phones and other ICTs were more confident using SaaS and are able to complete their tasks faster and more efficiently those students who did not have prior access to ICTs and only had access at the university level. This review also showed that students who use SaaS effectively perform well in their academic activities and are among the top students in the departments. The students that use SaaS effectively also developed confidence and are able to participate in group discussions both in the class room and online.

SaaS has found its way into HEIs and there is no doubt that it is here to stay. SaaS plays an important role in improving student’s access to learning materials. It also contributes to the creation of a conducive academic environment for students. HEIs should increase their adoption and implementation of SaaS so as to create a conducive learning environment for students. There are many benefits that students can derive from their use of SaaS. These include improved access to software, applications, educational materials, exposure to new technologies, backup and recovery etc. Although there are so many benefits that students in HEIs can derive from the use of SaaS, students need to be aware that there are also limitations associated with the use of SaaS. Some of these limitations include reliance on the internet, possible interruption to service, security and privacy issues, new skills requirements etc. In order to ensure that students use SaaS effectively, internet should be available at all times both at home and on campus. Students should also be trained on the new skills required to use SaaS effectively so as to increase their confidence in SaaS. Students also need to safeguard their access details to prevent unwanted access to their data. Students should also avoid being distracted by unsolicited advertisements when using SaaS as this may take a lot of their time and prevent them from doing their academic work. If students are trained on how to effectively use SaaS and they follow the recommendations in this paper, they would enjoy the benefits of SaaS and enjoy a conducive academic environment.

10. FUTURE WORK

There is a need to build on the foundation laid by this paper. The researchers would like to identify a set of guidelines that would assist students in HEIs in their use of SaaS to ensure that they use it effectively. It would also be necessary to develop a framework that HEIs can use in their SaaS adoption and implementation so as to be able to identify the right SaaS offering that would contribute to the development of a conducive academic environment for students. Furthermore, there is a need to extend this research to other cloud computing service offerings such as Infrastructure as a Service and Platform as a Service as they are also becoming popular among HEIs.

11. ACKNOWLEDGMENTS

The authors would like to thank God for the grace to complete this paper. This work is supported by the National Research Foundation of South Africa (NRF). We would also like to thank Chief Samuel Oladapo Akande, Mrs Florence Ajoke Akande and Nozuko Aurelia April for their advice and support.

12. REFERENCES


