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EURASIA Journal of Mathematics, Science and Technology Education, 2018, 14(6), 2107-2119
ISSN:1305-8223 (online) 1305-8215 (print)
Research Paper https://doi.org/10.29333/ejmste/86467

Designing a System for English Evaluation and Teaching Devices: A PZB and TAM Model Analysis

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Received 10 April 2017 ▪ Revised 24 December 2017 ▪ Accepted 17 January 2018

ABSTRACT

This paper discusses an English evaluation and teaching system consisting of several parts. The first part is a database comprising numerous subdatabases, which store login data and various levels of test questions of different levels. The second part is an arithmetic processing unit with a login module that produces a login interface to receive users' accounts and passwords. The login module is electronically connected to the database system so that the module can verify the input accounts and passwords with the login data stored in the database. The unit also randomly selects questions from different levels to form evaluation sets and generates an evaluation interface. In addition, the device features an input unit for inputting instructions and a display unit to display interfaces during use. Knowledge innovation and management accelerates with the prevalence of online assessment and learning because it has no difficulties in breaking through the limits of both space and time. Previous studies developing English evaluation and teaching device systems have rarely been researched from the dual perspective of developing the information technology system and learning and teaching language. Utilising the technology acceptance model as our fundamental theory to design the use of learning system is a must for the English e-learners.

Keywords: technology acceptance model, online learning behaviour, computer-assisted language learning, learning management system, artificial intelligence, semantics, cognitive science

INTRODUCTION

Most English-learning websites provide self-learning, online teaching, and adult education services. Although common English-testing websites provide tests, they could be considerably improved. Currently, tests in many online testing systems have fixed questions. They appear to differ only because of the random order in which the questions are organised, rather than because questions are selected or organised according to the needs of users. In other words, test levels and difficulties cannot be customised according to the needs of users. To address this problem, our device offers an effective alternative. (Tan, 2013a; Tan, 2013b; Tan, 2015; Tan & Hsu, 2017a). Standardised testing mainly involves group tests. Depending on their compilation and design, these tests can be used to evaluate aspects such as achievements, interests, and capabilities. Test items are revised in accordance with test objectives and project preparations. Effective testing requires an emphasis on reliability and validity (Retrieved from http://edglossary.org/standardisedtest/). Various computer-based grading models have been created as a substitute to manual grading and have become a product for research and development. Although such systems are at the initial stage, an increasing number of people are joining the debates regarding the issue of digitalisation. Consideration must be given to the costs, markets, functions, innovative technologies, customer needs, marketing channels, quality, and sustainability of digital products. Designers of digital products must integrate the given company's internal ideas and the ideas of different customers in order to strengthen the technological capability of a digital product's innovative aesthetic design, assist in design-related problem solving, and provide an optimal blueprint for the digital product. Furthermore, research on the product's structure and an evaluation of its system development costs are required. With regard to digital product design, stable design methods and optimal

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Contribution of this paper to the literature

- Provides a better learning system for language courses.
- System designers can perform knowledge management functions and fulfill interface requirements for students, thus enabling them to operate these systems.
- Examines the efficiency of e-learning and e-assessment systems from different perspectives, such as system development and web-design quality.

platforms for digital product design must be utilized under optimal resource allocation limitations. Furthermore, artificial intelligence technologies should be used to achieve optimal customisation. The optimal design of a digital product may be achieved by using the function of three-dimensional diagrams. The challenges faced by innovative digital products must be identified by looking at market and corporate business trends in markets where digital products are sold. With respect to digital product design, market strategies must be determined and market competition strategies and channel arrangements must be formulated. Costs and profits related to digital products must be effectively controlled in order to prevent or reduce losses and achieve innovation. As such, a company will play an important role in digital product models, colours, materials, service quality, and overall aesthetics. Each company seeks to increase aesthetic appreciation in its customers in order to improve its competitiveness (Tan & Hsu, 2017b).

DESIGN OF UTILITY MODEL CONTENT

This system is an English evaluation and teaching device that enables administrators and users to log in and complete tests. The database includes tests with various levels of difficulty, the questions for which are randomly drawn from the different levels; administrators or users can also alter the difficulty level of tests.

To achieve its teaching and evaluation objective, this system consists of the following parts:

(1) A database comprising numerous sub databases that store login data and test questions.

(2) An arithmetic processing unit with a login module that produces a login interface to receive users' accounts and passwords. The login module is electronically connected with the database system to verify input accounts and passwords with the login data stored in the database. The unit also randomly selects test questions from different levels to form evaluation sets and generates an evaluation interface.

(3) An input unit electronically connected to the arithmetic processing unit that enables users to input instructions.

(4) A display unit electronically connected to the arithmetic processing unit that displays interfaces during use.

(5) A notification interface, which is generated when the accounts and passwords received by the login module do not match with those stored in the database system.

(6) An administrator's interface that is generated when the account and password of an administrator are entered.

The overall structure and specifications should be determined in digital product design, based on which the overall system layout is defined. Thus, digital product design is important as it involves the butterfly effect: if a digital product's design lacks a production concept, large expenses will be needed in the production process to regulate and replace equipment, materials, and labour. In contrast, the good design of a digital product is reflected not only in functional advantages but also in its ease of manufacture and low production costs, which increase the product's sustainability and competitiveness. Many leading companies in the digital product market emphasise digital product design and aim to design digital products with low fabrication costs and unique functions.

Digital Product Research and Development Framework

Digital product research and development aims at innovative design and requires the integration of digital product design technologies and users, understanding of trends in the service industry and technological developments, user earned value management, coordination of internal and external resources, and construction of the product organisational framework. Thus, creation of the optimal value of digital products and customers must be considered in enterprise transformation.

SYSTEM INSTALLATION METHOD

Clients can acquire a profound understanding of the objective and benefits of this system from the illustrations provided in the figures. **Figure 1** presents a schematic outline of the system. The system has a database (1) that is

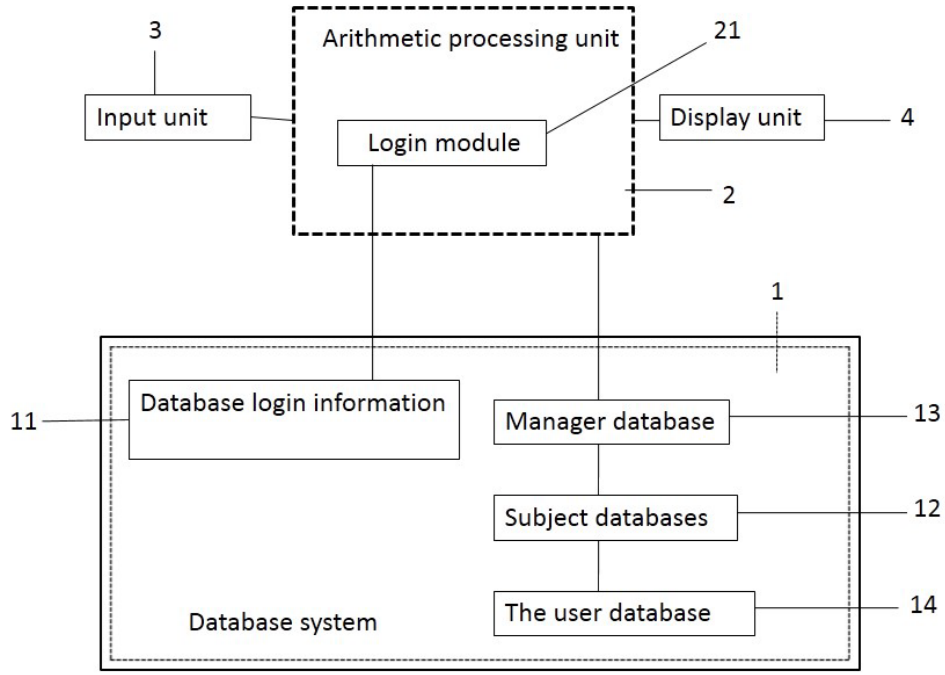

Figure 1. Outline of the proposed English evaluation and teaching device

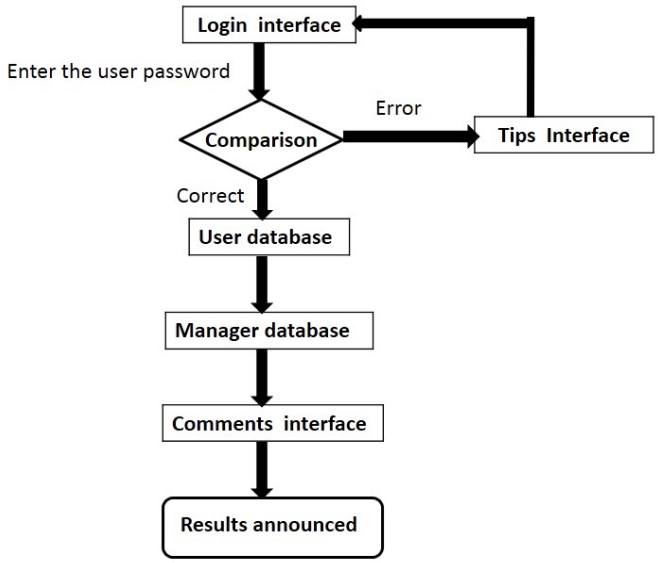

Figure 2. Evaluation procedures initiated by the system when a general user is logged in

divided into numerous subdatabases including a login database that stores login data (11) and a test question database (12) that stores test questions. The login database stores all the login accounts (e.g., student number or identification number) and passwords of users and administrators. The questions in the database are classified into advanced, intermediate, and basic levels.

The system also has an arithmetic processing unit (2) with a login module (21) that produces a login interface to receive the accounts and passwords of users. This unit is electronically connected to an input unit (3) and a display unit (4). The input unit (e.g., a keyboard or mouse) enables commands, such as accounts and passwords, to be entered, and the display unit (e.g. computer monitor) presents interfaces during use. In addition, the login module (21) is electronically connected to the database (1). As shown in **Figure 2**, this electronic connection enables the module to verify the input accounts and passwords with the login data stored in the database. If the verification result is valid, the system proceeds to the next step; by contrast, if the login account does not exist or the password is invalid, a notification interface is generated to notify the user of such errors, and the user is redirected to the login interface to reenter the account and password.

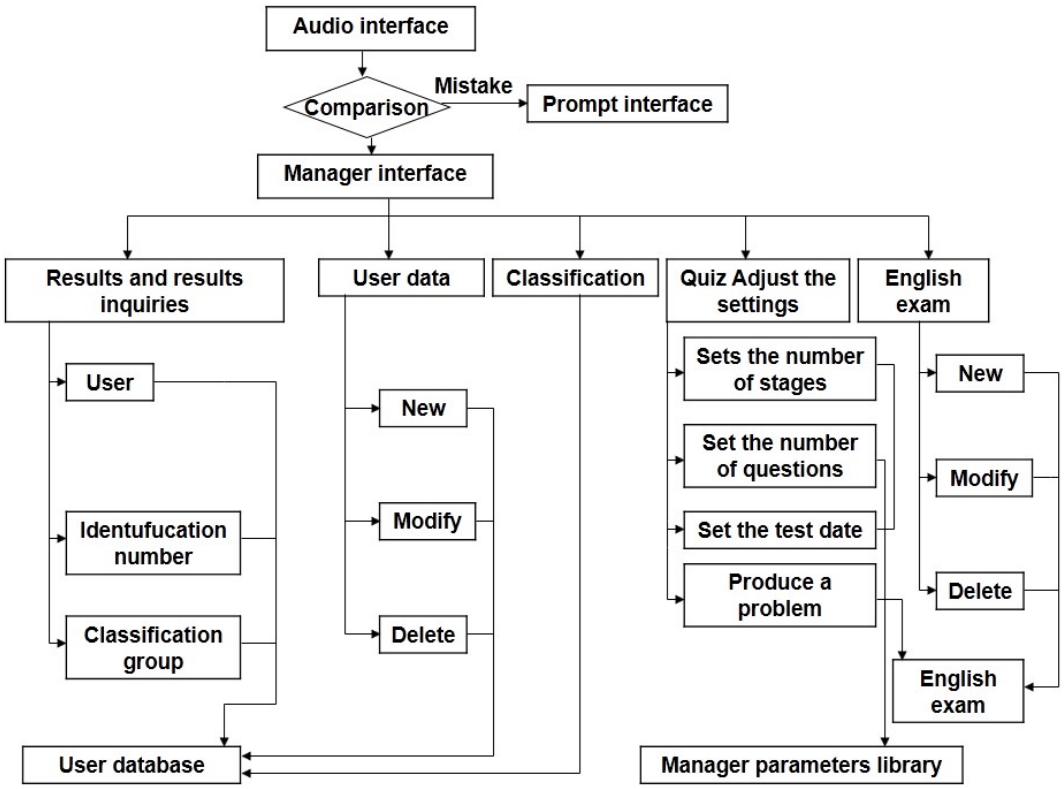

Figure 3. Overview of the administrator interface after the account and password are verified

Finally, **Figure 3** depicts how the login module generates an administrator interface after the administrator enters his or her account and password in the login interface and they are verified as valid. The administrator can then modify parameters in the system as follows:

(1) Add, edit, or delete data in the login data database.

(2) Add, edit, or delete data in the test question database.

(3) Search evaluation results according to the class, department, college, school, or person.

(4) Modify the settings of evaluations, such as randomly generating tests for different student groups or modifying the time of evaluations, method of selecting questions for different levels, or number of levels.

(5) Group students into levels according to the settings and levels.

The updated parameters are subsequently stored in the administrator's parameter database (13) in the database system (1) (**Figure 1**).

Figure 2 indicates that when a general user, not including the administrator, is logged in, the system initiates evaluation procedures. The arithmetic processing unit randomly selects questions of different difficulty levels from the test question database (12) to form evaluation sets, and an evaluation interface is generated for the user to answer the questions through the input unit (3). An administrator can change the percentage of questions that are selected from the different difficulty levels by modifying the parameters. In the evaluation interface, users select and submit answers within the set evaluation time, after which their scores are calculated and announced by the arithmetic processing unit (2); questions that users have not answered are scored 0. Finally, the results are transmitted to the student database (14) in the database system (1).

As indicated by the aforementioned discussion, the English evaluation system is easy to operate. Moreover, because the questions can be varied according to the level of difficulty, the evaluation results have validity and credibility and can precisely differentiate students' knowledge levels (**Table 1**). By using this system, students can be properly grouped according to their level of academic performance and be enrolled in courses suitable to their needs. Overall, this system can enhance the student learning.

Table 1. Basic Characteristics (Tan, 2013a; Tan, 2013b; Tan, 2015)

Characteristics	Traditional classroom learning	E-learning	5W1H
Location and time limits	Place and time dependent Physical evidence is limited	Can take place anywhere and at anytime Free	When and Where
Teaching and learning content	Teacher-centred	Learner-centred	Who
Personalisation	Push method One learning path (lowest common denominator)	Pull method Learning pace and path determined by learner	How and Which
Learning methods	Inflexible	Flexible	What

ENGLISH E-LEARNING FOR COMPUTER-AIDED LANGUAGE LEARNING IN THE GLOBAL COMMUNITY

English has become the universal language for communicating on an international scale. With the growing numbers of foreign students enrolling in U.S. universities and colleges, several higher-education English as a second language (ESL) learning programmes have been developed. Many of these programmes use learning management systems (LMSs) as their computer-aided language learning tool to design e-learning courses. Liu (2013) suggested that this learning community deserves more attention because it contributes to U.S. academic practices. Irrespective of whether it is for academic research, pedagogical practice, or navigating in everyday life, it is crucial to understand the adaptability of other countries and help students succeed in their learning activities. English is currently the primary language for communication at many international conferences and is closely related to most programming languages, which ensures the widespread use of the language within various global communities.

Learning Management System (LMS) Designing

LMS is a high-level strategic solution applicable to the planning, submission, and management of learning activities in organisations. LMS includes online, virtual classroom, and teacher-guided learning. The solution involves system evaluation and improvement of the overall organisation's abilities and performance and presents an alternative to isolated and scattered learning. LMS focuses on management learners and tracks their progress and performance in all types of training activities. It is used for serious management tasks, such as human resource and ERP system reporting. However, it is not applied to the building of course content.

EDUCATIONAL PROGRAMMES OF ENGLISH LEARNING IN TAIWAN

English is a compulsory course for elementary, middle, and junior high school students in Taiwan. College students also usually need to achieve a certain level of English proficiency to get a well-paying job, because Taiwanese universities often use original-copy English textbooks in their classes. However, English is not only a required course for students, but an important international language; as Huang (2005) pointed out, 'English skills are a major factor in the educational success of Taiwanese students, and programmes are provided to prepare students for future career prospects. Thus, more and more young learners are receiving ESL lessons in school.'

Learning Content Management System (LCMS) Designing

LCMS focuses on learning content. It helps authors, educational designers, and subject experts more effectively develop e-learning content. The main business problem solved by LCMS is the timely development of sufficient content, which aims to satisfy individual and group learners' needs. LCMS features include the utilization of learning objects to form the system's basic framework, the availability of all learning content in a database, and the ability to reuse and restructure learning content in various ways (Tan & Hsu, 2017ab).

DESIGNING SYSTEMS AND TOOLS FOR ENGLISH E-LEARNING AND ONLINE ASSESSMENT

Currently, there are various methods and tools geared towards ESL learning, which are generally divided into two types: traditional learning and e-learning. In traditional approaches, students have their own space in a classroom, where they learn English from teachers and textbooks within a set time. Students can only receive the information from their teacher and cannot receive any additional information they require. By contrast, in e-

Table 2. Disadvantages and Advantages of Traditional and E-learning Approaches (Zhang et al, 2004; Tan, 2013a; Tan, 2013b; Tan, 2015)

	Traditional approaches	**E-learning approaches**
Advantages	◎ Familiar to both teachers and students ◎ Direct feedback ◎ Cultivation of a social community ◎ Motivates users	◎ User-centred and self-paced ◎ Place- and time-flexible ◎ Potentially provided to universal learners ◎ Cost-effective for users ◎ Archival ability for information resharing and reusing
Disadvantages	◎ Teacher-centred ◎ Place- and time-limited ◎ More expensive (learner resources and teacher wages)	◎ Lack of immediate direct feedback in a synchronous learning environment ◎ Uncomfortable for some users ◎ Can be expensive (hardware system) ◎ Potentially more confusion, frustration, and anxiety ◎ Increased preparation time required by learners

learning approaches, students can learn from teachers or computers to receive more information immediately. There are also no time constraints in e-learning situations, and students do not even need a teacher. Furthermore, students can learn English by themselves because language e-learning systems provide whatever information they need. **Table 1** presents an overview of the main differences between the traditional and e-learning methods.

With the advent of English e-learning technology over the past decade, accessibility to training, teaching, and learning has increased substantially. The challenge currently encountered by education enterprises is attracting students to their English e-learning services. In this study, we developed a technical system to help clarify learners' intentions and their continued desire to use the system in order to assist them with English e-learning and online assessment**.**

As indicated in **Table 1**, e-learning and traditional approaches offer different learning methods. For example, in traditional approaches, students only learn from their teachers and cannot access the newest information immediately. However, in e-learning approaches, students use a computer to learn English and can search the Internet to efficiently obtain other information not provided by the programme (**Table 1**). The disadvantages and advantages of the e-learning and traditional approaches are listed in **Table 2**.

ENGLISH LEARNERS IN TAIWAN

In Taiwan, English is viewed as a key language that connects the Taiwanese with the rest of the world. In particular, English has an important role in Taiwan's economy because it is vital for success in the financial and technology sectors. Technology in our lives that is the case, we can solve a lot of problems through this method (Joiner, 1981). In a study on applied linguistics, Krashen, Long, and Scarcella (1979) pointed out that younger learners can learn languages more effectively. Thus, Taiwanese English learners begin as children and learn English through various avenues, including online learning sites, language schools, and talking with foreigners in person. Although some debates and questions about English learning in Taiwan remain, it is undeniable that learning English is a critical and effective way for Taiwan to establish a foothold in international communities.

ENGLISH LEARNERS IN MALAYSIA

Teo, Wong, Thammetar, and Chattiwat (2011) studied the self-reported intentions of 245 Malaysian teachers and students' intention to use (ITU) computer behaviour, and they found that perceived usefulness (PU) of computer technology, perceived ease of use (PEOU), and attitudes towards computer use were essential determinants of teachers' and students' ITU. Furthermore, their research confirmed that the technology acceptance model (TAM) is suitable for predicting the technical acceptance among students and teachers; overall, technology was well-accepted by the studied population in Malaysia.

E-LEARNING AND E-ASSESSMENT

E-learning is changing the way education is conducted and is recognised as the most convenient and effective method for learning. Thus, educational institutions have begun to realise that e-learning can help them enhance their teaching; moreover, the benefits of an effective education strategy can outweigh its costs (Urdan, 2000).

Some previous studies on learner acceptance of LMSs have been conducted using the unified theory of acceptance and use of technology (UTAUT) model. For example, Yoo, Han, and Huang (2012) found that employers in South Korea were positively influenced by factors such as effort expectancy and attitude towards e-learning in

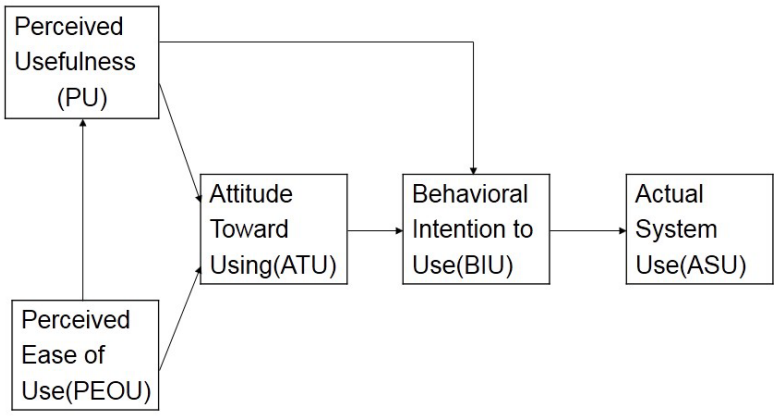

Figure 4. Technology acceptance model (TAM) (Davis, 1986; Davis, 1989a Davis et al, 1989b; Venkatesh et al, 2003)

the workplace. Additionally, Chiu and Wang (2008) confirmed that performance expectancy, effort expectancy, and positive subjective task value can lead to the success of college students who take web-based courses.

Regardless of the benefits, some users change their learning attitude towards e-learning during their learning procedures and activities if the results are not what they expected. E-learning typically requires more self-motivation, and learners who work alone can easily become frustrated. Thus, previous studies have indicated that designers and researchers should regularly check for any inconveniences or system errors and fix them quickly to provide a better e-learning environment for their users.

Most e-learning systems provides services for searching, downloading, and delivering content (Tan, 2013a; Tan, 2013b; Tan, 2017a). They also provide e-users with various learning tools, such as systems, e-books, audio files, e-content, and videos to enhance their teaching and learning performance.

Differences between LMS and LCMS Development

Both tools allow for the management and tracking of content with regard to learning objects. However, LMS can manage and track fused curriculums that combine online content, classroom activities, virtual classroom meetings, and other sources. Although LCMS does not manage fused learning, it manages content at a lower intensity level compared to that used for learning objects, which in turn allows for the reorganization and reuse of online content. Furthermore, high-level LCMS can dynamically create learning objects based on user configuration files and learning styles. If both systems follow XML standards, information can be easily transmitted from the object level to the LMS level (Greenberg, 2013).

ADOPTION THEORIES TO DEVELOP A SYSTEM

For the past decade, scholars and practitioners have explored people's interest in new technologies and have tried to predict or affect their likely use. Overall, their finding demonstrate that intention positively influences e-learning acceptance (Chen, 2011; Liao & Lu, 2008; Padilla-Meléndez, Garrido-Moreno, & Del Aguila-Obra, 2008; Tan, 2013a; Tan, 2013b; Tan, 2015; Toral, Barrero, & Martínez-Torres, 2007). As Davis (1986, 1989) and Davis, Bagozzi, and Warshaw (1989) noted, 'A wide body of research focuses on identifying factors affecting people's intentions to use new technologies and how these intentions predict actual usage (**Figure 4**).'

The TAM was developed from another psychological construct, the theory of reasoned action (TRA) (Urdan, 2000), which was developed by Davis (1986). The TAM comprises two main factors, PU and PEOU, which are believed to positively affect attitudes towards using and subsequently positively affect behavioural ITU and actual system use (Tan, 2013a; Tan, 2013b; Tan, 2015; Chen, 2011).

PREVIOUS STUDIES

Adopting the concept of IS (information system) acceptance to identify behavioural determinants is useful for designing and implementing the guiding systems of theoretical models. The TAM posits that IS acceptance is primarily determined by two systemic beliefs: PEOU and PU (Davis, 1986, 1989; Davis et al, 1989).

Table 3. Review of Previous Studies (Tan, 2013a; Tan, 2013b; Tan, 2015)

Author(s)	Theory	Major Findings
Fishbein and Ajzen (1975)	TAM, TRA	TAM is a psychological theory that explains how an individual's action is decided by his or her BI to perform and assumes the strength of the TRA.
Davis (1989a)	TAM	TAM has been adopted in various studies to examine the user acceptance of information technology.
Taylor and Todd (1995)	TAM, TPB	The role of prior experience, as well as combined social influences and behavioural control, were investigated using the TAM.
Agarwal and Prasad (1997)	IDT, TAM	TAM and IDT were used to examine the behaviours of pre- and post-adoption attitudes towards information technology.
Venkatesh and Davis (2000)	TAM	Utilising a particular system can help with job performance. The degree to which a person strongly believes
Venkatesh et al. (2003)	TAM, TRA	From the current specification, the TAM was simplified by changing the attitude structure found in the TRA.
Wixom and Todd (2005)	TAM	The antecedents and moderators of PU and PEOU and additional or alternative belief elements were examined. The TAM was expanded by introducing elements from related models.
Liaw et al. (2007)	TAM	The basic guidelines for expanding e-learning systems and environments were described, and instructors' and learners' attitudes towards e-learning methods were examined.
King and He (2006)	TAM	Meta-analysis as a rigorous alternative to narrative and qualitative literature reviews was explored. In total, 88 published studies and learners as surrogates for professionals in the TAM studies were reviewed.
Lee (2006)	TAM	The effects of e-content quality and e-course attributes on PU were found to be significant and significantly negative, respectively. In addition, computer self-efficacy was shown to have a significant influence on PEOU.
Polančič et al. (2010)	TAM	The successful use of frameworks was found to be dependent on two major factors: the PU of the framework and a continued ITU.
Tan (2013a)	TAM, UTAUT	English e-learning websites can help users increase their knowledge and are easy to use; however, system designers should continue to work to improve these sites.
Tan (2013b)	TAM, UTAUT	Four core constructs have a significantly positive influence on behavioural intention. E-placement tests are more appreciated by the students and are more likely to be used by them. Furthermore, administrators intending to encourage e-placement tests in their schools should include such constructs in the placement testing implementation.
Lakhal et al. (2013)	TAM, UTAUT	The suggestions proposed at the BIU desktop video conference focused on the factors most critical for administrators and faculties in higher education to consider when they implement academic online courses.
Tan (2015)	TAM	System designer must focus on e-users' demands when developing e-learning and online assessment systems. If LMSs are provided for e-users and meet the criteria for pragmatic learning purposes, such provisions can help maintain and enhance e-users' satisfaction and loyalty.
Tan & Hsu (2017a)	PZB & TAM	Digital products must be manufactured based on consumer demands and satisfactions for fast and high quality products, and digital product designers must incorporate ideas from different consumers.

MOTIVATION FOR DEVELOPING A NEW SYSTEM

English is not an official language in Taiwan, and in the past, it was not widely spoken in the country. However, because of globalisation, the Taiwanese have begun to learn English and speak with people from other countries. English is one of the most used languages in the world, and it has many learners. Considering the global importance of English, we aimed to create a system that would help the e-learners who prefer to learn through online techniques. We expect that entrepreneurs will appreciate an assessment of learners' interest in e-learning, because understanding the factors that affect their attitudes and behaviours is key to creating a high-quality and satisfactory system; it is crucial to design new learning technologies for e-users (**Table 3**).

PURPOSES OF THE DESIGN

This study examined English learners' attitudes towards English evaluation and teaching devices. The system developed herein quantifies people's perception, intentions, and attitudes towards the use of e-learning technologies to verify the significance of PU and PEOU when people decide to utilise a new system. We contend that appreciating the factors that influence people's use of new technologies will help improve these technologies.

The specific purposes of this study were:

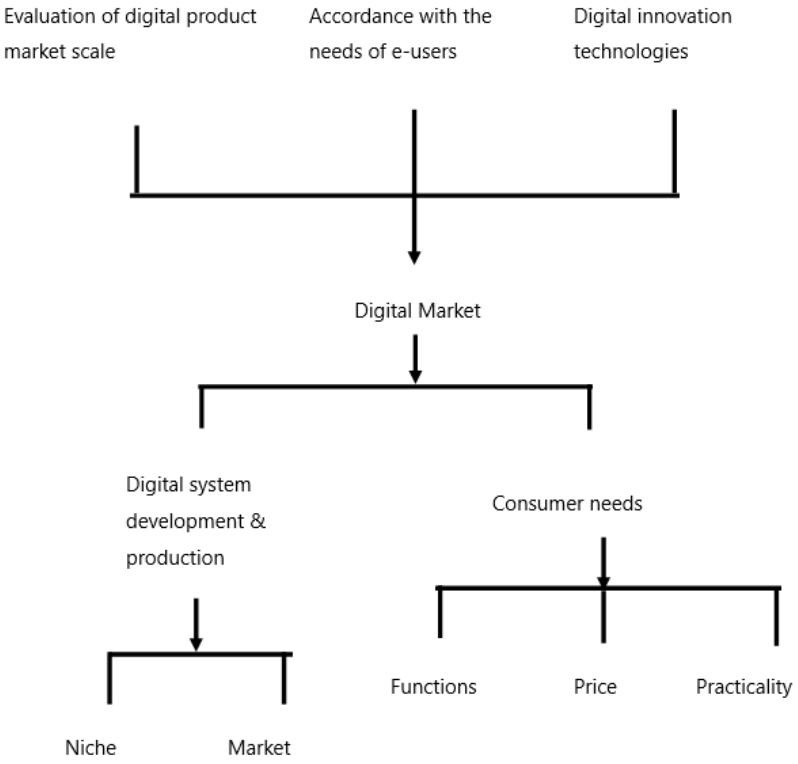

Figure 5. Digital system product (e-content) research and development procedure

1. To understand the value of a newly developed system and the reasons learners decide to continue using a particular tool.
2. To understand the types of skills e-learners want to obtain from a learning system.
3. To understand the attitudes of learners towards a system.
4. To design a system that can assist e-learners with obtaining improved learning results.
5. To judge if a system is likely to play a substantial role in e-learners knowledge development.
6. To determine the factors that influence e-learners' intentions and behaviours to utilise systems as the primary learning resources.

IMPLICATIONS FOR PRACTICE IN INDUSTRIES

E-learning systems must address e-users' demands; responding to their concerns and feedback is useful for maintaining and enhancing the e-users' loyalty towards particular English e-learning LMS systems. Moreover, if PU does not significantly correlate with attitudes towards usage, it can appear that the informative nature of the systems has no effect on learners' usage attitudes. In other words, PU was significantly correlated with both PEOU and attitudes towards usage, which can diminish the apparent impact of PU and may be more important for the PU. Furthermore, PU continues to have a significant impact on usage, regardless of its failure to affect attitudes. Thus, if systems designers want more e-users to use and feel satisfied with their system, they should work to improve the e-content quality. Quality is critical to the whole system, and studies have revealed that system designers should improve knowledge management functions and improve user interfaces to render them easier to operate (i.e., 'design the right systems, design the systems right') (**Figure 5**) (Tan, 2013a; Huang, 2005; Parasuraman, Zeithaml, & Berry, 1985).

SERVICE QUALITY GAP MODEL

The quality revolution of the 1980s was not only limited to manufacturing but also influenced all organisations, services, and levels of government. Thus, the importance of quality management since then can be deduced (Niranjan & Metri, 2008). The first model had only a few key structures, and it was used to improve the basic competition for improving the quality, urging services, companies and their competitors could provide better services.

The service quality gap model (also known as the PZB model) was developed by Parasuraman et al. (1985). Quality is considered the highest priority for companies to meet the desired outcome of their services and is related to high expectations from clients. Parasuraman et al. (1985) identified 10 criteria to evaluate the initial quality of a service, which is defined as the difference between the expected and received service. The 10 criteria are as follows:

(1) Understanding: making an effort to understand clients' needs
(2) Reliability: offering dependable and reliable services
(3) Responsiveness: being willing to provide services to clients
(4) Tangibles: physical evidence of the service
(5) Courtesy: providing consideration, respect, friendliness, and politeness to clients
(6) Communication: listening and responding to clients' requests and feedback
(7) Credibility: ensuring honesty, trustworthiness, and believability
(8) Competence: having the knowledge and skills necessary to provide services
(9) Access: ensuring ease of contact and approachability for clients
(10) Security: ensuring that danger, doubt, and risk are minimised

Notably, these criteria include the five main dimensions for measuring, delivering, and anticipating a company's service: reliability, responsiveness, assurance, empathy, and tangibility. In this model, the client sets expectations according to their perceptions of a company's performance or behavioural decisions (Kang & James, 2004). These criteria and the PZB model were later applied to develop the SERVQUAL scale, which measures the discrepancy between received and expected service quality and is widely cited in the marketing literature (Brønn, 2012; Kang & James, 2004). Currently, both the PZB and SERVQUAL models are widely utilised in the industry.

RECOMMENDATIONS FOR FUTURE DESIGN AND RESEARCH

Further research and system designs should widen the scope of the current study, which was designed focus on restricted to this particular system development field. Future studies and system designs can use the following suggestions:

1. Collect data from domains other than language learning to increase external validity.
2. Examine the efficiency of e-learning and e-assessment systems from different perspectives, such as system development and web-design quality.
3. Test the system with participating e-learners from different locations.
4. Use the plan-do-check-act model to re-examine the quality of the system developed in the present study.
5. Use the PZB model to re-examine client satisfaction with the system developed in the present study.

CONCLUSION

Design the right systems and design the systems right; do the right things and do the things right (**Figure 6**).

Digital product research and development:

(1) Digital product designers must consider the company's internal ideas and the ideas of different customers.
(2) Strengthen technological capability of the digital product's innovative aesthetic design, assist in design-related problem-solving, provide a comprehensive product blueprint.
(3) Research on digital product structure and evaluation of design costs.
(4) Steady design methods must be obtained through an optimal platform for digital product design under optimal resource allocation limitations (ERP concept).
(5) Use artificial intelligence technologies to achieve optimal customization. Use the function of three-dimensional diagrams to achieve optimal digital product design.
(6) Identify the challenges faced by innovative digital products by looking at market and corporate trends in markets where digital products are sold.
(7) With respect to digital product design, market strategies must be determined and market competition strategies and channel arrangements must be formulated.
(8) Costs and profits related to digital products must be effectively controlled in a reasonable manner in order to prevent or reduce losses, achieve innovation, and overcome business difficulties. As such, a company will play an important role in digital product models, colours, materials, service quality, and overall aesthetics. This will increase aesthetic appreciation in a company's customers and improve its competitiveness.

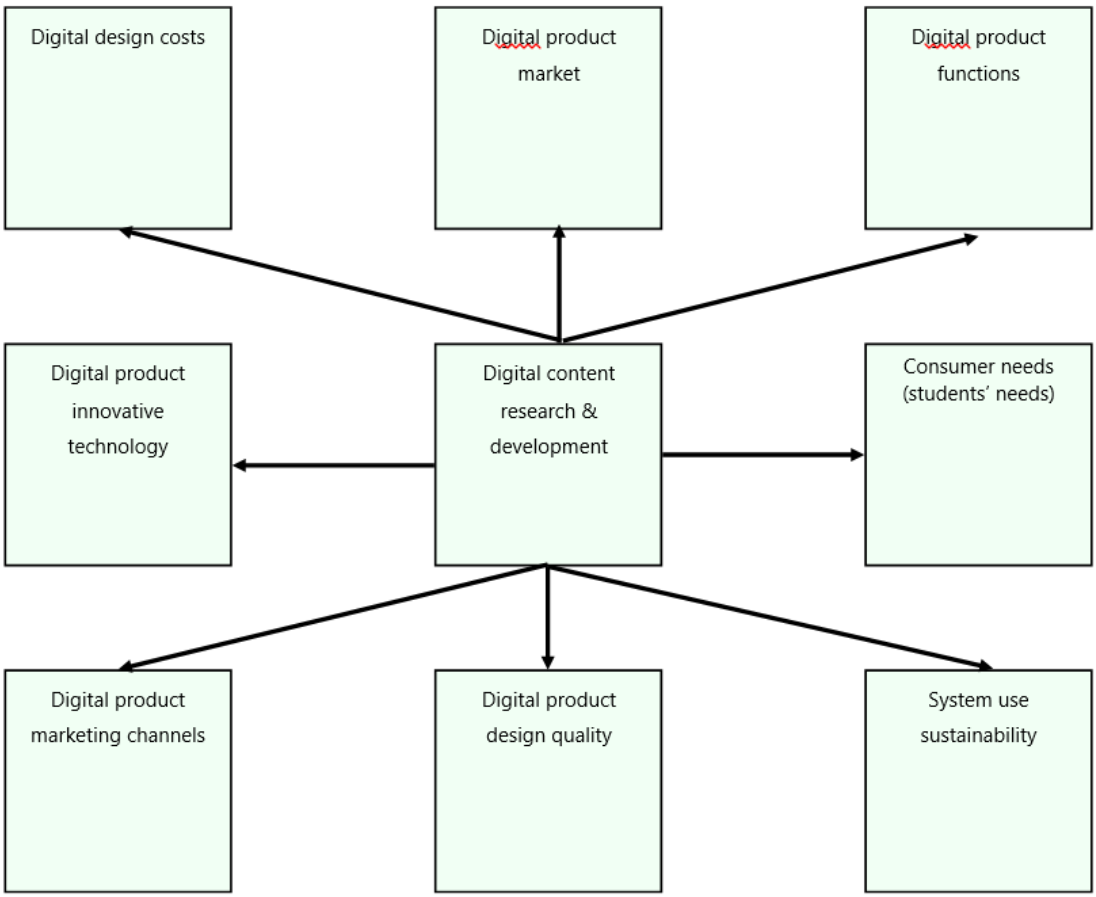

Figure 6. Digital product research and development processes

Digital products must be manufactured based on consumer demands and satisfactions for fast and high quality products, and digital product designers must incorporate ideas from different consumers. The technological capability of digital products' creative and aesthetic design should be improved. Assistance must be given to digital product consumers in solving system issues, and comprehensive digital product design services must be provided (**Figure 5** and **Figure 6**).

Knowledge management and basic concepts in digital product design include four essential factors:

(1) Social and natural environment factors: Social factors include politics, culture, and religion. Natural environment factors include resources and energy and other materials obtained from nature.

(2) Technological factors: Technological factors include energy, processing techniques, and functions. It can be said that these are the factors that most directly restrict the implementation of a design.

(3) Aesthetic factors: Aesthetics-related solutions are multifaceted and include the object's social environment, educational level, value system, personality, etc.

(4) Human factors: Looking at the design history of digital system products, it can be seen that the genuine emergence of the "people-oriented" approach occurred only during the digital age. In the future, the development of digital design will focus more on the coordinated development of human, technological, and environmental elements.

The design of a digital product must consider all four types of factors so that the digital product meets the digital market demand and adapts to social development and production (Retrieved from MBALib wiki: http://wiki.mbalib.com/zhtw/%E4%BA%A7%E5%93%81%E8%AE%BE%E8%AE%A1).

A company's overall digitalisation requires support from information technologies. It is necessary to determine whether one concept or system is applied (William & Michael, 2002), to establish the direction of digitalisation users, to define the knowledge management of product innovation, to use optimal purposes of the digital product, and to determine the product innovation's basic knowledge and abilities.

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