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A Portfolio towards the Development of Cloud University

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Abstract: This study presents the portfolio towards the development of cloud university. The developed portfolio was produced by assessing the level of quality of system applications, hardware, current cloud technologies and internet infrastructure. The appropriateness of the policies and procedures for cloud operations, the preferences on the subjects to take and the services to receive online and the best practices and the challenges encountered by the schools offering online courses were also identified. Using the descriptive statistics the mixed method was employed to collect qualitative and quantitative data gathered through surveys, interviews and document analysis. The triangulation approach was used to cross verify results from different sources to increase validity and credibility of this study. These were treated, analysed and presented. The results from the study were used to come up with the following plans and projects, policy development for cloud university, on-line course design conversion, development of website, restructuring of organization and faculty and non-teaching staff development. The developed portfolio may be used as reference towards running the university's entire operation on internet using cloud computing technology.

Keywords: Portfolio, cloud based university, cloud computing, qualitative and quantitative data, increase validity and credibility

INTRODUCTION

The idea of rendering business online started in 2006 when amazon.com piloted the operation of compute cloud (Amazon EC2). With this technology, some companies were able to take advantage of this and use it as a vehicle to reach out to a wider customer delivering the same quality of products and services at a reduced cost 24×7 in global market. The combination of services Software As A Service (SAAS), Platform As A Service (PAAS) and Infrastructure As A Service (IAAS) made physical setup of an organization establishment possible in the cloud. The migration, deployment and adoption of process in the cloud can be considered as the next driver of innovation.

In the academe, these developments found its way to influence on how schools deliver education, creating a new shape on the conduct of teaching and learning. In fact the opening of Massive Open and Online Courses (MOOCS) where free education is given by 38 charter members and 27 members (edx.org) showcase how lessons could be offered online (AWS, 2015). These platforms enable lessons and activities from the top calibre schools headed by Harvard University available to all users on a weekly basis at no cost. Students can access on their free time at any time and in any place. Real classroom experiences were provided through video presentations which are divided into series that last from 3-15 min. Offline activities were given to intensify learning while online quizzes were given to test acquire knowledge. The forum from these sites houses the threads of communication for student's interaction, discussion and recitation. MOOCS provided a new technology on how learning could be self-directed in a different setting.

Similar with what "hole in the wall" experiment in India studied by Mitra *et al.* (2005) which claims that learning could take place with less helped and instruction. In the same way, Minimally Invasive Education (MIE) proves that learning could take happen with lesser intervention from teachers (Armbrust *et al*., 2010).

The growth of online learning enthusiast is inevitable. As what Babson reported that there are 6.7 million students are learning online with 10% growth rate each year. With this innovation and findings combined with cloud services putting the entire operation of the school in the cloud is possible.

Literature review: Masud *et al.* (2012) studied an architectural layer for e-learning. These layers for e-learning are infrastructure, software resource, management layer and hardware resources. Each layer plays an important task to make learning happen on the internet. Applying this architecture will result to a fast delivery of information in real time could be achieved. A high storage capacity allows multi-tasking where in application could be loaded at the same time. As a result, teachers could load up varied instructional materials for online delivery that students could access in a breeze.

Similar to what Masud suggested, Alabbadi (2011) researched on the additional layer thereby completing the quadrant for cloud computing. This layer is a space exclusive for educational and learning area to house instructional materials and all pertaining to school operation while the three layers were dedicated to software, infrastructure and platform. To support that learning could take place on-line, Prasad *et al.* (2013) tested AgroMobile Software to assist farmers for crop cultivation and marketing. These farmers downloaded the application in their mobile devices, followed the instructions and compared images so that appropriate action can be taken to solve their problems in farming. This study supports Yadav (2014) claimed that schools can provide quality education using cloud computing technology without minding that it actually happen at a distance. The "hole in the wall" experiment provided 17 computer Kiosks in the street of India. These computers where used to investigate whether students could learn to use computers on their own. In this study, the children explored the functionalities of computers, used paint, open and close an application. It found out that when a child has an initiative to learn, education could happen. On the contrary, Arora (2010) yielded a different result when he applied the same experiment to children of Himalaya. They did not learn computer by themselves. The action could be attributed to the icons because it suggested its functionalities. Payal even questioned the sustainability of such learning methodology when implemented.

However, a comparative study made by Masud and Huang (2012) on the proposed cloud system with the existing system revealed that migration to cloud due to data security is difficult among school administrators. To address this issue, Jayasena (2012) identified the risk and limitations of cloud computing and suggested ways implementing policies about passwords. The policies should be complete with detailed procedures on how to change in case the user wants or how it is created. Jayasena also suggested that seeking a third party to audit the software with note, Kuyoro (2011) suggested that understanding the mod complete and minuted details on where data is kept and protected is also an intervention for data protection. In the same els of deployments to explain how data is treated in this set up should be part of the security considerations.

In school settings, the interchange of student's data should be the main concern. Plunkett *et al.* (2014) reported aside from data security, the danger of being exposed to the public is also an issue in cloud computing environment. He pointed out that the data should only be for the consumption of the school and the district that owns it. To implement this, adherence and strict implementation to the standard procedures on data access is necessary. A proposed a virtual educational system by Anitha *et al.* (2014) to implement an authentication strategy on the data exchanges from hardware to user and vice versa through common server before granting access to data is also a good strategy to secure information in the cloud. In the same note, Anitha (2016) suggested that data splitting or saving those data in different sectors can be a technique to use for data security. Through this technique, the hackers will have a hard time finding the pieces because bits of data are scattered in different location. Hoboken *et al.* (2012) also suggested the following, ownership of data and granting privileges in accessing depends on the organization who owns it. A point person should be assigned to be liable to whatever error or action his decision on the security and privacy of data. There should be a parental consent should a third party wants access to information particularly those owned by the students. Data exchanges should be identified and are recorded on the system logs. The aforementioned studies suggests that strategies and technology when combined, data security in the cloud is no big deal.

Statement of the problem: This study aims to develop a portfolio containing actions, programs, projects and strategies towards cloud university. Specifically, it seeks answers to the following questions:

- How do the respondents assess the current technology being used in CEU's operation in terms of:
- Level of quality of the different systems application
- Level of quality of servers being used
- Level of performance of hardware
- Level of quality of the current cloud technologies
- Level of quality of the internet infrastructure
- Level of appropriateness of the policies and Procedures for cloud operations?

How do the respondents assess their preference in terms of:

- Courses to take online?
- Services to receive online?
- What are the best practices of the universities offering online courses?
- What are the challenges encountered by the universities offering online courses?
- What are policies, strategies and projects needed towards a cloud university?

MATERIALS AND METHODS

Using the descriptive and inferential statistics, the mixed method was employed to collect qualitative and quantitative data gathered through surveys, interviews and document analysis. The triangulation approach was

Table 1: Assessment of current technologies

	Students			Employees		
Technologies	Mean	SD	VI	Mean	SD	VI
Quality of different system apps	3.44	1.0	Good	3.82	0.98	Very good
Quality of hardware	3.04	1.02	Good	3.53	0.95	Very good
Quality of the cloud technologies	3.29	1.14	Good	3.72	0.86	Good
Quality of internet infrastructure	2.65	1.15	Good	3.44	0.92	Good

used to cross verify results from different sources to increase validity and credibility of this study. These were treated, analyzed and presented. The study was conducted at Centro Escolar University among the graduate school students, faculty and staff from all campuses during the 2nd semester of school year 2014-2015 and selected respondents from universities offering online education.

In getting the needed sample, out of 541 graduate school students, faculty and staff from different campuses of the three schools of Centro Escolar University, the researcher used Sloven's formula with 5% degree of error. The researcher used survey questionnaire, interview, data and document and web analysis to gather data. The four different sets of questionnaire were distributed to the students, faculty and non-teaching staffs of CEU and the last set was given to the universities offering online courses. To counter checked the veracity of the answers, a follow up interview was and observation was conducted.

In validating the questionnaire, the researcher consulted I.T. professionals, statistician and other experts to ensure the correctness and the validity of the instrument. Trial run was conducted to achieve the high degree of validity. These were submitted to the CEU Center for Statistical Analysis for internal consistency using Chronbach's alpha which yielded 0.965 and 0.940 scores. After administering the questionnaires, the data were counted, scored and tabulated using Statistical Package for Social Sciences (SPSS/PC). The results were used as basis for analysis and interpretation Table 1.

RESULTS AND DISCUSSION

Determining available technology for cloud operation: Since, cloud computing is composed of three services, Software As A Service (SAAS), Platform As A Service (PAAS) and Infrastructure As A Service (IAAS), assessing the quality of different system application, hardware, cloud technologies and internet infrastructure is one of the factors to determine possibility of physical set up in cloud setting.

As seen in Table 1, employee rated the quality of the different systems application as very good with a mean score of 3.82 while students rated as them as good with an average mean of 3.44. The systems that were rated are the key application in CEU's operation which includes Enrollment and Registration System (EARS), on-line grading sytem, CEU Website, Teacher Behavior Inventory (TBI), Student Service Personnel Survey (SPSS) and University Student Council Election System (USCEC). On level of quality of hardware, comprising microcomputers, servers, local area network and wi-fi equipment resulted to 3.04 and 3.53 mean with an equivalent verbal interpretation of "good" and "very good" while the level of quality of the current cloud technologies received 3.29 and 3.72 with equivalent verbal interpretation of "good. This cloud technologies are as follows includes Google apps, on-line grades, alumni tracer and moodle. Moodle is being hosted at www.hivelocity.com for $2,028 annually using 15761 Quad-Core 3.1 GHz e3-1220Xeon Sandy Bridge 8MB capacity. Using speed and reliability to measure internet infrastructure, both students and employees rated this as "good" receiving 2.65 and 3.44 mean averages respectively. Having all of these technologies, it shows that the university is ready to migrate to the cloud (Table 2).

D**etermining appropriateness of policies and procedures to cloud operation:** As seen in the Table 2 both employees and students overall rating of 4.31 and 3.61 with a verbal interpretation of "very much appropriate" shows that the listed policies and procedures are appropriate to cloud operations. Migrating to cloud will affect the policies and procedures; revisions, development and conversion should be studied. Although, the findings yielded that majority are very much appropriate, some needed adjustments this includes application for cross enrollment, application for transferring to another HEI, applying for scholarships, renting out lockers, requesting for the use of facilities and replacing lost documents. On the other hand the need for developing new policies for preparation of on-line courses, ensuring quality of online learning, applying technology in designing a course, deployment

Table 2: Policies and procedures to cloud operation

	Students			Employees		
Technologies	Mean	SD	VI	Mean	SD	VI
Policies and procedures to cloud operation	3.61	0.99	Very much appropriate	4.31	0.79	Very much appropriate

Table 3: Operation plan for policy conversion and development

Objectives	Key Performance Indicator (KPI)	Milestones	Strategies
To develop/convert policies appropriate for cloud operation	Number policies converted/developed for cloud operation	All appropriate policies for cloud operations were converted/developed	Convene a committee that will convert/develop existing policies for cloud operation

Table 4: Preferences of the subjects to take/teach on-line

	Students			Employees		
Subjects	Mean	SD	VI	Mean	SD	VI
Core	3.44	0.96	Much preferred	3.82	0.75	Much preferred
Professional	3.04	1.09	Much preferred	3.53	0.81	Much preferred
Cognates	3.29	0.99	Much preferred	3.72	0.85	Much preferred

Table 5: Online course design conversion/development operation plan

Objectives	Key Performance Indicator (KPI)	Milestones	Strategies
To design/convert on-line courses for online delivery	Number of converted/designed courses for online delivery	All courses were converted and evaluated for online delivery	Convene a committee that will design, convert and evaluate courses for online delivery Assign experts for the content development Hire multimedia artist for the course conversion and development Conduct user acceptance testing and evaluation

of on line course, implementation and evaluation of online courses is recommended. Table 3 and 4 shows the operation plan for policy conversion and development.

Operation plan for policy conversion and development

Preferences of the subjects to take/teach on-liNE: The students and employees rated core subjects as the highest mean score of 3.9 and 4.2, respectively with an equivalent verbal interpretation of "much preferred". Also, the table shows that there is a slight difference between the results of professional and cognate subjects on both student's and employee's scores. The mean scores are 3.8 and 3.7, respectively for the students and 4.1 and 3.92 for the employees with equivalent verbal interpretation of "much preferred".

The overall ratings of 3.87 and 4.07 of students and employees with equivalent verbal interpretation of much preferred implied that subjects in the graduate school can be taken and teach online. In getting the preferences of the respondents, the result could be used as a basis to prioritize, design and convert courses for on-line delivery. This also shows the willingness of the respondents to use a different platform in the delivery of teaching and learning. Table 5 presents the operation plan in on-line course design conversion/development and Fig. 1 shows an example screen shot of a course converted to course management system.

Online course design conversion/development operation plan

Preferences on services to receive on-line: The enrolment and registration received the highest mean score of 4.30 with equivalent verbal interpretation of "much preferred" among the listed services to receive online. While requesting for the use of facilities scored the lowest mean with a mark of 3.79 and an equivalent verbal interpretation of "much preferred". The overall summary of 3.99 for student's preferences to receive online services with equivalent verbal interpretation of "much preferred", shows that students want the services concerning them to be received online (Table 6).

Based from Table 6, evaluating and reporting of student achievement, enrolling new students and accomplishing class lists received the same mean score of 4.57, the highest mean score among the listed services with equivalent verbal interpretation of "very much preferred". The overall summary of 4.47 on average of services the teachers want to receive online with equivalent verbal interpretation of "very much preferred" implies that teachers do want the services that concerns them to be done online. Combining the result of the respondent's preferences to take and teach online and their preferences on services to receive online there is a need to restructure organization. Table 7 shows the operation plan to implement such action and Fig. 2 for the recommended organizational chart of the university.

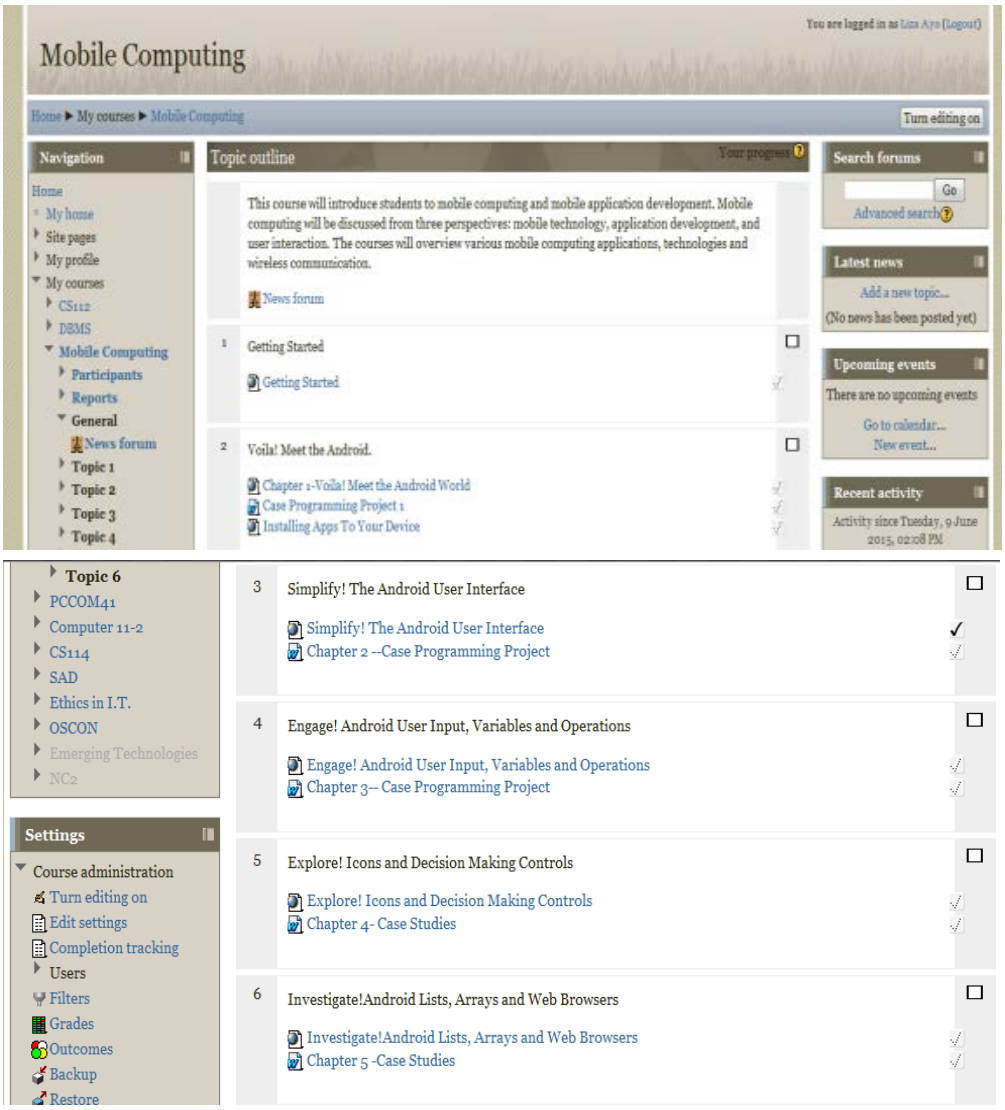

Fig. 1: Example course uploaded in the CMS

Table 6: Preferences on services to receive on-line

	Students			Employees		
Variables	Mean	SD	VI	Mean	SD	VI
Listed services to receive on-line	3.99	0.99	Much preferred	4.47	0.73	Much preferred

Table 7: Operation plan for restructuring of organization

Objectives	Key Performance Indicator (KPI)	Milestones	Strategies
To create a department that will oversee operation, planning and implementation of projects needed for cloud university	Number of created/identified department to oversee operation, planning and implementation of projects needed for cloud university	All departments affected by operation, planning and implementation of projects needed for a cloud university were identified	Convene a committee that will study on the need of the cloud university department Formulate job description and job qualifications Hire additional or transfer needed employees.
	Number of revised job description needed for cloud university	All job descriptions that need revisions for a cloud university were revised	Convene a committee to formulate job description and job qualifications

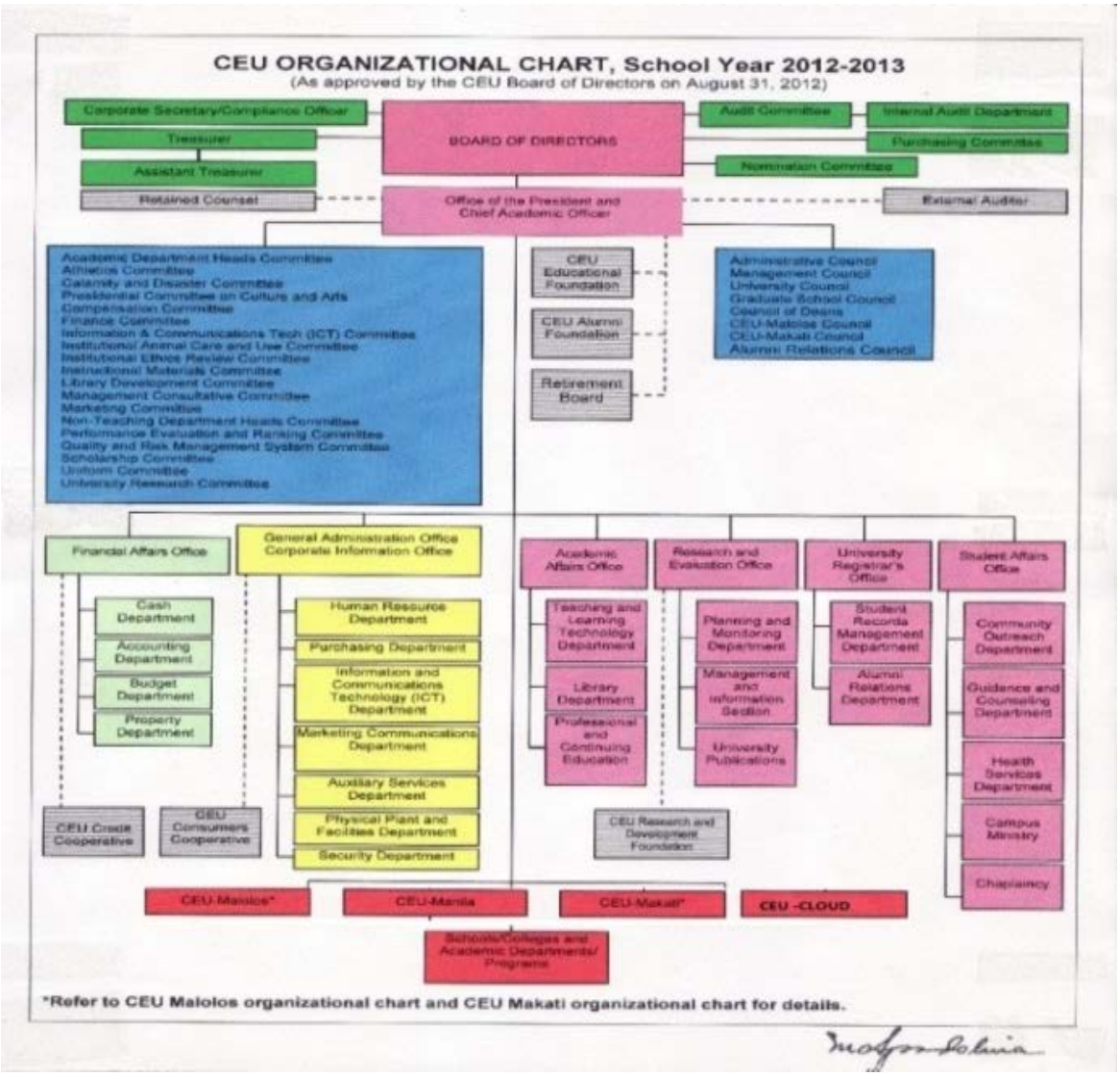

Fig. 2: Organizational chart

Table 8: Best practices of online schools

Best practices	F-values	Percentage
Physical plant facilities are available to support delivery of online courses	8	80
Assurance that students exhibited the expected outcomes before a degree or certificate is awarded	10	100
Curricula are designed by academically qualified persons	10	100
Commitment to provide students with quality online education	10	100
Availability of Website that is loaded with procedures for faculty, employees and students with all the procedure concerning them is clear and concise	4	40
Provision for online library services	10	100
Availability of Help desk for students and faculty	10	100
Online payment arrangements	10	100
Procedures are clear and concise	10	100
Require and review records/document of applicants to determine qualified students	10	100
There is a policy on refund of payments	6	60

Restructuring of organization: As seen on Table 8, 8 out of 10 online universities have available physical plant facilities to support delivery of online courses. Access to their branches nationwide of these 8 schools are open to online students. In assuring that online students, exhibited the expected outcomes before a degree or

Table 9: Operation plan for website development

Objectives	Key Performance Indicator (KPI)	Milestones	Strategies
To develop a complete website for cloud university	Number companies invited for bidding and project proposal	At least 10 companies invited for bidding and project disposal	Invite companies for project proposal
	Number of identified operation/module	All needed operation/module for cloud operation were identified	Evaluation of the identified operation/module
	Number of business process requirements that were determined and put into web	All needed business process requirements were determined and put into web	Identify business requirements for cloud operation Convene a committee that will work with the outsourced company on the business requirements
	Number of process that underwent testing and evaluation	All processes underwent testing and evaluation	Convene a committee to test and evaluate the processes
	Number of process that are ready on the scheduled go live deployment	All processes are ready on the scheduled go live deployment	Convene a committee for go-live deployment

Table 10: Challenges encountered by the schools offering online courses

Best practices	F-values	Percentage	R
Faculty involvement in online learning	7	70	5
Converting their traditional courses to an online format	8	80	1
Technical skills for faculty on the process of designing, developing, and instructing an online course	7	70	5
Faculty attitude	7	70	5
Faculty time and schedule	8	80	1
Quality of their online courses	8	40	1
Learners attitude	4	40	11
Orientation for learners	4	40	11
Administrative support	2	20	12
Conversion cost	5	50	9
Adequate hardware	5	50	9

certificate is awarded, majority of the school conduct extensive evaluation process. The students have to take major examinations in their testing centers to ensure that student received the expected competency that the degree requires. For off shore students in the case of online school 1, testing centers are available at the Philippine Embassy in their country. Eight out of 10 online institutions offers the same degree with what they are offering in the main university. On the other hand two institutions offers a different course. As reflected also in the table, all schools are committed to provide students with quality online education as posted in the website of the online universities. The online university website serves as the student's entry point to their virtual classroom. all on-line schools have clear and concise procedures. However, 6 from 10 online university websites need content improvement. In terms of library services, almost all online universities provide their students with online library services. For those schools with branches nationwide, library are open to their online students. On the other hand, in one of the two schools that operates solely as an online institution, the online schools signup a Memoradum of Agreement (MOA) with selected universities to become their learning centers, thus the library is open also to those enrolled online. For their tuition fee, an online payment arrangement through bank transactions, credit card, XOOM and various wired transfer method are accepted. However, when it comes to refunding of payments in case an online students drop out, 6 out of 10 have clear policy on these.

The common practice for these schools is the use of various instructional strategies like webinar, teleconferencing, webcast, podcast, video lectures, emailing and instant messaging through their student portal accessible through their student portal. This portal is where consolidated activities and files are kept needed in the delivery of the lesson. Moodle, e-classroom and e-mabini learning portal are examples of them. In addition, tedious authentication process of all relevant documents, the use of third party organization that checks on the authencity of the submitted documents, student portal, occasional meet up in their learning centers, presence of help desk, traditional commencement exercises are being practiced by the university. In terms of faculty remuneration the salary in on-line schools is higher compared to traditional school. However, technical know-how for faculty is a must and knowledge in using course management system is a required skill for a teacher applicant.

Incorporating all the best practices presented in this study, a website is hereby recommended. Table 9 presents the operation plan for the development of website and Fig. 3 is the screen shot of the recommended modules for the site.

Fig. 3: Recommended website modules

Table 11: Operation plan for faculty training module

Topics	Objectives	Participants
Information technology essentials	Use office productivity tools in the teaching and learning process Apply the knowledge gained in information technology essentials Troubleshoot their own information technology problems whenever they encountered one	Novice
Web 2.0 technologies	Use WEB 2.0 technologies in the teaching and learning process Share and collaborate to online practitioners on the latest trends in education using WEB 2.0 technologies Apply Web 2.0 technologies in collaborating with the students	
Course management system	Learn to use moodle in the offering of courses via blended mode Communicate problems in using course management system Conduct classes in blended mode if possible	Professionals
Fundamentals of online teaching and learning	Equip teachers with expertise in the technical know-how of online teaching and learning with the relevant theories for it	Professionals
On line learning tools and software	Develop courses suited for online delivery Produce instructional materials for online the teaching and learning online Use appropriate learning tools and software in the delivery of online courses	Expert
Managing, evaluating and assessing online students	Manage an online class using appropriate theories Use learning management systems in evaluating and assessing the students	Expert Expert

Website development

Challenges on offering online courses: As shown in Table 10 converting their traditional courses to an online format, quality of their online courses, faculty time and schedule were the top challenges encountered by the schools in offering online education. These identified challenges are needed in the development of on-line courses to create quality instructional materials for online delivery.

There is a need to identify the training suited for faculty and employees to serve as a basis in addressing the gap towards cloud university. An appropriate training module is designed for the identified level of faculty while employees will undergo online customer service satisfaction and online customer tools aside from upgrading their skill in information technology essentials. Table 11 and 12 shows the operation plan for the faculty and staff development shows the recommended module for the identified gaps:

- Faculty training module
- Non-teaching training module

Table 12: Operation plan for non-teaching training module

Topics	Objectives	Participants
Information technology essentials	Use office productivity tools in their workplace Apply the knowledge gained in information technology essentials Troubleshoot their own information technology problems whenever they encountered one	Non-teaching staff
Web 2.0 technologies	Use WEB 2.0 technologies in their workplace Use WEB 2.0 technologies to share and collaborate to online	Non-teaching staff
Online customer tools	Use the developed customer tools in the website	Non-teaching staff
Online customer service satisfaction	Acquire the skills in serving on line customers Maintain records/account of online customers	Non-teaching staff

CONCLUSION

In investigating available technologies, appropriateness of procedures, identifying best practices and determining challenges encountered in offering online courses, cloud university can happen. The possibilities of providing services to online students both in curricular and co-curricular activities similar to a regular student enrolled in a university is possible through the presented operation plan, strategies, actions and projects in this study. These include policy development, on-line course design conversion, development of website, restructuring of organization and faculty and non-teaching staff development.

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