

# ANDROID APPLICATION FOR MUSIC DEVELOPMENT ON KIDS USING SUM METHODOLOGY FOR VIDEOGAMES

Juan Carlos Bolaños Tarapues

jcbolitogb@hotmail.com

**Resumen.** Estudio de la metodología SUM para videojuegos, y desarrollo del juego educativo "Aventura Musical" para el sistema operativo Android usando software libre.

**Palabras Claves:** Estudio, SUM, Android.

**Abstract.** Study about SUM methodology for videogames, and development of the game "Aventura Musical" for the Android operative system using free software.

**Keywords:** Study, SUM, Android.

## 1. Introduction

Currently most parents in our midst are unaware of the great benefits of music education in children, nor there are music educational programs in child development centers, almost all activities carried out by parents or child development centers with children are motor development activities or language development, but none is focused on the development of musical skills and abilities.

In addition, most households in urban areas with children under 6 years old have one of the best devices for multimedia instruction in the form of smartphones and tablets, but now in its great majority they are used almost exclusively for entertainment. Similarly, the Google Play store has almost no musical applications to promote Child Development.

The aim of this work is to write and get on the Google Play market an application that can encourage the development of musical skills and abilities in children under 6 years old, give parents a new tool of easy access for the development of creativity and the imagination of their children, and investigate the best free software technologies applicable to develop the application of "Aventura Musical".

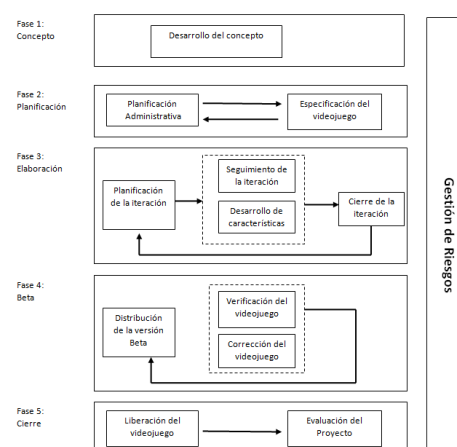
## 2. Methodologies and Tools

### 2.1 Software development Methodology SUM

The videogame developing SUM methodology aims to produce quality videogames in time and cost, as well a continuous improvement of the development process to increase the effectiveness and efficiency of it. Seeks to obtain predictable results, efficiently manage resources and project risks, and to achieve high productivity of the development team. [1]

SUM allows an easy team up of interdisciplinary teams; in the development of video games there are different aspects such as audio, video, story and plot of the game, work will not only be distributed in a better way, but each will be working in their area of experience.

The delivery process is divided into iterative and incremental phases that are executed sequentially except for the phase of risk management which will be performed throughout the project. [2]



**Figura 1.** Fases del Proceso

**Fuente:** Acerenza, Coppes, Mesa, Viera. (2009). Una Metodología Ágil para Desarrollo de Videojuegos.

## 2.2 Android Applications

All Android applications are written in Java language; Android SDK tools compile the code, data and resources in an APK, this APK will be used to install the application on Android devices. [3 ]

Characteristics:

- The Android operating system is a multiuser Linux system where each application is a different user.
- By default, the system assigns each application an unique Linux user ID, this ID is used only by the system and is unknown to the user, files from an application can only be accessed by this ID.
- Each process has its own virtual machine , so that each application code runs in isolation.
- Android starts a process when a component of an application should be executed, it will be automatically closed when not needed or the system needs memory for other applications.

## 2.3 Android Studio

AndroidSDK provides a rich application framework for building innovative applications and mobile games in Java. [3].

In a couple of years since its Beta launch it has become the official tool and recommended by Google to develop applications for the Android Operating System, because applications developed on Android Studio adapt to any device using Android OS .

Characteristics

- Smart code editor. At the core of Android Studio we found a publisher of predictive code, not only able to complete code on the fly, but to detect errors, refactor and analyze code.
- Code templates and integration with Github. Integration and ease to search code via Github, it really helps any programmer get familiar with Android Studio and all its possibilities when creating applications.
- Development for different screens. Android Studio through its XML design allows mobile applications to run on different devices such as watches, televisions, mobile phones and tablets.
- Elegant and efficient emulator that contains almost all android commercially available devices.
- Improved compilation. With Gradle its posible to create multiple installers with different characteristics using the same project.

## 2.4 Facebook Sdk

Facebook SDK is a set of tools and libraries that allows applications from different platforms to access the

advantages offered by Facebook as well as providing a quick way to create accounts. [4]

Being a product of one of the largest companies in the world Facebook SDK is continually evolving , becoming faster and reliable, continually providing a better experience for users and developers.

Advantages:

- **Account creation.** Applications that incorporate Facebook Login will have a great advantage over other applications, because users who have Facebook accounts can create them with just the push of a button.
- **Customization.** Facebook can provide data that would be very difficult to collect otherwise, as things the user likes, place of birth, date of birth among others. Tools that allow a developer to provide a different experience for each user.
- **Social development.** The majority of the most successful applications have something in common, the social aspect, the ability to play or interact with friends.

## 3. System Description and Operation

### 3.1 Vision

It is an educational game designed for children, which will teach about rhythm and musical notes through musical games where children can learn while having fun. The game is designed for mobile devices, as it will be much easier for children to interact with the game on a touch screen.

### 3.2 Game mechanics

On the screen the player will have controls to simulate a bass drum and cymbals , while a song plays the user should try to keep time playing these percussion instruments, in the central part of the screen you can see which instruments should play next and when. In the second part of the game the user can touch a piano to learn to recognize the seven musical notes, he will practice with simple songs and can also find on the screen wich notes he should play next.

Sketches

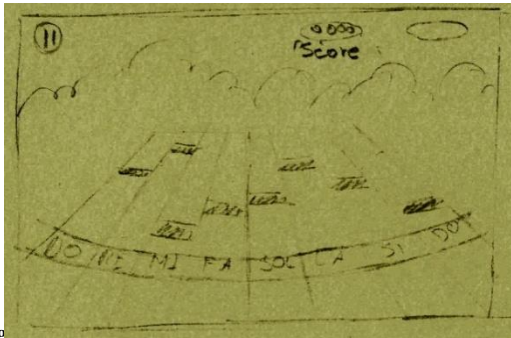


Figura 2. Boceto número 1. Juego Piano

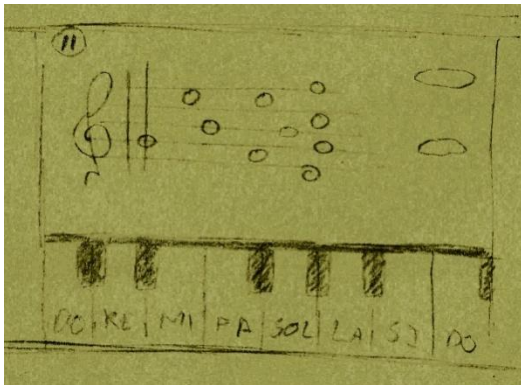


Figura 3. Boceto número 2. Juego Piano

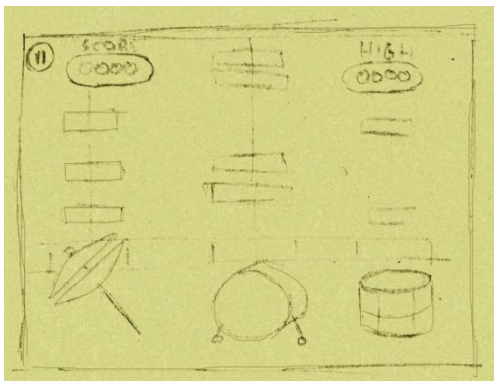


Figura 4. Boceto número 1. Juego Bateria

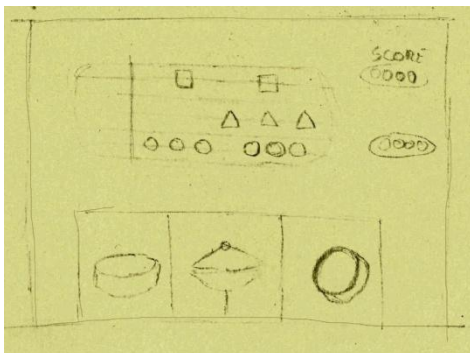


Figura 5. Boceto número 2. Juego Bateria

### 3.3 Main Objective

Develop a game that incentivates the development of musical skills abilities in children under 6 years.

### 3.4 Especific Objectives

- Teach children to keep pace
- Teach children musical notes
- The game should be easy to learn
- The game interface should be attractive and with a child's theme
- Allow users to connect with Facebook for additional benefits

### 3.5 Game modes

- Percussion/Rhythm

In this game mode the user will have 2 or 3 percussion instruments ( drums, bass drum or cymbal ), these will be located at the bottom of the screen, and as the game is for mobile devices with touch screens it will be controlled simply with the fingers, the user will hear a children's song, and in a bar that is constantly updating the user will see what instrument should be played next and when.

- Piano/notes

This game mode teaches the user the different musical notes and as are situated on a piano, the user interact through a keypad composed of 8 keys that represent an octave and an extra key, in a pentagram the user will see which key he should play to perform the song and the time when he should play them. Depending on its successes the player can advance to more levels.

### 3.6 Interface

The interface will be made with a kids motive in light colors without much contrast as to not disturb their eyes, in addition to access different parts of the game there will be large buttons to facilitate navigation. The following figure shows the screens that will be in the game.

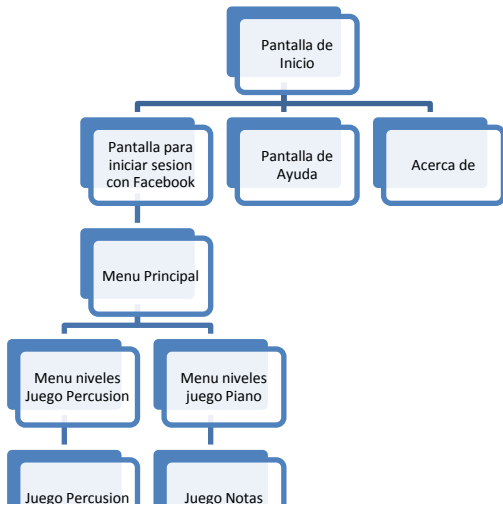


Figura 6: Pantallas de juego: Aventura Musical

## 4. Application Development

### 4.1 Final Log List

The development project was carried out in 6 iterations, each with a duration of five days; from the first iteration a functional product was reached which was improved with each iteration, the list of tasks needed to develop it are detailed below.

Table 1: Final Log List

Ítem	Description	Hours
Iteration 1		
1	Make the interface draft "Game Percussion " screen (Graphicss)	12
2	Choose the song and sounds for the first test, and times where you should play every instrument. (Sound)	4
3	Implement classes and methods to handle sound and graphics . (Programming)	6
4	Form the first draft of the game with the resources provided in the above 3 tasks.	20
Iteration 2		
5	Perform GUI design for "Main Menu" , "Menu percussion levels" , "record Screen", "Start Screen" .	8
6	Define 9 songs more to use in the game.	8
7	Implement navigation on the new screens designed .	2
8	Implement methods to control the different states that can have an Android application.	8
9	Physically record player progression (levels and records) .	8
Iteración 3		
10	Realizar diseño de la interfaz gráfica para "Pantalla de juego", "Pantalla de opciones", "Pantalla Acerca de", "Pantalla para iniciar sesión con Facebook" y "Menú niveles juego piano".	12
11	Terminar de implementar la navegación a través de todas las pantallas del videojuego	2
12	Implementar Facebook para el videojuego	16
Iteración 4		
14	Diseñar la interfaz gráfica para juego notas.	6
15	Revisar colores y temas a través de todas las pantallas gráficas en el videojuego.	4

16	Entregar 9 canciones restantes con los tiempos donde debe tocarse cada instrumento.	16
17	Revisar y optimizar código	4
Iteración 5		
18	Definir 10 canciones en piano para "Juego Notas"	8
19	Realizar las clases y métodos necesarios para incorporar "Juego Notas".	12
Iteración 6		
20	Revisar todo el contenido gráfico del juego y realizar las últimas correcciones	2
21	Entregar 10 canciones de piano con sus respectivas notas para "Juego Notas".	16
22	Implementar las últimas canciones en "Juego Notas"	2
23	Crear recursos para idioma inglés	4

### 4.2 Cronograma

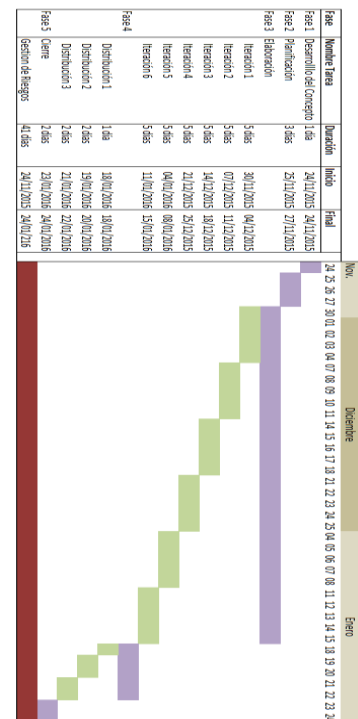


Figura 7: Cronograma

### 4.3 Beta Phase

Before the game hits the market the game should be tested and find as many errors that the rest of the team may have overlooked, since the game is dedicated to children, the game must be shown to children and report their reactions and comments to it.

#### 4.3.1 Evaluation and errors found

In the Table number 2 are the errors and recommendations found by the verifier, this errors were solved in 3 iterations, each one of 2 day duration.

Table 2: Beta tester Assessment

<i>Errors</i>	
Type	Description
Sound	Battery game Fourth level song doesnt stop after level ends.
Programming	Game percussion restart button does not work.
Programming	Game notes , the hit counter does not work properly when playing two notes at once.
Graphics	In game it must say percentage and not punctuation
Gráficos	User photo doesn't scale properly on small devices.
Programming	Spinner language object in Options Screen does not save the selected option.
Programming	Game notes the fifth level is shown as locked even though it has successfully unlocked.
Programming	Game may freeze for a few miliseconds.
<i>Gameplay</i>	
Type	Description
None	There were no suggestions to change the game mode.
<i>Entertainment</i>	
Type	Description
Design	Game battery, is suggested to eliminate the first 2 levels the songs are very repetitive.
Graphics	Home, user and options screens are very similar.
<i>Difficulty</i>	
Type	Description
Sound	Game notes, song "London Bridge" is way too difficult for kids.
Sound	Game battery, game notes instruments shouldn't be played 2 times or more in a period of less than 20 milliseconds.
<i>Learning Curve</i>	
Tipo	Description
Sound	Levels should be reorganized with the easiest songs at the start and hardest at the end.
Design	Battery game, children have difficulty in playing two instruments at the same time is recommended to place songs with these features in final levels.
Design	Game notes, it is recommended to take into account that children have small fingers, the greatest difficulty for them is to play notes separated in a short amount of time, it is recommended to put any songs with those qualities in later levels.

#### 4.4 Closing and Distribution Phase

The game is uploaded in Google Store, so it can be downloaded for free.

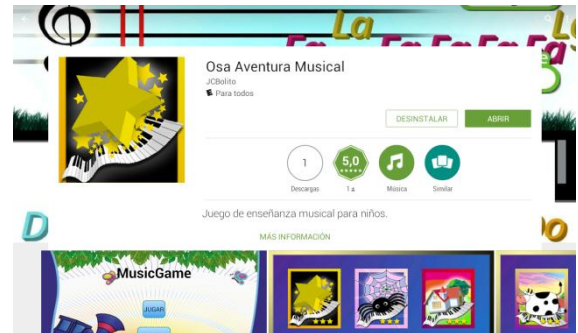


Figure 8: Google Store

### 5. Conclusions

- Android Studio, a tool used in the development of this project and backed by Google, has become in just two years the best tool for developing applications for mobile devices with Android operating system; because its free, has great documentation and various forums dedicated to help new developers.
- An efficient alternative to unveil new games is Facebook, one of the most important social platforms in the world, it offers a set of tools for applications to include a social aspect as well as a system to create accounts across multiple platforms.
- When the tastes of the target audience are difficult to quantify as in the case of children, the verification phase (BETA) is of great importance; during this project it allowed many changes that were only apparent when children used the game.
- Children have successfully tested are able to recognize a staff and learn the names of the musical notes, but more research is needed on strategies to help them recognize the location of each note on the staff.
- SUM methodology for video games easily adapts to new teams, provides a lot of flexibility and encourages teams that use it to learn from their mistakes and adapt the methodology to the team work way.
- The creation of interdisciplinary teams as recommended by SUM methodology allows to delegate tasks according to capacity and expertise, allowing develop better applications.

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## About the author...

**Juan Carlos Bolanos Tarapues** Born on Ibarra - Ecuador the day of January 16 of 1981. Son of Lidia Maria Tarapues and Segundo Bolanos. He completed his primary studies at the Don Bosco School. In 2000 he obtained his Bachelor degree of Mathematical Physics at school Sanchez y Cifuentes. Currently, a graduate of the School of Engineering in Computer Systems at the "Universidad Técnica del Norte" in the city of Ibarra.

**uan Carlos Bolaños Tarapues** Nació en Ibarra-Ecuador el 16 de enero de 1981. Hijo de Segundo Bolaños y Maria Lidia Tarapues. Realizó sus estudios primarios en la Escuela Don Bosco. En el año 2000 obtuvo su título de Bachiller en Físico Matemático en el colegio Sanchez y Cifuentes. Actualmente, egresada de la Carrera de Ingeniería en Sistemas Computacionales de la Universidad Técnica del Norte de la ciudad de Ibarra.