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Published in:
Procedia Computer Science

Published: 01/01/2018

Document Version:
Final Published version, also known as Publisher's PDF, Publisher's Final version or Version of Record

License:
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Publication record in CityU Scholars:
Go to record

Published version (DOI):
10.1016/j.procs.2018.04.337

Publication details:
Developing Drop Box Systems for non-eLearning-based Tertiary Programmes – A Hong Kong Case Study with Broad Relevance

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Abstract

This paper describes a development project aimed at providing Drop Box systems for non-eLearning-based self-financing Tertiary programmes with due consideration on the speed, efficiency, usability and user acceptance for the stakeholders including students, teaching faculties, programme administrative staff. During the development process, different stakeholders were involved covering students, program administrative staff and teaching faculties. The result was very favorable due to the speed of access, the clarity of design based on newest Microsoft Rapid Application Prototyping platform plus latest Microsoft Database Management system, and the User Interface design technique targeted primarily for smart phone and other smart device access.

Keywords: I.T. support; development strategy; broad relevance; usability; technology adoption.

1. Introduction

The World Bank [1] defines Tertiary Education as including universities as well as trade schools and colleges. In the case of Hong Kong, the Tertiary Education institutions cover Universities of government funded, private universities, and vocational training colleges. Table 1 shows some of the institutions in Hong Kong as at end 2017 and their eLearning platform and their eLearning platform.
Table 1. Hong Kong Tertiary Education Institutions end 2017 and their eLearning platform.

From the table, it is found that over 54 percent of institutions use Moodle open source platform to support eLearning. Fig. 1. Shows some of the MOODLE based eLearning login sites.
2. New Platform ERS100 Electronic Resource System for non-elearning-based Tertiary Programmes

2.1. Objectives of New Platform ERS100 project

The main objective of New Platform ERS100 is to provide web based electronic drop box functions for programmes that do not have any eLearning platforms like Canvas or Blackboard. It provides a web interface for teaching faculties to upload learning materials to the system, program admin personnel to upload announcements to the system, and for students to download the learning material or to read announcements from the system through their smart phone or desktop computer.

2.2. User and Stakeholders Response

2.2.1. Smart phone based easy access

The first version of the New Platform ERS100 drop box system demo has only one big drop box for all teaching faculties. The system has been demonstrated to two full-degree (Partnership programmes with UK University) students who volunteer to come and view the demo (demo 1). Their response was that since it is smart phone enabled, they can feel the ease of use and the effective usability, for example reading the lecture material from the download drop box after the teaching faculty has uploaded them, and reading the announcements from the drop box uploaded by program admin personnel. A typical example of announcement is a change of classroom location due to problems in campus facilities.

2.2.2. User Friendliness

The programme administrative personnel, during a pilot system demo (demo 2), has the perception that, for better ease of use, it would be useful for students’ direct access if one Drop Box each is allocated to one teaching faculty. The perceptions came naturally as the programme administrative personnel used to work with full degree (one year Top-up degree OR 3 years full degree) programmes which provide eLearning platform (Canvas or Blackboard) with functions like Collaborative Workspace, linking to social media tools like Skype, Twitter etc., Fig. 2.

Fig. 1. The free MOODLE eLearning management platform developed by the major Hong Kong Tertiary Educational Institutions.

Fig. 2. Comparing Canvas (Expensive tool) with New Platform ERS100 (Home-made based on free development software from Microsoft).
2.3 eLearning Platforms: the paid commercial platforms vs the New Platform ERS100 system

Comparing the paid eLearning platform and the self-developed New Platform ERS100 system, of course, the eLearning platform has a lot more functions, Fig. 2. However it was mentioned that the cost would be over HKD 1 million or more, and that is it is only available from overseas partner universities eLearning contract (part of the contract between local institution and the overseas institution), while the New Platform ERS100 system was built from with free tools from Microsoft (that is recently possible because of Microsoft’s strategic movement towards other competitive products like Oracle and IBM database products), and academic (low price) version of database management system (Microsoft SQL Server 2016).

2.3.1 The Making of New Platform ERS100

The system was finished around October 2017, three months after startup of the project in Summer 2017, based on design experience over the last 2-3 years when PHP programing and MYSQL database management system was used, benchmarking with contemporary development trend by other I.T. staff in sister institutions. Due to the request from school management that, if possible, Microsoft platform could be tried in order for the systems to be integrated into other systems. Therefore, around, 2015-2016, we started leveraging on the Visual Studio 2007 Integrated Development Environment, which provides a collection of development tools [2] through a common user interface, with Visual C Sharp as programming language; and for database management, we tried out different Microsoft Database Management System versions: 2008, 2012, 2014, 2016. Purpose trying out newer version of software is straight forward – as we assume that newer versions provide more functionality and more user-friendliness in terms of usage. However, many problems arise, as newer versions does not support the work of older versions in terms of compatibility. Days and days of work including Saturdays and Sundays have been spent in the last 2 years, when support for technical assistance were not available since we were using the trial version of product.

2.3.2 Staff Development training supporting the work

In the last 2-3 years many staff development training activities have been taken covering the Windows Server 2000 installation course, the Visual C Sharp, Visual Studio, and Web development courses offered by Microsoft authorized centers (Fig. 3.).

Fig. 3. Programming and Web Development staff development courses sponsored by the company.

2.3.3 Other technical difficulties encountered

During development work on the Microsoft platform, more problems aroused, including: network connectivity for the database management system - a lot of hands-on work and a lot of time have been spent before a stable environment of database access, and programming work could be started. For example, when using the Microsoft Visual Studio development templates, Fig. 4., huge amount of time were spent figuring out the practical use of the
different Web Site templates such as Razor, Dynamic Data Entities etc.

Some of the templates provide some preset database facilities, while some provide pull down menu sample application with master pages functions [3] for system startup. But, further development work based on the template structure were never easy. The ideas of a Microsoft Project vs Microsoft Web-site application, how to deploy a project [4], how to deploy a web-site took many months of work using the training material, the trying out on the School and the University’s network etc. all consumes lots of time. Luckily some of the problems were resolved through seeking assistance from YouTube videos – thanks to those authors sharing their knowledge.

2.3.4 Development Approach without using any Microsoft Quick Start template

Around mid-2016, we decided to adopt a home-made tailor-made from scratch approach, i.e. just focusing on website access; we did not use any more preset templates. We adopt the ASP.NET Empty Website as our standard. We were interested and focus on smart device and web-based access, in particular, targeting on the iPhone as an access device. In fact, many courses on iPhone development, html5, etc., mobile app developments etc. have been attended throughout 2014-2016 on a self-financed basis in order to pioneer our work in the smart phone based I.T. applications.

2.3.5 Starting to Rollout a series of pilot applications with an empty ASP.NET Empty Web Site as a development standard

With the ASP.NET Empty Web Site as a choice of standard, many sample pilot applications were built such as alumni record system, online smartphone based application system, student record system (small scale functions) etc. to show proof of concept, using the School and the University’s network.

2.3.6 The year of harvest 2016-2017

In brief, the tremendous amount of work in 2015-2016 secured a return on investment. We have had sufficient experience on web-based system design with smart phone (iPhone) access, with technique of CLARITY OF DESIGN – i.e. a simple smart phone user interface simply for speed of access. It was also the time when universities
and other colleges’ I.T. staff started to upgrade their desktop based I.T. systems to work with smart phone access. This was followed by the school’s sponsorship on Microsoft SQL Database 2016 in Quarter 3, 2017, plus the sponsorship from Microsoft Development Network on the newly emerged Visual Studio Community 2017 Integrated Development Environment (IDE) Rapid Application Prototyping platform. Before that, we had sincerely reflected to Microsoft Company that their versions and versions of tools and database versions incompatibility caused a menace to us as developers. As time goes by, with a database resource and a development platform, coupled with the SQL Management Studio (version 17) we started to experience a happy development environment. The New Platform ERS100 project initiative came at a good time for us to try out new technology.

3. The New Platform ERS100 Electronic Resource System is Button-based, not Pull-down-menu based

3.1 Developing the Set of Student, Teaching Faculty, and Programme Administrative Personnel Smart phone Button-based User Interface

In Microsoft technical terms, each button on the user interface (screen) is an object with Visual C Sharp programming code inside, including code for database table access, username password validation, file upload function, file download function etc. (Fig. 5a,b,c.). And with this structure it is well suited to mobile device access, and it has been tried out with iPhone as an access device throughout development of the project.
Fig. 5a. Each button (Go to Student Page, Go to Teacher Page, Go to Programme Admin Page) represents a function, such as Login to the System.

Fig. 5b. c. Student Login, Teacher Login, Programme Administrative Login screens on a smartphone (tested with iPhone 6 plus) access.
3.2 Pilot Testing Result Well Received

The New Platform ERS100, based on the latest Visual Studio Community 2017 and the Microsoft SQL Server 2016 Database Management System (purchased as an academic version around HKD1,800 where the commercial version would cost close to HKD80,000) were used to complete a set of total of 9 systems (partly shown in Fig. 5d.), with each system having independent access as requested by the Programme administrative personnel. Each system has independent login screens without being shared with other systems. The Programme administrative personnel was given two systems for use, one for creating and managing student username and password, one for creating and managing teaching faculty username and password, and one independent system for announcement upload, whereas the teaching faculties were each given a system for course material upload. For students they were given a system which provide access to different course drop boxes, in this case, all users have a feel of safety usage based on a database table managed login and password design.

Communications of the Drop Box system development were done through the TEDTalk based [5] YouTube Channel which was developed some three years ago where a YouTube channel has been granted without the need to pay fee (early users of YouTube). Users and potential users were requested to view the recorded videos prepared before the pilot system demo (a rehearsal of the pilot systems as backup in case problems arise during the demo session). This gave users flexible viewing time to appreciate our system usability design (Fig. 5e.).
Fig. 5e (part 1 of 4). The YouTube channel storing the ERS100 Drop Box system demos videos.
Fig. 5e (part 2 of 4). The YouTube channel storing the ERS100 Drop Box system demos videos.

Fig. 5e (part 3 of 4). The YouTube channel, available for viewing in smartphone.
The design rationale of the YouTube TedTalk channel was based on the introduction of the TedTalk (Technology, Engineering and Design) 1984 framework by a senior member of colleague in the School of Continuing and Professional Education (SCOPE):

https://www.youtube.com/channel/UCclr6GAftYq0DNpOtuoVMXQ

The practical usage of the TEDTalk concept, based on, for example, 5-7 minutes of video and no more than 18 minutes of video presentation seems to be working. Over 30 videos have been rolled out to the YouTube channel during October - December 2017), showcasing the User Interface design, the Smart phone web access interface design, the clarity of design, and the speed of access through smart phone.

3.3 Plug in to SCOPE Web Site for QF3, 4 (i.e. Diploma, Advanced Diploma programmes) December 2017
The systems were designed to show a plug in to the School’s (School of Continuing and Professional Education-SCOPE) web site in mid-December 2017 based on the experience of previous web site development training and web site development work. The web-site development tool used is called Microsoft Expression version 4 (Fig. 5f).

Fig. 5f. ERS100 system plugged into the School’s web site using the Microsoft Expression version 4 rapid application development tool.

The New Platform ERS100 System was plugged in to a Programme called Continuing Education Diploma, in the School’s web site in the Programme called “Continuing Education Diploma in Tax Advisory (through modifying the Download Area, Fig. 5g., the New Platform 2 Download Area access path in the left hand column of the screen).
3.4. Is New Platform ERS100 designed for ALL Diploma Programmes?

The New Platform ERS100 development model can be expanded for ALL Diploma Programmes with speed. Compared to major eLearning platform like Canvas, Fig. 6,7., it is believed that the system can be expanded for add-on services like Student Information System for use by Programme Leaders, Marketing Information Database such as Part-Time teachers expertise etc. using a local server.

Fig. 6,7. Canvas function showing Dashboard and Course Download Box, where the Dashboard is similar in function to the Programme Announcement Drop Box, Fig. 8.
3.4.1. Is Smart Device a standard for Quick Access of eLearning platform, is it Speed or Functionality?

In the New Platform ERS100 system design and prototype process, a lot of time have been spent and tried out on User Interface design, with a spin-off or detachment of previous design concepts used by contemporary developers who believed in the versatility of pull-down menu structure like the Microsoft Word pulldown-menu-based working mode, Fig. 9.

Smart Device like iPhone likes a top down structure, not a pull-down menu structure. We might not like smartphone as it is eye stretching, but that is the current mode of I.T. access! Therefore, Smart Device is our fundamental
tenet when rolling out more eLearning based I.T. applications for our stakeholders of students, teaching faculties and programme administrative personnel.

3.5 New Platform ERS100 is Architecture Upfront as a Sustainable and Expandable Development Framework

The New Platform Architecture is based on emerging database management software i.e. Microsoft SQL Server 2016, and rapid application prototyping software, i.e. Visual Studio Community 2017. The advantages are: from the developer’s perspective - easier to use, or developer friendly, with pre-built programming code in the toolset of the visual Studio Community 2017 Integrated Development Environment (IDE) from screen design, button based (or object based) functions for database access.

Based on this developer friendly New Platform Architecture of Drop Box System (New Platform 2, Fig.11.), three additional sets of systems have been worked out: Online Mobile Application System (New Platform 1), Assignment Submission System (New Platform 3), Mobile Attendance Record System (New Platform 4):

3.5.1 Online Mobile Application System (New Platform 1, Fig.11.)

The Mobile Application system is based on the idea that the schools can collect the basic yet important data like email, name and mobile phone number, where the Program Administrative Personnel can follow up through email, for example, mailing the full word document to the applicant, and, for experienced Program Administrative Personnel, they can call the applicant direct to give speedy acceptance result, Fig. 10.
3.5.2 Assignment Submission System (New Platform 3, Fig. 11.)

The Assignment Submission system can be created and modified from the ERS100 Download Area (i.e. Course Download system). This is possible based on the object-oriented design feature of Visual Studio Community 2017. It is not a direct copy, but the development technique can be used (Fig. 11.).
3.5.3 Mobile Attendance Record System (New Platform 4, Fig.11.)

The Mobile Attendance System has been designed, programmed and tested using iPhone access (Fig. 12.), where a Teaching Faculty can submit Attendance Record through the camera function of the smart phone (in our work, an iPhone 6 Plus was used). A YouTube video (in Chinese) has been prepared:

https://www.youtube.com/watch?v=x-p0U570d7c

The YouTube channel (Alternatively, in YouTube, search bkt siu) records different stages of project development work (Fig.13.) for easy access:

https://www.youtube.com/channel/UCclrl6GAftYq0DNpOtuoVMXQ
Fig. 12. The New Platform ERS100 System, showing a series covering Mobile Application (New Platform 1), Download Area (New Platform 2), Assignment Submission (New Platform 3), Mobile Attendance Record (New Platform 4).
4. Conclusion and Discussion

4.1 Conclusion

We have developed New Platform ERS100 Electronic Resource System with three add-on systems totaling: New Platform 1 Mobile Application; New Platform 2 (Course and Announcement Drop Box Download Area); New Platform 3 (Assignment Submission Drop Box, which will be adapted from the New Platform 2 systems); New Platform 4 (Mobile Attendance Record). All systems can be accessed and they were designed for access by smartphone (we have all the way tested the systems with an iPhone 6 Plus). We have also recorded a video showing how we make use of an iPhone to take a photo of the attendance record in a classroom, upload the Attendance Record to the Program Administrative Personnel drop box, which will be useful in our School environment, where a Program Administrative Personnel may be handling 5 programmes which will be delivered by 5 teaching faculties on a day such as Friday, when and where the teaching faculty can upload the attendance record to the system online, and when and where giving the Programme Administrative Personnel a clear picture of the Course Attendance pattern, through a click of the Announcement Drop Box tailor-made for the Programme Administrative Personnel. In this system architecture, this type of management information is available to the management staff for real-time access, anytime, anywhere where smartphone web-based access to the New Platform 1,2,3,4, Systems is available (Fig.12.). A YouTube TEDTalk video was made showing the proof of concept video (in Chinese language in order that more colleague can view), available for online viewing:

https://www.youtube.com/watch?v=x-p0U570d7c
But, whether teaching faculties follow the usage, or prefer other forms of submitting the attendance record - it is a matter of choice. We suggest, if not weekly photo of record submission through iPhone, a summary (for example usually in Week 12 of the course) record should be submitted for Programme Administrative Personnel reference. Teaching faculty can submit the form through scan of the record, store the image on a USB then upload to the Programme Administrative Personnel Drop Box through New Platform 4 web-based access. Our testing out using iPhone 6 Plus shows that it is fast and efficient. The upload of the record towards the end of the class takes less than 3 minutes using our system, and it is to the advantage of all (the teaching faculty, and the students) that the Attendance Record and Attendance pattern is the concern as well as the care of programme management and teaching management.

From our pragmatic and practical work in this Case Study work, in particular on the fast speed of work through our New Platform system (which takes less than 3-4 minutes using iPhone camera based online submission of attendance record), we postulate that paid eLearning platforms, though function rich with many pedagogy features, may cause a usability issue when users access the system through mobile device, viz. mobile phone in the local Hong Kong setting, which may be due to the remote site reason, where the eLearning server is located in countries like Europe.

Our use of latest Microsoft development platform, viz. the Visual Studio Community 2017 version (which is a free version offered kindly by Microsoft to developers), the academic version of the Microsoft SQL Server 2016 (which is less than 2-3% of the Commercial price), coupled with series of Staff Development programmes (Fig. 3,4) and lots of day and night development work, through a series of software versions and releases, give us the confidence to say that student learning environment can be improved based on our in-house developed eLearning support platform viz. the sustainable New Platform 1, New Platform 2, New Platform 3, and New Platform 4 (Fig. 12.) series of systems. Mobile Attendance record, Mobile Programme and Mobile Course application is not just a trend, it may be a competitive strategy for institutions competing for participants.

4.2 Discussion

Drawing on the empirical experience of our New Platform ERS100 project development work, we propose 5 topics of broad relevance for sharing with I.T. Development Management and Tertiary Education Management stakeholders:

Topic 1. Should staff development budgets be provided for I.T. staff who are interested in moving to the Microsoft Integrated Development Environment and the Microsoft Web Programming for web based development to support non-eLearning-based programmes (Fig. 3.).

Topic 2. It is noted that some Tertiary Education institutions have average 30 to over 100 I.T. development and support personnel working on MOODLE based development (Fig.1.), with the PHP programming platform.

Topic 3. It is not sure whether we should move to Moodle open source platform to support eLearning, using PHP programming platform (which is somewhat procedure programming based), OR to expand our New Platform ERS100 system development projects using the Microsoft Visual Studio Integrated Development Environment (IDE), and object-oriented Visual C Sharp programming environment.

Topic 4. From the user perspectives students teaching faculty, program admin personnel we are pretty sure that all or most of them have smartphone on hand, then how can we develop more systems which leverage on both the smart phone (for example our Mobile Attendance system) towards mobile phone based course attendance, course work upload, and other learning activities.
Topic 5. While we are not able to create a complete set of functions as given by up-market eLearning platforms like Canvas and Blackboard, we can focus on the efficiency aspect based on the smart phone device web-based interface which has been shown by our pilot system demos – ease of use and efficiency, with the servers situated in Hong Kong for faster speed.

Topic 6. The Microsoft Database Management system is a good source for designing applications for management information based on designing a set of database tables in a central database environment, thereby linking up different applications for producing quick and pre-set management information for Tertiary Education management. We cannot over claim on the power of the Microsoft IDE but the current 2016 database system and 2017 visual studio environment seems to provide a stable platform for development. The move towards mobile phone user interface is evidenced by large corporations such as the HSBC which re-aligns their systems to the smart phone (or what I call the object-oriented) interface (Fig. 14.).

![HSBC web site towards desktop as well as Smart Device interface.](image)

**Fig. 14. HSBC web site towards desktop as well as Smart Device interface.**

**Acknowledgements**

The work was partially supported by staff development budgets from the School of Continuing and Professional Education (SCOPE); partly supported by the Microsoft Developer Network; plus those volunteering students, academic staff and programme administrative personnel in earlier releases of New Platform ERS100; to the assistance of an Academic Coordinator, and the practical discussion with a Director of the eLearning and Innovation Centre of a local Vocational Group of Training Institute. In particular, we wish to record our vote of thanks to the
Director of SCOPE, innovating the TEDTalk concept, and colleagues in the I.T. team initiating this New Platform project, and supplying just-in-time database management software.

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