Scrum to support application development project for online learning

VIANY UTAMI TJHIN*

BINUS Graduate Program – Master of Information Systems Management, Bina Nusantara University, Jakarta, Indonesia 11480

REGINA EKA RIANTINI

Management Department, BINUS Business School Undergraduate Program, Bina Nusantara University, Jakarta, Indonesia 11480

DWI LISTRIANA KUSUMASTUTI

Information Systems Department, School of Information Systems, Bina Nusantara University, Jakarta, Indonesia 11480

ELLYNIA

Health Administration Program, STIKES RS Husada, Jakarta, Indonesia 10730

CCS CONCEPTS • Applied computing • Education • Learning management systems

Good health services require adequate human resources, especially nursing personnel during a pandemic. To produce quality human resources in the health sector, a quality learning process is needed in health education institutions. One of the steps that can be taken to achieve this is to transform online and mobile-based nursing education. Technological developments have changed the way applications developed. Application users have also experienced changes by prioritizing mobile-based applications. This change makes application developers look for new methods in developing applications that can be used effectively. This article presented a study that applies the principles of agile mobile application development. The agile methodology used in this study is SCRUM for application development. This study prepared a mobile-based learning application that will be used by nursing students. The development of this application uses an agile methodology. This paper discusses Scrum's use in developing mobile-based applications that will be used in the nursing department's learning environment. The requirements are deliberately modified to provoke changes to the software being developed. Our findings revealed that agile practices were capable of assisting mobile software development. The advantage of this method was the ease of managing the project. control, and speed of development. However, aspects of user interface and user experience, different development platforms, and user expectations still represented the challenges in developing mobile applications.

CCS CONCEPTS • Insert your first CCS term here • Insert your second CCS term here • Insert your third CCS term here

Additional Keywords and Phrases: mobile application, SCRUM, online learning, nursing education

---

* Corresponding Author

1 INTRODUCTION

Compared to previous years, Internet users in Indonesia have a tendency to use mobile devices to access the Internet, namely around 47.6% [1]. This means that there is already a change in the preferences of Internet users in terms of device use from PCs and laptops to mobile devices. With the development of technology and the transition to mobile, the education sector has also experienced a change from face-to-face (conventional) classes to online learning.

According to the Indonesian Ministry of Education and Culture (2017), the problem of human resources in the health sector is inadequate numbers and unequal distribution. Human resources in the health sector include doctors, midwives and nurses. Therefore, the responsibility of the Government of the Republic of Indonesia is to provide equal distribution of health workers, including nursing personnel. The need for health personnel in Indonesia is high, especially for nursing personnel [2].

Based on the projection of the need for health personnel related to the 2014 National Health Act, the need for nurses has increased by around 33% from 398,357 to 593,336 people (2014 to 2025). Likewise, the need for health workers from abroad is also very high, namely in particular for nursing personnel increasing by 45% from 9,280 to 16,920 people (2014 to 2025). This shows that the demand for nursing personnel needs to get attention from the Government and nursing education institutions.

Prospective nursing staff or nursing students are scattered throughout Indonesia. To reach the scattered prospective students, a distance learning system or online is needed. Based on technological developments, there are Internet users in Indonesia with the highest penetration rate of students as much as 89.7% [1]. However, the main reason for Internet users in Indonesia related to education is still quite low, namely 9.2%. This presents a challenge for educational institutions to design quality learning content.

For this reason, it is necessary to build a learning management system that is adequate to support teaching and learning activities online or remotely. It is hoped that this will improve the quality of education in the nursing field, which in turn can produce quality nursing personnel. With the development of technology and the transition to mobile, the education sector has also experienced changes in this trend [1]. Likewise with education in the field of nursing which needs attention from various parties. The learning system is not only done face-to-face in class, but can also be done online. Therefore, researchers are interested in developing m-LMS in helping the online learning process for students and lecturers of nursing education institutions. From the background above, the problem formulations to be studied are as follows: How to develop mobile-based applications to meet the needs of students and lecturers as users in online learning in nursing education?

The researcher proposes a mobile-based online learning system (m-LMS) prototype which will be used and adopted by students and lecturers at the nursing academy. The application built included mobile Learning Management System (m-LMS). The system development method used the Scrum Development method.

2 LITERATURE REVIEW

Agility enables the rapid development of computer programs by adopting iterative and incremental models. This method is interspersed with analysis, design and construction activities [3]. Agility enables the rapid development of computer programs by adopting iterative and incremental models. This method is interspersed with analysis, design and construction activities [3]. There are several methodologies with this feature, all based on a set of principles collected in an agile form [4]. This study discusses extensively the

philosophy, principles and practices of agile methodology [3] [4] [5]. In this field of research, empirical research is more focused on educational scenarios than on an industrial perspective [6]. On the other hand, software engineering is a practical field, where the learning process should not rely on an automated repetition of concepts or theoretical case studies. Application development should involve activities that present scenarios to students to generate their own knowledge from new experiences.

2.1 SCRUM

The Scrum framework was originally developed by Jeff Sutherland and Ken Schwaber [7] [8]. Scrum is one of the most popular agile methodologies today as well as an additional and iterative framework for projects. It divides the development process into work cycles called Sprints, which last from 2 to 4 weeks. These sprints must each be carried out without interruption and have a time-boxed, even though the planned activities have not been completed. Scrum is a model that can help application development teams to build applications quickly and effectively

At the start of each Sprint, a multi-discipline team selected what requirements to apply from a priority list called the Product Backlog. This team is responsible for fully developing these requirements at the end of the Sprint. During the Sprint, the selected item cannot be changed. Each day, team members check their progress and adjust the next steps as needed to complete the job completely. At the end of the Sprint, the team and stakeholders review the results. This demonstration provides feedback that will allow the team to build new features to include in the following Sprint. Periodically, the team reflects on the development process to find ways to improve it through retrospective meetings or similar tools [9].

At first the Scrum method aimed to deliver this complex project in development programming that could be applied to any type of project. This framework is simple in nature and makes it possible to deliver complex projects. This method separates or scales them into simpler modules, or black boxes. The final goal to be achieved is to form the final product.

Some of the key concepts of Scrum are:
1. Product owner: Clients normally have an initial idea. Development team will create a product backlog. During the development stage, the clients will assess every module's partial results. They are able to make modifications for the next module (as long as these changes do not affect the basic tenets of the project).
2. Scrum Master: This keyperson is in contact with the customer directly. Their responsibilities are make assessment of prioritizing requisites, coordinate, assign activities and supervise the work of each developer.
3. Development team: Project's team will share out the work in line with the Scrum Master's guidelines. Each member will be in charge of the specific tasks required by the project, such as: web design, layout, web programming, mobile apps programming (Android or iOS).
4. Sprint or iteration: The Scrum Master will draw up a series of modules from the goals' list. He will establish a set of activities for the team to execute to complete each partial delivery. This sprint will last a specified amount of time, depending on the project's complexity, normally 7, 15 or 30 days The sprint's final objective is to produce a partial or total product delivery, which can be seen by the final customer. If it is a partial delivery, another iteration with its goals will be presented. The final part of the sprint consists of reviewing progress made so far and assessing it in order to ensure optimal results in

future iterations. After each sprint, the tasks done will be presented to the client in demo mode. Within this experiment, all the work done will be seen, and the client will be able to make new requirements to meet their needs, so the Scrum Master will re-plan the project if required.

5. Daily scrum: There will be a scrum between the team and the Scrum Master everyday. They will review the sprint's current state, difficulties encountered, and the best way to solve them. The goals of this meeting are: review progress since the last meeting, synchronize tasks with dependencies between them, plan priorities for next tasks to be executed within the product backlog, and anticipate future difficulties.

2.2 Mobile application

The development of mobile applications plays an important role in the teaching and learning process [10]. Mobile application development is a new trend in the software industry. Other devices such as cameras, sensors, touch and GPS combined with the mobile platform increase the possibility to develop new mobile applications (applications). In addition, devices are becoming more complex and mission important due to the sudden surge of mobile device usage [11].

In the Waterfall Model, requirements are usually determined in advance. Users often find it difficult to describe what they need from the mobile application. This results in failure to collect requirements for the application. This failure occurs in the first stage of the life cycle as collect requirements, and spreads to other stages [12].

3 METHODS

The development of this learning application is focused on programming software for the Android platform using Java [13]. The development of this application is experimental and uses the SCRUM agile methodology [14]. The scope of System Development using Scrum Method were shown in Figure 1.

S/N	Student & Teacher	Remarks
1	**Information Architecture** • Detail scoping ○ Identification of user, roles and responsibilities ○ Identification & analysis of required information to be handled/ processed by system/module ○ Design/Evaluation of business processes and information flow ○ Define system and function coverage and boundary ○ Identification of use cases and exceptions • Database design ○ Identification of information to be stored ○ Deriving entity-relationship model (ERD) ○ Database schema design ○ Creation of database scripts • System Architecture design ○ Identification of information to be stored ○ Proposed architecture ○ Micro services layer (API), design and documentation	5 man-days

Figure 1. Scope of System Development using Scrum Method

In addition, the results of the implementation of the LMS system will be surveyed of students and lecturers/ tutors as an online learning community. The research object will be carried out at a private Hospital Nursing

Academy and collaborating with one of the hospitals in Indonesia. The sampling technique used in this research was simple random sampling. This development conducted over six months. In collecting data, researchers will conduct interviews, surveys, and Forum Group Discussions (FGD) which will be conducted on study program managers and Subject Matter Expert (SME) as online learning material developer. The Sprints of Mobile Learning Management Systems Development were shown in Figure 2 and Figure 3.

S/N	Student & Teacher App Descriptions	Remarks
1	**Splash Screen, Login & Forgot Page** • Login and Authentication • Password reset with email notification / OTP Code • OTP integration • Register	3 man-days
2	**Landing Screen/ Home dashboard** • Dynamic group of menu displayed, fetch from backend to decide which menu will be displayed, and which menu will not be displayed. • List of knowledge -> Able to go to view all list • List of What's on -> Able to go to view all list • List of Campus directory -> displayed in Horizontal scroll • Able to display menu in tabbar in the bottom of application • Able to display more in focus view	5 man-days
3	**Knowledge Module** • Display detail information of content • Able to download attachment / image / file	4 man-days
4	**What's on module** • Display detail information of content • Able to download attachment / image / file	4 man-days
5	**Campus Directory Module** • Display detail information of content • Able to display direction through map view • Able to display contact information and can do specific action such as Email, Phone Call, Text / message	4 man-days
6	**About module** • Display detail information of content	1 man-days
7	**Schedule Module** • Display calendar view and able to filter by specific selected date • Display list of schedule base on selected date • Display list of exam base on selected action • Able to create separate view between schedule and exam	5 man-days
8	**Schedule Detail Module** • Display detail information of schedule • Able to download attachment / image / file	3 man-days
9	**Exam Detail module** • Display detail information of current exam	3 man-days
10	**More Module** • Display list of menu collection • Display in focus mode	4 man-days
11	**Topic module** • Display list of topic grouped by period • Able to go to detail to display session list based on selected topic	4 man-days

Figure 2. The Sprints of Mobile Learning Management Systems Development

12	**Session Module**
	  • Display list of session based on selected topic
	  • Able to go to list of sub topic based on selected session
		4 man-days

13	**Sub Topic module**
	  • Display list of sub topic based on selected session
	  • Able to download material and save to local storage
	  • Able to stream the content through application
		4 man-days

14	**Forum module**
	  • Display list of post grouped by period and latest
	  • Able to go to detail to display content of post
		4 man-days

15	**Detail Forum module**
	  • Display detail information of forum / post
	  • Able to reply through comment section
		3 man-days

16	**Attendance module**
	  • Display list of attendance based on session
	  • Able to go to detail to display attendance
		4 man-days

17	**Score module** • Display score information	2 man-days
	TOTAL ANDROID DEVELOPMENT FOR BOTH STUDENT & TEACHER APPLICATION	**TOTAL : 66 man-days**

Figure 3. The Sprints of Mobile Learning Management Systems Development (cont.)

4 RESULT AND DISCUSSION

This article reported the design of a mobile-based online learning system that has been carried out using the Scrum method in the previous discussion. The initial appearance of this application is the Splash Screen and Login Screen as can be seen in Figure 4.
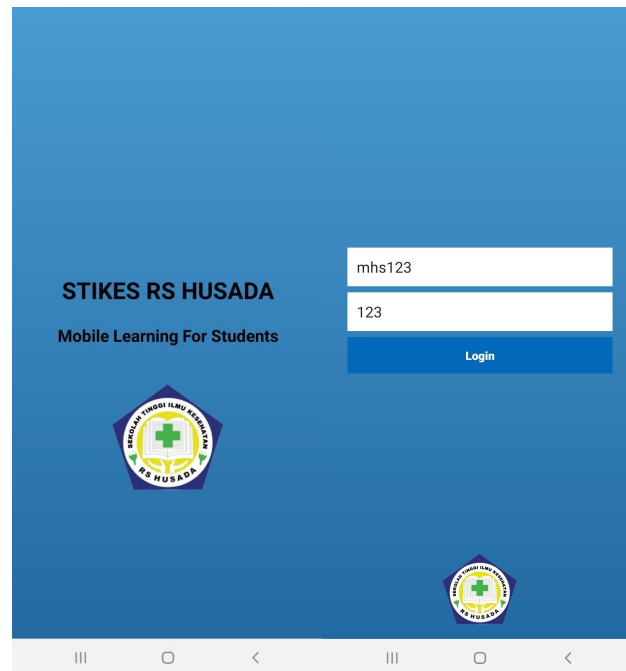
Figure 4: Splash Screen and Login Screen

Some of the menu options available in this mobile-based online learning application were the Schedule, Course, Forum, and Attendance menu as can be seen in Figure 5. In addition, data structure design was also carried out on a number of tables used in this application (Table 1). Developers also designed database tables that are connected to each other. This database can be seen in Figure 6.
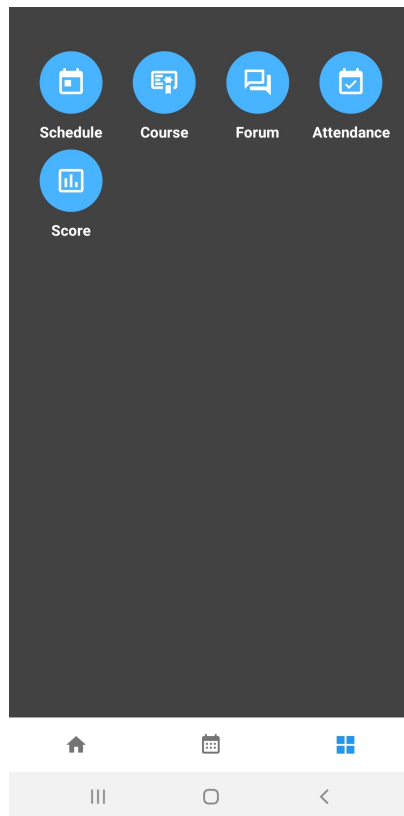
Figure 5: The Layout of Menu

Table 1: Example of Data Structure

DATABASE MOBILE LEARNING

Table "announcement" {
    "id_announcement" int(11) [not null]
    "img" text [not null]
    "title" text [not null]
    "content" text [not null]
    "status" text [not null]
    "date" datetime [not null]
}

Table "campus" {
    "id_campus int(11) [not null]
    "img" text [not null]
    "title" text [not null]

   "content" text [not null]

   "type" text [not null]

   "date" datetime [not null]

}

Table "knowledge"

   "id_campus int(11) [not null]

   "img" text [not null]

   "title" text [not null]

   "content" text [not null]

   "type" text [not null]

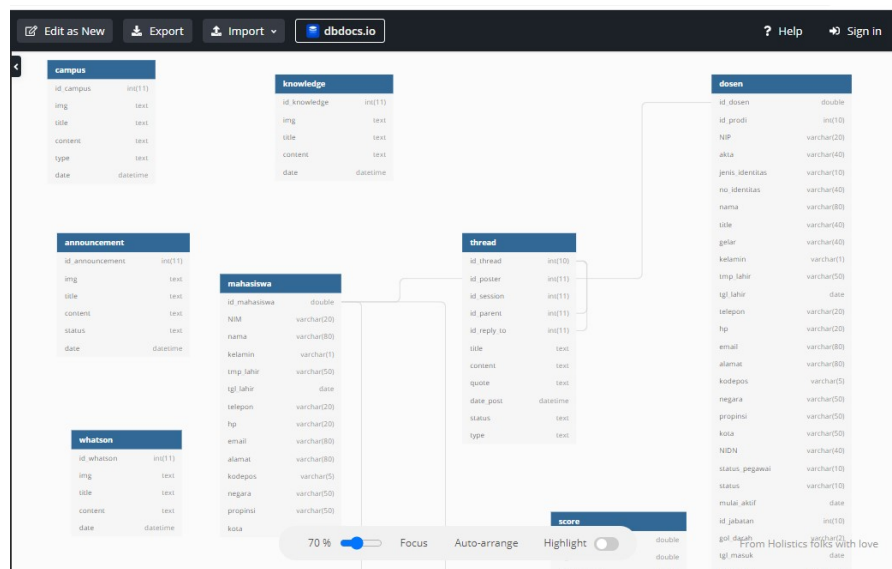   "date" datetime [not null]

}

Figure 6: Database Diagram

This study conducted experiments on a small number of respondents and from an Android development course. In addition, our results were drawn from both student and lecturer point of view. The features of a mobile-based Learning Management System highlighted the fact that participants may feel comfortable with it, and accepted the environmental challenges and limitations of it. This research showed that Scrum is a teamwork methodology that boosts achieving functional results in an effective way for mobile application development projects.

However, the results of this study indicated that the use of agile practices as part of a mobile application development environment is similar to previous literature studies [15]. This study also showed that short development cycles and small releases are important features in a mobile app development environment. We

found indications in our research that agile methodology is the best approach for a mobile software development environment.

5 CONCLUSION

This article reported a case study in which SCRUM was evaluated from an educational perspective in a university setting. Team project developed their own versions of the same mobile application in Java for Android; this group implemented SCRUM. The results revealed that SCRUM can produce good quality software in a short time and can be implemented easily by students with little experience in mobile application development. Team project learnt the basics of agile development and mobile programming and build useful applications for clients. They were motivated to use this methodology in future projects. They felt favorable responses to relationships among team members and reported good performance perceptions of using SCRUM methodologies.

ACKNOWLEDGMENTS

REFERENCES

[1] APJII (2019). Indonesian Internet User Penetration and Behavior: Survey 2019. Jakarta: Indonesia Internet Service Provider Association.

[2] Indonesian Ministry of Education and Culture (2017). National Competency Test for Health Workers to Improve Graduate Standards and Competitiveness. http://belmawa.ristekdikti.go.id/2017/03/20/uji-kompetensi-nasional-tenaga-k Health-t Enhanced-standaris-lulus-dan-daya-saing. Accessed on June 6, 2017.

[3] Pressman, R. (2014). Software Engineering: A Practitioner's approach (6 ed.). United States: McGrawHill.

[4] Kendall, &Kendall. (2013). Systems Analysis and Design. United States: Prentice Hall.

[5] Beck, K., & Andres, C. (2005). eXtreme Programming explained. Embrace Change. United States: Addison Wesley.

[6] Fuertes A., Y., & Sepúlveda C., J. (2016). Scrum, Kanban and Canvas in the commercial, industrial and educational sector - A literature review. Revista Antioqueña De Las Ciencias Computacionales, 6(1), 46-50.

[7] Schwaber, K. Scrum Development Process. Oct. 1995. In proceedings of the 10th Annual ACM Conference on Object Oriented Programming Systems, Languages and Applications (Austin, TX, USA 15-19 Oct. 1995). OOPSLA '95. ACM.

[8] Sutherland, J. et al. Scrum and CMMI Level 5: The Magic Potion for Code Warriors. Jan. 2008. In proceeding of the 41st annual Hawaii International Conference on System Sciences 2008 Hawaii, USA 07-10 Jan. 2008). HICSS '08. IEEE.

[9] Torrecilla Salinas, C.J., Escalona, M.J. & Mejías. (2012). A scrum-based approach to CMMI maturity level 2 in web development environments. IIWAS '12: Proceedings of the 14th International Conference on Information Integration and Web-based Applications & ServicesDecember 2012 Pages 282

[10] Zhang, Y. (2015). Development of Mobile Application for Higher Education: An Introduction. In Zhang, Y. A., editor, Handbook of Mobile Teaching and Learning, pages 1–4. Springer Berlin Heidelberg.

[11] Lewis, G. A., Nagappan, N., Gray, J., Rosenblum, D., Muccini, H., and Shihab, E. (2013). Report of the 2013 ICSE 1st International Workshop on Engineering Mobile-enabled Systems (MOBS 2013): 12. SIGSOFT Software Engineering Notes, 38(5):55–58.

[12] Panicker, S. & Kv, M. (2016). Use of Agile Methodology for Mobile Applications. International Journal of Latest Technology in Engineering, Management & Applied Science (IJLTEMAS), Volume V, Issue X, October 2016 | ISSN 2278-2540

[13] Friesen, J. (2014). Learn Java for Android Development. United States: Apress.

[14] Sims, C., & Johnson, H. L. (2012). SCRUM: Abreathtakinly Brief and Agile Introduction.

[15] Santos, A., Kroll, J., Sales, A., Fernandes, P. and Wildt, D. Investigating the Adoption of Agile Practices in Mobile Application Development. In Proceedings of the 18th International Conference on Enterprise Information Systems (ICEIS 2016) - Volume 1, pages 490-497