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A Cloud Based Learning Framework for Eradicating the Learning Challenges of Ethiopian Working Professionals, Disables and Women

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Abstract: Information Technologies have been changing with high speed and existing educational and training frameworks are required to be reviewed, restructured, and redesigned in aligning with the evolving technologies and advanced features. This can strengthen their survival in the highly competitive professional environment. Many of the institutions across the world have been consistently trying to upgrade and transform their educational systems to reduce the cost of learning, enhance the convenience and comfort in normal or adverse situations like pandemics or turbulences. The Ethiopian education system is one of them which has been consistently facing certain critical challenges to afford the education extensions & teaching facilities for citizens. These issues and challenges become critical to those who are working professionals, disabled, and females with pregnancy or the learners who can't join the classes on regular basis with traditional teaching-learning processes like regular, summer, extension and distance education etc. In recent years a limited number of institutions in Ethiopia tried to encounter accessibility barriers by adopting advanced learning & teaching systems but acceptable level of such systems is still not satisfactory, promising, and popular. However, it has been observed that there is a strong and urgent need to have a better and alternative educational platform with extensive accessibility. Such systems become vital when pandemics or other issues lockdown the traditional education and communication systems. The strategic shift from traditional classroom to e-learning and e-learning to cloud-based learning can be a promising transformation and significant improvement towards next generation teaching-learning environment. To achieve this, a Unified Cloud based E-Learning Framework (UCELF) is proposed and functionally tested using Cloud based Opens Source applications. This study is an attempt to apply an exploratory applied research design using mixed research approach for assessment of the challenges and finally proposing a new cloud-based solution framework for women, disabled, working professionals, and the people challenged by accidental injuries.

Index Terms: Cloud Computing, E-learning, UCELF, Disables, Females, Professionals, Ethiopia

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1. Introduction

In recent years [1, 2, 3] the opportunity of higher education has become a great challenge in Ethiopia due to the population growth and the shortage of educational institutions and facilities. Although the government is striving to fill the gap of teaching professionals through hiring the foreign professionals, still both the quality and quantity of education is not attainable. It has also been experienced that governmental organization and academics institutions have been facing critical challenges for how to upgrade their ICT and E-Learning systems and losing their data with UpToDate security and privacy within on-premise IT infrastructure. Not only this, the limitation of sharing teaching and learning resources for online studies especially for busier/engaged professionals is still another issue that setbacks the accessibility and wide extension of education to everybody. Ethiopia is a developing country in the horn of Africa and its higher educational institutions are still either in developing or underdeveloped state. In the existing state of the art, they have traditional teaching-learning systems but most often these systems are challenged by heavy rain, flood, uncertain pandemics like Covid-19 and other disturbances not only for normal citizen but also for disabled, women, working professionals, and injured citizens, and therefore; to alleviate all aforementioned challenges, a contextualized alternative teaching-learning system is anticipated. Such a solution can be a better solution for improvised data storage, long term sustainability, convenience and suitability, easy upgradability, resource shareability as an extension of higher education systems with low cost and better ease so that working professionals and learners can learn anywhere at any time using any device based on their comfort and convenience. Using cloud computing, higher institutions with voluminous data such as education systems are being explored as next-generation technology with numerous features to alleviate the above-mentioned issues and challenges like the ease of use, anytime, anywhere access, on-demand and scalable ICT needs, and flexible/elastic solutions [4, 5, 6, 7]. Educational institutions across developed and developing countries including Ethiopia has been adopting or implementing on-premise e-learnings systems to support education to extend the accessibility of education to a broader level to solve the Ethiopian learning needs but unfortunately the cost of ICT infrastructure is not affordable to many organizations and hence their adoption and the transformation rate is very low. Even though e-learning solves the several challenges and problems of traditional education system platforms but still there are several issues and concerns such as software purchase, frequent system update, cost of maintenance, scalability, flexibilities, integration, and need based contextualization of educational platforms which need to be investigated and analyzed carefully [8, 9, 10]. Today cloud computing has widely proved to be an alternative way out for numerous systems like management, commerce, governance, and educational computing, communication, and collaborations. It can facilitate better profit margins as it reduces the cost of hardware and software and improves the efficiency of the delivery of computing resources via the internet. And also, it helps for energy conservation as research identified that more different data centers have the largest power consumption [11, 12, 13]. The main motivation of this research study is to investigate and analyze the multifactor educational challenges in the existing state of art system solutions for working professionals disables, women, and people with temporary disability like injuries in Ethiopian context and to bring a remedial the solution towards ease of use of and affordability for learners' community with improved facilities like anytime, anywhere over any device along with comfort and convenience.

This is aimed to the whole country into forefront line of digital education and transformation that leads to a significant change of economy and educational quantities & qualities. The main objective of this study is to investigate and analyze the current challenges in existing state of art education delivery systems and platforms and designing an alternative cloud-based framework with better suitability, comfort, convenience, and improved facilities for the learners' community such as working professionals, disabled, women, and other needy people.

1.1. Problem under Investigation with Goal of the Research

Access to academic and learning resources, and protecting the data in a traditional ICT infrastructure now has become an unsolved problem. The stakeholders being affected mostly are working professionals, people with disabilities, Females with pregnancy, people with accidental injuries and, government officials who are not able to access education to upgrade their knowledge and credentials on regular basis. Not only this, upgrading the existing e-learning system, maintenance, and cost of the software are another big issue that setback the prosperity of academics' institutions and individuals who want to resolve their learning issues. These strongly affected working professionals are private/Govt employees, disabled, and females with pregnancy who are not able to afford the cost of self-sponsor and others living expenses such as; transport cost from far distant to school / college/university centers. In related the situation, physically challenged groups such as disabled and pregnant women are not able to travel and get educational institutions far away from their residential places but unfortunately the current educational systems failed to resolve such problems in Ethiopia. Another big problem is with working employees who are staying away from the latest technology that can promote and develop their technical skills through available online training and certification programs [6, 14]. These problems are declining the quantity and quality both in terms of educated or trained professionals in the country. In recent years few universities and colleges in Ethiopia have adopted advanced teaching learning systems like e-learning over their owned and managed e-learning servers but acceptance and success level of these systems is not satisfactory and wider popular because the sector has limited research studies that can support

better educational analytics and technology supported modeling in the Ethiopian context. The reasons behind such learning challenges are wider and need to be investigated, examined/measured and then an alternative technology framework over web or cloud is aimed to be designed for resolving the enlisted issues and challenges. Further, it is still unknown that what are the real challenging concerns and what kind of systems should be needed for next-generation teaching/learning in Ethiopian the context that can support working professionals', disabled, women with pregnancy and accidentally injured people and help them and develop their careers in their respective working organizations. This research study tried to determine the following research questions using preliminary interview of the target beneficiaries and stakeholders from the selected areas:

- What are the basic learning challenges faced by working professionals, disabled, females with pregnancy?
- What are the challenges that could not be alleviated by existing e-learning technologies?
- What kinds of educational framework over an alternative technology like the cloud can be able to resolve such challenges of target professionals, disabled, and women with pregnancy?
- Which the educational delivery framework can be the best suitable and acceptable to the target stakeholders?

After careful investigation through survey, interview, technical observation, and rigorous multifactor analysis of the collected data, this paper proposed a cloud-based educational delivery framework that can be the best suitable solution than web-based e-learning or traditional learning systems. The limitation of the proposed solution will be only the network backbone i.e., the internet bandwidth to connect with the cloud data centers. The user acceptance test of the framework was found promising and encouraging.

2. Review of Concepts and Related Works

To understand the domain; the technical concepts used in this this research studies are carefully reviewed with critical evaluation and remarks.

A rigorous review of related and previously research works are done to evaluate the existing research contributions in the domain and presented in Table 1. The related research papers were selected and prioritized based on the three parameters; Relevancy to the research domain, Quality of Journal, the year of their publication (latest).

Table 1. Review of related literature with critical remarks

No	Author & Year	Title & Journal Names	Major findings, contribution, evaluation and critical remarks
1	Rumana Javali, 2016 [15]	Cloud Computing in Education System (*International Journal of Advanced Research in Computer Science and Software Engineering)*	The researcher concludes that a Cloud-based education system can reduce infrastructure costs, increase ease of access, make possible collaboration, and enhance flexibility and customization of software based on the need of organization, and also modernizing the learning by introducing technology to classrooms. It can also increase student's learning opportunities while improving students' skills. Researcher quantified the advantage & drawback of cloud computing. In fact, the research showed an important contribution by introducing the core advantages of cloud computing in education but as a new solution contribution like model or framework is missing that can make it a better solution for education systems transformation with the contextual need of working professionals, disables and females with pregnancy as our study proposed.
2	Kiran Yadav 2014 [16]	Role of Cloud Computing in Education *International Journal of Innovative Research in Computer and Communication Engineering*	The research presents how the cloud could be a better alternative technology for adaption or adoption in higher educational intuitions to ensure the multifactor benefits to the learners' community, educators & institutes. This study was also confined to investigating the role of cloud computing in educational institutions. As an alternative solution that how cloud technology can provide a new way of transformation of education for the target stakeholders having distinct challenges like physical, social, economic, and economic is not addressed. The investigation is very shallow and the way forward especially for how to implement this technology by using both functional & theoretical framework over the cloud is missing.

3	Alemseged & Prof DP Sharma, 2016 [13]	Suitability analytics and cloud computing adoption modeling For educational institutions *Pezzottaite journals*	This research paper has good attempt and researchers tried to develop a cloud adoption model for higher educational institutions in Ethiopian context and the model was developed with limited scope but no implementation and validation in the organization. This study is relevant to the proposed research but it does not cover the opportunities and challenges in higher education delivery for working professionals disable and females with pregnancy using selected factors such as convenient and cost in the Ethiopian context and our paper developed and tested a cloud-based framework for the community-specific issues and challenges. It followed a rigorous test and validation to open new doors for disables, pregnant women, and injured people working professionals to learn from anywhere, anytime, using any device i.e., education at your door. After a rigorous review of the focused and user-specific research studies in the regional domain, it was clearly observed that there is an acute shortage of efforts to adapt, adopt, and contextualize the solutions for the delivery of educations through alternative technology for the classified community. This clearly implied that the research study is worth doing not only to alleviate the learning challenges to the working professionals, disable, pregnant women but also for the general people who have certain challenges for the access to education in convenient and cost-effective manners
4.	Dipti Pawade, Sagar Jape, Rahul Balasubramanian, Mihir Kulkarni, Avani Sakhapara [18]	Distributed Ledger Management for an Organization using Blockchains, International Journal of Education and Management Engineering(IJEME), 2018	Digitalization over cloud is rapidly transforming the systems towards trust and efficiency with add on features. Similarly the financial systems of the modern era, needs trust that is always been a missing concerns; attentions on power and trust have created several challenges. This paper tried to recommend a solution over Blockchains. His idea of new data structure over cloud based private Blockchain can allow better trust in creating cryptically secured distributed tamperproof ledgers. But the paper only discusses the data structure over Blockchain but missed the concept of cloud based Blockchain.
5.	Abebe Alambo, Durga Prasad Sharma [19]	DPS-AA: Intranet Migration Strategy Model for Clouds, I.J. Modern Education and Computer Science(IJMECS), 2020	This research study provided another fold of motivation towards cloud migration but confined only to the university system education transformations in general and selected universities of Ethiopia as a case analysis. This paper indicates that how intranet technology and the organizational work culture in higher educational institutions can be changed by migration over cloud for exploring the full potential of next generation computing and communication systems like paperless office, project control and monitoring over handheld mobile devices. This study motivated researchers to shift their systems over cloud from traditional computing infrastructures so that the high end performance, rapid updating of hardware and software, on demand ICTs and scalability of the ICTs with promised features on low cost using pay per use model can be provided.
6.	Kenneth Patrick Asiimwe, Dina Machuve, Mussa Ally Dida [20]	A Web-based Portal for Ornamental Plants and Flowers in Arusha City, Tanzania, International Journal of Information Technology and Computer Science(IJITCS), 2020	This paper is somehow motivation towards digitalization and its migration towards cloud. Digitalization is exponentially growing in the world but the information on the varied species of ornamental plants and flowers in the country Tanzania where this study was done is still lagging behind. This limits the judicious access to the scientific community and the public fetching on these diversities in Arusha a growing preservation apprehension. Also the small-scale enterprises and vendors have limited visibility in the regional, national and the international markets which hampers their business growth worldwide. The portal developed and demonstrated as prototype over web indicates the potential to help stakeholders in the area. But this study still needs a robust, highly updated and cost effective solutions for the mentioned stakeholders and the cloud is one of them which can ensure the high end solutions.
7.	Muhammad Junaid Arshad, Muhammad Umair, Saima Munawar, Nasir Naveed, Humaira Naeem [21]	Improving Cloud Data Encryption Using Customized Genetic Algorithm, International Journal of Intelligent Systems and Applications(IJISA), 2020	In the computing world, the Data Encryption is broadly applied for guaranteeing data privacy, integrity, and confidentiality. A huge volume of data is being stored over the cloud and exposed to vulnerability and adds to security breaches and privacy violations. An ideal solution suggested by this paper i.e. a local intelligence-based algorithm can be a promising instrumental in the educational content security over cloud
8.	M.W.P Maduranga, Ruvan Abeysekera [22]	TreeLoc: An Ensemble Learning-based Approach for Range Based Indoor Localization, International Journal of Wireless and Microwave Technologies(IJWMT), 2021	Teaching – Learning process is transforming in the world. Learning-based localization plays a noteworthy role in wireless indoor localization problems over deterministic or probabilistic-based methods. This paper revealed that the TreeLoc algorithm showed better performances in position estimation for indoor environments with RMSE 8.79 for the x coordinate and 8.83 for the y coordinate. If the outcome of this paper is used in designing next generation learning as a feature decision, could be a significantly new idea for betterment of the e learning systems

3. Research Design and Methodology

3.1. Research Design and Approach

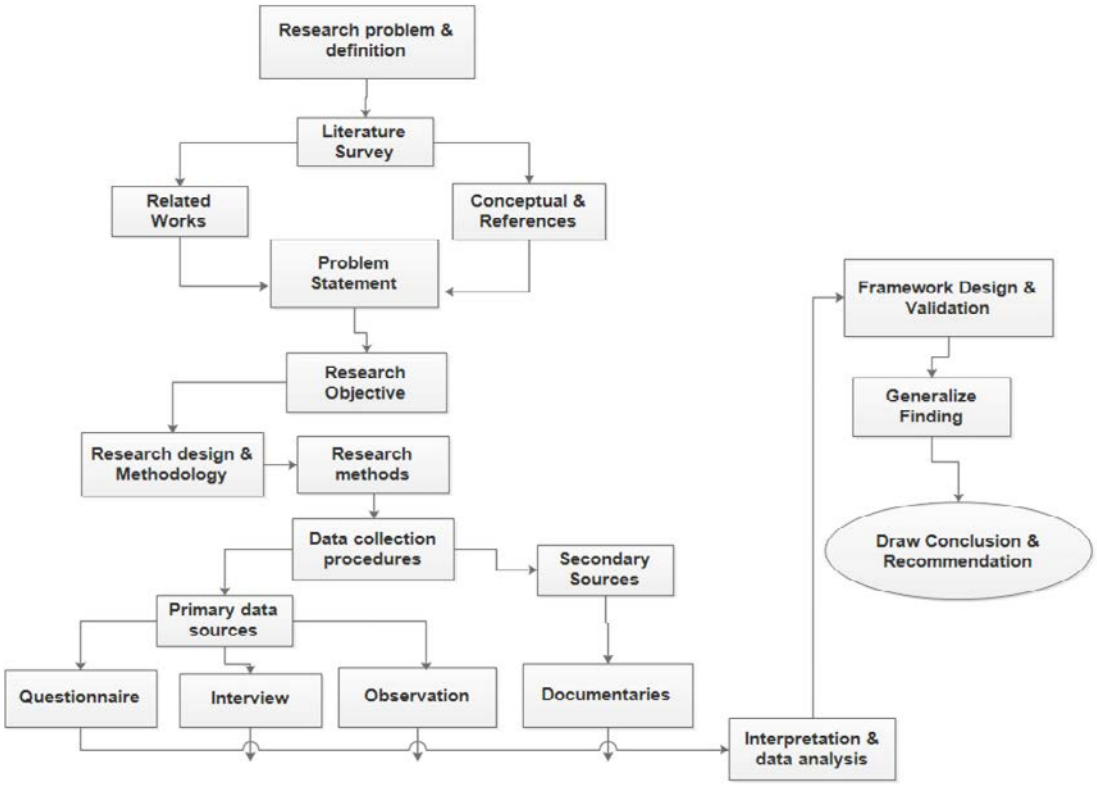

Fig.1. Research process flow and methodology

This study is mixed of i.e., exploratory and applied research because the study problem is in the pilot stage as only limited researchers have done efforts in conducting the research in the target domain community with contextualized parameters. A mixed design is the most suitable approach if the study requires both quantitative and qualitative designs to analyze the problem parameters. An exploratory applied design provides a clear view of the problem, familiarity with the idea, and development of a framework and test.

In order to answer the research questions and achieve the research objectives, the study followed a general research approach using chosen methods & tools for statistical analysis of stakeholders' inputs qualitatively and quantitatively using questionnaires, document analysis, and technical observation. In order to find out the critical gap in the previous works, several related works published in journals, research reports, thesis projects were critically reviewed and summarized.

In order to synthesize what the researcher has proposed to do through the study, the researcher's summarized the flow of works as presented in Fig, 1 of how this research study was done.

4. Data Analysis and Discussion

This research study conducted 1) Interview of education and ICT experts, 2) Technical observation by researchers themselves and 1) survey for investigation of the views and need input of salient stakeholders (working professionals) like teachers, managers, secretariats official and others employees relating to the learning challenges in existing learning delivery systems and their learning perceptions/expectations over cloud to support their learning accessibility as primary data input of the study.

The research questions were designed in consultation with professionals in the domain by following the standard format of questionnaire for 1) quantitative and 2) qualitative facts collection and analysis mechanisms.

A. Existing Technical Challenges in Traditional & in On-premise E-learning

1. The major challenges faced in the current traditional/conventional or existing e-learning environment (You may select/tick one or more options)

According to the responses as presented in the Fig, 2, on major challenges in both traditional classroom & e-learning platform, it is observed that the high cost of infrastructures and server availability is found 57.4%. This is the biggest challenges being faced in the usability of traditional e-learning delivery methods. Furthermore, another challenge assessed was scalability and target respondents' responses revealed that 42% of traditional systems, 28.6%

lack of fault tolerant & disaster recovery with cost of maintaining and security of data confidentiality is missing in the existing state of art systems. This also verified the highest correlation with the research findings in the review of the literatures and related gaps. Also, it was revealed that the on-premise e-learning & traditional learning platform have the highest cost of infrastructures i.e., 71.4% i.e., it needs serious attention to reduce for the developing countries.

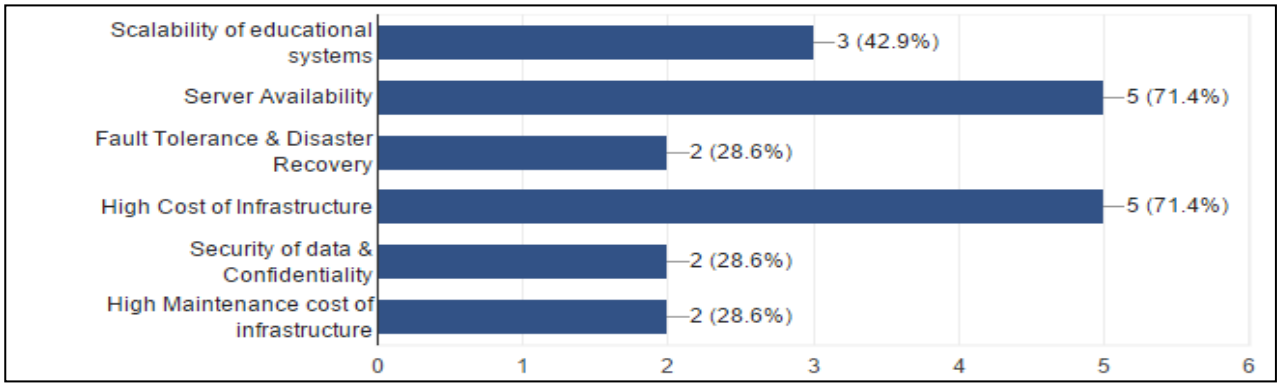

Fig. 2. Challenges faced in the current traditional education system

B. Responses of Respondents on Current E-learning Satisfaction in Educational Delivery

1. Are you a working professional and satisfied with current education delivery systems in traditional/conventional or e-learning systems?

Based on the responses of the respondents (as presented in the Fig, 3) on how these traditional delivery methods impact their learning experiences? It was identified and observed that the highest i.e., 71.4% respondents strongly expressed their dissatisfaction with the current learning platforms. And 28.6% (as presented in the Fig, 4) expressed decent concern in these traditional deliveries. This proved that different learners have different learning preferences. May be learning in this system satisfied their learning need and demand. This clearly reveals that two third majority of the target stakeholders need an alternative education and training delivery systems for their convenience and comfort

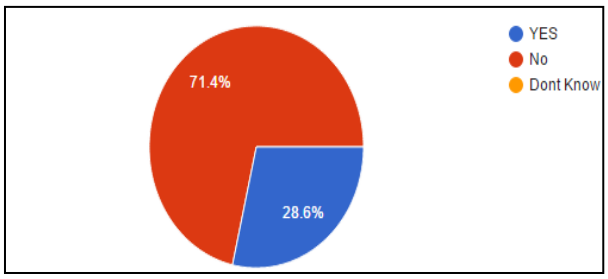

Fig.3. Working professional satisfaction level

2. Which amongst the following do you believe to be expected benefit of learning over the cloud than traditional e-learning for higher education by working professionals? (You may select/tick one or more options?)

According to the responses of the respondents as presented in the Fig, 4, it has been observed that working professionals like and prefer to move towards the learning platform over the cloud for their learning convenience that have been responded as the highest degree of 85.7% and is not available in others learning platforms that strongly supported by the research [17], Cloud computing have high interoperability for the salient types of access devices. Furthermore, high availability also ranks third with 42.9%. Also, devices interoperability with 71.4% (as presented in the Fig, 4) is the second significant use of e-learning over the cloud. All these were the keys motivations to many companies as the study [8] revealed about the availability, devices interoperability & cost cutting which are the main factors for migrating data/information/ systems like learning systems over the clouds infrastructures.

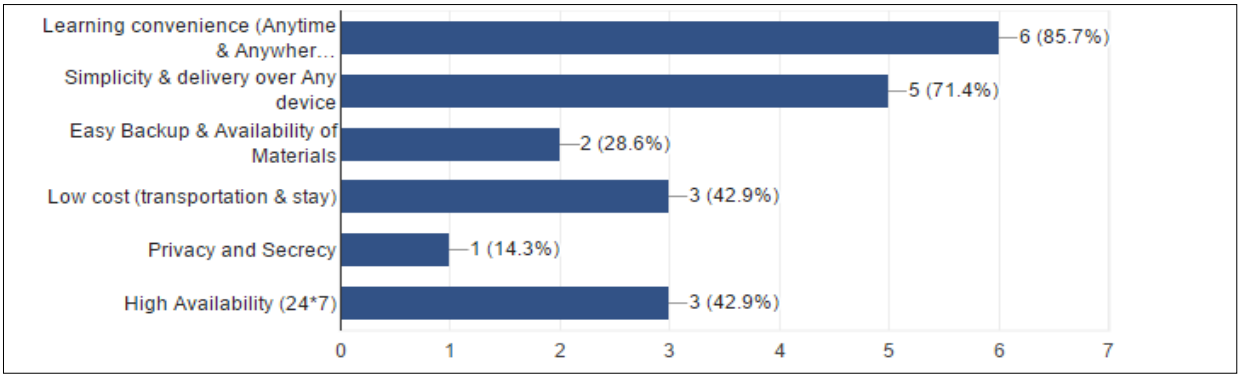

Fig.4. Expected benefit of cloud computing in Higher Education

3. *Which amongst the following you believe to be a main challenge for the implementation of cloud-based learning in higher education for working professionals? (You may select/tick one or more options)*

The users' negative reactions over cloud-based e-learning implementation is also revealed but limited to user control over the system with 71.4% and presented in the Fig, 5. The confidentiality issues & network outages were observed 57.1% respectively and are significantly not important factors in transformation strategies. The ownership issue with 28.6%, which is most likely because owners always like to own their data in their own hands but they also accepted during fact findings that maintenance and owning security is not only costly but challenging these days in connected world. These issues were assumed to be resolved by implementing hybrid cloud and with appropriate Serve Level Agreement (SLA) as research finding recommended.

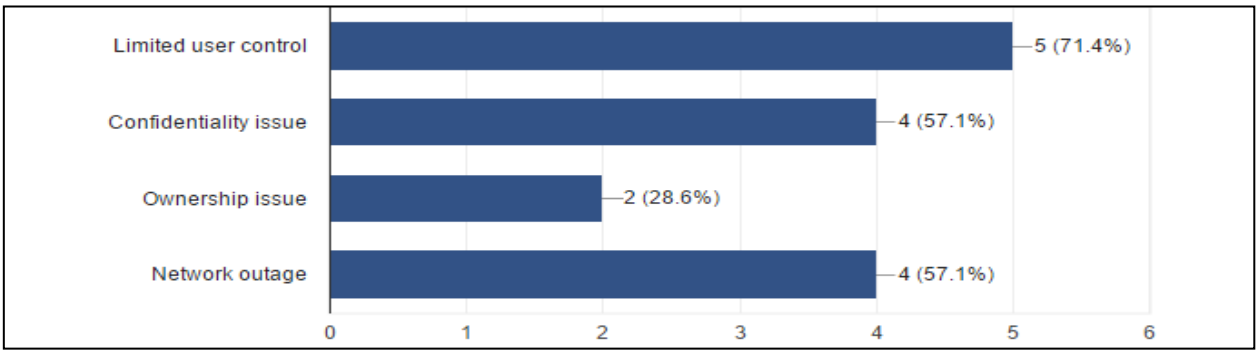

Fig.5. Main challenges for cloud computing implementation

Feature Based Critical Analysis

In the table 2, the features based critical analysis was done using observation and facts collected from the studies and finally supported by secondary sources.

Table 2. Feature Based Critical Analysis of Existing Learning Platforms vs. Learning over Cloud Based [4, 5, 6, 7].

S/N	Parameters	Traditional Learning	E-Learning	Cloud Based Learning	Critical remarks
1.	Security	Low	Medium	High	However, Cloud based learning platform ensures promising security under SLAs
2.	Accessibility	Low	Medium	High	Every one having mobile or any hand-held device can access e-resources over cloud via the internet.
3.	Scalability	Low	Low	Very High	Cloud based learning systems promise high scalability (vertical/horizontal) with no geographical limitations.
4	Flexibility	Low	Medium	Very high	The contents of cloud-based management are very dynamic. Anyone can customize but this feature doesn't exist in existing learning platforms.
5	Storage	Low	Medium	Very high	Both traditional learning and e-learning systems have limited storage capacities but in case of cloud it's unlimited and 24/7 scalable with fast upgradability
6	Blending	Low	Medium	High	Only one or two styles of learning existing in both traditional teaching methods but over cloud variety is available.
7	Collaboration	Low	Medium	High	Class based & on-premise eLearning teaching methods have limited interaction in 24/7 model for learners but cloud based is 24/7 anywhere over any device.

8	Compatibility	Low	Low	High	The cloud-based learning platform has better compatibility because it supports all accessible devices. It supports cross platform
9	Infrastructure Cost	High	High	Very Low	Both traditional platforms need high-capacity infrastructures and the cost of maintenance, and installation are very high but over cloud based only internet connection needed and rests are very low or almost negligible
10	Fault tolerant	Low	Low	Very High	Cloud based education systems have better fault tolerance and reliability because the cloud service providers promise 99.99 percent uptime. The on-premise eLearning & traditional class room method are not high fault tolerance and all time available.
11	Disaster recovery	Low	Medium	Very High	In traditional or on-premise eLearning methods, there is limited provisions of disaster recovery but over the cloud, the offsite replication and redundancy of servers ensure high disaster recovery and promised under SLAs.

5. Proposed Framework Design

Technologies have been changing with the fast pace and speed. The existing systems, Frameworks in educational domains are required to be reviewed, restructured, and redesigned in aligning with evolving technologies so that they can sustain and survive for a longer time in highly competitive global environments. The International Society for Technology in Education (ISTE) based standards revealed an idea that education delivery systems should transform from traditional to the technology-enabled environment for learners and educators. Currently the COVID-19 pandemic has also proved that we must have an alternative teaching-learning system so as to alleviate the challenges that appeared unexpectedly, emergencies and disasters. The proposed framework coins a new idea of solving the planned and abrupt problems of learning challenges using Unified Learning Method and it can be deployed over the cloud platform as a Unified Cloud-based E-Learning Solution Framework. The Unified Learning Platform Framework is defined as:

$$\textbf{Unified Learning} = \frac{\boldsymbol{f}(\boldsymbol{time}, \boldsymbol{space}, \boldsymbol{path}, \boldsymbol{place}, \boldsymbol{teacher}, \boldsymbol{resources})}{\boldsymbol{individual\ learning\ objective}} + \boldsymbol{f}(\boldsymbol{Mobile\ Technology})$$

a. Design and Implementation of Cloud based Unified E-Learning Framework

In the literature review, it has been clearly observed that the existing eLearning systems of both traditional and on-premise have a lot of limitations/shortcomings and challenges that are faced by higher education systems and their stakeholders like working professionals, disable and pregnant women. However, the proposed Unified Learning Platform Framework over cloud in Ethiopian context can be a better and alternative learning solution that can be the best fit in localized system context for the target community of learners. Also existing or pre adopted Ethiopian curriculums can easily adapt, adopt, contextualize and install over the cloud platform to achieve flexibility in Hardware/Software/Communication (HW/SW/COM) services, accessibility, and cost effectiveness with high security and high scalability of learning system without any disparity. Here the entire teaching-learning process is required to be migrated from either traditional or e-learning to cloud-based teaching-learning environments/platforms. All the Advanced features and add on services can be easily availed, provisioned, re-provisioned, and integrated as on-demand instantly in an autonomic manner when needed in education delivery systems after migration overcloud. Fig, 6 presents the proposed i.e., cloud-based unified e-learning framework. The proposed framework i.e., Unified Cloud-based E-learning Framework (UCELF) has following layers as described in Fig. 6:

1) User Interface & Access control: This layer (as presented in Fig, 6) of the framework is the first entry layer gateway of the proposed framework that is used by users to access the education service or resources over the cloud infrastructure. It includes the browsers platform, different website links, users' portals and services catalogs. In this design, users can use access educational delivery services through any access devices using any browsers. And before accessing any services, the users should pass through services catalogs. These services catalogs contain services that are available within the blended learning system i.e., learning system over technology platform like proposed in this paper. Now users can choose their services or program preference based on their interests. After users choose their preference program, they can create their course over the portal site. And the admin within the university can provide access controls to users through a cloud infrastructure interface. After the creation of the course over the portal, the users can access the blended learning spaces layers that rely on the Software as services. 2) Blended learning space: After the successful registration of the users over the learning system over the cloud, the system directs them to enter into this layer (as presented in Fig, 6) where the users can use the different SaaS applications and other cloud-based educational tools that are blended together for learning support of working professionals, disables, women etc. In this layer the blended learning resources are populated so that learners' communities can access them using any device through their registered web portals. The experienced users such as developer, Lecturers and professionals can develop, design and deploy their applications over the cloud and can access public cloud services and some advanced services such as

Platform as Services & Infrastructures as Service based on their demand. 3) Service Layer: In this layer (as presented in the Fig, 6), the users can get everything/anything as a service. These services are Software as Services (SaaS) that can be blended with different resources to enhance the learning environment. SaaS gives clients to access over different application gadget through system interfaces, and Platform as Services (PaaS). In PaaS, users can have control over their application deployment. In this regard, advanced programs can be placed there and can be accessed by advanced users. Virtual Infrastructure (IaaS), provides more flexibility that included; the Hardware layer through the virtualization of IT infrastructures such as servers, computation, networks, and Data Centers. The notion of implementing IaaS is utilizing ICT Infrastructure to overcome the resources limitations and boundaries. In this framework, Public Cloud is proposed to be embedded with Infrastructures so that the users can access virtualized services in the blended learning space. 4) Cloud Management Layer: The proposed cloud framework's e-resources are designed to be managed by higher education in collaboration with the ministry of education in the case of Ethiopia or another country. In this layer (as presented in Fig, 6), the ministry can work as a negotiator that can agree with cloud vendors for liability and policy of the services based on the service level agreement (SLA). Within this management layer, there are cloud builds in the management service. These services are; performance and scheduling services that report cloud framework performance to its adopters in different tasks and activities scheduling with cloud deployment management policy. 5) Database Layer: This layer (as presented in Fig, 6) is the place where the user log, courses, training, contents, and all others services data are stored as a centralized repository but distributed over replicas and used and managed by the hosting institution.

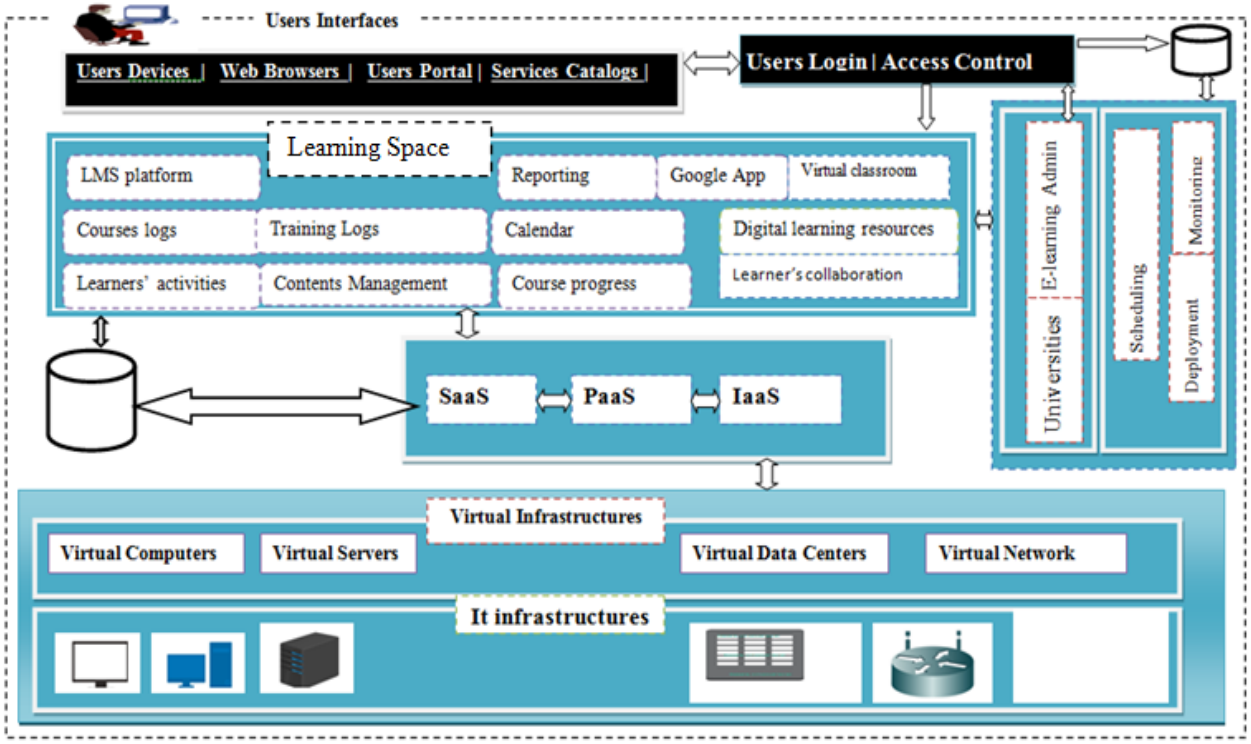

Fig. 6. Unified Cloud based E-learning Framework (UCELF)

b. Processes of Unified Learning Framework over Cloud

The proposed framework does not change or alter the features of the existing learning platforms (i.e., Traditional Class Room Learning, E-Learning over localized Intranets/servers) rather, it just promises to enhance and integrate all the best features and practices together so that the working professionals can have sufficient choice to choose among different learning styles /platforms they want. And cloud is advised to be the best amongst all. The Fig, 7 clearly compares the three specified learning platform features with quantitative measures and justifications.

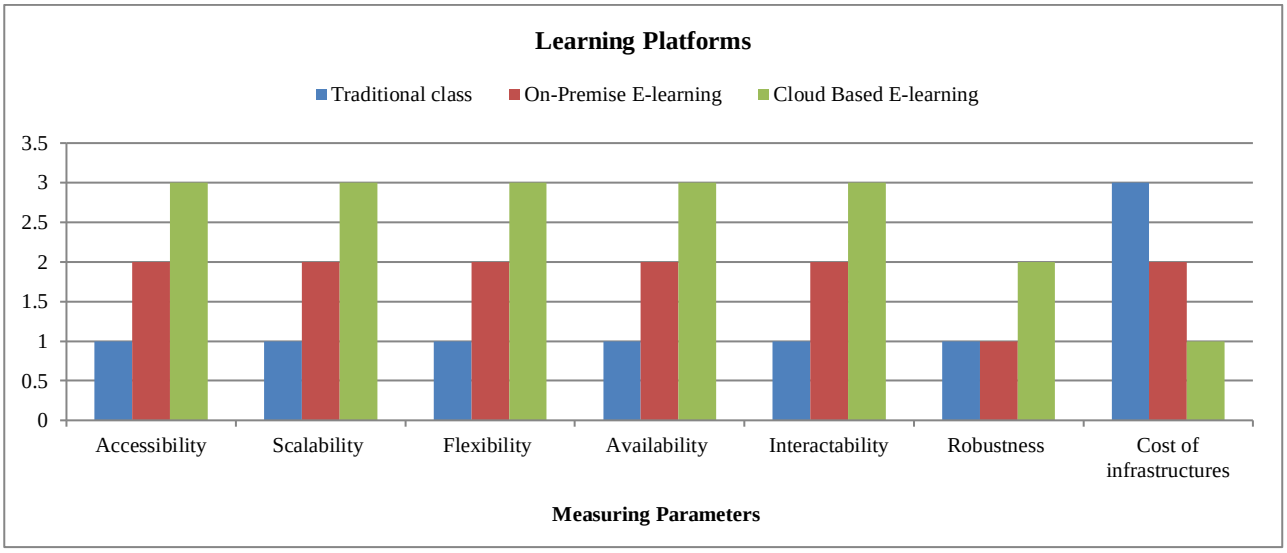

Fig. 7. Comparing the learning platform features

6. Evaluation, and Validation of the Framework

In this framework, the existing educational delivery in both traditional & on-premise eLearning platform vs. education over Cloud have been evaluated for their performance in terms of high uptime (*availability*), *On demand needs fulfilment (scalability)*, *On demand* provision and provision of products and services (flexibility), Promising reliability with Least downtime (reliability), Cross boundary usage over any electronic device (accessibility) and Promising optimized performance under SLA (performance) in the real world computing and communication scenarios of higher education environment.

User's acceptance & Availability of System

Available of educational e-resources over the server is the most critical challenges in many academics' institutions. The 99.99% of On-premise/traditional eLearning systems are not guaranteed while 99.99% uptime from the cloud counterpart are guaranteed. Due to these challenges, there is no or poorly guaranteed availability for e-learning over existing platforms. There is no such SLA provided by existing e-Learning service providers as on date in Ethiopia. Hence cloud-based eLearning platform can definitely promise 99.99% uptime availability. The Fig, 8 shows the output comparison of On-premise E-Learning over localized intranet vs. Cloud Based Intranet Availability based on 24/7 requirement. This challenge has already been investigated and proved for high uptime assurance services over cloud.

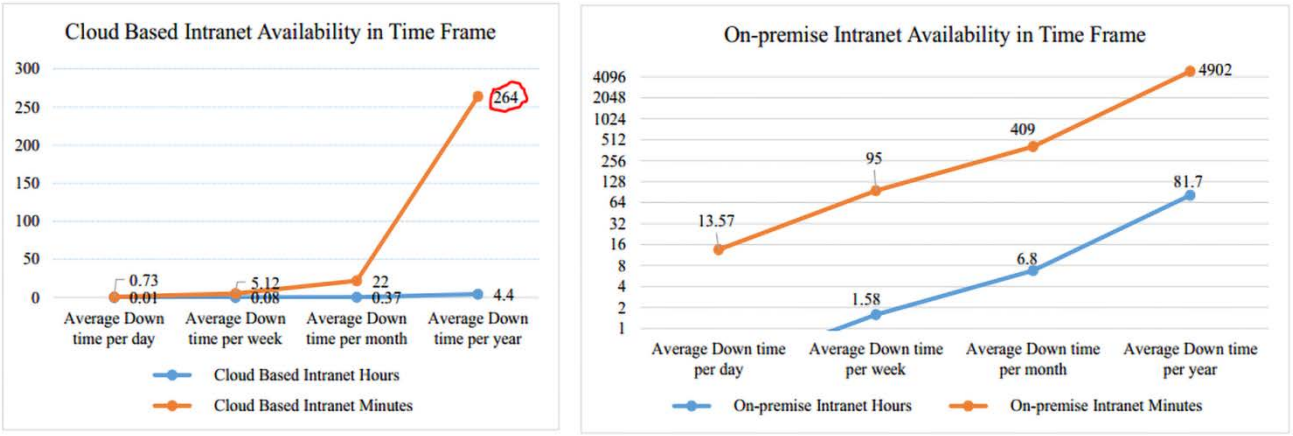

Fig. 8. Comparison of availability of On-premise vs. Cloud Based Intranet Services like E Learning

Security, Reliability and Privacy

During the survey, security, privacy and reliability of the data over the cloud platform were criticized. Apart from this; there is another angle, where different stakeholders also understand and feel that these challenges are also associated with both the traditional education system like; Traditional class method and On-premise E-learning methods. Researchers compared these challenges against three learning platforms with special reference and focus of learning

objectives of working professionals. The critical observations with argumentations of the results are presented are in the Fig, 9 (plotting point graph). As a final note, security, privacy and reliability perspectives conclude that cloud-based education system has better and promising data security, privacy and reliability with recovery commitment and guarantees under SLA. However traditional system or e-educational system over local intranets or web servers are missing such provisions under SLA, even no SLA exists in their practices.

The Fig. 9 is drawn based on the inputs provided by the selected stakeholders and participants who were primarily included in the survey, interview and researcher's self-observation of the existing system practices using questionnaire and chekists respectively. They once again participated in the process of user acceptance survey for validation of the proposed framework during functional demo of the proposed framework.

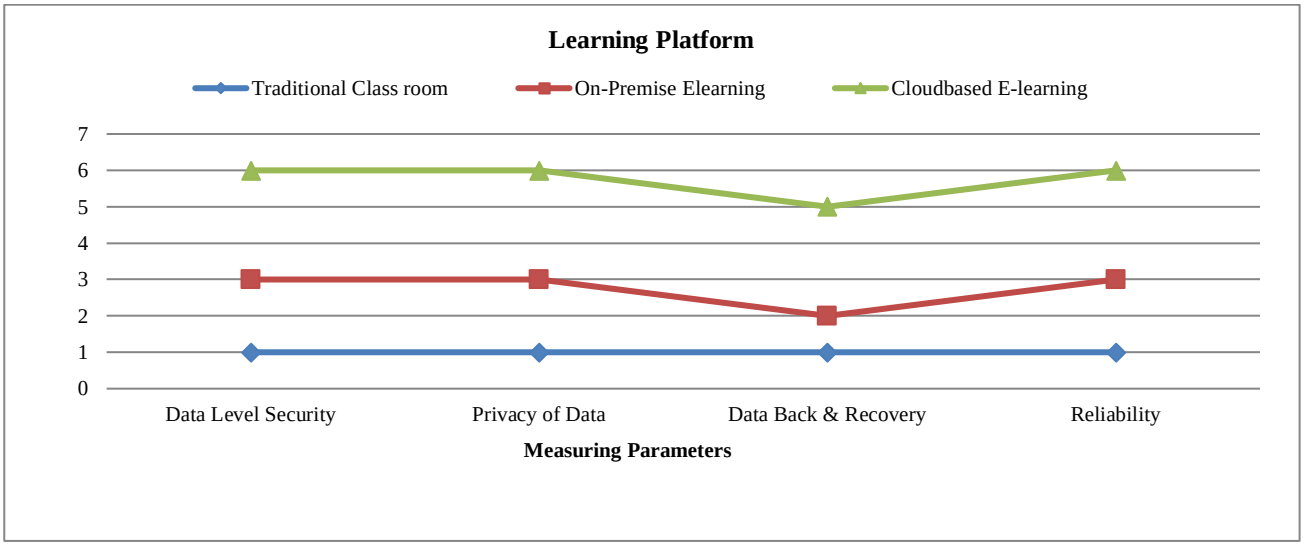

Fig. 9. Data reliability, security & privacy comparison

7. Conclusion and Recommendation

In this research, existing state of art education delivery and access systems for working professionals disabled and women with pregnancy are investigated and analyzed to develop an alternative technology-enabled blended system framework. The issues, challenges in the existing learning systems are studies and analyzed based on the selected features and facilities. Further based on the study outcomes and recommendations, the best-suited framework i.e., Unified Cloud-based E-learning Framework (UCELF) is designed and tested with user acceptance validation.

The benefits of the shifting e-learning systems over cloud platforms, their scope and limitations are also carefully studied and analyzed with different perspectives and parameters. During information gathering & analysis, the researcher grouped the questionnaire under four different categories based on the stakeholders' responses to research questions and associated problems. Demographically the majority of the respondents i.e., 87.7% clearly revealed that the education challenges in traditional classroom delivery systems and eLearning over web or intranets are serious concerns such as limited time to attend the classes, poor technical feasibility of On-premise e-learning (71.1%) for working professionals, disabled, and women. The respondents perceived that the cloud platform can be a better option for learning convenience (85.7%) and they agreed to move education system over the cloud to harness the cloud's potential features like high uptime (availability), On-demand needs fulfillment (scalability), On-demand provision and provision of products and services (flexibility), Promising reliability with Least downtime (reliability), Cross-boundary usage over any the electronic device (accessibility) and Promising optimized performance under SLA (performance), better security, privacy, and robustness of the system at low cost. Different inputs from different stakeholders pointed out that both the traditional education delivery system and non-contextualized cloud platform migration might not improve the Ethiopian delivery education systems and therefore the proposed Unified Cloud-based Education Framework (UCELF) can be an important instrumental and guideline to alleviate the existing challenges faced by Ethiopian working professionals disables and women. Also, this framework can reduce the complexity of the previously adopted cloud-based frameworks that lack contextualization of Ethiopian learning systems. Here the cloud-based Learning Management Systems (LMSs) were compared and Talents was selected to demonstrate the learning collaboration of the framework's users. The Unified structure of designed framework, the researcher concluded that this framework can significantly alleviate many of the aforementioned issues and challenges that hinder the extension of higher education to the door of learners especially working professionals, disable and females with pregnancy.

Recommendation

During the research survey and data analysis, it has been found that higher education needs an alternative learning platform that can support working professionals, the disabled, and women. In this regards the researcher likely to recommend that; the proposed Unified Cloud-Based Education Framework (UCELF) need full implementation over real sites so that's its full potential benefits can be cross verified and explored. And also, it should be checked for all the stakeholders like academicians, institutions, and government to invest in the most suitable platforms of education to serve better as a future generation of educational systems

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