Designing Mobile Educational Games on Voter's Education: A Tale of Three Engines

Nadia Rowena C. Leetian, Ma. Regina E. Estuar, and Michael B. Syson

Abstract—The rapid growth of mobile learning is influenced by the ability to access learning content anytime and anywhere. The on demand capability is available because mobile devices allow for convergence of internet and communications technologies. At the same time, the availability of engines makes development of mobile applications faster and seamless. However, not all mobile development engines are alike. This paper discusses on the development of mobile learning applications using mobile development engines in teaching Filipinos on responsible voting. Specifically, this paper discusses how AndEngine, Ren'Py, and homegrown Usbong were used to develop a mobile board game and a mobile comic book to promote responsible voting to the Filipino youth.

Index Terms—Android, e-learning, mobile learning, mobile engines, voter's education.

I. INTRODUCTION

A. Context and Purpose of the Study

Ever since the release of smartphones, there has been a switch from desktop computing to mobile computing.. The capability of smartphones to serve as substitutes to desktop computing had led a significant increase in the number of smartphone users. A Singapore-based research firm called GfK released data which shows that smartphone take-up rate in the Philippines reached 146 percent, and approximately 6 million smartphones have been sold in April 2012 to March 2013 alone. Their data shows that 1 out of 3 Filipinos own a smartphone as the cost of smartphones are decreasing and becoming more affordable [1]. According to Douglas Gilstrap, senior vice president of Ericsson, "Expectations of mobile-network quality have been elevated by the availability of smartphones and tablets that have changed the way we use the Internet. Mobility is becoming an increasingly significant part of our daily lives; we always have devices within arm's reach, allowing us instant access to information, entertainment and social interaction [2]." The availability and affordability of smartphone devices, be it

Nadia Rowena C. Leetian is with the Ateneo Java Wireless Competency Center, Ateneo de Manila University, Quezon City, Philippines 1108 (email: nleetian@gmail.com).

Ma. Regina E. Estuar. Regina is with the Department of Information Systems and Computer Science, Ateneo de Manila University, Loyola Heights, Quezon City, Philippines (email: restuar@ateneo.edu).

Michael B. Syson is with the Japanese Studies Department, Ateneo de Manila University, Loyola Heights, Quezon City, Philippines (email: masarapmabuhay@gmail.com).

mobile phones, tablets and even televisions has provided another opportunity to include and utilize another learning medium.

The penetration of mobile devices in the Philippine environment paved the way to several innovations in mobile learning. For example, textbook publishing companies have provided primary and secondary schools with an option to access digital resources via tablets [3] and convert their textbooks into digital formats as well [4]. Private high schools have also deployed tablets instead of classic textbooks in order to relieve their students from carrying books and encourage them to learn about digital technology which prepares them for the real world [5]. These actions innovations will help promote greater access to knowledge, interactivity, and developing skills in utilizing information.

Taking advantage of the amount of smartphones in the country, it is possible to promote mobile learning in the Philippines. The aim of this research is to create an entertaining way of promoting mobile education to encourage the youth.

B. Preparing the Filipino Youth in Responsible Voting: Content for mLearning

The PPCRV (*Parish Pastoral Council for Responsible Voting*) aims to promote educating the youth about the dangers and effects of vote buying and political dynasties. They have been promoting clean, accurate, meaningful, and peaceful elections. They are a national parish-based political but non-partisan lay movement established in 1991. They have recently released a web comic titled CHAMPS aimed towards the youth, which tells about the story of five teenagers who are fighting for better and cleaner elections. The reason why they aimed to communicate with the youth is because the youth currently comprise around 1/3 of the voting population [6], which is approximately 20 million out of 50 million. It is important to educate the youth early because they have the highest potential to disseminate information due to their exposure to social media. Voter's education is also made more accessible by the increasing usage of smartphones by Filipinos statistics show that 1 out of 4 Filipinos own a smartphone [6].

C. Voters Education Campaigns

Information and Communication technologies are an essential tool to promote transparency and reduce corruption in governments. Using these technologies, it is possible to easily inform other people about practices done by certain candidates.. For example, e-government and social media can be used as a platform for social empowerment in monitoring and preventing corruption [7]. Anti-corruption practices rely on the spreading of information to and by the citizens.

Combining this with mobile learning and social media, it is possible to educate the citizens about malign practices done by candidates.

To cite specific examples, during pre-election periods, some citizen's groups provide voters with mobile and web services such as precinct finder, candidate and partylist profiles, and election information [8]. Users can also call or text their concerns to group and a representative will assist them with their inquiries.

In the most recent national elections, the Comission on Elections (COMELEC), which enforces laws and regulations relative to the conduct of and elections, plebiscite, initiative, referendum, and recall, together with one of the top telecommuncations company in the country, created a website (http://reportmycomelec.tv) and mobile application entitled 'e-Leksyon 2013' which aims to help the Filipinos on the proceedings of the May 2013 elections [9]. The website focuses on informing the people about common violations done both by candidates and voters, which includes a submission link to report a violation. It also offers a simulation of filling out a sample ballot and highlighting the information one needs to look out for in order to find out their precinct.

D. The PPCRV Mobile Applications

PPCRV, together with the Ateneo Java Wireless Competency Center, designed and developed mLearning content on voter's education using appropriate game engines. Using 3 engines, namely AndEngine, Ren'Py, and Usbong, the team was able to develop two mobile applications called the PPCRV Tsunami and a PPCRV Visual Novel. The first game is based on a snakes and ladders game mixed with trivia questions. The game asks the user a question relating to electoral topics; if the user answers it correctly, they get to move on, otherwise, they move back a number of spaces. The database of questions is updated periodically, and the game is playable by up to four players. The whole application was made using an engine specialized for gaming on mobile platforms, specifically the Android operating system.

The visual novel game presents a different kind of gameplay. The game presents choices to the user, good or bad, and the outcome of the game is dependent on the user's choice. This was created using decision trees developed in Usbong and Ren'Py. Both games promote social awareness by allowing the user to share or post on twitter and Facebook.

E. Research Questions

The objective of the study was to compare different mobile development engines by creating mLearning applications targeted towards the youth. In this study, we asked: how does one design mobile games using existing and homegrown engines on the mobile platform? Specifically, what are the similarities and differences in designing and developing mobile games using AndEngine, Ren'Py and Usbong.

II. REVIEW OF RELATED LITERATURE

The following studies were selected in relevance to the goal of our paper – using a mobile game engine for eLearning.

The articles discuss why it is beneficial to use the Android operating system over other mobile operating systems, and the effectiveness of using a mobile game framework in a socially relevant manner, which is necessary in producing an effective tool for eLearning.

A. Android-Based Mobile Learning

Several institutions have incorporated mobile learning using android into their studies. One of these is a study done by Hanafi and Samsudin [10], in which they developed a Mobile Learning Environment System (MLES) to monitor a schools undergraduates learning. Mobile learning is preferred due to its ability to carry out the learning anywhere, for as long as the institution has access to wireless coverage. This approach also encourages students to seek learning contents via mobile services rather than find proprietary courseware which is not readily available. The MLES framework is shown in Fig. 1.
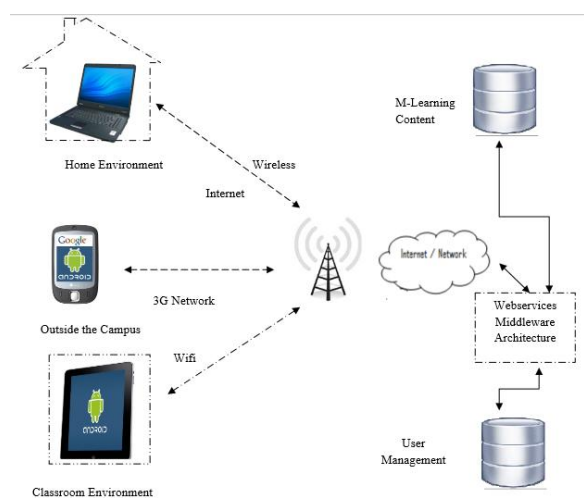

Fig. 1. Mobile learning environment system framework.

The system begins with the mobile device, which can be accessed at home, the campus, or inside a classroom. These devices then connect to the internet via a wired or wireless network, or a 3G mobile network in the case of a 3G enabled device such as a mobile phone. The internet will then provide access to the mLearning content. This framework shows that students can gain fast access to learning contents and materials using their mobile devices.

According to Campanella [11], one of the most widely used architecture for mobile learning is web-based. The advantages of using a web-based platform are:
- Improved user interface;
- Support for multimedia content;
- The e-learning content can be easily updated on the server

However, web-based platforms also have their disadvantages:
- User must install and configure the client application;
- User must learn to use the application;
- Any additional costs for traffic usage.

Mobile learning applications for Android in educational institutions are usually comprised of modules such as courses, quizzes, tests, and messages. In system management, the modules developed are user control, content management, courses, tests, and marks.

Mobile learning is similar to e-learning but with a subtle difference - contents are delivered into mobile devices rather than ubiquitous desktop or laptop computers. Teaching and learning via the Android operating system can be implemented without any heavy computing investment. First, the mobile devices are widely available in the market. Second, these mobile devices make it easy to share information because of their integration with various social media [10]. The results of Hanafi and Samsudin's research showed that the students found it easy to download lecture notes, and the method of mobile learning promoted self-learning [10]. Android's user interface is also simple and intuitive [12] as shown by the simple selection module which can be used for quizzes in Fig. 2.
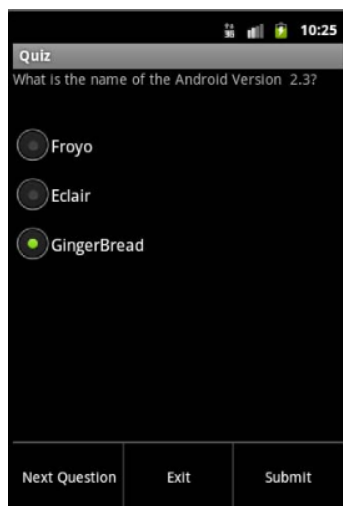

Fig. 2. Android sample selection module.

Using this environment combined with games, one can develop an effective way to promote learning, and give the user more immersion provided by the gaming aspect.

B. Mobile Game Frameworks and Engines for Android

Several game engines exist for the Android operating system, and the two main ones are AndEngine for 2D games and Ren'Py for visual novel and decision-tree type games. For the Tsunami application, the game engine AndEngine, created by Nicolas Gramlich, was used due to its ease of development for 2D games. The PPCRV Visual Novel was created using both Ren'Py and Usbong due to its reliance on decision trees. Ren'Py allows the application to be deployed on Windows, Linux, Android, and soon iOS, which makes it a good choice for the application to reach a big audience. Ren'Py however, is unable to deploy on lower-end phones which has below 512MB of RAM due to its graphical requirements. Due to this limitation, the Usbong Engine, which is less strict in the graphics requirements, was used to cater to the lower-end phones should the Ren'Py application fail to run.

C. AndEngine – Game Engine for Android

AndEngine is a game engine library that makes it easier to write two-dimensional games for Android devices. It is created by Nicolas Gramlich and is built on top of the basic Android SDK. It is possible to make a game using the basic Android APIs, but there are some advantages to using a game engine [13]. First is the ability to leverage the work of others. Using the basic Android APIs alone will create a very basic game, but by using a specialized game engine, one can push the potential of the basic APIs. Next is building a community with other developers. With open-source code, like that used in AndEngine, developers always have the option of extending the engine functionality. It is also a way of contributing to each other's games, as one can always ask the community of how to do certain functionalities or ask for assistance in graphics.

AndEngine is comprised of the following main components [13]:
1) Camera – The camera determines the view of the game presented to players. It is able to pan and zoom across the scene to change the view.
2) Scene – Each sequence of scenes is driven by a Scene Manager, much like a director of a movie and the order of scenes is dependent on the game.
3) Sprite – Sprites are visual representations of the characters in the game.
4) Entity – Entities are objects drawn on to the screen. Sprites, as well as tiles and lines, are entities.
5) Modifier – Modifiers change the properties of an entity to create movement or effects.
6) Texture – a texture is a 2D bitmapped graphic that can be applied to objects to give them texture.
7) Engine – An Engine runs a scene. It handles animations and modifiers. It takes care of letting animations and modifiers know when to update the graphics, coordinates the actual drawing, handles user input events (touch, keys, sensors), and generally manages the progress of the game.
8) BaseActivity - BaseGameActivity handles the work common to all scenes, setting up the game engine, conforming to the Android Activity Lifecycle requirements, and enabling sensors.

The concepts mentioned above are used in creating the PPCRV Tsunami application. The components are essential when creating a 2D game.

D. Ren'Py Visual Novel Engine

Ren'Py is a visual novel engine that helps one use words, images, and sounds to narrate stories with a computer or mobile devices. These can be either visual novels or life simulation games. The script language allows one to efficiently write large, text-heavy visual novels, while its Python scripting is used for more complex games such as a full-scale RPG. Even without in-depth customization, Ren'Py provides the basic features players have come to expect from their visual novels in the basic template, such as save and load states. It is open source and supports multiple platforms such as Windows, Mac OS X, Linux, Android, and soon, iOS.

According to the main Ren'Py homepage [14], Visual novels are defined by being computer-based stories that are told through words, images, sounds, and music. Many visual novels are made to present the player with menu choices that allow the player to control how the story is told. Life Simulation games, such as management and dating simulations, are more interactive games that mix story with gameplay. Ren'Py's screen language allows one to create complex interfaces, while its support for the Python scripting

language makes allows for complex game logic. Some of the default features Ren'Py packaged with the basic template are the following [14]:

- A main menu that allows the user to start a new game, load a game, or adjust settings.
- A game menu that lets the user load, save, and adjust settings.
- Automatic saving of games.
- Predictive image loading, which loads images in the background. This feature reduces the waiting time of the user to finish loading images
- The ability to skip through text when replaying, including the ability to skip only text that's been read.
- The ability to independently change music, sound effect, and voice volume.

Ren'Py also supports numerous image animations and movie playback is also supported.

E. Usbong

Usbong is a platform that allows even non-technical people to create their own web-mobile systems to digitize and streamline processes, such as for assessments and surveys. For those who are more creatively inclined, Usbong can also be used to create choose-your-own-adventure storybooks with matching illustrations through the use of decision trees.

At present, Usbong runs on Android devices, whether smartphones or tablets, that have version 2.3 and up. Similar to ebook readers, once Usbong is installed, it shows a list of files that it can read or "play". The file type that Usbong uses is .utree. To create these .utree files, a Graphical User Interface (GUI) or a Spreadsheet running on Google Drive can be used.

While it is possible to use both Ren'Py and Usbong to tell visual stories, Usbong should be looked at more as a visual novel with illustrations than a visual novel with talking heads or persons. In Usbong, not all the screens would necessarily have illustrations.

Some of the features already available in Usbong include:

- A file selection screen that allows the user to select a file to be read/"played".
- Availablility of components such as textDisplay, imageDisplay, textImageDisplay, and link.
- Availability of other components like textfields and textareas for end-user inputs.
- Ability to add HTML tags in the text (e.g. to change font color and size, add hyperlinks).
- Clickable images, which can then have more information or links about the image.
- The path chosen and decisions made by the end-user are stored on the sdcard or sent to a server.

III. METHODOLOGY

This section discusses the various technologies used in developing the PPCRV applications for voter's education.

A. PPCRV Tsunami Application

The game design used for this application is competition and sociability. By definition, a game is competitive if players are emotionally invested in defeating each other. The goal of this game is to produce a measurable outcome- a winning player. Combined with its results being integrated

with social networks, it gives the application a good environment for players to compete during their spare time. It offers a sense of educational entertainment to the users and this system may be used for further educational purposes.

The Tsunami Application was created using the Eclipse SDK with the AndEngine game library. The flow of the game was created using just one activity and multiple game scenes or states handled by AndEngine. As with any game, the first thing one should do is define the sprites. In AndEngine, sprites are defined by the following statement:

mJessa=
BitmapTextureAtlasTextureRegionFactory.createFromAsset
(this.mBitmapTextureAtlas, this, "jessa.png", 0, 0);
  mBitmapTextureAtlas.load();

The code above is located inside the onCreateResources() method which is available inside every class extending the SimpleBaseGameActivity class of AndEngine. BitmapTextureAtlas is similar to a box where you can put in images or textures. In order to display these images, it must be called and attached in the game scenes which are handled by a built-in scene manager in the engine. The changing of scenes is handled by the following line of code:

activity.setCurrentScene(new StartMenu());

The setCurrentScene method is called inside the event wherein one wants to change the scene. For example, in the game, when the user hits the "Start Game" button, the changing of the current scene is handled inside the button listener. All the scene classes extend the parent class Scene. Once the scene is loaded, the loaded images from the initial activity can be converted into sprites and displayed by the following statement:

Sprite jessSprite = new Sprite(startX, startY, activity.mJessa,
activity.getVertexBufferObjectManager());
attachChild(jessSprite);

The game board was created in a similar way, with the sprites being different colored tiles. A splash scene was also created which lasts for about 2 seconds before loading the main game scene in order to act as a loading screen to give a delay to load the resources needed. For the sprite movement, a modifier was used to move the sprite horizontally or vertically in a set speed. One must declare a movement modifier, and register it to the preferred sprite at the moment one wants the sprite to move, shown in the sample code below. In the code, the sprite will move from startX to finalX in 0.2 seconds.

MoveXModifier mod = new MoveXModifier((float) 0.2, startX,
finalX);
jessSprite.registerEntityModifier(mod.deepCopy());

For the main game, a question loader was created which contains the question database along with the answers, making it easy to add, remove, or edit questions as necessary. The questions are stored in a simple text file so that more questions can be added to the database. The questions are formatted as follows:

1) What does P stand for in PPCRV?
- *Parish**
- Principle

- Polite
- Persistent

2) What does C stand for in PPCRV?
- Couple
- Complete
- *Council**
- Court

The application will randomized the order of the answers when the questions are displayed to insure that the player will read the answers rather than memorize the letter corresponding to the answer.

The questions are ranked by their difficulty and are chosen randomly depending on the player's location on the game board. If the player is closer to the finish line, the questions chosen are from the harder ranks, giving the game more challenge. Upon ending the game, the winning player is given the choice to share their results on Facebook or Twitter, forming a social aspect to spreading voter's education. The Facebook and Twitter share option was handled by a java library called SocialAuth. It handles authenticating users through external oAuth providers like Gmail, Hotmail, Yahoo, Twitter, Facebook, LinkedIn, Foursquare, MySpace, Salesforce, among others. Facebook and Twitter were mainly selected due to it being the most active social networks in the Philippines.

B. PPCRV Visual Novel

As opposed to the competitive nature of the Tsunami application, the PPCRV Visual Novel is centered on a main character- the player, and a strong plot. The character's choices in the game are all controlled by the player. Whether the game will end in a good way or not are all decided by the choices selected. This type of game was created in order to promote the concept of bearing the consequences of your actions. While the Tsunami application was a linear game due to it being a question and answer type of game where the answers are predetermined, the PPCRV Visual Novel is nonlinear – meaning, the answers all lead to a different ending of the game.

For the Visual Novel, a popular visual novel engine called Ren'Py was used. Ren'Py is one of the standards for visual novels due to its easy to understand syntax which is formatted like a screenplay. The save and load states are also handled automatically by Ren'Py. Furthermore, it can also connect to web-based services which make it possible to obtain the answers of the players and evaluate their moral standing.

First, the images are defined by declaring it as a background (bg) or a character. Each character can have multiple images assigned to them such as when they have different expressions. The excerpt below shows how images and characters are defined:

```
image bg bench = "bench.jpg"
image Jessa normal = "jessa1.png"
image Jessa mad = "jessa3.png"
image Jessa explaining = "jessa2.png"
image Jessa talking = "jessa4.png"
#j and mb is a short variable name to display the name "Jessa" or
#"Manong Bok" above the text box.
define j = Character('Jessa', ctc="ctc2", ctc_position="fixed",
show_two_window=True)
define mb = Character('Manong Bok', ctc="ctc2",
ctc_position="fixed", show_two_window=True)
```

Once the images have been defined, they can simply be displayed on screen by the following statements. Additional effects can be added such as fading and moving by using the "with" statement. Each section of the story can be assigned to a label, which can be accessed by a "menu" statement for branching:

```
label scene8:
scene bg cafe
with fade
show Jessa explaining at right with moveinbottom
```

The branching is automatically handled by a 'menu' statement; each option in the menu can simply 'jump' to a different label or story point when selected in the game. Below is an example of the Ren'Py syntax:

```
mb "You see, we have a problem. As usual, you have a decision to
make. (He looked at their confused faces and shrugged)."
mb "Decide. Do we go to him and attack right away? Do we
investigate first? Or, do we do nothing?"
menu:
    "Attack right away":
        jump scene6

    "Investigate first":
        jump scene7

    "Do nothing":
        jump scene8
```

Fig. 3 shows how the menu statement appears on Ren'Py.

Fig. 3. Selection module in game.

The default Ren'Py output is an executable file which can be run on windows. In order to convert it into an Android APK, one must use the Ren'Py Android Packaging Tool (RAPT). RAPT is a program, downloaded separately from Ren'Py, that creates an Android package for testing or release purposes. It runs via the command line. According to the RAPT homepage and documentation[12], the following are the default keybindings applied when converting the game into an APK:

Home
> Returns to the Android home screen, suspending the Ren'Py game. As part of the suspend process, Ren'Py will automatically save the game. If necessary, the save will be automatically loaded when the user returns to the game.

Menu
> Brings up the in-game menu, and returns to the game.

Back
> Rolls back.

Volume Up, Volume Down
> Controls Android's media volume.

Alongside Ren'Py, the Usbong engine was also used to handle the lower end phones as mentioned earlier. It is similar to Ren'Py wherein it specializes in decision trees, but instead of a plain text format, it uses a GUI or a Spreadsheet to create the trees.

The first step is to identify which component to use for each screen that would be displayed on the device. For visual novels, this would typically be:

textDisplay: displays a text on the screen
imageDisplay: displays an image on the screen
textImageDisplay: displays text and image on the screen.
link: enables the end-user to select one choice to go to from a radio button group.

Once the appropriate component has been identified, it is just a matter of putting it in the correct task-node box (for the GUI) or the correct cell (for the spreadsheet) using a valid syntax. Fig. 4 shows a screenshot of the GUI.
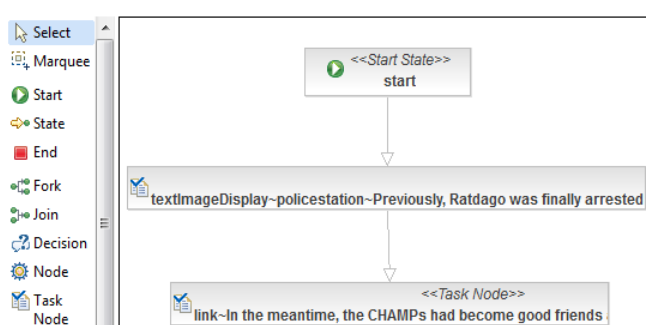
Fig. 4. Screenshot of the GUI.

Fig. 5 shows a screenshot of the Spreadsheet running on Google Drive with the same values as the one on the GUI.

Fig. 5. Screenshot of the spreadsheet.

Both the GUI and the Spreadsheet produce an .xml file, which is stored in the .utree file, along with the res folder. The res folder contains the images of the tree.

```
<task-node name="textImageDisplay~policestation~Previously,
Ratdago was finally arrested for the crimes he had committed while
he was in power, thanks to the persistence of the CHAMPs. A trip to
the future through the TPG showed that peace and order was
restored in the future version of their town. But will this last?">
    <transition to="link~In the meantime, the CHAMPs had
become good friends and started to bond…"
name="Any"></transition>
    </task-node>
```

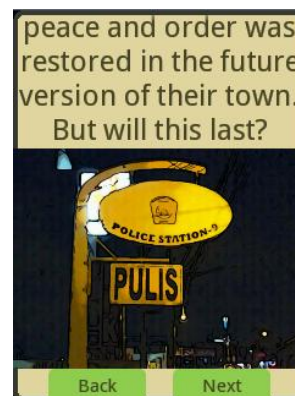Fig. 6 shows screenshots of the application itself.

Fig. 6. Screenshots of the application.

C. Data Gathering and Exposure

Upon release of the two games after the 2013 elections, the user data provided by the players are stored and sent to a secure web server. Using these data, it is possible to create a trend line to see which information is the most common mistake the users for the Tsunami Application select. For the Visual Novel, their choices throughout the game are sent in order to see the common choice and standing of the people – whether more citizens choose to be indifferent in the game, or if they really reflect their beliefs in the game choices.

IV. RESULTS

In the case of PPCRV's voter's education application, two games were created the PPCRV Tsunami Application and the PPCRV Visual Novels. Both of these applications incorporate gaming into education by making it more appealing to the youth voters. The Tsunami application is a quiz game incorporated into the traditional snakes and ladders game. The questions aim to educate the voters on how to become a model citizen, avoid malign practices, and proper candidate evaluation. The Ren'Py game framework and Usbong Platform on the other hand, were used to create two versions of the comic book in mobile story-book format. This type of game relies heavily on decision trees, which both Ren'Py and Usbong have, and therefore allowed for the development of choose your own adventure type of game. Since the aim of the game was to make the user live out the consequences of being an active citizen or an inactive citizen in the game's world, it was necessary to design the app such that there would be decision points and branching out to several possible scenarios. While the Tsunami application aims to teach trivia and facts, the visual novel aims to teach moral engagement to the youth voters.

A. PPCRV Tsunami Application

The Tsunami Application output consists of an android application using AndEngine with Facebook and Twitter integration. The Facebook and Twitter post only consists of the time the player took to finish the game and a link to the Google Play Store such that other users can download. The main application consists of five main classes: QuestionManager, BaseActivity, MainMenuScene, MainGameScene, and PlayerSelectionScene. The QuestionManager class as mentioned in the earlier section is

the question loader which handles the data obtained from the QuestionParser, which reads from the text file of questions. The BaseActivity is the main class of the application, which handles the initial loading of the environment and game scenes. The game scenes are very linear – it simply moves back and forth between the scene classes every time the user clicks a button. For example, in the MainMenuScene, if the user presses "Start" in the menu, it will load up the PlayerSelectionScene, and once the user selects his preferred character, it then loads up the MainGameScene. The MainGameScene is where the logic of the main game is stored such as the winning conditions, the logic of the movement of players across the board, and the dice generation. Fig. 7 shows a screenshot of the main Tsunami game and how a question shows up on a dialog.
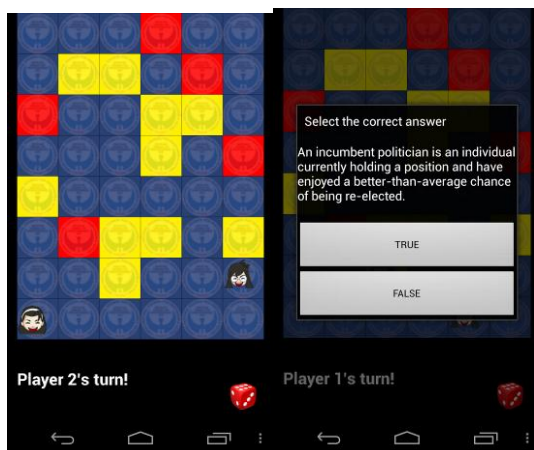

Fig. 7. Screenshots of the main Tsunami game and a sample question.

The game begins with the players in the starting position and a dice button. It is patterned after a board game and the board is marked with several icons which activate if a player lands on them. If the icon is yellow, a player who landed on the icon is given a question generated by the question loader. If the player answers it correctly, they stay on the icon and wait for their next turn. Otherwise, they will be sent back a random number of steps. Note that it is possible for a player to encounter more than one icon in a single turn. If the icon is red, they will be sent back a random number of steps automatically.

B. Ren'Py and Usbong Visual Novel

For the Visual Novel, two engines were used to release the game to Android, namely Ren'Py and Usbong. For Ren'Py, the development was straightforward with its screenplay syntax, which was written in just one script file as shown in the methodology. All images are loaded externally in the main folder of the game, and the script file simply calls a photo if needed. Fig. 8 shows the final output of a Ren'Py application. The save and load buttons saves the player's game state and can later be accessed in the game menu in Fig. 9.The skip button skips a previously read section when given the situation where the player has finished the game once but the player still wishes to play the game from the beginning to view the other outcomes of the game. Instead of having to read all previously read scenes, the user can opt to skip the scenes and it will stop skipping when it detects a scene which the user hasn't seen yet.

Fig. 8. Screenshot of the layout and gameplay of the visual novel.

Fig. 9. Game menu where save states are stored.

For Usbong, there are two ways to create the visual novel: the GUI or the Spreadsheet. While there is a slight learning curve in using either one, once the concept has been understood, it is also straightforward to use. All the images are stored in the res folder of the .utree file, and the "script" that calls the photos needed is in a .xml file. Fig. 10 shows the final output of an Usbong tree.

Fig. 10. Screenshots of the visual novel in Usbong.

V. CONCLUSION

The use of a game engine such as AndEngine made the development of the game easier as compared to doing it in basic Android since most game engines already have incorporated methods for interpolation and animation which is most commonly present in games. Similarly, using Ren'Py made the development of the visual novel faster because the most common game elements such as save and load states are already incorporated into the basic template, which means no additional code has to be written before implementation.

Given that these engines built a simple framework around an existing one (namely Android for AndEngine and Python for Ren'Py), it is possible to further abstract these engines to focus on creating a framework for a specific type of game and to make it simpler for beginners. Instead of using a separate framework such as SocialAuth for integrating with social networks, it is possible to create a framework and combine that feature into AndEngine itself. Since AndEngine also has a plethora of commands for different types of games, one can extract the basic commands in order to create a quiz game such as the Tsunami application.

Usbong, a homegrown engine for mobile applications development, on the other hand provides an environment that can readily be used by non-programmers. The template allows novice app developers to use a simple spreadsheet to incorporate the story, the images and the decision points.

The essence behind mobile game engines is that it provides a less complex development environment. Successful development and deployment provide evidence that these engines may be used by educators in creating content for the mobile platform. In a third world country such as the Philippines, where good quality education is hindered because of social and physical barriers, mLearning provides a promising alternative to enhancing and improving the quality of education for the present and future generations.

ACKNOWLEDGMENT

REFERENCES

[1] L. Agcaoili. (May 2013). Phl is SE Asia's fastest growing market for smartphones. [Online]. Available: http://www.philstar.com/business-usual/2013/05/20/943965/phl-se-asi as-fastest-growing-market-smartphones-study.

[2] J. M. Tuazon. (November 2012). Philippines has 5 million more mobile subscribers in Q3. [Online]. Available: http://www.interaksyon.com/infotech/philippines-has-5-million-more-mobile-subscribers-in-q3-report.

[3] The Philippine Star. (November 2012). Anytime, anywhere learning with YoPad. [Online]. Available: http://www.philstar.com/gadgets/2012/11/04/862980/anytime-anywhere-learning-yopad.

[4] A. Nolasco. (2013). Vibal and PNU create Center for Digital Education. [Online]. Available: http://www.vibalpublishing.com/news/item/481-vibal-and-pnu-create-center-for-digital-education.html.

[5] Calvin. (August 2011). La Salle Green Hills deploys Samsung Galaxy Tab 8.9 to students for advanced digital learning. [Online]. Available: http://www.pinoytechblog.com/archives/la-salle-green-hills-deploys-s amsung-galaxy-tab-8-9-to-students-for-advanced-digital-learning

[6] Journal Online. (October 2012). Youths Urged to Register for 2013 Elections. [Online]. Available: http://www.journal.com.ph/index.php/news/national/39663-youths-ur ged-to-register-for-2013-elections.

[7] J. Bertot, P. Jaeger, and J. Grimes "Using ICTs to create a culture of transparency: E-government and social media as openness and anti-corruption tools for societies," *Government Information Quarterly*, pp. 264-271, July 2010.

[8] P. Evangelista. (May 2013). SLB uses technology for voters' education. [Online]. Available: http://www.admu.edu.ph/news/features/slb-uses-technology-voters% E2%80%99-education.

[9] E. Reyes. (April 2013). Comelec, Smart launch 'e-Leksyon 2013´ website, mobile app. [Online]. Available: http://www.interaksyon.com/infotech/comelec-smart-launch-e-leksyo n-2013-website-mobile-app

[10] H. Hanafi and K. Samsudin, "Mobile learning environment system (MLES): The case of Android-based learning application on undergraduates' learning," *International Journal of Advanced Computer Science and Applications*, vol. 3, no. 3, April 2012.

[11] P. Campanella, "Mobile learning application for Android using web service," *Informatica Economica*, vol. 14, no. 3, pp. 106-115, March 2010.

[12] M. Shanmugapriyam and A. Tamilarasia, "Designing an m-learning application for a ubiquitous learning environment in the Android based mobile devices using web services," *Indian Journal of Computer Science and Engineering*, vol. 2, no. 1, pp. 21-30, 2012.

[13] R. Rogers, *Learning Android Game Programming: A Hands-On Guide to Building Your First Android Game,* 1st ed. Chichester, U.S.A.: Addison-Wesley, 2011, ch. 2, pp. 18-19.

[14] Ren'Py. The Ren'Py Documentation Page. [Online]. Available: http://www.renpy.org/doc/html/android.html.

Nadia Rowena C. Leetian is a student taking up her masters in computer science in the Ateneo de Manila University. She graduated from her undergraduate course of computer science with specialization in interactive multimedia in 2012 in the same university. Her previous summer work consisted of being a game programmer in a Philippine game company called Inkstone who developed a number of Facebook games.

Ma. Regina E. Estuar is an associate professor at the Ateneo de Manila University. She currently holds the Executive Director post for the Ateneo Java Wireless Competency Center, the mobile research and development lab of the Department of Information Systems and Computer Science.

Michael B. Syson is both a teacher and a social entrepreneur. He teaches Japanese Language and Culture at the Ateneo de Manila University. On the side, he, along with his team, develop and improve Usbong, an open source platform that allows non-technical people to digitize and streamline processes for use in assessments, surveys, and even visual storytelling. He graduated with a M.Sc. in Computer Science at the Ateneo de Manila University.