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The Reduction of Fragmentation in the Conduct of Online Distance Learning using my.eskwela

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Abstract

With (Corona Virus Disease) COVID-19 pandemic, academic institutions worldwide were forced to facilitate distance learning and it quickly became the standard mode of instructional delivery for everyone. Even if implementation is met with problems like lack of manpower skills and training, perceptions, and the internet connectivity, Filipinos are still optimistic to overcome the limitations by using its ingenuity in finding the appropriate solution. Solutions may include the fragmentation of variety of platforms in the conduct of online distance learning. It is the desire of this study to introduce my.eskwela to reduce if not eliminate the need for the fragmented approach in delivering online distance learning. Such realization comes with the hope to minimize the mental stress experienced from switching platforms.

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1. Introduction

Distance learning is a form of instructional delivery that is not confined within a physical classroom, it uses tools to deliver the lessons no matter the distance, education reaches the learners wherever they are. Two tools dominate the implementation of distance learning: printed materials (also known as modules) and learning management systems. Printed materials can be considered as a tool in delivering offline mode of distance learning where learners receive the learning module and perform the activities as specified by the teachers. Whereas, learning management system is used in the conduct of online class. Learning Management System (LMS) is computer application which serves as tool in delivering distance learning that is usually accessible using a web-browser implying the use of the internet connection. The utilization of LMS in delivering distance education is called On-Line Distance Learning (ODL). For ODL to succeed, participants must be properly grounded with the skill for self-directed learning and with decent
internet connection. ODL allows any person who does not have the luxury of time in attending face-to-face (f2f) classes to learn at their most convenient time and place, it is like: education anytime, anywhere.

With (Corona Virus Disease) COVID-19 pandemic, academic institutions worldwide were forced to facilitate distance learning and it quickly became the standard mode of instructional delivery for everyone irregardless of whether the student has the time to go and attend face-to-face classes or not. Distance learning is synonymous to ODL to some countries where internet connectivity is good enough so LMS can run smoothly on the participants end. However, this may not be the case for countries like Philippines with unstable and expensive internet connection [8]. As a result, education delivery in the Philippines is either offline or online with majority being delivered offline. For those who opted online delivery, participants uses fragmented technologies for videoconferencing, distribution of digital learning materials, distribution of grades, and announcements as influenced by the choice of the teacher. The choice of fragmented technologies in delivering ODL contributes to mental stress as already pointed out in a study [14]. The need for the videoconferencing software comes from the fact that educators tries to conduct a virtual face-to-face class as a remedy to the strict implementation of quarantine guidelines which prohibits anyone to conduct face-to-face classes. The need for a virtual face-to-face is suggested because majority of the education sector are still in a transition towards self-directed learning.

Due to budget constraints, teachers usually opt to use free available software that may be provided by popular Tech Companies. However, problems come with the functional restrictions of the free software like the 1-hour limit for some popular videoconferencing providers. Fragmentation and restricted features are just some of the factors contributing to difficulty in delivering ODL in the Philippines. To mitigate the problem, a software solution called my.eskwela is introduced. my.eskwela is an inclusive social learning management system that tries to reduce the fragmentation and breaks the functional restriction of videoconferencing by providing more than one hour for the conduct of virtual face-to-face classes. Inclusivity means that persons involved in education delivery like superintendent, supervisors, principals, teachers, students, and parents are given functionalities for them to perform their tasks in the system.

By adding videoconferencing functionalities in my.eskwela, among others, in delivering ODL, this study tries to answer the following questions:

1. What is the resulting cloud architecture of my.eskwela when video conferencing architecture is integrated?
2. How will the users evaluate the system features for ODL?

2. Learning Management Systems in the Philippines

2.1. Pre-pandemic

The utilization of LMS in the Philippines started way back in the 2001, when the University of the Philippines Open University (UPOU) started implementing e-learning. They have gone through different phases of adoption from treating LMS in supplementing face-to-face interactions, to full-adoption of LMS by delivering on-line courses in the year 2017. UPOU uses Modular Object Oriented Dynamic Learning Environment (MOODLE), a popular open-source LMS, as the platform to simulate conventional teaching from instructional delivery, submission of requirements, grading and taking exams. UPOU also provided an online forum so that students can post questions or concerns regarding the course and professors can respond to the query. With this, some frequently asked questions answered by the professor can be read by other students, so the professor saves time in answering recurring questions. UPOU also implemented a less restricted social online environment called ”kapehan” (or coffee shop) so students can socialize and interact with other students. From their experience, it has been observed that those who completed the course are satisfied students [18].

Mindanao State University-Iligan Institute of Technology (MSU-IIT) have started using MOODLE-based learning system way back on the first quarter of 2003 consequently referred to as MSU-IIT Online Learning Environment (MOLÉ). However, it was observed that from 2002-2012 usage had not increased mainly because there are different levels of acceptance in using LMS among academics. Motivation and disposition in using the system justifies the associated utilization benefit. While training, learning environment and institutional level are enumerated as environmental constraints concepts [21].
Getting insights at student’s adoption of e-learning technology, a study of ten Philippine schools (with 629 respondents out of 800 invited students) revealed that internet connectivity is an important factor for adoption. System interactivity and social media influence has effect on perceived usefulness. The study is optimistic that adopting e-learning in the Philippines can increase learning experiences and academic achievements of college students specially if instruction is enhance with multimedia [10]. The same sentiment has been observed in University of the Philippines- Los Baños (UPLB) which lead them to suggest that LMS be utilized by all educators because of perceived student’s improved performance [7].

However, all these positive outlook tends to be dependent by the Philippine internet infrastructure which was according to internet speed report, is the slowest among Asia Pacific countries [8]. Because of this, a Portable Learning Management System (PLMS) was introduced in the four provinces of Central Visayas Higher Education Institutions (HEIs) offering teacher education programs. PLMS distinguished itself by being available even without the internet connection, a promising technology given the current slow internet connection status of the Philippines. The result of the study suggests a positive perception can be observed with teachers towards the development of PLMS [17].

One conceptualization on the independence of internet connection is to deliver LMS functionality through the use of short message service (SMS). My.Aral project is one such realization of the concept. The project was designed to work both on mobile devices with interfaces to mobile web and SMS access. The SMS implementation is limited only to notifications and quizzes. My.Aral was designed to work with system admin, faculty members, and students users. All these users have used the features of My.Aral and majority of them strongly agree on the effectiveness of the implemented system [16].

Summarizing the Philippines’ effort in utilizing LMS in instruction delivery, it can be stated that the UPOU is by far the successful institution in utilizing LMS. The success has catapulted them to become country’s pioneer provider of MOOCs. Their implementation have also extended the functionality of MOODLE to enable social interactions among students. Such feature, social media influence, have already been noted to influence perceived usefulness. It can also be observed that most LMS implementation utilized MOODLE which coincides with the fact that 95% of Philippines’ schools used the technology for LMS implementation [3]. In fact, the Philippines DICT own Gabay Aral is also MOODLE-based [6].

2.2. During the Pandemic

Education in the New Normal is the term coined to the learning continuity amidst the quarantine restrictions during the COVID-19 pandemic. A learning continuity plan was suggested by the Department of Education (DepEd) and Commission on Higher Education (CHED) for basic and tertiary education, respectively. The learning continuity plan promotes offline and online distance delivery. DepEd introduced the web application DepEd Commons serving as online repository of learning materials. Meanwhile, the CHED suggested the utilization of online platforms for online distance learning. ODL are delivered into two modes: synchronous and asynchronous. Asynchronous ODL shares the same characteristics with offline distance learning, but with asynchronous ODL digitized materials are uploaded to LMS so students can perform the teacher’s specified activities. Whereas synchronous ODL is an augmentation of asynchronous ODL because teachers add on videoconferencing feature for real-time class discussion, virtual face-to-face.

However, all these recommended tools are threatened with the quality of internet connection in the Philippines resulting to lesser ODL activities in basic education, and an option to offline learning are offered by some tertiary colleges and universities [11, 20]. In the actual implementation, variety of tools were utilized in the conduct of online distance learning [1, 5, 4].

2.3. Summary

All the discussed Philippine experiences of using LMS have proven the country’s desire to improve the learning experiences by embracing the benefits of the technology. Even if implementation is met with problems like lack of manpower skills and training, perceptions, and the internet connectivity, Filipinos are still optimistic to overcome the limitations by using its ingenuity in finding the appropriate solution. Solutions may include the fragmentation of variety of platforms in the conduct of online distance learning. It is the desire of this study to introduce my.eskwela
to reduce if not eliminate the need for the fragmented approach in delivering ODL. Such realization comes with the hope to minimize the mental stress experienced from switching platforms.

3. Integrating Video Conference Feature to my.eskwela

my.eskwela development started since 2011 and was originally designed as an extension to the existing in-house student information system of Mindanao State University-Iligan Institute of Technology (MSU-IIT). The goal was to include the parents in the system so they can track the progress of their student(s) enrolled in the university [12]. Then a need came that my.eskwela was re-designed from ground-up tailor-fitted to the DepEd workflow that is available anytime, anywhere using the cloud technologies [13]. Social features were enabled allowing any users to interact with the post using reactions and comments [14]. Prior to the pandemic, my.eskwela was utilized as a platform used as means to integrate ICT into teaching whereas face-to-face is the recommended form of class interaction. In this setup, the Principal can track compliance of Teachers in reportorial requirements, Teachers can post announcements and grades among others, and students and parents can view the teachers posts [15]. During the pandemic, there is a need to distribute the digital copies of learning materials and virtual face to face were needed as part of the learning continuity plan.

3.1. Architecture

The architecture of the cloudified my.eskwela is best described using Aggregator Design Pattern (ADP). The ADP considers a central entity, called the aggregator, that receives requests and aggregates responses after sending a request from different services [19]. In Figure 1, the implementation of the RESTful API acts as the aggregator that calls services from database and cloud Software as a Service (SaaS) like the Video as a Service, Storage as a Service, and Picture Server as a Service.

![Fig. 1. my.eskwela Architecture with Video Conference](image)

3.1.1. RESTful Application Programming Interface (API)

The RESTful (API) follows the specification from the work of Roy Fielding that describes an architectural style on the access of online resources called the Representational State Transfer (REST) [9]. Resources are exposed that receives JavaScript Object Notation (JSON) payload as parameters to the request and returns JSON payload as response to the request. JSON is an open standard file format for information interchange, it is lightweight and compact.
compared to returning a response using HyperText Markup Language (HTML) format. The aggregator is designed such that it only needs to access the SaaS needed to respond the request. For example, suppose the request pertains to storing a learning resource by accessing a resource called file. In that case, the aggregator will communicate to the Storage as a Service so the learning resource will be kept and save the learning resource link in the database before returning the resource link as a response.

3.1.2. Video as a Service

my.eskwela integrates Jitsi as the videoconferencing platform. Jitsi is a free and open source videoconferencing platform that offers an open API to embed videoconferencing capabilities for variety of platforms from web applications to mobile applications. Jitsi runs on the client but access is controlled by authentication and a notion of a virtual room id. Each homeroom class is assigned a unique virtual room id and is accessed every time a teacher or student attends a synchronous class. The design is also considered such that management features like mute/unmute, kickout, among others are assigned to the appropriate moderator, like the teacher for the synchronous class.

3.1.3. Storage as a Service

Storage as a Service (storage) is a type of Software as a Service that offers space for storing files. Some storage service offers API so clients can access the service programmatically using the specifications. The need for using a separate storage comes from the requirement of persistently storing digital learning materials. Also, the platform to which the aggregator ran offers a temporary storage useful for receiving the file from the client before the transfer to the storage service. Any future access request of the uploaded learning resource is done by using the file link.

3.1.4. Picture as a Service

Picture as a Service (picstore) is similar to the storage described in the previous section with the exception that this picstore specializes in storing pictures and also offers picture manipulation tools. The picstore also exposes API so clients can programmatically store original or manipulated pictures persistently.

3.1.5. Client

For now, the client of the aggregator is a web-based application with user interface (UI) elements from AdminLTE. AdminLTE offers social widgets, themes, among others so developers does not have to start from scratch in integrating and designing UI into their system. Careful design considerations are taken in order to reduce the user’s cognitive load (or learning curve) [14]. The goal is to minimize the physical load (i.e., click of mouse, typing, etc) in accessing a feature. In this respect, it was designed that students access to videoconference feature with just one-step after login and 2 steps for teachers after login and the video conference will be prepared immediately (see Figure 2).

Fig. 2. my.eskwela Video Conference Session
4. Results and Discussion

A conduct of user evaluation survey took place after a year (January 2021-December 2021) of deployment to beneficiary school, Tambo Central School. The questionnaire was derived from technology acceptance model (TAM) which contain different sections for evaluation. To follow are discussions that focus on perceived usefulness as questions are formulated to evaluate the system in this time of pandemic. Also, there will be discussions on the challenges of the integrated videoconference software, Jitsi.

4.1. Users’ Evaluation Survey

The user’s evaluation survey (survey) was conducted to the teachers, students, and parents. The eight survey items are tailor-fitted for each respondent type as they perform different system tasks, implying different perspectives of evaluation. The evaluation rating of the respondents uses the Likert Scale from 1 to 4, with 4 being the highest. The purpose of this range is to avoid uncertainty in the rating.

The survey was checked for internal consistency using the Cronbach’s Alpha with coefficients of 0.9791, 0.8233, and 0.9045 for teacher, student, and parent, respectively. The coefficient values indicate that the questionnaires surpasses the acceptable internal consistency.

4.1.1. Survey Results Properties

Table 1 summarizes the results of the averaged participants’ responses to the eight questions of perceived usefulness. The number of respondents from each group is not of the same population size as there are only 72 respondents for the teachers and 76 respondents for parents and students groups. Many choose the highest score for each item (mode = 4). In contrast, the perceived usefulness evaluation of the user group’s majority is greater than or equal to 3.3 (mean and median). The lowest assessment for the parent and teacher groups is at 1, whereas it is at 2.125 for students. The distribution of the user group responses is negatively skewed, with at least 0.27 standard error 1.

| Perceived Usefulness (PU) | PARENT | STUDENT | TEACHER |
|---------------------------|--------|---------|---------|
| Valid                     | 76     | 76      | 72      |
| Missing                   | 0      | 0       | 0       |
| Mode                      | 4.000  | 4.000   | 4.000   |
| Median                    | 3.563  | 3.500   | 3.313   |
| Mean                      | 3.444  | 3.484   | 3.205   |
| Std. Deviation            | 0.602  | 0.483   | 0.866   |
| Coefficient of Variation  | 0.175  | 0.139   | 0.270   |
| Variance                  | 0.362  | 0.233   | 0.751   |
| Skewness                  | −1.728 | −0.636  | −1.318  |
| Std. Error of Skewness    | 0.276  | 0.276   | 0.283   |
| Minimum                   | 1.000  | 2.125   | 1.000   |
| Maximum                   | 4.000  | 4.000   | 4.000   |

One can observe after plotting the data using raincloud plots, as seen in Figure 3, that the shape of the distribution for each group is almost identical, and certain outliers are evident in parent and teacher user groups. With this, the Kruskal-Wallis test was used to determine the heterogeneity of user responses, assuming a significance p-value less than 0.05. The resulting p-value was 0.258 (p > 0.05), indicating the homogeneity of user responses which means users groups agree on the perceived usefulness of the application.

1 JASP open-source statistics software provided the results of this section.
4.1.2. Summary

The survey results indicate that the affordance of features in the conduct of ODL using my.eskwela as a platform is positively perceived as valuable by the majority of respondents from teachers, students, and parents.

4.2. Challenges in Integrating Video Conference

As pointed out in Section 2, Philippine’s internet infrastructure is slow and expensive, and negatively affects the conduct of ODL. The situation prompted my.eskwela to start the video into low quality by default, in order to save the bandwidth in the conduct of synchronous online class. However, some internet connections are just too slow that participants were not able to access the online class. This scenario prompted some teachers and/or parents to switch and use other popular platform for the videoconferencing, but still, the same problem existed. However, some teachers/parents stick to the popular product in the conduct of synchronous online learning, but still uses my.eskwela for other purposes.

There are also cases wherein a browser handled the video conferencing well from the beginning but did not work later due to updates [2]. Good thing some parents also contributed to informing other parents on the usage of other browsers where the videoconferencing worked. In addition, the updated codebase reflected the proposed solution to avoid the videoconferencing problem.

5. Conclusion

Integrating the videoconference feature results in an additional Software as a Service that must be handled by the aggregator in order to properly respond the client’s request. The Aggregator Design Pattern (ADP) that is used from the previous versions of my.eskwela makes it easier to conceptualize and implement the integration of cloud services into the application. Also, the positive evaluation of my.eskwela’s ODL features from majority of respondents signifies the appreciation of the users on the presence of such feature in one platform.

However, because of the problem on internet connectivity, the participants are forced to use other popular videoconferencing platform resulting into fragmentation, the thing that my.eskwela is trying hard to eliminate. But since the teachers used my.eskwela for other features that might require them to use many platforms before the introduction of my.eskwela, it can be stated that my.eskwela at least reduced the fragmentation of tools used in the conduct of ODL.

6. Recommendation

To address one of the challenges in accessing videoconferencing using a browser, future efforts is geared towards the development of mobile and desktop applications so videoconferencing features will not be browser dependent.
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