

The satisfaction of using an oral pathology mobile application (PathoPal) in dental students

Supachai Chuenjitwongsa
Department of Biochemistry
Chulalongkorn University
Bangkok, Thailand
supachai.c@chula.ac.th

Krerik Piromsopa
Department of Computer Engineer
Chulalongkorn University
Bangkok, Thailand
krerk.p@chula.ac.th

Risa Chaisuparat
Department of Oral Pathology
Chulalongkorn University
Bangkok, Thailand
risa.c@chula.ac.th

Abstract - The objective of this study was to develop the oral pathology mobile application (PathoPal) to support dental students' learning process and to identify satisfaction of dental students in using the mobile application. Participants were the third- and fifth- year dental students (193 students) at Faculty of Dentistry, Chulalongkorn University. Students were given one week to use the application then their satisfaction in using the application were gathered via a questionnaire survey. Of 193 participants, 60 percent were satisfied with the application. When compared with textbooks, the most significant advantage was the

convenience of use and the speed of data processing in identifying pathological information. Students reported that the application was more accessible than textbooks resulting in their learning process became more effective. In conclusion, the PathoPal application can be helpful for inexperienced dental students as it provides tentative differential diagnoses of all possible oral pathologic diseases supporting learning and clinical reasoning skills.

Keywords—oral pathology, mobile application, satisfaction

I. INTRODUCTION

A proper diagnosis of the oral lesions leads to an appropriate treatment plan for patients. The common oral problems such as tooth decays and periodontal diseases can be diagnosed by history taking, clinical examination, and radiographic interpretation. The diagnosis of the oral and maxillofacial lesions may not rely solely on clinical investigation; therefore, biopsy and consultation from oral pathologists are required to achieve the final diagnoses of those cases. However, general dentists should possess knowledge and skills at giving clinical diagnosis and differential diagnosis of the lesion to reach the most beneficial outcomes for patients. Additionally, an integration of such knowledge and skills should be developed in order to be a competent practitioner [1].

The 6 year-undergraduate dental curriculum at Chulalongkorn University is divided into pre-clinical part and clinical part. This categorization adopted the principles of novice-expert continuum [2]. During the pre-clinic part, students develop knowledge and skills separately to progress from the novice stage to the advanced beginner stage. In the clinical part, students expose to real professional contexts in order to link and integrate knowledge and skills to gain competencies and progress toward the competent stage. Foundation of the oral and maxillofacial lesions is taught in the pre-clinical courses which then further transfer to a basis for application to treat

patients in the clinical courses. The problem is found that most dental students tend to focus only on diagnosis of dental caries and gum diseases, probably because their lack of experiences in oral mucosal and maxillofacial diagnosis. Hence, access to oral pathologic data references should be convenient and instant in order to assist students to perform diagnosis of different lesions. These references act as a scaffold to help students link new information with prior knowledge in order to gain deep learning [3]. When information is easily approachable (e.g. be available on the mobile phone), dental students probably feel familiar with this method over using regular textbooks. Many studies have shown that physicians, medical students and interns are frequently using smartphones in daily life, with overall use rates of 80% [4]. A study of attitudes in dental students on the use of the mobile technologies showed that having the Internet on their smartphones had a positive impact on their dental education (55%) [4]. Because of the familiarity of accessing to knowledge, the students would be more confident when they have to face complicate oral lesions which reduce the problem of their lack of experience.

Nowadays, technology plays a prominent role in how students learn. For instance, online learning is helpful in self-studying and provides students achievement toward learning outcomes similarly to learning via general classroom, simulation serves as virtual situations for elevation of skills practice

without doing harm to patients, and mobile technologies make information access become easier [5-7]. Though textbooks could be also available in hospital library, using them in rush hours in clinical practice would be impractical. Instead of the difficulties stated, mobile applications can be promptly approached because phones are basic gadgets in daily basis. Moreover, most people prefer mobile applications to computers since the latter is more beneficial as it obtains better internet speed, is compatible with a wide range of WiFi signals, and accesses any online sources without prohibitions. Advantages of immediate access to information are absence of delayed decision-making in patient treatments and reduction in patient anxiety and pain [8]. According to complexity of giving diagnoses to oral diseases and abundance benefits of mobile application usage, developing a mobile application will help dental students and practitioners be more confident in providing diagnosis. Thus, before any application would be published and used widely it should be surveyed the satisfaction of users in term of its educational benefits and practicality, which is the aim of this research project.

The PathoPal application was designed as differential diagnosis aid for chairside use when facing patients with unfamiliar oral pathologic lesion. To use the application, users have to access the application by logging in with student identification number and passwords to be verified as dental students. This process purpose was to ensure that the users were dental students of Chulalongkorn University. Afterwards, the categories of clinical findings of the lesions was chosen by the users, following by clinical characteristics found in patients. Possible differential diagnoses would be provided by the application in the last step, and each disease would be linked to their short definitions and illustrations.

II. METHODS

The conceptual background for our study was consisted of three parts. First, the mobile application was collaboratively developed by Chulalongkorn dental and engineer student teams. The second part's purpose was to implement the mobile application to dental students and to evaluate the satisfaction of the usage. In this part, the web-application address was given to the participants and the questionnaire was checked for purposes of the questions. The participants then answered the questionnaire. In the last part, all user satisfaction data were analyzed by using descriptive statistics to find the correlation among the users based on specific criteria. This study protocol has been ethically approved by the Human Research Ethics Committee of the Faculty of Dentistry, Chulalongkorn University (Study code: HREC-DCU 2018-037).

A. Developing the application

The application, named "PathoPal", was designed to be consisted of two parts. The first part provided differential diagnoses after the user input the clinical findings of the lesions. The second part presented brief definition of each oral pathologic disease and some illustration of the lesions with distinguished appearance.

Researchers gathered contents of clinical characteristics of oral pathologic diseases from textbooks to develop flowcharts for the first part. The diseases that have similar pattern were categorized into the same group. There were four main groups; color changes, masses or enlargements, surface alterations, and jaw bone lesions. Each group was divided by clinical features, such as location of the lesion, size of the lesion, or whether the lesion was associated with systemic conditions. Possible differential diagnoses were shown as the final results.

After information and illustrations were reviewed by a board certified oral pathologist, the web-based application was devised by a post-graduate engineering student. Figure 1 represents the structure of the Patho Pal application. Internet connection was required in order to operate the application. Participants also received a briefly verbal instructions on using the application by the researchers prior using. Research ethics approval for the PathoPal mobile application satisfaction evaluation was obtained from Faculty of Dentistry, Chulalongkorn University.

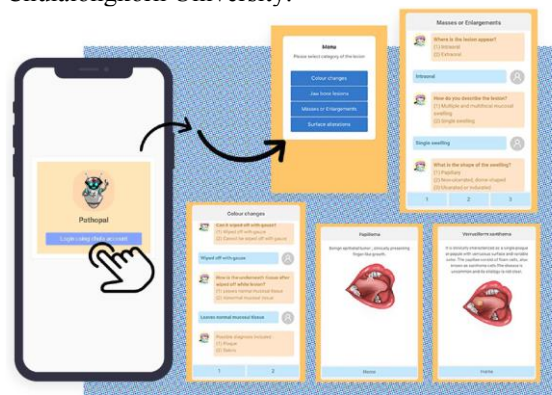


Fig. 1. Structure of the Patho Pal mobile application

B. Using the application

One hundred and ninety-three eligible participants were third-year and fifth-year dental students in faculty of dentistry in Chulalongkorn University in 2018, who had a personal smartphone or tablet. Only those who were not willing to participate were excluded from this study. The participants were permitted access to the web-application to use for one week.

C. Evaluating the satisfaction of users

After using the application, a Google form consisted of a questionnaire and informed consent was given to the students. All participants were asked to complete a form with demographic data, including gender, age, year of study, grade point average, and

prior experiences with smartphones or similar platforms (i.e. tablets).

The questionnaire comprised four sections in terms of users' satisfaction of the application containing five-level Likert-scales and open-ended questions as following:

1. Overall satisfaction on the appearance of the application: font style, font size, application color, element layout, data accessibility, accuracy of the illustrations

2. Satisfaction on convenience of use of the application: application installation, data search, convenience of use, reliability of data, accuracy of results, speed of data processing, clinical application of data, overall satisfaction level of the application

3. Satisfaction on using mobile application when compared to conventional textbooks: data input, data search, data display, convenience of use

4. Additional comments:

4.1 Among 5 choices; lecture, active learning course, actual practice, self-learning from mobile app, and others, what were best three effective learning method

4.2 Whether they had experience with other self-learning mobile application and reasons why they chose to use or not to

4.3 Among five choices; mobile application, textbooks, lecture handouts, the internet, and indecisive, which choice would they prefer to obtain clinical diagnoses and reasons why

4.4 Whether they would recommend the application to others with reasons why

4.5 Problems they found in using the application and things that should be improved

D. Data analysis

Responses from users collected in Google forms were automatically transferred to Microsoft Excel software. To assess the characteristics of the study sample, numerical data were analysed using descriptive statistics and qualitative data were analysed thematically. Using Microsoft Excel, frequency and percentage of satisfied participants was calculated. For 5-level satisfaction question, scores that were 4 points and higher were determined as satisfied. As for 10-level satisfaction question, the mean score of over-all satisfaction level was calculated as 8.52. Therefore, the cut-point was set as score 8 and higher. Moreover, percentage of satisfied third-year and fifth-year students were evaluated separately comparing to entire participants. Finally, all collected data were used to create graphs to illustrate understanding of users' preference of the application.

III. RESULTS

A total of 193 participants, which were 77 third-year students and 118 fifth-year students, were eligible for this study. The response rate overall was 100%. Most were female (119 students, 61.66%) with average age of 21.9 years. All participants

reported routine use of smartphones and tablets in daily life, but only 83 students (43%) admitted using them for educational purposes.

Third-year students used the application showed 45% of overall satisfaction, while fifth-year students showed higher overall satisfaction of 69%. When calculated from total participants, it resulted that 60% of them were satisfied with the application, as shown in Figure 2.

In Figure 3, it is shown that the percentage of students who found the convenience of use, data search, data input, and data display had advantages over textbooks were 83, 79, 78, 77 respectively.

In terms of satisfaction on convenience of use of the application, it is reported in Figure 4 that hardly different results were shown in each aspect. Majority of participants was satisfied with speed of data processing (83%), accuracy of results (82%), clinical application of data (81%), reliability of data (72%), application installation (70%), convenience of use (70%), and data search (69%).

According to Figure 5, font style was found to be the most desirable among students (82%). 75% of students was satisfied with the color of application, while 73% was satisfied with the font size. For data accessibility was 69%, for element layout was 67% and for accuracy of the illustration was 50%.

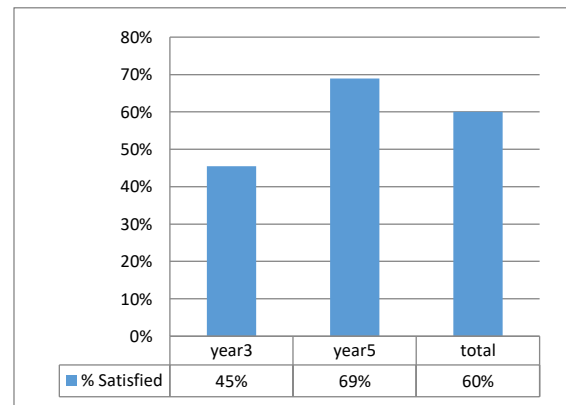


Fig. 2. Overall satisfaction level of the application

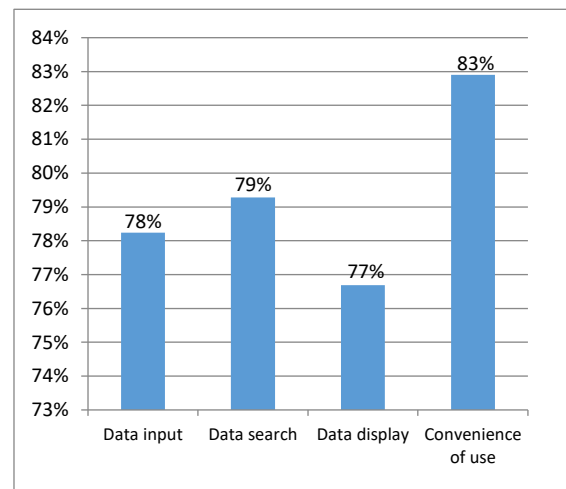


Fig. 3. Satisfaction on using mobile application when compared to conventional textbooks

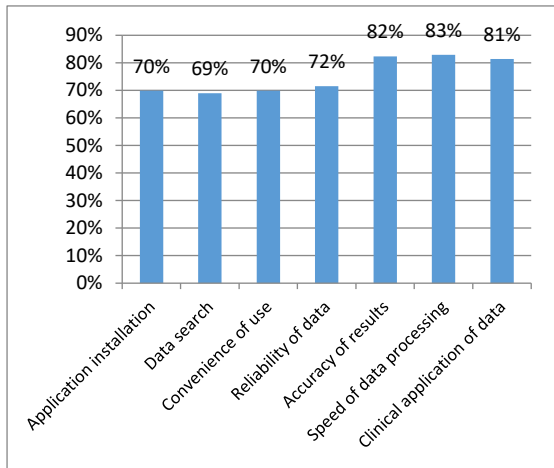


Fig. 4. Satisfaction on convenience of use of the application

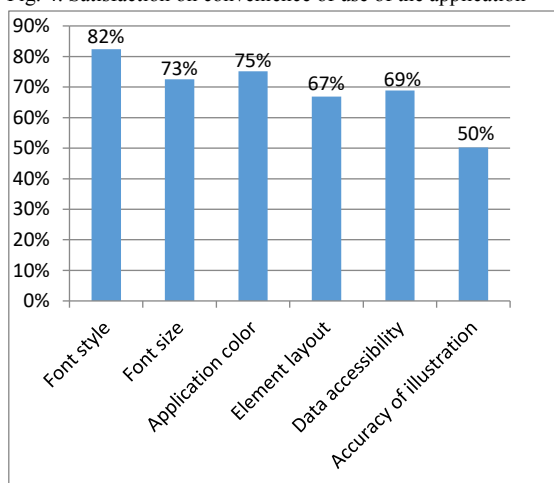


Fig. 5. Overall satisfaction on the appearance of the application

IV. DISCUSSION

Of 193 users, there were 115 users (60%) satisfied with the PathoPal application. The other 78 users (40%) disliked the application mainly because of the application instability and technical errors. 82 of satisfied group (71%) had experience with using mobile application as a learning method. Therefore, we could assume that those who had used learning mobile application prior the study would be more familiar with gadgets and more satisfied with the PathoPal application. This also possibly implies that the familiarization with mobile learning can reduce cognitive load (i.e. mental requirements to learn how to use the application) [9] resulting in that students learn better and feel more satisfied.

Of 115 satisfied students, it was reported that 80 students (70%) would use the PathoPal application in the future, while 33 students (29%) were indecisive and 2 students (1%) would not use the application. Lack of detailed information in the application was complained by those two students. They also had the same preference of choosing textbooks over other methods for more reliable and detailed contents. However, the purpose of this mobile application was to provide possible differential diagnoses in chairside circumstances which only brief descriptions would

be needed. Basic knowledge of users was also expected because the application was not designed to replace conventional learning methods. This situation probably confirms that the PathoPal application is a learning scaffold assisting student learnings and development rather than a detailed source of information.

Our study was in concordance with the ones observed in similar experiences. In 2016, Webb et al published an analysis of trainees' case reports of how a mobile application improve the quality of patient care provided by trainee doctors. The application gave access to medical textbooks. Performance was measured using a thematic content analysis. The result of the study showed that this application supported quality improvement in giving patient care in terms of efficiency, timeliness, effectiveness, safety and patient-centeredness [8]. Similar finding was seen in our study, in which the speed of information access was the most desired aspect of using both mobile applications. In addition, our findings were also similar to Martinez et al's in 2017, which stated that students who had many experiences with smartphone applications might have been able to use the application faster than those who had no such background [10].

Strengths and Limitations

This study was strengthened because previous data showed good correlations among overall satisfaction scores. For example, those who had used educational mobile application before would be satisfied of the PathoPal application. Consequently, they would be likely to use the application again in the future. These data showed potential to be helpful for the design of upcoming versions.

Several limitations need to be taken into consideration. First, third-year students used the application when it was newly launched. Some instability and technical problems were found which resulted in lower satisfaction level of third-year students compared to of fifth-year students who used the updated version. Second, although the contents in the PathoPal application were developed based on reliable textbooks, the references were not included in the application. Thus, some of the participants criticized of the data reliability.

Future directions

The questionnaire would be included in the application in the next version, which would eliminate the use of Google Forms. According to users' recommendations, instructions on using the application, clinical photos of the lesions would be added for more understanding of users. Moreover, the pattern of choosing the choices in the application would be changed to be more user-friendly. After proper developments, the application would not only be available for dental students but also general practitioners in the future.

From an education viewpoint, in-depth information regarding how students develop

learning, apply knowledge, and provide clinical judgement from the use of the PathoPal application should be explored to indicate on how and when to effectively use the application. This will also guide both educators and students on how to enhance development of competency in clinical diagnosis and differential diagnosis.

ACKNOWLEDGEMENT

This study was supported by Ratchadaphiseksomphot Endowment Fund Chulalongkorn University.

REFERENCES

- [1] D. W. Chambers, "Toward a competency-based curriculum," *J. Dent. Educ.*, vol. 57(11), pp. 790-793, November 1993.
- [2] D. W. Chambers, and P. Glassman, "A primer on competency-based evaluation," *J. Dent. Educ.*, vol. 61(8), pp. 651-666, August 1997.
- [3] P. A. Ertmer, and T. J. Newby, "Behaviorism, cognitivism, constructivism. Foundations of Learning and Instructional Design Technology", 2017.
- [4] B. Khatoon, K. B. Hill, and A. D. Walmsle, "Dental students' uptake of mobile technologies," *Br. Dent. J.*, vol. 216(12), pp.669-673, June 2014.
- [5] A. Bullock, and P.G.M. de Jong, "Technology-enhanced learning. Understanding Medical Education," John Wiley & Sons, Ltd, 2013, p. 149-160,.
- [6] NN Mergany, AE Dafalla, E Awooda, "Effect of mobile learning on academic achievement and attitude of Sudanese dental students: a preliminary study," *BMC Med Educ*, vol.21(1), February 2021.
- [7] R Matos Lamenha-Lins, D Maria de Carvalho Pugliesi, F José Camello de Lima, A Regina Oliveira Moreira, P Gonçalves Correia de Leite de Marcelos, VE Jr Dos Santos, "Mobile application as a learning tool for improving dental students' knowledge regarding dental trauma," *Eur J Dent Educ*, vol. 26(4), November 2022.
- [8] K. Webb, A. Bullock, R. Dimond, M. Stacey, "Can a mobile app improve the quality of patient care provided by trainee doctors? Analysis of trainees' case reports," *BMJ Open*, vol. 6(9), September 2016.
- [9] M. Bannert, "Managing cognitive load—recent trends in cognitive load theory. Learning and instruction," vol.12(1), pp. 139-146, 2002.
- [10] F. Martinez, C. Tobar, and C. Taramasco, "Implementation of a Smartphone application in medical education: a randomized trial (iSTART)," *BMC. Med. Educ.*, vol. 17(1), pp.168, September 2017.