Journal of Education and Practice www.iiste.org
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.6, No.3, 2015

Assessing Affordances of Selected Cloud Computing Tools for Language Teacher Education in Nigeria

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Abstract
This paper reports part of a study that hoped to understand Teacher Educators' (TE) assessment of the affordances of selected cloud computing tools ranked among the top 100 for the year 2010. Research has shown that ICT and by extension cloud computing has positive impacts on daily life and this informed the Nigerian government's policy to integrate ICT into education with teachers playing critical roles in this enterprise. For teachers to effectively integrate cloud computing into education they must first be able to identify the uses of these tools. It becomes necessary to understand TE's perceptions of the affordances of the newest ICT frontier for language teacher education. Participants in the study were randomly selected Nigerian TEs studying in the United Kingdom. They used the tools for various activities and their assessments measured against a checklist. They were also asked to think aloud while using the tools while the researcher took notes of what they said. Their assessments were classified according to thematic paradigms. The results indicate that TEs were able to correctly identify intended, perceived, unintended and false affordances. The implications for language teacher education include recognizing that enlightenment and training are critical for the integration of cloud computing tools into the classroom. Stakeholders should Consider Strategic development of basic ICT infrastructure. It may be more effective to use a comprehensive approach to adoption. Moreover there is the need for further studies with a focus on other levels of education and cloud computing tools.
Keywords: Affordances, Cloud Computing, Language Teacher Education

1. Introduction and Background Information

Language education in Nigeria is beset with problems like inadequate manpower (Durosaro, 2005; Jegede, 2007), empathy towards technology (Ajayi, 2010) and ineffective implementation of the National Policy on Education (Musa, 2012; Durosaro, 2005; Dauda & Ofemile, 1991) but, research has shown that Information and Communications Technology (henceforth, ICT) has positive impact on learner performance and supports innovation by teachers (Balanskat, Blamire, & Kefala, 2006). It positively stimulates teachers, makes classroom setting more stimulating and aids higher quality lessons (Lewin, Mavers, & Somekh, 2003).

Moreover, the Federal Government of Nigeria hopes to use ICT for education by integrating it into mainstream education (FGN, 2005) and Teacher Educators' (henceforth TEs) are expected play critical roles for successful implementation. Since cloud computing (Henceforth CC) represents the new frontier in ICT, there is the need to understand TEs perceptions of the affordances of selected cloud computing tools for language teacher education in Nigeria. This paper reports a study that tried to answer the question what affordances can cloud computing offer TEs in Nigeria.

2. Literature review

The review of literature focuses on cloud computing and characterisation of affordances because there is the need to understand the basic theoretical foundations upon which the paper is built.

2.1 Characteristics of cloud computing

The concept has been variously defined, but for the purposes of this paper, CC is as defined by Barnatt (2010:14)

> **Cloud computing is where dynamically scalable, device-independent and task-centric computing resources are obtained over the Internet, with any charges (where payable) being on a per usage basis. (2010:14)**

The International Data Corporation (henceforth, IDC) makes a distinction between cloud services and cloud computing. Services refer to consumer and business products, services and solutions that are delivered and consumed in real time over the Internet while, cloud computing is an emerging Information technology development, deployment and delivery model enabling real-time delivery of products, services and solutions over the Internet (IDC, 2008). I believe that IDC's distinction clarifies Barnatt's definition because it lists CC characteristics and functions

Firstly, CC provides services through an abstracted infrastructure called 'virtualisation' (Rhoton, 2008) at various levels while functionality is provided as a service which enables clear categorisation and characterisation of each level for example, Software as Service (SaaS), Platform as a Service (PaaS), Infrastructure as a Service (IaaS) and Human as a Service (Henceforth HuaaS) in the stack (see Lenk et al, 2009). However, the focus of this paper is SaaS which is described as "...a software deployment model in which an enterprise application is delivered and managed as a service by the vendor to meet the needs of multiple customers simultaneously" (Kaplan, 2009:2) for example Google docs and Dropbox

Secondly, CC is dynamically scalable (Barnatt, 2010) or provisioned' (Corporation, IDC, 2008). This implies that resources and services are offered in real time or near real time through finely grained or graduated Infrastructure systems based on perceived needs and consumption and supply of online resources is elastic like electricity for example, Google Docs and Dropbox are offered in different levels based on the ICT needs of the user.

Consequently, users are charged using flexible billing based on usage (Rhoton, 2010; Barnatt, 2010) and pricing arrangements with service providers enable technology costs to be highly scaled against revenues generated thus producing a favourable economy of scale for investors and consumers. This makes it possible for low budget organisations and individuals to access sophisticated services e.g. Google docs 20 GB storage costs $5 per year.

In addition, CC application software has '...a multitenant architecture and a rich variety of configuration options' (IDC, 2008) that enables models to be built around user objectives and needs not particular software, hardware or infrastructure. Resources are thus pooled together across customers to increase scalability, save costs and protect users. This enables google docs to become more economical to deliver and users enjoy continuous service upgrade without falling into the upgrade trap while benefits of industry best practices help improve vendor – customer relationship.

Furthermore, it is device independent (Barnatt, 2010), off premises (Rhoton, 2008) and not 'location-agnostic' (Corporation, 2008) thus enabling users access resources from any computer with internet connection for example, Google docs and Dropbox are designed to serve a highly dispersed user population by capitalizing on the ubiquity of the web such that I can access this work from any computer with internet connection.

Moreover, there is resource standardisation (Rhoton, 2010) in the system because the interface employed by both the user and service provider comes through a 'standards–based framework' and virtualisation (Rhoton, 2010; O'Reilly, 2005) for access and integration within the cloud environment at various levels. This means that users, network components and service providers use the web as platform to connect to one another giving the network leverage to provide high quality, secured and optimized applications to the user (Corporation, 2008) in the form of service.

Furthermore, SaaS consists of Basic Application Service and Composite Application Services that enable users to develop, run their applications, use the available IaaS infrastructure and create easy mashups of applications. Sturgeon (2006) describes mashups as "... the functionality of various online services to provide a new one." An example is the use of lucid chart, highlight and dictionaries to for editing presentations on docs and the combined use of over 36000 apps in dropbox to create new services by users.

CC is also characterized by resource democratisation through shared resources with common versions occasioned by universal access. Users customize shared resources through 'multiple collaboration' (Rhoton, 2008) using the configuration options available as done with the development of the Wikipedia by collaborators from all over the world.

Finally, all these characteristics are effective because cloud computing specifications are simplified for the user and thus requires minimal or low IT skills to implement and its administration is also simplified. For example, Google docs do not require skills beyond typing, drag and drop to utilize

2.2 Cloud Computing Tools used

The tools used are dropbox and google docs. Dropbox is a folder (fig 3) on a user's computer that synchronizes files online and across computers. Any files placed within it will be available on other computers with Dropbox, as well as the web. This means that all of your files are available from any computer that has an internet connection. Furthermore, any updates to the files within Dropbox will be updated across all other computers automatically and can be synchronized no matter what computer is used. Dropbox for business is connected to

over 30,000 apps that provide multilevel functionalities beyond the scope of this paper because, the free version was used for the research.

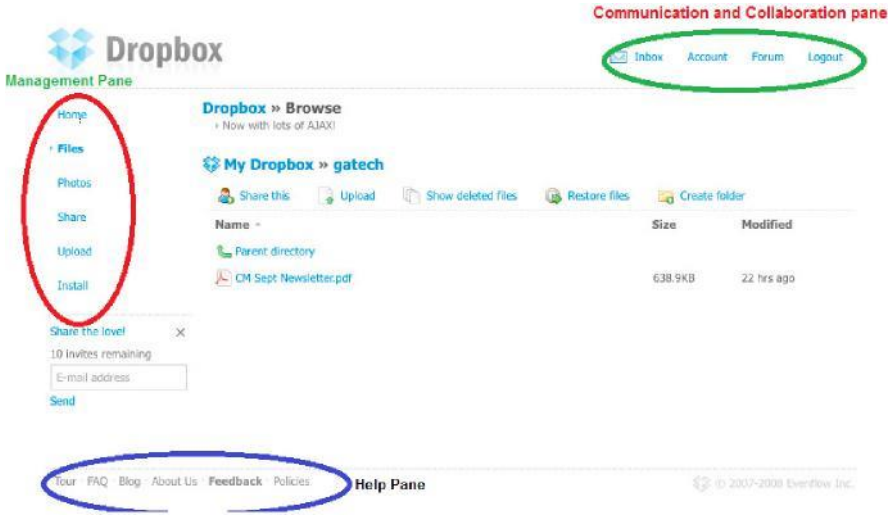

Figure 1: Dropbox Interface

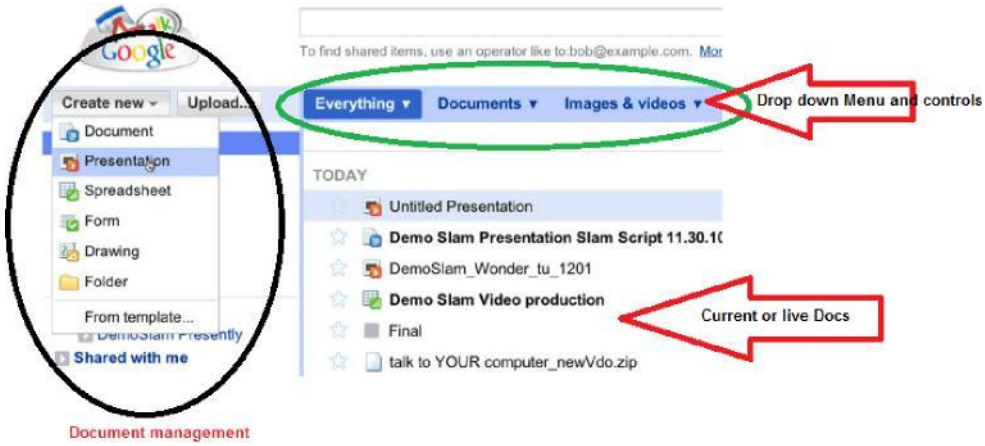

Figure 2: Google docs Interface

As at 2010, Google docs suite (figs 2) included a word processor, spreadsheet and presentation application like traditional office suites. It also has drawing and form creator applications. The interface is clean and user friendly cloud –based suite. It opens documents fast but when multiple documents tabs are open, it slows down to a crawl. It has collaboration features like many people working on a single document from different locations, ten people on word processing and presentation documents and fifty on a worksheet. A user can send links out to others to view or edit your documents. It also has a chat facility that enables users chat in real time while the calendar enables time management while email is used for communication.

2.3 Characterising of Affordances

Affordances refer to the interaction between an organism or actor with the environment or its surroundings (Gibson, 1971). Gibson believes that the environment determines the organism's behaviour or actions (Ofemile, 2014). Interactionists hold that an organism's behaviour and actions depend on the relevant contextualised information available and that, the perception of phenomena like time by people occurs in contextual terms (Sadler & Given, 2007).

Perception provides opportunity for people to assess the level of engagement with an environment (Ofemile, 2010). In addition, affordances can refer to the organism and the environment because they complement and affect each other during interaction. For example, when we see a book, our first thoughts may be to read, open tear or throw it.

Norman (1999) focused on interaction between humans and computers and posits that the appearance of a device gives the clues to its operation but stressed that training and experience influences the organism's level of perception and engagement with it. He goes further stating that an object's designer had a purpose for it. This contradicts Gibson who believes that an object's affordances are imbued by a user's meaning and purposes. There is the concept disaffordances described by Norman (1999) as anything that can create a limited access in an organism's interaction with an environment or object and cautions that, they should not be confused with constraints.

Affordances have been severally classified as perceptible, hidden, or false (Gaver, 1991; Norman, 1988), real, intended, proposed (Dainoff & Mark, 2007; Dainoff, Mark, & Gardener, 1999), perceived (Gibson, 1979, 1977) and cultural affordance (Ziglari, 2008).Gavin's diagram (fig 1 below) emphasises the importance of an affordance being perceived as such by a user.

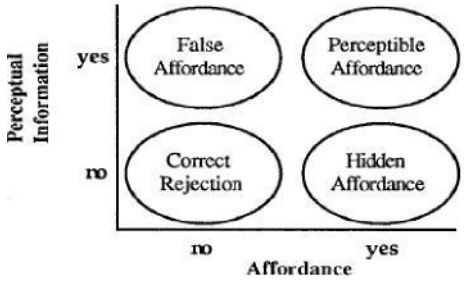

Figure 3: Gaver's Typology of affordances (Ofemile, 2010:45 citing Gaver, 1991:80)

2.4 Real and Perceived Affordances

Norman believes that no two people perceive an object in exactly the same way and this becomes important when distinguishing between an object's 'proposed uses', real or intended uses (Dainoff & Mark, 2007), 'intended affordance' (Norman, 1999, 1988) and its perceived uses. I will illustrate with the table, it could provide opportunities for providing shade from the sun, or blocking an access road to control traffic, drumming. Tables are primarily designed for seating with a chair behind them but, to an extent the affordances provided depend on the needs of the user not the prescription of the carpenter.

Perceptible affordances are actions that the user thinks or sees to be possible than what is true (Norman, 1999). While Gaver, (1991) stresses that perceptibility depends on the availability of information for the existing affordance. For example in a phone that can be voice activated , Norman (1999) explains that the device that makes voice activation possible is not an affordance rather it advertises the affordance and is thus the perceived affordance. Voice activation is only perceptible if the user has information about it in the first place.

2.5 Hidden affordances

An affordance is said to be hidden when there is no information available about its existence and the user has to infer this from other evidences(Gaver, 1991; Norman, 1988) for example, using a table to control traffic is a hidden affordance. Affordances can be unhidden with information for example, labelling rooms for specific uses like 'toilet', to let or 'Exit 'on a door or wall with an arrow.

2.6 False affordances

If information suggests a non-existent affordance then, a false affordance exists upon which people act (Gaver, 1991). This comes from the general perception among people that every button placed around them does their bidding because they have been conditioned to press buttons and get rewards but, the reality is that most public buttons are placed to comfort us (McRaney, 2010; Lockton, 2008). For example, a placebo button like walk buttons in traffic lights or some door close buttons in lifts or thermostats in buildings suggest that they give users some sense of control when to a large extent the contrary is the case.

2.7 Natural and Cultural affordances

While focusing on language learning, Ziglari (2008) believes that affordances can be learned and classifies them as being natural and cultural. Gibson (1999) believes that such a distinction is a mistake and argues that there is only one world where the material environment is not distinct from a mental one. While this is true to an extent, I believe that in the case of Cloud computing space is a distinct environment that has the quality of being created,

simulated, operated, manipulated or carried on by means of a computer or computer network. Natural affordance here refers to the relationship between a user and activities on virtual spaces for example, accessing emails, sharing, uploading or printing documents. Cultural affordance refers to specific meanings and values within an interaction environment or group like, clicking ctrl +A to select or ctrl +C to copy a document.

2.8 Sequential hierarchy of affordances

Gaver (1991) introduces the concepts of sequential affordances and nested affordances. Sequential affordances occur when one affordance leads to another which is like Vicente and Rasmussen's (1990) hierarchy of affordances with the lower one leading to the higher. For example, when making purchases online, the higher order goal maybe to purchase a book but, the sequence begins with signing into the internet to locate the online stores. Nested affordances refer to a combination of affordances occurring at the same time within the same space (Gaver, 1991) for example, the possible services available on google at once.

2.9 Constraints and Conventions

Constraints enable the proper characterisation of affordances and abilities that Norman (1999) identified as physical, logical and cultural summarized as follows. Physical constraints are closely related to real affordances and cannot be ignored or changed by the user like the font sizes available in a word processing program or the work space of the screen.

Logical constraints enable users to use reasoning and deductions to determine available alternatives while interacting with the computer or online learning environment. For example, clicking on a draw down menu like 'Paste' that provides more sub menus leads the user to make an appropriate choice from alternatives shown and they guide the behaviour of users.

Cultural constraints prohibit some actions while encouraging others and a violation is risky because they evolve over time from a community of practice and have become accepted by members. Thus, Norman said that "*When you learn not to click unless you have the proper cursor form, you are following a cultural constraint***" (1999:40) and I believe that this may indicate shared beliefs, interaction, feedback and cultural conventions within a community of practice.**

3. Methodological Considerations

The ecological approach informed data gathering and analysis in this study because it has been used to study information behaviour among people creating, retrieving and trying to understand information in their contexts (Sadler & Given, 2007; Heinstrȍm, 2005; Whitmire, 2004; Saumure & Given, 2004; Given, 2002). In addition, it enables me to focus on cloud computing tools in a context like language teacher education (Sadler & Given, 2007) instead of focusing on the tools per se.

3.1. Population

The population comprised Nigerian TEs studying in Leeds, UK. The TEs randomly selected were experienced in Nigeria with some teaching experience in the UK. Five TEs were used to assess affordances as recommended (Nielsen,1993; Scholtz, 2006) to get a balanced view. Assessors' identities were anonymised using pseudonyms to ensure confidentiality.

3.2. Checklist and Task Design

The checklist designed is subjective and had four columns and from left to right with questions then 'Yes/ No' guiding response and the action response. It was designed based on a business model by (Bartram & Gibson, 1997) that enabled user segmentation (Rhoton, 2010) information organisation and drawing parallels between perspectives (Rhoton, 2010 ;Preece, 1994;Nielsen, 1993). The checklist enables a researcher to separate affordances from the information available about them for easy distinction (Gavin (1991) and categorisation of affordances.

QUESTIONS	YES	NO	RESPONSE
Are perceptions accurate or clearly stated by Assessors	√	√	Define Inaccuracies and investigate how it happened
Do perceptions describe any affordance	√	√	Identify the type of affordance from relevant perceptions: Real; Perceptible; False; Hidden; Natural; Cultural
			At Institutional and individual levels identify the hierarchy of affordances High ; Low Define the level of deviance and investigate

Figure 4: Checklist for assessing Affordances

Assessment was done within the 'context- of- use' (Scholtz, 2006:2) with a real google docs and dropbox interfaces to ensure that results were based on the representative users' actual perception of the affordances from the interface. The main task for the participants was to access google docs from a computer and use the interface to process, edit, store, retrieve, share documents. The researcher observed participants use the tools because when assessing affordances "Don't speculate. Don't argue. Observe" (Norman, 1999:41) earlier stressed by Gaver (1991). Each participant was asked to think aloud and later make notes of feelings if possible, this was to enable me follow their line of thoughts as they interacted with the interface and get their immediate interaction experiences. Research has shown this to be valuable in online learning (Cotton & Gresty, 2005) however, this method raises concerns about level of observer interference and difficulty of data analysis. To counter these, group discussions were done using interview guides. Note that the coloured portion is the focus of analysis in each section.

4.1 Results and Presentation

The checklist was used to ascertain the level of the users' awareness, how successful they will be at using cloud computing tools and the ease with which they use them. The analysis matrix is adapted from (Sadler & Given, 2007)

INTENDED BY TOOL DESIGNERS			
		YES	NO
PERCEIVED BY USER	YES	INTENDED & PERCEIVED. .Create personal accounts .Create & share documents .Install dropbox software on personal computers .Teach language skills to challenged learners.	PERCEIVED BUT NOT INTENDED. .Use Google docs to share restricted documents. .Use Google docs as M drive .For class control
	NO	INTENDED BUT NOT PERCEIVED Advanced sharing menu Accessing related services like add ons from third parties or creating mashups	

Figure 5: Summary of affordances (Adapted from Sadler & Given, 2007:120)

The first step is to ask whether the affordance was intended by the designers of the tool and whether the users perceived it since "... there can be no affordance that was neither intended nor perceived" (Norman, 1999:40). Like I said earlier, affordances provide opportunities for the users to create personal accounts or upload a document on Google docs and dropbox.

4.1.1 Intended and Perceived affordances

INTENDED BY TOOL DESIGNERS			
		YES	NO
PERCEIVED BY USER	YES	INTENDED & PERCEIVED. • Create personal accounts • Create & share documents • Install dropbox software on personal computers • Teach language skills to challenged learners. • Ability to synchronize files and data for free	PERCEIVED BUT NOT INTENDED. .Use Google docs to share restricted documents. .Use Google docs as M drive .For class control
	NO	INTENDED BUT NOT PERCEIVED Advanced sharing menu Accessing dropbox from any computer Printing from dropbox	

Figure 6: Intended and perceived affordances

If the answers to the two questions is 'Yes' then we have affordances that intended by the designer and perceived by the users. Observation showed that the participants could create personal accounts, create and share documents on Google docs as real affordances described in 2.4. One participant 'Gwamma' said "I can use this to teach different language skills to challenged learners like writing and reading". This is a real affordance intended by the designers and perceived because, Gwamma watched the introductory video and matched what she knows about wikis with her knowledge of children with special needs aided by the very visible Google docs menu.

4.1.2 Affordances perceived that were not intended

INTENDED BY TOOL DESIGNERS			
		YES	NO
PERCEIVED BY USER	YES	INTENDED & PERCEIVED. • Create personal accounts • Create & share documents • Install dropbox software on personal computers. • Teach language skills to challenged learners.	PERCEIVED BUT NOT INTENDED. .Use Google docs to share restricted documents. .Use Google docs as M drive .For class control
	NO	INTENDED BUT NOT PERCEIVED Advanced sharing menu Accessing dropbox from any computer Printing from dropbox	

Figure 7: Affordances perceived that were not intended

Here the designer did not provide an affordance yet the user perceives it. Shina decided to use Google docs as his M drive since files can be created online and the others agreed that it would replace the one provided by University. Efe said he will upload all his hand outs and share them with people who need them while, Saminu said he will use it for class control in a large class by giving each pupil a different role in a group assignment. These were never intended by the designers of Google docs but became possible due to the flexibility and individual competence.

Users also recognized that the tools provided a work place in the clouds that they could make private and control. For example, Google docs could be shared with only those the user wants and they could also keep an eye on what is going on and this informed Bauna's observation. He observed that the notice 'Saminu is watching' or 'Nobody is watching' while collaborating on a document is reassuring. Olokodano said 'This is really surprisingly easy, fast and builds confidence in the user' while Nkem believed that the tools provide security and

increases pace of work. In addition, Efe raised an issue on the consequences of depending on technology (Sadler and Given, 2007) when he says 'my problem with this system is can this work in Nigeria in view of slow internet speed and poor infrastructure?'

4.1.3 Affordance gaps

<table>
<tr><th colspan="4">INTENDED BY TOOL DESIGNERS</th></tr>
<tr><th colspan="2"></th><th>YES</th><th>NO</th></tr>
<tr><th rowspan="2">PERCEIVED BY USER</th><th>YES</th><td>INTENDED & PERCEIVED.
Create personal accounts
Create & share documents
Install dropbox software on personal computers
Teach language skills to challenged learners.</td><td>PERCEIVED BUT NOT INTENDED.
.Use Google docs to share restricted documents.
.Use Google docs as M drive
.For class control</td></tr>
<tr><th>NO</th><td>INTENDED BUT NOT PERCEIVED
Advanced sharing menu
Accessing dropbox from any computer
Printing documents from dropbox</td><td></td></tr>
</table>

Figure 8: Summary of affordance gaps

Any affordance intended but not recognized by the user is considered a gap (Sadler & Given, 2007). For example, none of the participants was aware of the offerings in the advanced sharing menu in Google docs or how to print document from dropbox.

5.10 Conclusions and Implications

On the whole, participants were able to perceive the opportunities to use cloud computing tools to collaboratively create and share documents online, create personal accounts, install programs, upload and store data in a cloud environment e.g. dropbox. In addition, they saw the opportunity to use these tools in the classroom e.g. teach language skills. Participants were also able to perceive unintended affordances like using them for class control and unauthorized sharing of academic materials with people. However, there were affordances intended but not perceived by the participants e.g. they were unable to print documents from dropbox or use the advanced sharing menu in Google docs.

The study had some major implications for language teacher education. The first is that CC maybe a useful tool in language teacher education in view of the positive features and the affordances perceived by the TEs. However, there is need for enlightenment and needs based training for TEs, students and ICT managers in teacher training institutions.

Secondly, although there is a wireless network infrastructure in place, this needs to be strategically improved upon for maximum utilisation. In addition, there are security questions that need to be answered for effective management like how much data should institutions keep online, what levels of controls should be put in place and who has back door access to such data kept online.

A comprehensive approach to adoption could be considered with a focus on collaboration between and across service providers and users.

This study focused on language TEs in Colleges of Education thus, there is the need for further studies in other levels of education and other disciplines. Secondly, the scope of tools studied was narrow and other studies could look focus on more and newer tools. I believe that these will widen and deepen understanding and the knowledge base around CC in the Nigerian context for implementation, scholarship and economic purposes.

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