

# **Independent Study: Android App (Knowledge Tree-Java)**

Students: Sen Wang, [sew77@pitt.edu](mailto:sew77@pitt.edu)

Mengru Guo, [meg129@pitt.edu](mailto:meg129@pitt.edu)

Advisor: Professor Peter Brusilovsky, [peterb@pitt.edu](mailto:peterb@pitt.edu)

School of Information Sciences, University of Pittsburgh

Fall 2017

## **1. Introduction**

### **1.1. Background**

This project is an interface of KnowledgeTree Web system, an interactive adaptive system provided by the School of Information Sciences at the University of Pittsburgh. The KnowledgeTree system is a portal for learning support architecture which provides adaptive, dynamic access to the course material and diverse learning resources distributed over multiple resource servers [1]. Compared to other learning support systems, KnowledgeTree is more likely a game. Students can get immediately feedback of their trying to solve the questions and compare their performance with other students in the same group (“group” here means the same class name and same time). We are focusing on Java programming language part of KnowledgeTree in this project. In Java part, there are 19 main topics. In each topic, it has several questions related to this topic. To avoid students getting answer by trying multiple times without real thinking, the values in each question will be changed every time. With the help of KnowledgeTree system, many students improved their skills and get higher scores in the finals, which also means their understanding of Java concepts is much clearer than before.

### **1.2. Motivation**

With the development of electronic devices, the laptop and desktop are not the main electronic devices that take most of time from humans. According to the statistics analysis by Dave Chaffey [2], the mobile users are increased as twice as the speed of PC users and mobile users exceed in 2014. Nowadays, the average person spent 2 hr and 51 min per day on mobile [3]. However, there is no mobile version of KnowledgeTree system. If we can create a mobile app for KnowledgeTree, there will be much more students who will use this system to improve Java skills when they are on buses, on travelling, on sofa or at café. If this becomes true, the mobile KnowledgeTree just like Angry Birds game, which means students can play for fun when they have a couple mins free. Compared to the limitations of Web system, the mobile version will be much convenient and easy to use. Based on the thought above, we decided to build an Android version mobile app for KnowledgeTree.

## **2. Application Overview**

This Java KnowledgeTree(KT) Android Mobile App connected with the server in the School of Information Sciences, in which all the data of students and practice questions are stored. To utilize these

resources, the student should have an account of KT to login. If student doesn't have account, he or she can create new account through this app. After create account, the student can use his user name and password to login to KT to see the topics and corresponding questions. Additionally, the correct answer will directly be shown immediately after submission. All these procedures are same as the web KT, which is easy for user to use both systems without additional training.

### **2.1. Assumptions**

1. The users have Internet in their mobile devices.
2. The users have more than 2 year-experience of using smart phone or mobile devices.

### **2.2. Intended Users**

Students who are learning Java programming language in beginning stage and need additional tools to improve their skills or who are interested in Java and need some tools to help them learning by themselves.

### **2.3. General Objectives**

1. Provide attractive interfaces to get more users (like a mobile game).
2. Provide mobile version of KT to help students improve their skills whenever they need help.

### **2.4. Requirements**

- The app must have a login page for students to login and get all the personal data.
- The app must have registration function to let students who have no account in KT to create new accounts and marked as mobile user.
- In the topic selection part, the progress indicators must be provided to show the progress of this students and the average value of all users in this group.
- In the part of showing questions of each topic, the success rate of each question should be showed close to its title (both the user's and average value of group). Additionally, the success rate cannot be increased by submitting right answer multiple times.
- The immediate feedback of submission of answer should be provided.

### **3. Design and Implement**

#### **3.1. Stage 1**

The initial design is based on the thought like a web browser, which can bring all the web system function and appearance into mobile devices. And this kind function was implemented. The following link is a short video of initial version of KT.

[https://drive.google.com/file/d/1AFIv\\_4fXwUakXoIGWNWycfqDqkNIMAIV/view?usp=sharing](https://drive.google.com/file/d/1AFIv_4fXwUakXoIGWNWycfqDqkNIMAIV/view?usp=sharing)

However, there are several problems found after we implemented this version. The appearance of web system is totally not suitable for mobile device. The app should support landscape orientation. Also, the buttons designed for web on which the users use mouse to click are too hard for users to use finger to press.

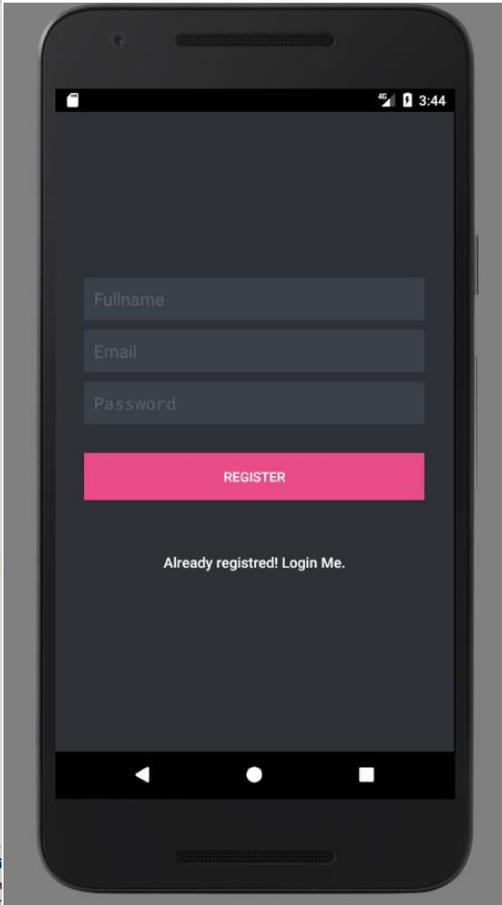
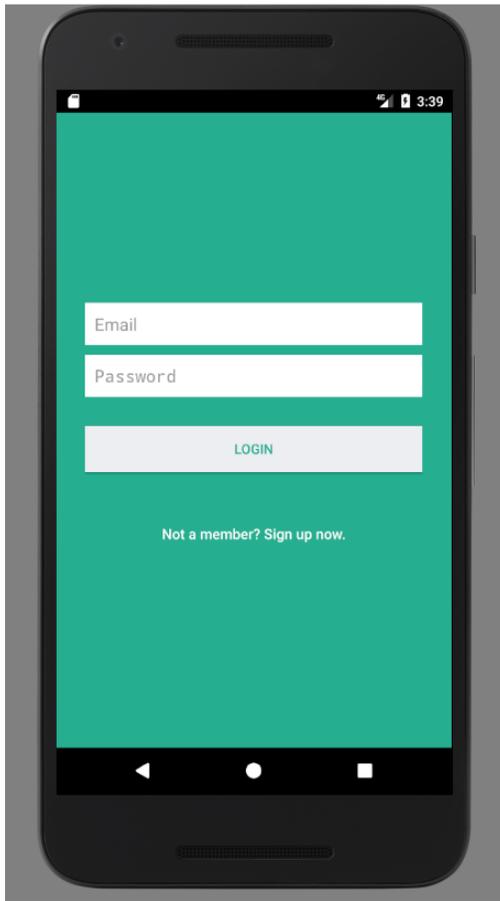
To fix these problems, the buttons and progress page should be redesigned for mobile devices. Also, in the question page, the no used empty area must minimized, which means the page should only show the question part to optimize the space of screen. Thus, the stage 2 came out.

#### **3.2. Stage 2**

The stage 2 implement new login and register function for mobile users and has new designs of topics part and questions part, shown in figure 1, 2 and 3.

In the Figure 1, the 2 interfaces in the upper part are new designed app login and register pages. The bot one is the original login page of web system. It is obviously that the original interface is not suitable for mobile device due to the screen size. Contrarily, the new designed interfaces are much simple and easy to use on mobile device.

Due to the same reason above, the topics selection page is also redesigned, shown in Figure 2.



Michael V. Yudelson © 2005-2010

Knowledge Tree portal is a result of nearly a decade of research in the areas of adaptive web systems and user modeling. It provides access to a constellation of e-learning tools created at the [TALER Lab](#) and [PAWS Lab](#) of the [School of Information Sciences, University of Pittsburgh](#). These tools are supporting learning in a several domains, including C, Java, SQL, etc.

<p><b>Current users login here</b></p> <p>Login <input type="text" value="sew77"/></p> <p>Password <input type="password" value="*****"/></p> <p><a href="#">Forget?</a> <input type="button" value="Login"/></p>	<p><b>Create trial account</b></p> <p>To access our suite of showcase courses with personalized navigation support, create a trial account.</p> <p><input type="button" value="Create trial account"/></p>
---	--

If you are a researcher and would like to quickly try our adaptation tools, create a trial account (above) and proceed [here](#).

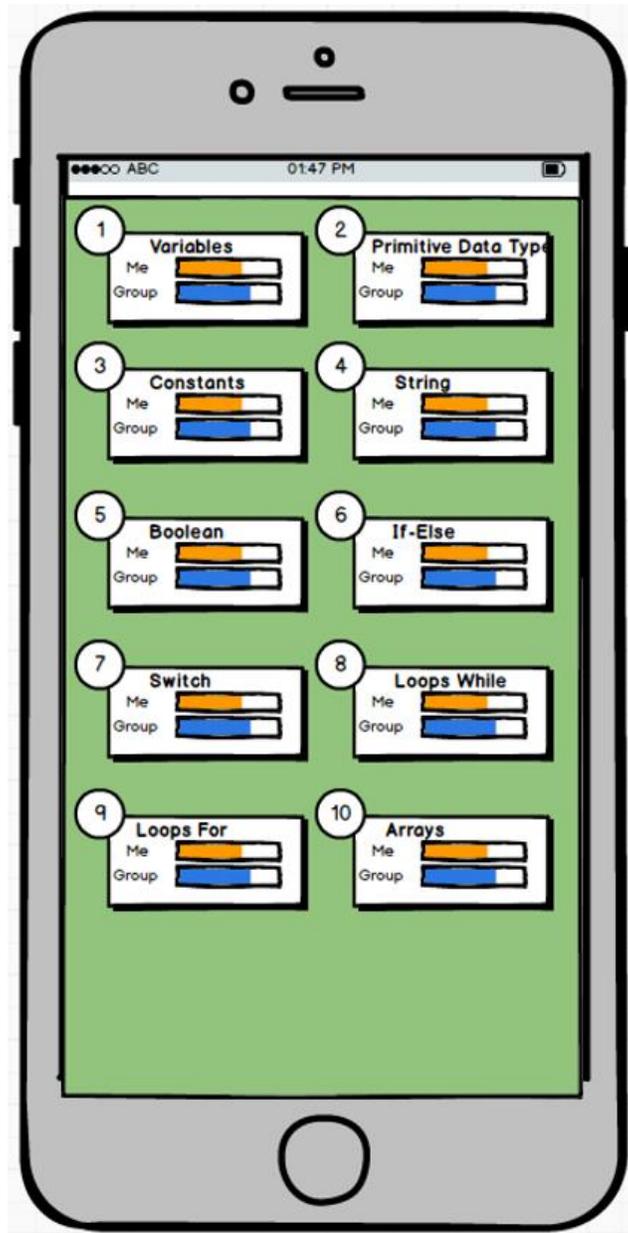
**Try without logging in**

Try our tools in-the-raw ...

... or with a group-based adaptive navigation support

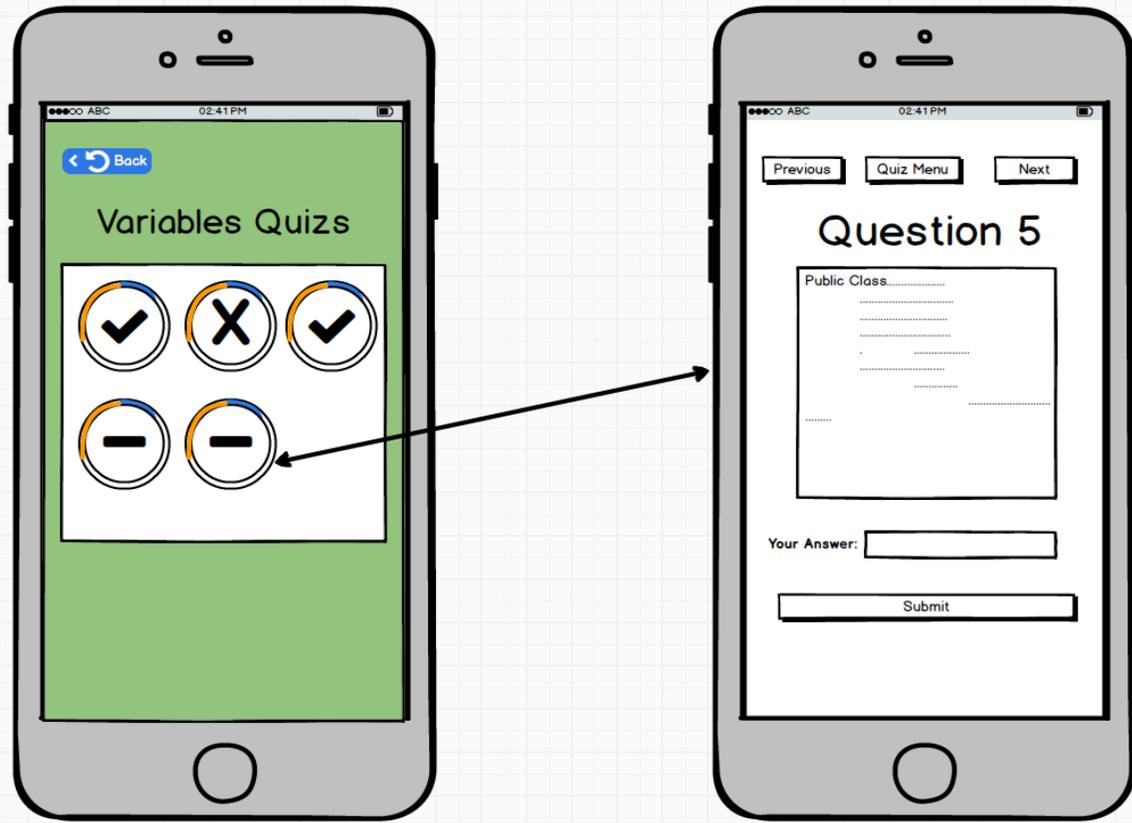
For more information go to [PAWS Lab page](#) or email us at [paws@pitt.edu](mailto:paws@pitt.edu)

**Figure 1.** Login and Register Pages



**Figure 2.** The Topic Selection Page Design

To meet the requirements, there are 2 progress bars shown in each topic button, yellow one for personal progress and blue one for average value of group. In each button, the name of topic is show at top.



**Figure 3.** Questions Part Interfaces Design

In this new design, the topic title will show at top of the page and all the questions corresponding to this topic will show as buttons below title. Each button of question can show the success rate of this student and whether student did this question correctly, or not even done yet.

After user study of 52 students in the School of Information Science, there are several aspects of design and features need to be redesigned and the summary of user study is shown in Table 1. There are more than half of them didn't like the topic and question part. Most of them think the question part is hard to understand and use.

**Table 1.** Summary of User Study (52 students) of 1<sup>st</sup> Version

	Login Part	Topic Part	Question Part
Do not like at all	1	16	30
Not like	2	20	21
It's ok	24	10	0
like	20	5	1
like it very much	5	1	0

Problems need to be fixed:

- Topic selection button is too complicated and not human friendly, which misleads the user to think this button as a folder and else.
- The success rate is not clear and doesn't make sense to new user.
- The appearance is boring, which makes user feels bad and doesn't want to use it.

### 3.3. Stage 3

Based on the summary above and suggestions from test users, in this stage, we redesign the appearance and customize the progress bar to show the success rate in question part. Additionally, the topic selection part is redesigned as a mobile game. All these changes are shown in Figure 4 and 5.

There are 2 different styles designs in Figure 4. After the vote of 31 students, we finally adopt the left one which uses the arc lines to connect each topic, just like a way from one station to others.

As to the unclear success rate bar, the new design uses a clear crossband to show the total attempt times and corresponding value showed beside the bar. Also, symmetric structure of personal and groups value obviously reflects the results of comparisons (shown in Figure 5).

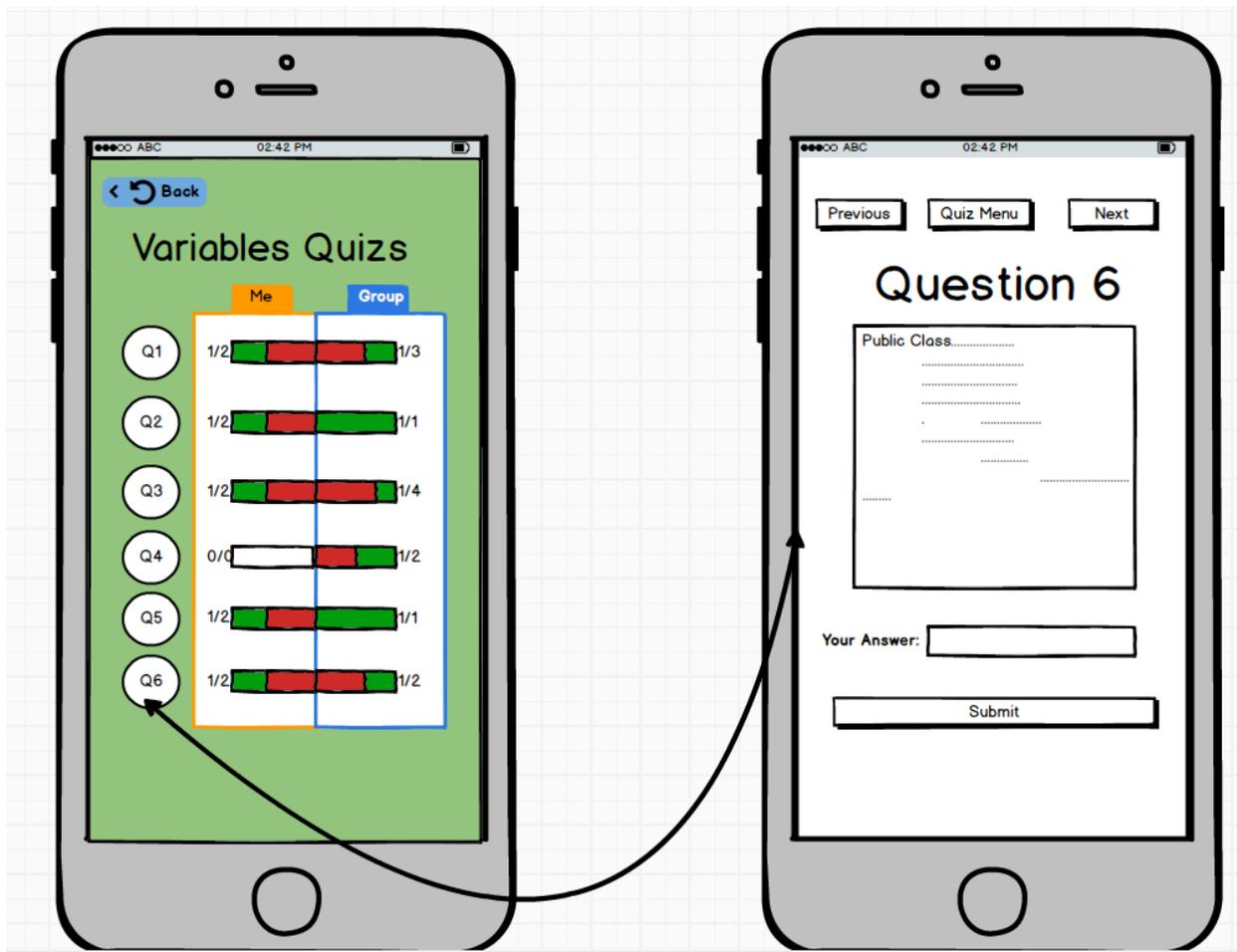
The summary of same 52 students about this new design is shown in Table 2. The result shows this new design is more accepted compared with previous one.

**Table 1.** Summary of User Study (52 students) of 2nd Version

	Login Part	Topic Part	Question Part
Do not like at all	1	1	5
Not like	4	6	1
It's ok	23	25	27
like	18	15	8
like it very much	6	5	11



**Figure 4.** Redesigned Topic Selection Pages



**Figure 5.** Redesigned Questions Selection Page and Customized Progress Bar

### 3.4. Stage 4

The main task in this stage is implementing this design. In the implement process, there are some small modifications in each page, since the new requirements added. All the pages of app shown from Figure 6 to 10.

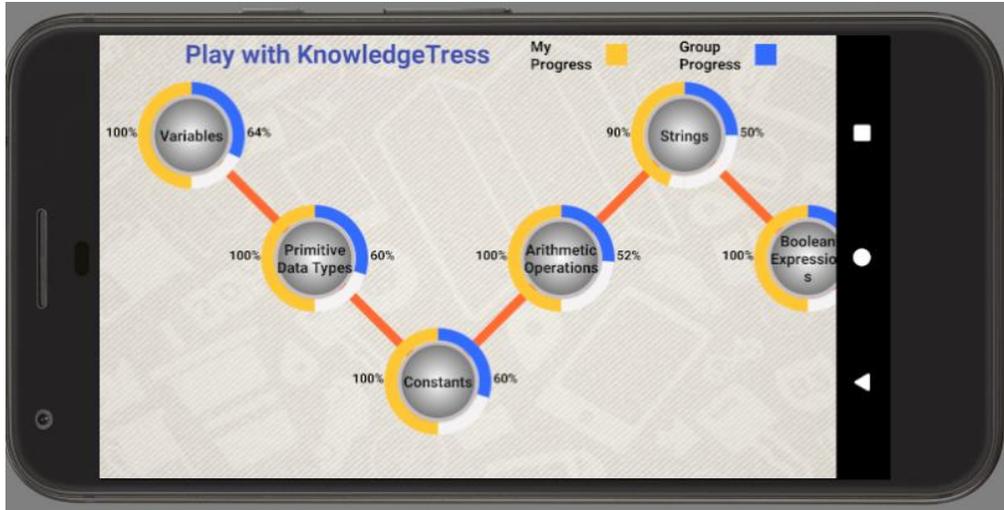
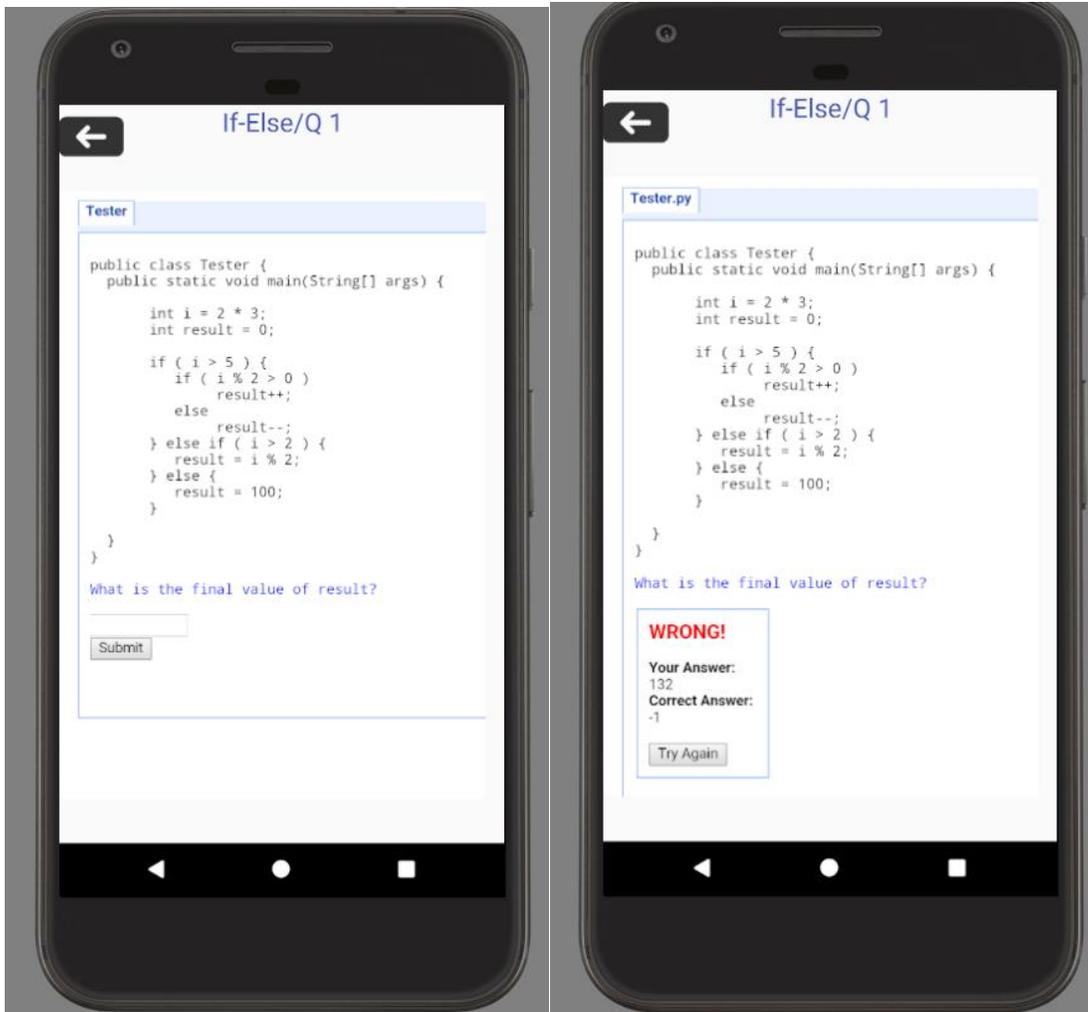


Figure 6. Static Topics Selection Page



Figure 7. Static Question Selection Page



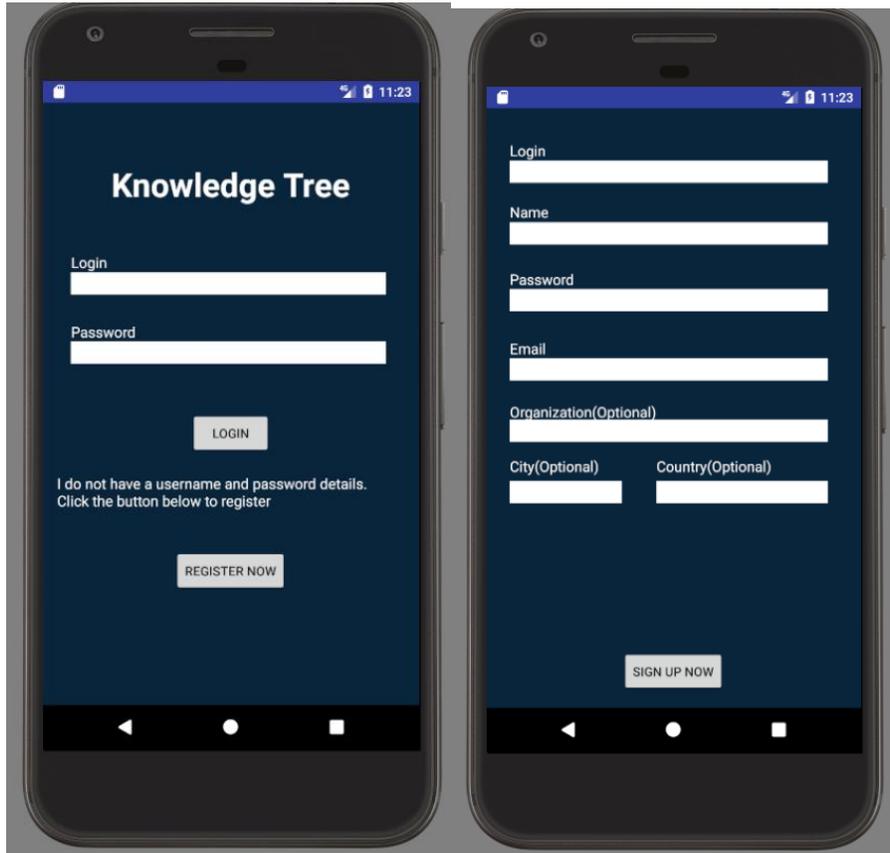
**Figure 8.** The Question Show Page

### 3.5. Stage 5

Since the new requirements, that all the features should be dynamic based on the received data from database, added to the project, the previous static mobile app cannot meet these requirements and need to be rebuild. In this rebuild process, there some new functions and features added:

- There is some extra information need to fill out in creating new account.
- Both landscape and portrait are supported in all pages.
- All the page structures are dynamically created based on the data received from server (name of button, number of buttons, titles, progress, success rate and correct answer).

This dynamic Android Program is also suitable for other courses in KT. The only thing needed is the same format data in server. This Android Program is a foundation program of all mobile apps in KnowledgeTree.



**Figure 9.** Login and Register of Portrait Screen



**Figure 10.** Login and Register of Landscape Screen



Figure 11. Topics Selection Page

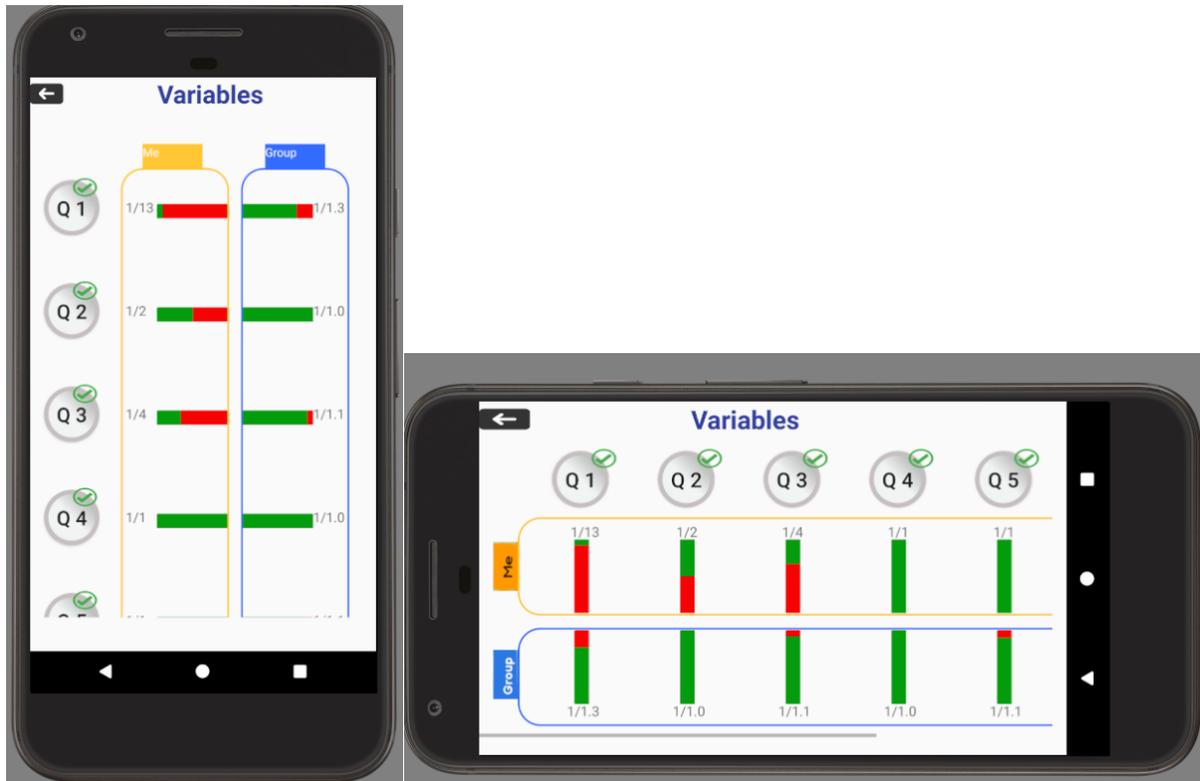
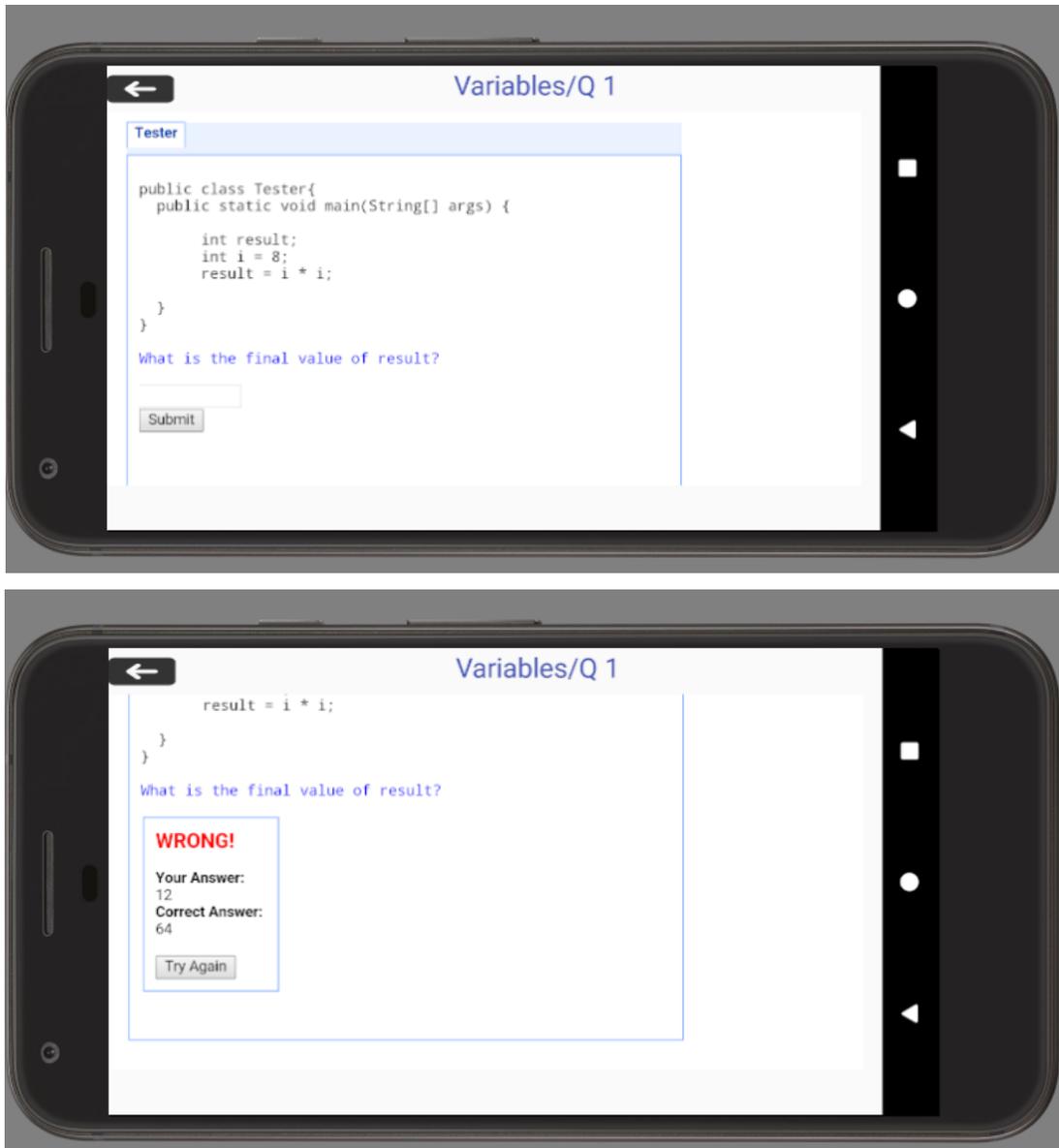


Figure 12. Questions Selection Page



**Figure 13.** Question Show Page

### 3.6 Stage 6 (Final Version)

However, there still some problems, since the first time create a dynamic android program. The program algorithms used in getting the data from server and navigating pages are inefficient and cumbersome, which calls the server every time and gets whole data but only use small part of it. Thus, to make app much more efficient, all the java programs are rewritten (85% of app are rebuilt). In this rebuilt process, there are 2 new functions added. First one is video teaching part (Figure 14). The other one is

comparison group customize setting part (Figure 15). Additionally, the button animation is also added to improve the user's experience.

In the video teaching part, there are two ICONS appearing when we press the topic button. One is YouTube Icon. Another one is Test Icon. This YouTube Icon let user go to the video page to see the teaching video related to the topic pressed. This function let students can learn the concepts more clearly without real teacher standing by (Figure 14). Meanwhile, this page support full screen playing.



**Figure 14.** Video Teaching Part

The Test Icon will navigate the user to the questions selection page to continue practice by doing the questions as previous version (Figure 16).

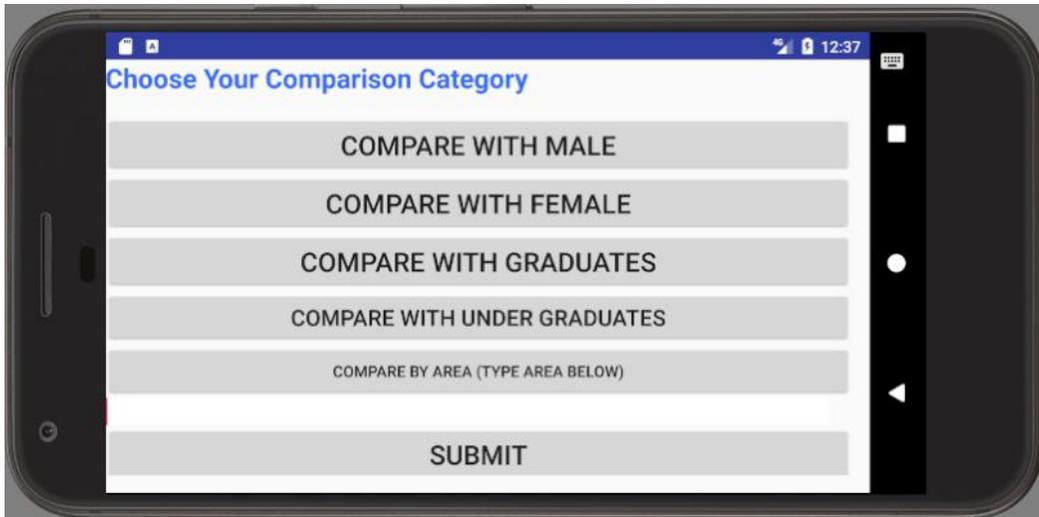


Figure 15. Comparison Group Customize Setting

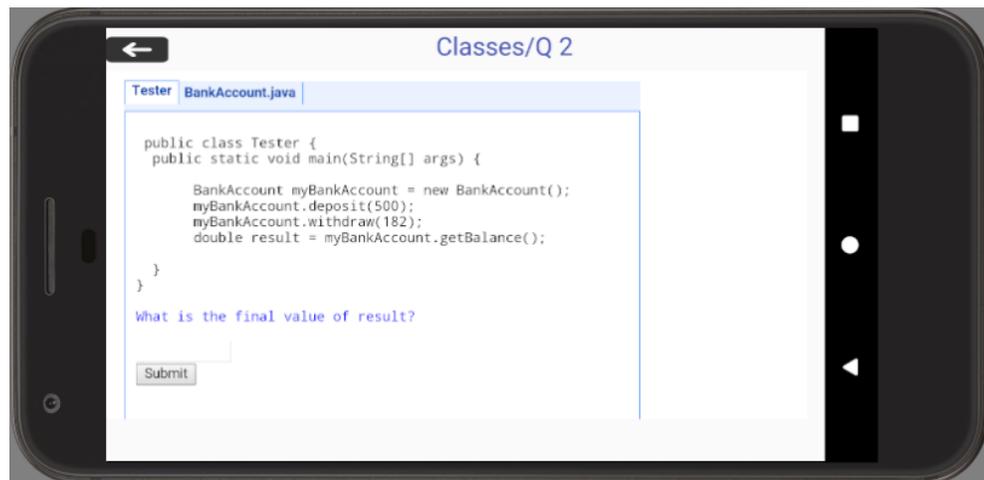


Figure 16. Pages showed after click "Test Icon"

After rebuilt, the reaction time of pages to pages is reduced from couple seconds to less than 0.5 second, which markedly improve the users' experience of using this app.

The user study shows that the final version attracts more people to use this app compared to original version (shown in Table 3). In detail, the beginner in Java is much more willing to use this app than the professional student in Java, which is also make sense since professional students have solid Java knowledge so that they don't need this basic teaching process.

**Table 3.** The Investigation of Satisfaction (59 students)

	Beginner	Median	Professional
Do not like at all	0	2	0
Not like to use	0	0	1
It's ok	5	10	20
want to use	18	6	3
use it right now	2	1	1

#### 4. Future Work

- Since the limitation of number of investigation, the small part of students may not be able to reflect real opinions from whole group students. Thus, the more user studies and user tests should be made to make sure the accuracy of the investigation.
- The comparison group setting function still need new database to support, which means the server need to add new queries to store these new features to meet the setting requirements.
- The example function needs to be implements in future to build a fully KnowledgeTree Mobile App.

#### 5. Conclusion

Most functions are implemented in Android Mobile App, which can support usability and improve user experience. All the requirements are met. The new functions and features make the app much funnier to use. Based on the proficiency of Java, the app will attract more beginners rather than professional one.

## Reference

1. KnowledgeTree, <http://www.pitt.edu/~taler/KnowledgeTree.html>
2. Chaffey, Dave. "Mobile marketing statistics compilation." *Smart Insights* 27 (2016).
3. Request, Text. "How Much Time Do People Spend on Their Mobile Phones in 2017?" Hacker Noon. May 09, 2017. Accessed December 13, 2017. <https://hackernoon.com/how-much-time-do-people-spend-on-their-mobile-phones-in-2017-e5f90a0b10a6>.<https://hackernoon.com/how-much-time-do-people-spend-on-their-mobile-phones-in-2017-e5f90a0b10a6>