International Journal of Engineering and Technology Innovation, vol. 14, no. 2, 2024, pp. 177-188

An Intelligent E-Pharmacopoeia Retrieval System Using Responsive Web Design

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Received 04 September 2023; received in revised form 11 December 2023; accepted 12 December 2023

DOI: https://doi.org/10.46604/ijeti.2023.12801

Abstract

To develop an e-pharmacopeia retrieval mobile system aimed at assisting medical personnel in efficiently assessing precise drug information and ensuring patient safety, this study utilized responsive web design. The research framework incorporated the convergence of the technology acceptance model (TAM) and the information systems success model (ISSM) to investigate user satisfaction and continuance intention. A survey was administered to 151 pharmacy students who had utilized the system for over 30 minutes. The findings revealed that the TAM-ISSM model significantly influenced user satisfaction, surpassing the individual impacts of TAM and ISSM. Furthermore, user satisfaction exhibited a positive and significant impact on continuance intention, which, in turn, demonstrated a positive and significant influence on both individual and organizational performance. This suggests that the proposed system is proficient in accurately identifying and processing drugs, thereby mitigating the pain induced by diseases in patients.

Keywords: intelligent retrieval, e-pharmacopeia, responsive web design, technology acceptance model, information systems success model

1. Introduction

With the growth in research and development, as well as the launch of new drugs, the types and number of clinical drugs are steadily increasing. Each drug product must provide relevant information such as the scientific name, product name, and side effects. Products from different pharmaceutical manufacturers differ in terms of dosage forms and specifications, resulting in increasingly bulky information for drug products. However, some medical institutes adopt a separate paper-based pharmacopeia, which causes inconvenience for medical personnel. Although some hospitals have developed drug product lookup systems, only a cell-based lookup function is available. If incorrect words are input, personnel may not be able to identify correct drug-related information. To address this problem, it is necessary to develop a useful e-pharmacopoeia retrieval mobile system to help medical personnel search for accurate drug information conveniently and maintain patient safety in drug use.

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English language proofreader: Yen-Chun Hsieh

The earliest information retrieval (IR) technique was Boolean search, which yields only matched or unmatched results; partially matched scenarios are not available. After Gadge and Bhirud [1] proposed a vector space model (VSM), accurate comparison search methods distinct from previous methods have been proposed to present search results based on similarities or relevance. Numerous relevant studies have been conducted; for example, Senin and Malinchik [2] combined the symbolic aggregate approximation (SAX) and VSM methods to propose a new method named SAX-VSM, which can identify eigenmodes in a time series and provide rapid, accurate, explainable classifications.

Mikolov et al. [3] proposed two model architectures to compute the continuous vectors of large data sets. This method reduced computational costs and increased accuracy. Sidorov et al. [4] proposed soft similarity and the soft cosine measure to compute the similarity between features; machine learning algorithms were used to explain the results. Another study proposed the term frequency-inverse document frequency (TF-IDF) to compute the weighting of words, and it combined association rule learning and latent semantic analysis to reduce the storage space and improve document classification accuracy. Therefore, the emergence of VSMs presented the concept of similarity to the searching of sentences, as well as the comparison of documents. This study used the similarity method to establish a VSM of pharmacopeia document files.

With the prevalence of smartphones and tablet computers, web design technologies have evolved. In 2011, Boston designer Ethan Marcotte [5] created the term responsive web design (RWD) to describe an emerging technology. After 2012, RWD became a popular web design and development technology. RWD uses percentage presentations and flexible screen design to enable layouts corresponding to display devices with varied resolutions, thereby demonstrating the optimal visual effect. Rensfeldt [6] compared web pages designed through conventional and RWD methods. The results revealed that RWD-based websites do not require users to perform horizontal rolling or zooming in or out to view the page. This design is easy to use for users. Gibbs and Gretzel [7] identified the relationship between mobile device design strategies and participating organizational standards. They indicated that organizations with higher website traffic have a greater likelihood of adopting RWD to design their websites.

Liao [8] used task-technology fit theory to perform a questionnaire survey that delved into the task fit and adoption intention of RWD among web designers. The results revealed that designers in Taiwan believed RWD conforms to their habitual preference for establishing web pages for mobile devices, and therefore had greater intention to adopt RWD. However, Liao [8] also mentioned that clients' reluctance to raise their budget may cause low intention to adopt the RWD technique for website development. Another study used the system usability scale to understand participants' satisfaction with the user interface. The results revealed that RWD web pages exhibited greater usability than the original mobile web page [9]. According to this finding, web pages developed using the RWD technique increase the level of ease of use and user acceptance. Therefore, the present study used RWD to develop an intelligent e-pharmacopoeia retrieval mobile system and distributed user questionnaires to investigate the proposed model.

To understand if a new information system is acceptable to users, the technology acceptance model (TAM) is commonly used as the theoretical basis to explain users' acceptance behavior of the system while analyzing various factors affecting user acceptance [10]. In addition, the information systems success model (ISSM) provides a crucial reference principle for evaluating the success of information systems [11]. Adeyemi and Issa [11] investigated the integration of ISSM and TAM. According to Lin and Chen [12], favorable performance must be explored from the perspective of fit. Therefore, the present study adopted the TAM-ISSM fit to explore user satisfaction with and continuance intention [13] for the intelligent e-pharmacopoeia retrieval mobile system.

In summary, the present study applied IR methods and the RWD technique to design an intelligent e-pharmacopoeia retrieval mobile system that physicians, pharmacists, and nurses can use on mobile or computer devices. After users input intended keywords of drug information, including scientific names, product names, and side effects, they can rapidly and

accurately access related information about the drug. Medical services performed through paperless methods can facilitate convenience of use, increase medical personnel's pharmacopeia search speed, and improve medical quality. Consequently, through a research hypothesis model, a questionnaire survey was conducted to evaluate user satisfaction and continuance intention regarding the proposed system as well as the causal relationship of the model.

2. The Intelligent e-Pharmacopoeia Retrieval Mobile System

As indicated above, a useful e-pharmacopoeia retrieval mobile system is necessary for accurate drug information and safety in drug use. However, if only a cell-based lookup function is available, personnel may not be able to identify correct drug-related information. In this session, an intelligent e-pharmacopoeia retrieval mobile system is designed to influence the investigation of user satisfaction and continuance intention.

2.1. The content of pharmacopoeia

This study used IR techniques to process a pharmacopeia Excel file provided by Kaohsiung Medical University Hospital. The Excel file contained drug codes, English product names, English scientific names, Chinese product names, drug properties, product descriptions, use methods, side effects, and cautions. It also contained both structured and unstructured data. First, rules were analyzed and the analysis results were stored in the "drug document database."

After phrase segmentation and TF-IDF-based calculation to quantify words, the quantification results were stored in the "word quantification document database." In addition, VSMs were established and stored in the "vector space model document database." After data processing, a total of 1,259 pieces of drug data were compiled. The word quantification results yielded a total of 54,202 words. After repeated words were removed, 7,277 words were presented. Then, two words with zero TF-IDF results, namely drug and mg, were excluded. The remaining 7,275 words formed the vector length of the present study.

2.2. System performance enhancement

To increase the system performance and establish learning mechanisms, through which the proposed system after learning can become a mobile pharmacopeia for individuals, a binary search tree had to be established after the word quantification document scientific name was obtained. The American Standard Code for Information Interchange (ASCII) was applied to divide the character into two parts, with the corresponding ASCII codes for "a" to "z" ranging from 97 to 122. Whenever a character is inserted, ASCII codes 97-109 enter the left subtree, whereas ASCII codes 110-122 enter the right subtree. At the last character, the node references a leaf node; then, the relevant quantification information of the complete word and number of phrases that appear is stored.

2.3. A responsive website construction

After the relevant data were stored in the database, the RWD technique was used to establish the website version of the intelligent e-pharmacopoeia retrieval mobile system. Users can use the system through web browsers on mobile devices or computers. This study mainly retrieved English words and drug codes. After the system obtains sentences input by the user, it segments the input sentences into phrases or words. The input sentences are examined through a keyword fault-tolerant processing mechanism to identify whether typos exist. If one exists, similar words are provided to the user to select the correct one, after which the system proceeds to the learning mechanism. If no typo is present, the learning mechanism is enabled directly. The aforementioned learning mechanism refers to an increase in the phrase count of a leaf node when the leaf node is visited during binary tree searching. Over long-term use, the influence of frequently searched keywords can be improved; thus, the system can become a capable mobile pharmacopeia for individuals. The function of providing similar words for users to select is implemented through a fuzzy search method [14].

2.4. Methods for keyword searching

The fuzzy search method comprises two parts. The first part is the short phrase search method, which involves the input of the first three to four characters, and then the system lists relevant words for users to select according to a weighting calculation. The second part is the long phrase comparison method; when the input keyword length is longer than four characters and error characters are present at certain lots, the edit distance method is applied to calculate the similarity between two strings.

The edit distance refers to the minimum number of characters that must be removed, inserted, or converted to convert string A into string B when strings A and B are given. When the system cannot identify the lookup phrases the user has input, said fuzzy search method is employed to compare words in the binary search tree. The results are presented in the form of similarity levels to provide users with words they can select from when searching.

2.5. Search outcome presentation

Finally, after the lookup phrases are converted to phrase vectors, a cosine similarity comparison with all documents is conducted. Drugs are ranked from high to low according to similarity. Simple information about the drug is presented on the screen, including the drug code English, and scientific name. Users can easily select the drug information they want to view. A demonstration of the developed intelligent e-pharmacopoeia retrieval mobile system's display interface is presented in Fig. 1.

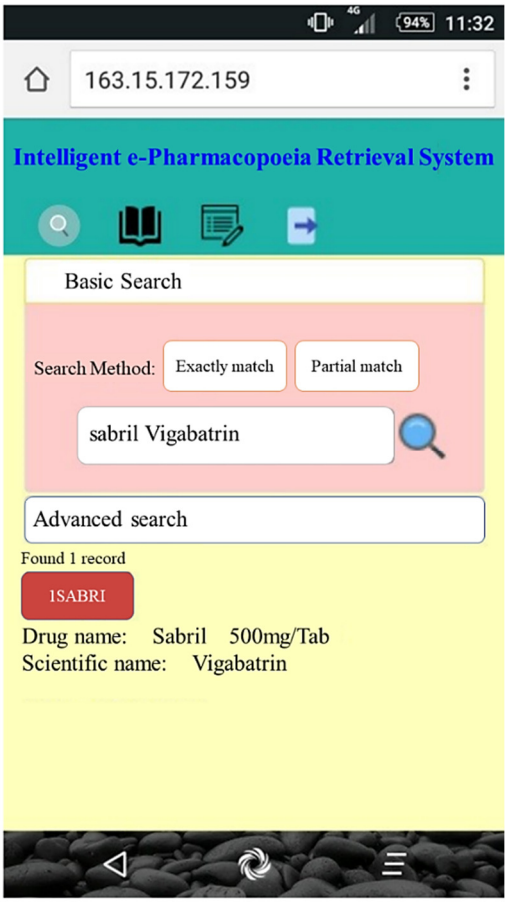

Fig. 1 Demonstration of the intelligent e-pharmacopoeia retrieval mobile system's display interface

To sum up, an IR method is adopted to analyze, process, and quantify terms in pharmacopeia document files of hospitals to establish vector space models of the documents and store them in archives. RWD technology was employed to establish an intelligent e-pharmacopoeia retrieval mobile system, through which users can search for drug names online using mobile devices or computers.

3. Research Model

The research hypothesis model of this study is presented in Fig. 2. The model uses the perceived ease of use and perceived usefulness of the TAM by Davis [15] and the system quality, information quality, and service quality in the ISSM by DeLone and McLean [16] to explore the possible relationships between TAM-ISSM fit and user satisfaction, continuance intention, individual performance, and organizational performance of the intelligent e-pharmacopoeia retrieval mobile system.

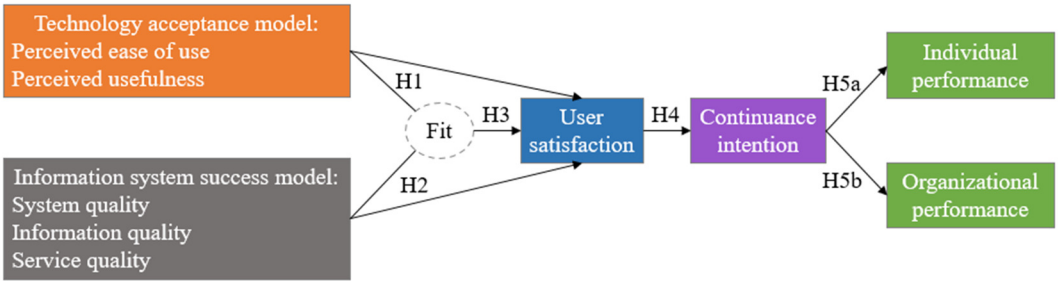

Fig. 2 The research hypothesis model

This study proposed the following hypotheses:

H1: The TAM of the intelligent e-pharmacopoeia retrieval mobile system's users significantly and positively affects user satisfaction.

H2: The ISSM of the intelligent e-pharmacopoeia retrieval mobile system significantly and positively affects user satisfaction.

H3: The significant and positive effect of TAM-ISSM fit on user satisfaction is greater than the effects in H1 and H2.

H4: Users' satisfaction with the intelligent e-pharmacopoeia retrieval mobile system significantly and positively affects their continuance intention.

H5a: Continuance intention significantly and positively affects individual performance.

H5b: Continuance intention significantly and positively affects organizational performance.

To verify the aforementioned hypotheses, this study employed perceived ease of use, perceived usefulness, system quality, information quality, and service quality as independent variables. User satisfaction was adopted as the dependent variable to facilitate the deduction and model verification of the hypotheses. A 5-point Likert scale was adopted with five anchors, namely strongly agree (strongly satisfied: 5 points), agree (satisfied: 4 points), no opinion (neutral: 3 points), disagree (dissatisfied: 2 points), and strongly disagree (strongly dissatisfied: 1 point), to measure independent and dependent variables. The operational definition of each dimension variable is provided as follows:

(1) Perceived ease of use: This study referenced the definition of perceived ease of use proposed by Davis et al. [17] and defined it as users' perceived ease of using the intelligent e-pharmacopoeia retrieval mobile system. Six measurement items were devised.

(2) Perceived usefulness: This study referenced the definition of perceived usefulness proposed by Davis et al. [17] and defined it as the degree to which users believe that using the intelligent e-pharmacopoeia retrieval mobile system can improve their performance. Four measurement items were devised.

(3) System quality: DeLone and McLean [16] claimed that system quality involves the evaluation of the quality of functions of the information system itself, including usability, reliability, availability, adaptability, and response time. This study selected immediacy, system flexibility, convenience of access, and functional usefulness to devise four measurement items.

(4) Information quality: DeLone and McLean [16] claimed that information quality involves the evaluation of the content produced by the information system, including personalization, timeliness, accuracy, ease of understanding, relevance,

security, and completeness. This study chose formatting, ease of understanding, clarity, and importance to devise five measurement items.

(5) Service quality: Following the rapid evolution of information technology, DeLone and McLean [16] adopted the views of Pitt et al. [18] and contended that information system service providers must provide comprehensive services, thereby increasing the dimensions of service quality, which include reliability, tangibility, responsiveness, assurance, and empathy. This study selected assurance and empathy to devise three measurement items.

(6) User satisfaction: DeLone and McLean [16] claimed that user satisfaction results from users' response and assessment of operating and using a system, that is, users' satisfaction level toward using the information system. This study used user satisfaction, information system acceptance, and overall user satisfaction to devise three measurement items.

(7) Continuance intention: This study adopted the definition of continuance intention proposed by Bhattacherjee [19] and defined it as users' intention to continually use the intelligent e-pharmacopoeia retrieval mobile system. Three measurement items were devised.

(8) Individual performance: Goodhue [20] indicated that individual performance refers to individuals' value in their work contribution, including improvement of work efficiency, performance, and quality. According to the system use environment, this study defined individual performance as users' level of improvement in work quality in clinical care after using the intelligent e-pharmacopeia retrieval mobile system. A total of four measurement items were devised.

(9) Organizational performance: Youndt and Snell [21] proposed that organizations' enhancement of their intellectual capital accumulation and the use and effective distribution of organizational resources affect organizational performance. Lin et al. [22] explored the effects of computer system success characteristics and individual information science capabilities on nursing organizations. They mentioned that hospitals mainly provide health care and professional knowledge services and use intellectual capital as the factor influencing organizations. Therefore, according to these studies, the present study defined organizational performance as the degree to which the organizational intellectual capital improved after the use of the intelligent e-pharmacopeia retrieval mobile system. Five measurement items were devised. According to the operational definition of each dimension, this study developed a questionnaire for the intelligent e-pharmacopoeia retrieval mobile system. The operational measurement items of variables in each dimension are provided in Appendix

Based total of 424 students of the School of Pharmacy at Kaohsiung Medical University have been requested to use the intelligent e-pharmacopoeia retrieval mobile system for more than 30 minutes in 5 days. Then this study adopted a purposive sampling method to select a total of 151 Pharmacy students (61 males and 90 females) who were invited to complete questionnaires. This study was approved by the Kaohsiung Medical University Chung-Ho Memorial Hospital Human Experiment and Ethics Committee under the institutional review board (IRB) code: KMUH-IRB-(E)I-20150210. SmartPLS 3.0 was used to conduct factor analysis. Then Cronbach's α values and composite reliability (CR) were used to test the questionnaire. Finally, the consistent PLS algorithm method from SmartPLS 3.0 was used to verify the hypothesis models.

4. Discussion

The factor analysis results of all items are presented in Table 1. The indicator reliability of each item was greater than 0.5; therefore, no items were eliminated. To test the questionnaire, Table 2 reveals that the Cronbach's α values of each dimension were greater than 0.7, indicating high reliability. The CR was also greater than 0.7, representing acceptable reliability of the developed questionnaire. In Table 2, the average variance extracted (AVE) represented the variance explanatory power of each measurement variable to their associated latent variable. Hair et al. [23] suggested that the AVE of a dimension should be greater than 0.5. The six main dimensions of the TAM and ISSM in this study reached the standard of 0.5 or above, indicating that the questionnaire had convergent validity.

Table 1 Factor analysis results

Measurement item code	TAM	Measurement item code	ISSM	Measurement item code	User satisfaction
PEU1	0.564	SYSQ1	0.815	S1	0.899
PEU2	0.592	SYSQ2	0.781	S2	0.923
PEU3	0.639	SYSQ3	0.787	S3	0.897
PEU4	0.773	SYSQ4	0.868		
PEU5	0.718	IQ1	0.765		
PEU6	0.784	IQ2	0.775		
PU1	0.768	IQ3	0.740		
PU2	0.814	IQ4	0.789	-	-
PU3	0.792	IQ5	0.821		
PU4	0.835	SERQ1	0.565		
-	-	SERQ2	0.747		
		SERQ3	0.723		
Measurement item code	Continuance intention	Measurement item code	Individual performance	Measurement item code	Organizational performance
CI1	0.946	IP1	0.690	OP1	0.864
CI2	0.888	IP2	0.898	OP2	0.879
CI3	0.926	IP3	0.913	OP3	0.831
-	-	IP4	0.729	OP4	0.926
		-	-	OP5	0.883

Table 2 Cronbach's α, composite reliability, and average variance extracted from each dimension

Dimension	Cronbach's α	CR	AVE
TAM	0.920	0.920	0.538
ISSM	0.945	0.945	0.590
User satisfaction	0.933	0.932	0.822
Continuance intention	0.943	0.943	0.847
Individual performance	0.932	0.932	0.775
Organizational performance	0.912	0.913	0.679

Then, the consistent PLS algorithm method from SmartPLS 3.0 was used to verify the hypothesis models. The path coefficient represents the strength and direction between variables. Positive values indicate that the independent variables are positively correlated with the dependent variables. By contrast, negative values indicate that the independent variables are negatively correlated with the dependent variables. The verification results of each hypothesis are presented in Table 3.

Table 3 Analysis results of structured models

Hypothesis		Path coefficient (β value)	Result
H1	The TAM of the intelligent e-pharmacopoeia retrieval mobile system's users significantly and positively affects user satisfaction.	0.360	Supported
H2	The ISSM of the intelligent e-pharmacopoeia retrieval mobile system significantly and positively affects user satisfaction.	0.564	Supported
H3	The significant and positive effect of TAM-ISSM fit on user satisfaction is greater than the effects in H1 and H2.	0.897	Supported
H4	Users' satisfaction with the intelligent e-pharmacopoeia retrieval mobile system significantly and positively affects continuance intention.	0.823	Supported
H5a	Continuance intention significantly and positively affects individual performance.	0.802	Supported
H5b	Continuance intention significantly and positively affects organizational performance.	0.731	Supported

The comprehensive analysis results revealed that all paths exhibited significance. The results are summarized as follows:

(1) The TAM of the intelligent e-pharmacopoeia retrieval mobile system significantly and positively affected user satisfaction with a path coefficient of 0.360, thereby supporting H1.

(2) The ISSM of the intelligent e-pharmacopoeia retrieval mobile system significantly and positively affected user satisfaction with a path coefficient of 0.564, thereby supporting H2.

(3) The TAM-ISSM fit significantly and positively affected user satisfaction with a path coefficient of 0.897, which was higher than those of H1 and H2, thereby supporting H3.

(4) The user satisfaction of the intelligent e-pharmacopoeia retrieval mobile system significantly and positively affected continuance intention with a path coefficient of 0.823, thereby supporting H4.

(5) Continuance intention significantly and positively affected individual performance with a path coefficient of 0.802, thereby supporting H5a.

(6) Continuance intention significantly and positively affected organizational performance with a path coefficient of 0.731, thereby supporting H5b.

In addition, R2 represents the variance explanatory power of external variables to internal variables. R2 values are between 0 and 1. A greater value represents greater model predictability. The hypothesis model path analysis diagrams involving the relationships of the TAM, ISSM, and TAM-ISSM fit with user satisfaction (Figs. 3 and 4) revealed that TAM and ISSM alone explained 80.2% of the variance in user satisfaction; TAM-ISSM fit explained 80.5% of the variance in user satisfaction; user satisfaction explained 67.8% of the variance in continuance intention; and continuance intention explained 64.3% of the variance in individual performance and 53.4% in organizational performance. According to these design requirements, the specialized joints and members include cam pairs, gear pairs, the frame, the input, and the output. Their symbols and representations are listed in Table 1. The whole process proceeds according to the following:

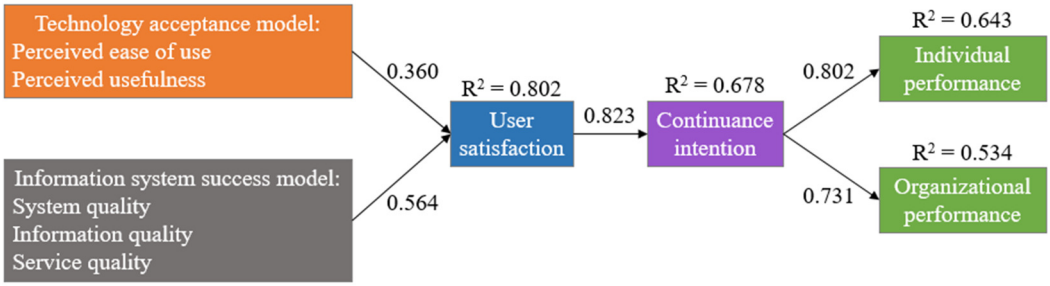

Fig. 3 Directly structured model path analysis diagram

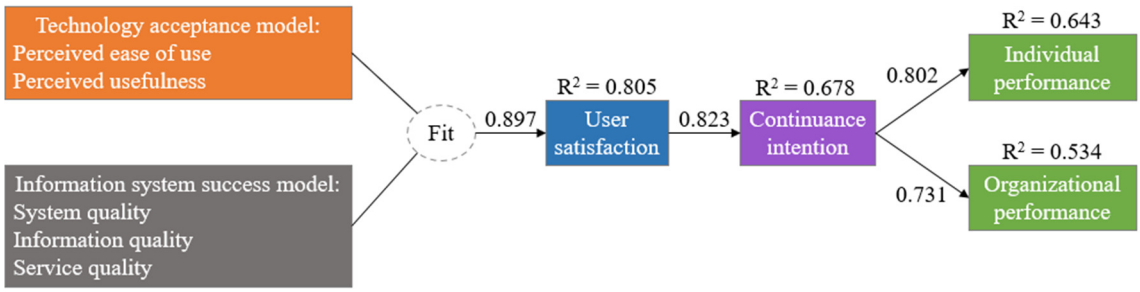

Fig. 4 TAM-ISSM fit structured model path analysis diagram

5. Conclusions

This study aimed to develop an intelligent e-pharmacopoeia retrieval mobile system and explore relationships between TAM-ISSM fit, user satisfaction, continuance intention, individual performance, and organizational performance. The analysis results of the collected questionnaire responses are summarized as follows:

(1) TAM-ISSM fit: This study identified that TAM-ISSM fit significantly affected user satisfaction and had greater explanatory power than TAM and ISSM alone on user satisfaction. In other words, in terms of user-perceived usefulness,

perceived ease of use, and system functions, when human-machine interaction reaches a certain level of fit, it considerably affects user satisfaction.

(2) User satisfaction: This study identified that the ISSM, including system quality, information quality, and service quality variables, positively and significantly affected user satisfaction. This result corresponded with those presented by Pitt et al. [18] and DeLone and McLean [16].

(3) Continuance intention: This study identified that user satisfaction positively and significantly affected continuance intention, corresponding to the results presented by Chiu et al. [24] and Zhao et al. [25].

(4) Individual and organizational performance: This study identified that continuance intention positively and significantly affected individual and organizational performance. This may be attributed to the target-oriented nature of healthcare services. Therefore, the proposed system had a significant effect on individual and organizational performance. The system mainly satisfies the needs of clinical healthcare workers in their search for drug information, contributing more to individual performance than to organizational performance.

Concerning future work, more functions like Mandarin character search, commonly used drug collections, recording and querying commonly used drug records, and reporting errors can be expanded to the system. When used clinically in hospitals, the department can also be determined according to the user's account, and commonly used drugs in different departments can be sorted to allow users to search for drug information more quickly. Ultimately, based on the results of this paper, e-pharmacopoeia searches can be explored further by TAM-ISSM fit in the future.

Funding

This study was supported by the National Science and Technology Council, Taiwan (Grant No. NSTC 112-2221-E-037-004-MY3), NSYSU-KMU JOINT RESEARCH PROJECT (#NSYSU-KMU-113-P07).

Conflicts of Interest

The authors declare no conflict of interest.

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Appendix

Operational measurement items of variables of each dimension

Variable	Code	Item content	Reference
Perceived ease of use	PEU1	1. Learning to use the intelligent e-pharmacopoeia retrieval mobile system is easy to me.	Lin et al. (2016) [26]
	PEU2	2. Learning the operating methods of the intelligent e-pharmacopoeia retrieval mobile system is clear and comprehensible to me.	
	PEU3	3. It is easy for me to become an adroit user of the intelligent e-pharmacopoeia retrieval mobile system.	
	PEU4	4. I rarely feel confused or puzzled when using the intelligent e-pharmacopoeia retrieval mobile system.	
	PEU5	5. I rarely encounter errors when using the intelligent e-pharmacopoeia retrieval mobile system.	
	PEU6	6. Overall, I think the intelligent e-pharmacopoeia retrieval mobile system is easy to use for me.	
Perceived usefulness	PU1	1. Using the intelligent e-pharmacopoeia retrieval mobile system helps improve my clinical healthcare work quality.	Lin et al. (2016) [26]
	PU2	2. Using the intelligent e-pharmacopoeia retrieval mobile system helps improve my work efficiency.	
	PU3	3. Using the intelligent e-pharmacopoeia retrieval mobile system helps improve my work capability.	
	PU4	4. Overall, the intelligent e-pharmacopoeia retrieval mobile system is useful to me.	
System quality	SYSQ1	1. The intelligent e-pharmacopoeia retrieval mobile system can be rapidly linked to the database.	Lin et al. (2016) [26]
	SYSQ2	2. The intelligent e-pharmacopoeia retrieval mobile system can provide necessary data transmission on wi-fi networks.	
	SYSQ3	3. The intelligent e-pharmacopoeia retrieval mobile system provides an interface that enables users to easily access the required data.	
	SYSQ4	4. Overall, the functions of the intelligent e-pharmacopoeia retrieval mobile system are favorable.	
Information quality	IQ1	1. The information format presented by the intelligent e-pharmacopoeia retrieval mobile system is easy to read.	Lin et al. (2016) [26]
	IQ2	2. The information format presented by the intelligent e-pharmacopoeia retrieval mobile system is easy to understand.	
	IQ3	3. The image resolution and access in the intelligent e-pharmacopoeia retrieval mobile system are favorable.	
	IQ4	4. The data contained in the intelligent e-pharmacopoeia retrieval mobile system are important.	
	IQ5	5. Overall, the intelligent e-pharmacopoeia retrieval mobile system provides high-quality drug information (image and text).	
Service quality	SERQ1	1. The technicians of the intelligent e-pharmacopoeia retrieval mobile system are polite to users.	Lin et al. (2016) [26]
	SERQ2	2. The technicians of the intelligent e-pharmacopoeia retrieval mobile system understand user needs.	
	SERQ3	3. The technicians of the intelligent e-pharmacopoeia retrieval mobile system have enough technical competency to maintain the system.	
User satisfaction	S1	1. The functions of the intelligent e-pharmacopoeia retrieval mobile system are satisfactory.	Chen et al. (2015) [27]
	S2	2. The intelligent e-pharmacopoeia retrieval mobile system can satisfy my needs in search of drugs.	
	S3	3. The overall performance of the intelligent e-pharmacopoeia retrieval mobile system is satisfactory.	

Continuance intention	CI1	1. I prefer selecting the intelligent e-pharmacopeia retrieval mobile system to select other tools to facilitate my clinical care work.	Cho et al. (2009) [28]
	CI2	2. I think the intelligent e-pharmacopoeia retrieval mobile system should be continuously applied in clinical care works.	
	CI3	3. Overall, I intend to continuously use the intelligent e-pharmacopoeia retrieval mobile system to facilitate my clinical care work.	
Individual performance	IP1	1. By using the intelligent e-pharmacopoeia retrieval mobile system, I can select the correct drug for patients at a precise time point.	Leggat et al. (2010) [29] and Chang et al. (2012) [30]
	IP2	2. By using the intelligent e-pharmacopoeia retrieval mobile system, I can provide safe drug dosages to patients.	
	IP3	3. By using the intelligent e-pharmacopoeia retrieval mobile system, I can accurately identify and process the drugs according to patient conditions.	
	IP4	4. By using the intelligent e-pharmacopoeia retrieval mobile system, I can alleviate the disease-induced pain of the patients.	
Organizational performance	OP1	1. Most physicians, pharmacists, and nurses clearly understand their purposes of services for patients in the hospital.	Lin et al. (2014) [22]
	OP2	2. Physicians, pharmacists, and nurses adopt the intelligent e-pharmacopoeia retrieval mobile system based on their prior experience in healthcare services.	
	OP3	3. The adoption of the intelligent e-pharmacopoeia retrieval mobile system enables individual physicians, pharmacists, and nurses to more accurately and efficiently use drugs.	
	OP4	4. The hospital possesses correct and effective drug use methods to develop a safe environment for medication in the hospital.	
	OP5	5. The hospital possesses effective mechanisms to measure the performance of correct drug use.	