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Research Paper

Forensica Application as Learning Media on Forensic

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ABSTRACT

Background: Time of death estimation is crucial to help investigators to solve a case. In this study, Forensica application, version 4, an android-based mobile phone application was developed as a tool to educate and calculate the time of death estimation. This study aimed to compare the level of knowledge between medical students that studied using the application and textbook.

Methods: Both groups had the same study duration and answered the same questions. Participants had then filled out a questionnaire about the Forensica.

Results: Statistical analysis shows that gender differences do not result in significant differences. The mean of the post-test result shows significant improvement (P=0.00) in both groups when compared to the pre-test result.

Conclusion: The result shows that generally, the respondents feel that learning with Forensica was easier, faster, more fun, more practical, and more exciting than learning compared with textbooks. Thus, Forensica application can be a better learning method alternative to textbooks that is easier, faster, more fun, more practical, and more exciting.

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1. Introduction

In the globalization era, the rapid development of products and technology makes it easy for humans to perform daily activities. The mobile phone is one example of technological development. Mobile devices' popularity is increasing worldwide, with an average use of 75% in developing countries in 2019. Mobile device has become a part of the learning process as all students nowadays own a smartphone. Numerous fields of education have widely used computer devices and mobile applications. Some studies have indicated the improvement of the learning experience through various forms of technology, such as digital handbook apps, mobile learning, computer device, and gamification [1-5].

The COVID-19 pandemic has changed medical education's form to mainly online. As meeting patients in person is necessary for medical students' skill development, it became a challenge to maximize the potential of virtual learning [1]. The presence of an accessible source of information in the clinical setting appeared to make students more confident. Having a mobile device with references was more practical than carrying a textbook all the time [1]. Learning media based on Android applications is an alternative to helping to solve problems during the learning process. In addition, the usefulness of mobile learning makes students prefer the convenience and ease of use of applications. Learning activities can be more engaging and consequently increase learning motivation. It makes teaching methods more varied, reduces learning boredom, and then students become more active. Many fields use Android applications, including education, agriculture, language, economics, marine, and health [2].

However, there were some issues regarding the screen size, which affected the clarity of text and images, the availability of updated materials, the speed connection, and the price [2]. The collaboration model could also improve the experience. Then, the available resources could lead to further curiosity [3]. The availability of good Internet access might be an issue in mobile learning. The use of mobile devices in the clinical setting has a positive impact on learning. However, students had concerns about professionalism and patients' acceptance of using mobile devices. There was also a concern about privacy and the security of personal data [4, 5].

Medical students tended to have low awareness of forensic medicine [6]. While one of the information needed from forensic medicine is postmortem interval, it is essential to recognize the evidence [7]. Postmortem interval is key to most death investigations. The longer time since death, the more difficult it is to estimate the interval. The frequent practices are livor mortis and rigor mortis as the artifact of decomposition, vitreous humor electrolytes concentration, temperature, and forensic entomology. The most common methods are livor mortis and rigor mortis, especially in the early stage of decomposition [7].

In this study, we decided to build a simple and free Android application to help determine the time of death. Furthermore, we combined livor mortis, rigor mortis, and putrefaction with an android device application so that users can easily predict the time of death of an unknown death. With the help of the application, data on livor mortis, rigor mortis, and putrefaction are digitally analyzed. In the end, the estimated time of death appears directly on the screen of the device. Besides being able to help medical students in understanding the timing of death, this study can also be used in future practice when finding unknown death in the community. The purpose of this study was to compare the level of knowledge between medical students using the application and those using a textbook.

2. Materials and Methods

In this study, we recruited the participants online, by giving them information about the descriptions and procedures of this study. The participants that gave their consent were then divided into application and textbook groups. Thirty-five participants were willing to submit to each of the groups. However, when the research was done in an online Zoom meeting, only 28 and 25 participants were present in the application and the textbook group, respectively.

All participants were undergraduate medical students with no experience in an intensive forensic course related to the estimation time of death. At the beginning of the study, all participants took a ten-minute pre-test and then were divided into two break-out rooms, namely the application and textbook groups. The textbook group then studied the estimation time of death using forensic pathology book [8]. This book is a national and international reference in forensic learning. Meanwhile, the application group studied to estimate the time of death using Forensica application, version 4, an android-based mobile phone application.

After both group participants had finished their self-study in 30 minutes, they returned to the main room to answer the same post-test questions. The closed-book post-test was conducted for 10 minutes. The application group participants then filled out a questionnaire that assessed Forensica's aspects of users, systems, and interactions.

The Forensica application was advanced through a comprehensive literature study to determine the parameters and time limits used to estimate the time of death. The input parameters used are rigor mortis, livor mortis, and decomposition stages. This application was improved through internal peer review, external peer review, and preliminary study. The application interface is shown in Figure 1.

Figure 1 A is the icon and the loading page that includes the title "forensica" and the tagline "easier learning, good understanding". Figure 1 B-D describes the description and function of the application. Figure 1 E is the starting page, in which the user records the patient's name and identity number. Figure 1 F-H is the pages to put the parameters of rigor mortis, livor mortis, and decomposition stages. Figure 1 I, J is the result page.

3. Results

The subjects were 17 males and 36 females, with a mean age of 22.58 years, 21 years old was the youngest, and 25 years old was the oldest age. According to Figure 2, the participants were undergraduate medical students from four universities. The majority of the participants were from Universitas Gadjah Mada (UGM), followed by Universitas Muhammadiyah Yogyakarta, Universitas Tarumanagara, and Universitas Sebelas Maret. By the domiciles, more than half of the participants came from the Special Region of Yogyakarta, followed by Central Java and Jakarta. Only one participant came from East Java, Banten, Riau, West Java, and Lampung.

There was no screening on gender conducted in the process of recruitment for this study. This results in uneven numbers between the genders. Most of the researchers were affiliated with the Faculty of Medicine, Public Health, and Nursing UGM; thus, the recruitment also was conducted first in FK-KMK UGM. Other recruitments were done only after the recruitment in the Faculty of Medicine, Public Health, and Nursing UGM was done. This explains why the majority of respondents are from UGM and the Special Region of Yogyakarta.

A discrimination test was done to calculate the differences in results by gender. The mean result was 78.23 for male respondents and 88 for female respondents, without significant difference (P=0.074). However, a previous study revealed that males had better learning outcomes than females in multimedia learning tasks [9]. This dissimilarity might come from the differences in the learning media used as we only utilized texts without any multimedia involved.

We then compared the result of the pre-test and post-test in each group. The application group's mean scores improved from 53.6 to 86.1. In the textbook group, the mean scores improved from 50 to 83.6. The mean post-test scores showed a significant improvement (P=0.00) in both groups compared to the pre-test result. Lastly, we compared the mean scores of the post-test between each group, 86.1 for the application group and 83.6 for the textbook group. There was no significant difference between the two groups, with a P=0.635. These results are in line with the former study that showed both mobile applications and the paper book had the same benefits and effectiveness as educational media [9, 10].

Acceptance of the use of technology can be evaluated from the cognitive and behavioral aspects. The user's reaction to the technology will be indicated by affective reaction and cognitive reaction. In this study, we measured cognitive reaction. There are three major concepts tested: Perceived usefulness, perceived ease of use, and computer self-efficacy [11, 12].

Table 1 shows the result of the user acceptance test. We used a 5-point Linkert scale for this questionnaire, from strongly disagree (1) to strongly agree (5). Most items were agreed upon and strongly agree upon. It means that the Forensica application gets good acceptance from the users.

When asked about their feelings toward the Forensica application, the majority of the respondents responded positively (Table 2). More than half of the respondents felt good/attracted to the application. The reason is that the application poses a new learning environment, turning learning into a more engaging activity. Some of the respondents felt that the application is simple, practical, and good, making the process of time of death estimation easier.

Even though the majority responded positively, one of the respondents suggested that the application is difficult to be a learning media and two other respondents suggested that the application has no resources. These suggestions are helpful to the further development of Forensica application. There were also two respondents that responded neutrally towards the application. No respondent responded negatively.

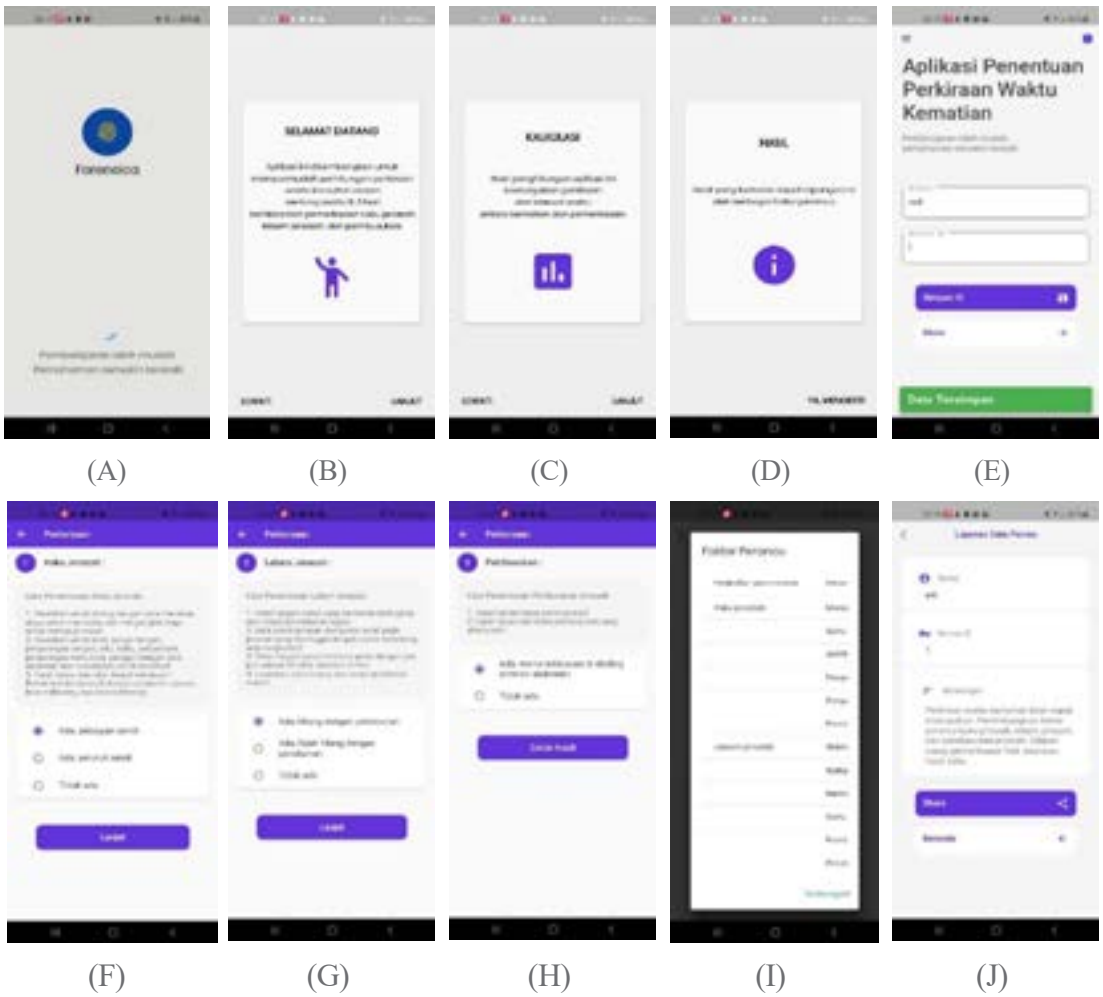

Figure 1. Forensica operational process interface

Table 1. User acceptance test

No	Questions	Results
1	Is the interface easy to symbolize?	4.361
2	Is the application easy to operate?	4.527
3	Is the color theme of the application easy on the eye?	4.222
4	Is the menu interface in the application easy to navigate?	4.25
5	Is the information available on the application easy to search?	3.75
6	Is the writing readable?	4.444
7	Is the application easy to download?	4.333
8	Are the symbols, icons, and pictures in the application easy to understand?	4.222
9	Is the information available on the application easy to access?	3.889
10	Is the function of the application in accordance with the goal?	4.222
11	Is the menu on the application easy to remember?	4.111

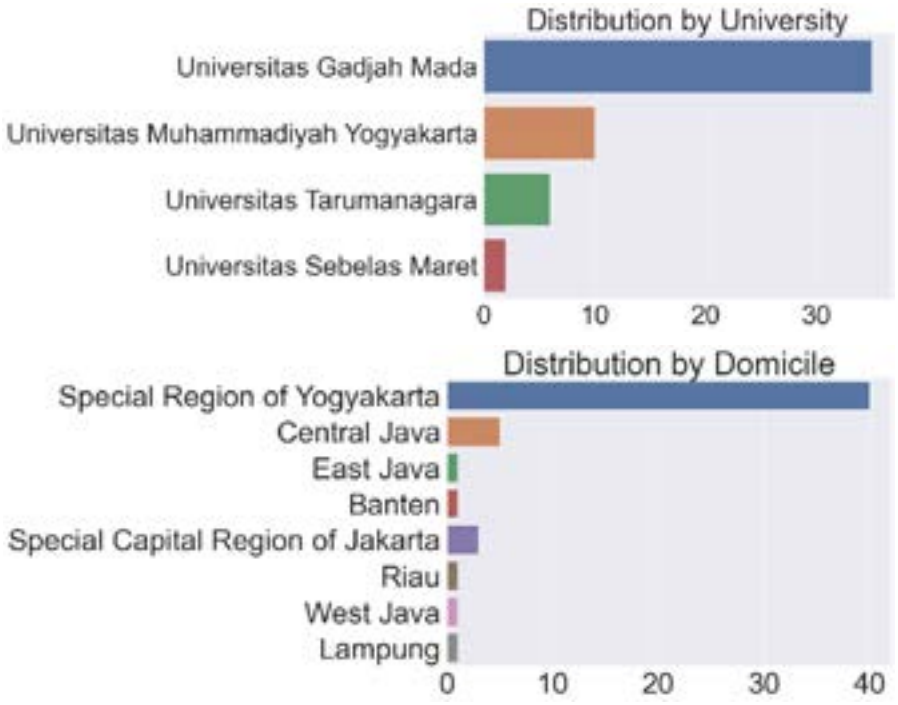

Figure 2. Respondent characteristics

Table 2. Respondents' feelings towards Forensica application

Feeling		No. (%)
Positive	Happy and/or attracted	12(52.17)
	Practical/simple	3(13.04)
	Good	2(8.69)
	Easier/helping	4(17.39)
Neutral	Normal	2(8.69)
Negative	-	-

Table 3. Comparison between Forensica application and textbook

Variables	Mean
Learning with Forensica application is easier than the textbook regarding learning and understanding how to calculate the time of death	4.13
Learning with Forensica application is faster than regarding learning and understanding how to calculate time of death	4.34
Learning with Forensica application is more fun than the textbook regarding learning and understanding how to calculate the time of death	4.26
Learning with Forensica application is more exciting than the textbook regarding learning and understanding how to calculate the time of death	4.13
Total	4.21

The respondents were asked to compare the process of learning using the Forensica application and textbook (Table 3). The process was assessed by a questionnaire using the Likert scale: Five means highly agree and one means highly disagree. The result shows that generally, the respondents felt that learning with the Forensica application is easier, faster, more fun, and more exciting than using the textbook.

The use of a smartphone as learning media has been demonstrated regarding the calculation of vital signs. Respondents using the application also felt helped by the smartphone application [9, 13]. The results of this study are in line with the result of another survey showed that respondents choose the mobile applications rather than the textbook as learning media [10, 14]. In general, the teaching process that integrates the usage of smartphone applications positively affects students [16, 17]. Thus, we can conclude that the Forensica application is helpful in the learning process of time of death estimation.

4. Discussion

The use of a smartphone as learning media has been demonstrated on the matter of vital signs calculation. Respondents on that application also felt helped by the smartphone application [9, 13]. The results of this study in line with the result of the other survey that showed that respondents choose mobile application rather than textbook as the learning media [10, 14]. In general, the teaching process that integrates the usage of smartphone application affects positively on the students [15, 17]. Thus, we can conclude that Forensica application are helpful in the learning process of time of death estimation.

5. Conclusion

Based on various statistical analyzes and questionnaires filled in by respondents, Forensia was as effective as learning media compared to textbooks in estimating the time of death. Forensica can be a better learning method alternative to textbooks as it is easier, faster, more fun, more practical, and more exciting.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Institutional Review Board of Medical and Health Research Ethics Committee (MHREC) Faculty of Medicine, Public Health, and Nursing Universitas Gadjah Mada-DR Sardjito General Hospital (ID No.: KE/FK/0567/EC/2021).

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Authors' contributions

Conceptualisation, study design, performed data, data analysis and writing: Idha Arfianti Wiraagni, Beta Ahlam Gizela and Firdaus; Data collection: All authors.

Conflict of interest

The authors declared no conflicts of interest.

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