

Review of the Critical Factors for Success of Mobile Learning for High School in Taiwan

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Abstract: The goal of this research is to find out the factors have the school willingness to implement digital mobile e-learning. The empirical results of this research indicate the following results: (1) In this study, we find that the school size, teacher-student ratio, tablet PC numbers, technical teacher ratio, the total equipment expenses associated with tablet PC and school attribute are important determinants for affecting the willingness of the schools to implement digital mobile e-learning. (2) Furthermore, the results of this study suggested that most of the schools who willing to implement the digital mobile e-learning are concentrated in the northern region of Taiwan. The main reason is that local governments (such as the Taipei city) have the funds to subsidize the school which cover the cost of facility construction. Therefore, the public schools in Taipei have the willingness and motivation to implement digital mobile e-learning each year.

Key words: Learning, mobile learning, digital mobile e-learning, vocational and senior high school.

1. Introduction

Over the past two decades, traditional teaching techniques have changed from textbook and whiteboard learning into Mobile learning (m-learning)— portable and networked — to the point that they have become pervasive in everyday life. Thus, the new learning model of the Digital Mobile E-learning, or "M-Learning" model, offers a new and modern way to support learning process through mobile devices, such as handheld or tablet computers, MP3 players, smartphones or mobile phones. Likewise, the digital mobile e-learning opens our minds to the possibility of a radically new paradigm and encourages us to abandon the constraints of our habitual ways of thinking, learning, communicating, designing and reacting [1]. As mentioned above, the teachers of today have to learn new teaching techniques to master the activity approach, up-to-date teaching aids, and many other innovations model. Hence, Teachers should recognize that using digital mobile e-learning to teach is important and is an emerging trend in the classroom.

On the other hand, the Ministry of Education began to import the digital mobile e-learning model in 2012. Until 2017, Over 100 schools have used the E-learning model throughout Taiwan, which allowed students and teachers in various counties and cities to develop the digital mobile e-learning by utilizing wireless networks to enhance teaching quality and increase students' interest level. The digital mobile e-learning model has thus become a topic of interest to both the academics and the private sectors. Public and private schools alike are striving to highlight their respective strengths, to increase their competitive advantages, to meet students' and parents' needs, and to establish unique attributes through innovative operations. In

addition, using the digital mobile e-learning model can win parents' and students' recognition, and raise schools' operational efficiency [2].

In recent years, schools in various counties and cities in Taiwan have gradually introduced education reforms and innovative teaching such as the digital mobile e-learning. A good deal of literature has reported that the digital mobile e-learning can increase students' interest in learning as well as their motivation to learn [1], [3], [4].

However, according to the statistics of Taiwan's Ministry of Education, there are total 506 high schools in Taiwan. On average, there are only about 50 schools applying digital mobile e-learning each year and near 90% of schools do not want to implement the digital mobile e-learning. What are the factors for not to apply the project for digital mobile e-learning? We discover that the relevant theoretical foundations are not able to explain the factors. Hence, what prompted the undertaking of the current study was to find out the factors, and to derive suitable policy recommendations.

This structure of this paper is as follows: Section 1 introduces the research background and goal of this research. Section 2 reviews the Conceptual framework and the overview of policy. Section 3 introduces our methodology. Section 4 explains the outcome of M-learning program. Section 5 points out the factors we found. And, finally, the last section provides the concluding remarks.

2. Conceptual Framework and Policy Overview

To address our research issue, this section will explain the conceptual framework and the overview of policy of digital mobile e-learning program in Taiwan.

2.1. Conceptual Framework

The digital mobile e-learning model has considered to be the simplification of learning and the access to educational content through the use of mobile devices [5]. Moreover, digital mobile e-learning is a relatively new phenomenon in contemporary education that follows the philosophy of e-learning but further extends it by introducing the concepts of mobility and flexibility. The digital mobile e-learning refers to any learning system that uses wireless mobile devices, including smartphones, tablet PCs, or PDAs, to connect learners and instructors, and to manage the learning process from anywhere at any time [6].

Thus, in recent years, mobile devices (such as smartphones, PDAs, tablet computers, etc.) are advanced each passing day [7], [8]. Digital mobile e-learning, i.e., M-learning both at home and abroad is popularized with the advancement of the Internet and technology. From the beginning of technology integration into teaching, the era of mobile learning has evolved into an era of M-learning. The personnel of each teaching site have deeply realized the importance and trend of the combination of teaching and science and technology [9].

To date, digital mobile e-learning can also help to enrich the educational context [10], for example, in the implementation of virtual classrooms [11] and in using experimental methods of teaching scientific and practical knowledge across many educational channels [12]. Furthermore, the digital mobile e-learning has gradually changed the scope of traditional digital learning activities and increased the freedom and convenience of teaching and learning. This makes personalized digital mobile e-learning no longer be restricted, allows students to learn more active and spontaneous sharing of resources interactively. Currently, the introduction of action learning has not only become the focus of education and exploration of different learning environments for students to learn, but also cultivate the experience of sustainable learning students. This learning model has changed the teaching model of teachers to promote students learning and to create a new educational potential. The ability to access information at any time and any place represents a significant advantage of digital mobile e-learning which again confirming that it is an extension of E-learning rather than a subset of it [6].

2.2. Policy Overview

The digital mobile e-learning technology in recent years has contributed to a steady growth of software and hardware development of digital learning technology. It is to make learning more flexible and engaging, potentially by anyone, anytime and anywhere. Hence, in 2013, the Ministry of Education and the Foundation of LearnMode Education in Taiwan have collaborated at the grassroots level to promote the digital mobile e-learning to schools in various counties and cities in Taiwan. The education policy is hoped to help teachers and students in these institutions to develop better teaching experience by utilizing wireless networks or platforms like mobile applications, as well as to enhance the teaching in schools and to increase students' interest in learning by utilizing digital mobile e-learning.

3. Methodology

Little has been known about the conceptual framework and working methods of digital mobile e-learning at present in Taiwan. Therefore, this study employed quantitative results to analysis study approach to gain an in-depth and holistic understanding of digital mobile e-learning. Moreover, we also utilize the analysis results from two articles [13], [14] to analyze these factors which affecting the relative efficiencies of schools by utilizing related factors.

4. Import Execution Results

This section will explain the outcome of digital mobile e-learning program.

4.1. Analysis on Digital Mobile e-Learning Project

According to the statistics of the Ministry of Education, there are total 506 high schools in Taiwan, and the digital mobile e-learning program has been implemented for 5 years. On average, there are only about 50 schools applying the project for digital mobile e-learning each year. Among them, there are about 16 schools planned to apply the project for digital mobile e-learning continuously. The government plans to spend up to 40 million Taiwan dollar a year. Only about 16 schools really enjoy the implementation of action learning. The percentage of number of schools which import digital mobile e-learning is less than 3% ($n=16/506$) and most of location of these schools are in Taipei City or Taipei county (about 10). The list of variables and the summary of statistics are presented in Table 1.

With 5 years implementation of the digital mobile e-learning program supported by the Ministry of Education, the outcome of this project is that exceed 50% (e.g., 2017 $n= (49-16) /16$) of the school are unwilling to continue the project application. It is noticed that there has been relatively little progress in digital mobile e-learning until recently.

Table 1. Statistics of School Applying for Mobile e-Learning Project

Year	All of the high school number	Number of schools implemented	Continuous import
2013	503	42	16
2014	503	38	16
2015	506	46	16
2016	506	49	16
2017	506	49	16

Source: This Study

4.2. Analysis on the School Districts

On average, there are only about 50 schools applying for digital mobile e-learning each year. We divide the school districts into four main areas as North, Central, South, and East district, respectively. We found that the number of school applying m-learning each year in north district is increasing. Conversely, the

number of school applying m-learning each year in Eastern district is decreasing. Schools located in the Northern part of Taiwan and applying for M-learning are accounted for nearly 50% (e.g., 2017 n=26/46) of the total number of schools. The statistics of school's district is presented in Table 2.

Table 2: The Statistics of School's District

Year	North	Central	South	East
2013	20	12	6	4
2014	18	8	7	3
2015	20	11	10	5
2016	26	8	12	3
2017	26	8	13	2

Source: This Study

5. Results Analyze

In this study, we use the findings of the relevant article to analyze the main issues of using digital mobile e-learning of high school in Taiwan.

In the paper of Liu *et al.* [13] indicated that uses the digital mobile e-learning can affect the school efficiency and the innovative of teaching in in Taiwan's high school. Their research used Tobit Regression Model (TRM) to find the determinants for affecting the efficiency of school management. In the paper of Hsiang-Hsi Liu and Kuo [14] that uses the Bootstrap Truncated Regression (BTR) model can help finding the determinants for affecting the efficiency of school management. Their paper also showed the digital mobile e-learning can affect the school efficiency and the innovative of teaching in in Taiwan's high school.

5.1. Indicators Definitions

As mentioned above, both of these papers have pointed out that the digital mobile e-learning is the critical factor. Hence, this study describes the definition of variables as follows and the research results are shown as in Table 3.

Z_1 : School size (total numbers of school students).

Z_2 : Teacher-student ratio (average number of students per teacher members) in each school.

Z_3 : The total number of tablet PC in each School.

Z_4 : Technical teacher ratio (measured by the ratio for the numbers of technicians as consultants for teaching tablet PC knowledge to total number of teachers in school) in each School i

Z_5 : Total equipment expenses associated with tablet PC in each School.

Z_6 : School location.

Z_7 : School attribute.

Table 3: The Important Determinants for Using Digital Mobile E-Learning

Model	Z_1	Z_2	Z_3	Z_4	Z_5	Z_6	Z_7
1: TRM	✓	✓	✓	✓	✓		✓
2: TBR	✓	✓	✓	✓	✓		✓

Source: This Study

(1) School size (Z_1)

According to the results of the two previously mentioned papers, it implies that the larger the school, the larger the economic scale that is capable for accomplishing the function expansion of the school such as teaching functions, research functions, and education or employment opportunities (enrollment rates). These are also the factors that can affect the efficiency of school's operational. By justifying the factors of a successful digital mobile e-learning integration, we think the increasing number of school students is also

important when implementation the digital mobile e-learning. Thus, the number of school students is added as one of the evaluation factors for the school's operational efficiency. Indeed, according to Table 2, there is, indeed, the phenomenon that schools applying for digital mobile e-learning are concentrated in the northern area (with more students) of Taiwan, whereas schools in the eastern area apply less (fewer students).

(2) Teacher-student ratio (Z_2)

This factor is based on the empirical results as shown in the previous mentioned two papers. Recent years due to the low birth rate in Taiwan, the number of students decreased. The estimation of the teacher-student ratio and the size of each class had dropped which lead to too many teachers are employed in each school. Therefore, resources can be misallocated to teachers or students which may cause the cost of resources being over counted and, hence, reduce operational efficiency of a school. Many schools take the issue of decreasing number of student seriously, therefore, as shown in Table 1, only 16 schools are willing to implemented the digital mobile e-learning continuously, i.e., most of the schools are unwilling to apply for the digital mobile e-learning. This is because the number of teacher needs to drop accordingly and the man-power of performing the digital mobile e-learning may be affected. Therefore, the teacher-student ratio is chosen as the second factor.

(3) The total number of tablet PC in each School (Z_3)

Based on the results shown in the previous mentioned two papers, the innovative teaching can affect the school's operation efficiency through using Tablet PC in digital mobile e-learning. This is because the Tablet PC enables learners to learn in any place at any time, i.e., they are able to experience the authentic joy of learning and attract students to join the study even after school. As results, the more Tablet PC numbers to be applied in high school will increase the school's operational efficiency, and to attract students to join digital mobile e-learning successfully can also cause school's operational efficiency. Thus, according to Table 2, those schools who willing to implement the digital mobile e-learning are mostly located in the northern region of Taiwan and this means these schools have more students are involved in digital mobile e-learning.

(4) Technical teacher ratio (Z_4)

This factor is based on the empirical results as shown in the previous mentioned two papers. In these situations, the role of the teachers needs to change from the presenter of expert knowledge to a moderator of opposing positions. In this role, teachers act as technicians and as consultants for teaching tablet PC knowledge who need to identify the students' interests, to relate these interests to the learning goals of the related topic, and to offer opportunities for a learner to reach these goals. Thus, the ratio increase of technical teacher may help to achieve it. Although the cost of expenditure may increase relatively, however, when the number of students, who apply for the program of digital mobile e-learning, increase, the school's operational efficiency increases too. Thus, according to Table 2, the schools, who willing to implement the digital mobile e-learning, are mostly located in the northern region of Taiwan. This phenomenon also indicates that the local governments such as the Taipei city and the New Taipei city are able to provide more funds to subsidize the cost of construction for digital mobile e-learning.

(5) Total equipment expenses associated with tablet PC in each School (Z_5)

This factor is based on the results shown in the previous mentioned two papers. In general, mobile e-learning (mobile-e-learning) is a kind of learning model which allows learners to obtain learning materials at anywhere and anytime. That is, the students are able to experience the authentic joy of new learning model in anywhere without geographical limitation. Therefore, it is necessary for the government to upgrade the wireless facilities such as Wi-Fi and network facilities so that the measurements of skills training (such as training personnel), capital support (such as the budget) can also be performed and implemented through mobile devices. This is to say that the internet and network equipment or devices

need to be constructed well and completely. Thus, according to Table 2, the schools are willing to implemented the digital mobile e-learning mostly are located in the northern region of Taiwan. The main reason is that the local governments (such as the Taipei city, the New Taipei city) have budgets to subsidize the school for the construction of internet and network equipment. This is also the reason why there are few schools in the eastern part of Taiwan willing implemented to the digital mobile e-learning because schools are lacking the budget and support from their local government support (such as the Hualien city).

(6) School location (Z_6)

This factor is based on the results shown in the previous mentioned two papers. For many years, high schools in various counties and cities in Taiwan have gradually and almost introduced education reforms and innovative teaching with mobile digital e-learning. Thus, according to Table 2, the government will not refuse to implement digital mobile e-learning because of the schools in the distant location. Mainly, the degree of school's operational efficiency also needs to be taken into account their school attributes such as equipment, teaching quality, management decisions and etc. (Liu et al., 2016). Hence, the effect of school location on school's operational efficiency may not significant.

(7) School attribute (Z_7)

This factor is based on the results shown in the previous mentioned two papers. In this study that operational efficiency of public school is better than that of private school. The budget of the accessory equipment of public school comes from the central government, but the budget of the accessory equipment of private school comes from school itself. Teaching quality in public high school, for example, can be easier to promote the mobile e-learning environments which utilize the latest technologies to bring an interactive learning environment into learning and teaching activities. This may also cause the public school to have better school's operational efficiency [15] Thus, according to Table 1, the schools are willing to implement the digital mobile e-learning are mostly located in the northern region of Taiwan. The main reason is that the local governments (such as the Taipei City or New Taipei City) have the budgets to subsidize the school for the construction of advance IT equipment. Therefore, the public schools in Northern Taiwan have the willingness to implement digital mobile e-learning each year.

6. Conclusion

In this study, we find that the school size, teacher-student ratio, tablet PC numbers, technical teacher ratio, the total equipment expenses associated with tablet PC and School attribute are important determinants for affecting the willingness of schools to implement digital mobile e-learning.

Owing to the government funding, it is a full implementation of the new learns model, that is, to be where the students able to experience the authentic joy of new learning model and attract students join. Thus, the digital mobile e-learning is a new model, the teachers of today have to learn new teaching techniques to master the activity approach, up-to-date teaching model aids, and continued to create other innovation in class. The results of this study clearly support the notion that school size, especially the numbers of technical teachers in teaching or consulting about digital mobile e-learning knowledge, and numbers of Tablet PC (the proxy for digital mobile e-learning) affect the efficiency of school management. In order to increase students learning effectiveness to enhance the school's operational efficiency, it is necessary to first add the school size, Tablet PC numbers, and technical teachers in this study. Another important issue to point out is that the schools are willing to implemented the digital mobile e-learning mostly located in the northern region of Taiwan. The main reason is that local governments (such as the Taipei city, the New Taipei city) have the budget to subsidize the school so that the cost of construction equipment can be covered. Therefore, the main reason why there are few schools in the eastern part of Taiwan unwilling to implement the digital mobile e-learning is because they are lacking of local

government's support (such as the Hualien city).

Lastly, the conclusions and recommendations presented here are based on the models constructed, sample data collected, and research methodologies employed for this study. Hence, it is necessary to take into consideration the current situation and changes in the environment that is impacting the public and private high schools and vocational schools in the Taiwan District. Therefore, any application of our findings can be further tailored to yield more accurate conclusions.

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