

**ANDROID BASED: SCIMATH FIGURE PUZZLE GAME  
(FOR GRADE IV TO VI PUPILS)**

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## Chapter I

### INTRODUCTION

#### Project Context

✓ According to Mar&Lanz (2012), playing games is fun and exciting. It provides from stress and unwind from our stressful works. Many of us spend their vacant or most of their time in playing and exploring new games. Today, with the rapid development of technology we have, games are also rising up together with it. Nowadays with the technology we have many games are develop for mobile phones most specifically for android. With the high technology equipped with those mobile phone, mobile games become robust and attract many people to buy or have this phone for them to experience what's inside it which makes it a trend for the new generation of mobile phones.

✓ Games provide an excellent environment to explore ideas of thinking. The fact that many games are available both in a non-computerized and computerized form, helps to create this excellent learning environment. Learning games can help students to contextualized and apply lesson content to themselves in real life. A modern education prepares pupils to be productive and responsible adult citizens in a word which mind/brain and computer working together is a common approach to solving problems and accomplishing tasks and also giving knowledge to children who's playing on it. Some electronic games



are merely computerized versions that existed long before computers. Others only exist in a computer format. Computer network have made possible games that allow many thousands of players to be participating simultaneously.

Education has many goals. There is a huge amount of research and practitioner knowledge about teaching and learning. They become better at puzzling figure or solving puzzle problems and accomplishing challenging task. From an educational point of view, it is clear that solving Figure Puzzles helps to maintain and improve children's skills and knowledge of many miscellaneous tidbits of information. Solving Figure Puzzles tends to contribute to one's self esteem. For children's their expertise in solving Figure Puzzles plays a role in their social interaction with other (people.uoregon.edu).

✓ Educational games are getting increasingly common to use in education, both in schools and in homes of the learners (Stansbury, 2009). At the same time, the amount of educational games on the market is increasing tremendously. Many children at this generation are hooked on certain types of Puzzle Games. Some children routinely start the day by spending time on gaming. In some sense, they have a type of addiction to games. The fun is in meeting the challenge of the puzzle, making some or a lot of progress in completing the puzzle. Puzzles draw upon children's generation knowledge, recalls of figure to be puzzle with a short definitions or pieces of information. Through study and practice,



a child learns some useful strategies and can make considerable gains in Figure Puzzle solving expertise. Doing a Figure Puzzle is like doing a certain type of brain exercise.

Puzzle is a type of game. In every case, the children's goal is to puzzle a particular object challenging problem or accomplish a particular challenging task. Through playing, a child learns some useful technique and can make considerable gains in knowledge when he/she finished in puzzling the object.

The computerized animation and interaction in these games bring a dimension to games. Your brain works by developing and storing patterns. As you work to solve a problem or accomplished a task, you draw upon this stored patterns data, information, knowledge and wisdom. Helps to create this excellent learning environment as noted from an online article ([pages.uoregon.edu](http://pages.uoregon.edu)).

According to Gartner Inc. (2011), mobile games are broadly defined, computer-based games that can be played "on the move", whether on hand-held or vehicle-mounted devices. Many mobile games are exactly the same as their stationary counterparts however, there is a class of mobile games being developed that incorporates things such as the players direction, speed, location, or proximity to objects in the physical world into the game play itself. Android provides a rich



application framework that allows you to build innovative apps and games for mobile devices.

Gartner Inc. (2011), also noted that mobile devices have changed the software development world by providing a platform for the rapid emergence of a new class of software applications (i.e., mobile apps). Mobile apps, commonly referred to as apps, distinguish themselves from the applications that run on typical desktops or servers by their limited functionality, low memory, touch interfaces, and limited screen sizes and resolutions. Smart phones have opened mobile gaming to a wide audience, beyond the hardcore gamer. It begins with an introduction to building Android applications with Google's SDK and Eclipse. It will also discover the basics of creating layouts and custom views, playing music and sound effects, and getting user input from the touch screen and accelerometer. Mobile apps have become hugely popular among both consumers and developers.

Anders Liljedal (2010) said that mobile games can be used in almost every environment and the games primary function is to entertain the user, not to be used, like location-aware systems, as a utility to aid in certain tasks.

Pawel (2011) noted that the android is one of the applications that is being use nowadays in developing a mobile learning. He defined that Android is an open source project developed by the open Handset



Alliance and held by Google Inc. Fairer to say that Android is a software stack for mobile devices. All phones running the android system come with a range of pre-installed applications like Maps, Google Search, Gmail or YouTube.

(As cited from Wikipedia, (2016), Android is a mobile operating system developed by Google. It is used by several Smartphone's, such as the Motorola Droid, the Samsung Galaxy, and Google's own Nexus One. Android is open source, meaning developers can modify and customize the OS for each phone. Therefore, different Android-based phones may have different graphical user interfaces GUI's even though they use the same OS. Android phones typically come with several built-in applications and also support third-party programs. Developers can create programs are written in Java and run through Google's "Davlik" virtual machine, which is optimized for mobile devices. A mobile game is a kind of video game played on mobile phones, smart phones, tablet computer, and other games that can be played in android. Google has also pulled together a large group of companies (called the Open Handset Alliance) that both contribute to and use the Android OS in their hardware devices. This means that there is industry-wide support for Google's OS, promising wide adoption across well-known vendors.



## Purpose and Description

The main purpose of this study is to develop an Android based Figure Puzzle Game to present challenges to a child's ability to concentrate and process information and to exercise their skills in solving puzzles and also to gain knowledge.

**Children.** This Android based Figure Puzzle Game can help the learners to have an automatic locomotors response to the shuffled picture and to enhance also their ability in playing the aforementioned educational game.

**Teachers.** This Android based Figure Puzzle Game is a form of educational innovation that will make teaching-learning process enjoyable and meaningful. This will aid the pupils to explore and experience visual brainstorming.

**Parents.** This form of activity motivates their children to widen the arithmetic skills in forming shuffled puzzles. It is also a form of recreational activity of the children. Directing them into such kind of activity can get away from unethical and immoral actuations.

**Future Research.** To inspire them to conduct similar research like this to come up with other or different educational games that will help the learners to equip with the necessary skills.



## Review of Literature

The gaming industry of today has reached new heights and successes over the past years. It truly had become a powerhouse industry and it sure would be for the coming years.

This portion presents a review of several literatures that would be beneficial to the study summarized from previous writings, showing detailed facts asserted by few people or pioneer in the field of computer industry. On this element of study some reviews of the author's passage in order to help the researchers to find ways in contact with the problem that have been encountered. Literature review has been made to generate ideas on how to solve the identified problem and to find solution for such problem exists in the project.

Given that the Philippines is one of the most popular destinations for business process outsourcing, it's not a cause of wonder that there should be a considerable number of local developers who would be making mobile games for international publishers like Rovio and Bulkypix. And then there are the noble few who opt to develop and publish games all by themselves, under their own names. As a result, some of your favorite games may have been developed, either partly or completely, by Filipinos, and you may not even know it.

Jane McGonigal, author of the book "*Reality is Broken: Why Games Make Us Better and How They Change the World*" said in an



interview. (*National Public Radio, 2011*) “Well, games seem to tap into the psychological state called eustress, or positive stress. You know, normally we think about stress as very negative. It makes us anxious or frustrated or burnt out. But it turns out that if we have chosen a goal for ourselves and if we feel in control of the work that we're doing, that stress is experienced very positively”. She also stated that “Games are doing a better job of provoking our most powerful, positive emotions, and also helping us build up remarkable social relationships that cannot only improve our real lives but also potentially help us change the real world. However McGonigal still encourages everyone to play games due to its convincing benefits but also insists that people should only play on controlled number of hours.

✓ There are also indications that games aid students in their studies. According to the Entertainment Software Association *Games: Improving Education* (ESA,2012) “researchers have found that video games have real potential as next-generation learning tools. Games use new technologies to incorporate principles crucial to human cognitive learning.” That is why the Department of Education (United States) fund institutions that practices game development to develop educational games, simulations , video games, virtual worlds and avatars that would serve as learning tools. In fact a game app that aims to reduce child obesity is already in the works as well as the game adaptation of the CSI TV series wherein the players learn to examine crime scenes and evidences, a game that aims to introduce to middle school children



forensic sciences. Some people might assume that playing video games are not good and almost always seen as an addiction but it cannot also be helped but see the benefits it gives to gamers. "Gaming improves creativity, decision-making and perception. The specific benefits are wide ranging, from improved hand-eye coordination in surgeons to vision changes that boost night driving ability" that is what the article of Robert Lee Hotz is trying to suggest *When Gaming is... (Hotz, 2012)*.

An article written by Lea Lebrilla *Top 5 Advantages... (Lebrilla, 2010)* suggests:

First, Video games can be a new way of teaching, in this manner video games are being used as a teaching tool and is seen to help students improve academic skills and creative thinking. Second, it helps improve hand to eye coordination. Third, Video games are also known to be used as a tool in psychological therapy aiding patients to distract themselves from pain and unwanted sensations by diverting their focus and getting them entertained in video games. Fourth, since most video games are goal oriented especially those games wherein the player is on a quest, it is believed to help improve one's creativity in thinking as well as improve imagination. And fifth, Video games can improve one's problem solving skills.

As some video games are logical in nature such as puzzle games and strategy games, it helps the player to enhance his/her critical thinking and sense of logic as he/she would come up with methods on how he/she would solve a certain problem in efficient and crafty ways. It



is almost safe to say that the advantages of gaming are somehow recognized especially here in the Philippines where internet cafes are seen almost everywhere and the industry of game development are young. According to Santa Rosa City, Laguna's website article *Video Games are... (Santarosa.com.ph ,n.d)* video games instead of being one of the community's growing problems can be an opportunity, "First there is the indisputable fact that the demands of game players and game designers have driven and paid for many advances in computer technology, creating benefits to countless other spheres of activity. Though all these claims also suggest to play games on moderation and still keep track of time, gaming has proven to people that when appropriately practiced and responsibly done then it can be a productive activity that would benefit many.

Oxland (2004) says that games need rules and boundaries, feedback, an interface to the game world, context sensitivity (or immersion), goals, quests and challenges, a game environment and balance (or playability). Koster (2005) provides a much less formal definition, saying that games are puzzles to solve, they are exercises for our brains and that it is the act of solving these puzzles that makes games fun.

It is hardly surprising that there is more focus on playability and fun in the definitions created by game designers in the entertainment industry, and it is important not to lose these elements of what makes



games engaging when considering how games could be used for learning. This is not an easy task, as Virvou and colleagues (2004) highlight, saying that “educational software games aim at serving two distinct aims, which are often conflicting each other: education and entertainment” (p 692). More recent definitions by researchers in the field of computer game-based learning have more in common with those of non-computer-based games researchers. Dempsey and colleagues (2002) define a game as an activity involving players (one or more), with goals, constraints, payoffs and consequences, which is rule-guided, artificial in some respects and has an element of competition, while Prensky (2001) describes six structural elements of games; namely rules, goals, outcomes and feedback, competition or challenge, interaction, and representation or story.

In recent years, there has been a growing interest in computer game-based learning. A number of factors have brought this about, including the move from traditional, didactic teaching theories to more learner-centred, active models of learning, coupled with the availability of easy-to-use games creation technologies and the growing body of evidence that games can be an effective tool for learning, as well as motivating and engaging students (Garris et al, 2002). This section first discusses reasons highlighted in the literature on computer game-based learning for its effectiveness, and then provides some examples of empirical studies showing the use of game-based learning. Finally, this



section examines some of the weaknesses and problems associated with the use of computer game-based learning.

These assumed motivational factors surrounding games are often used as a rationale for using games for learning, the argument being that if the motivational factors associated with games could be transferred to learning then the learning would be more effective. Dempsey and colleagues (2002) make this assumption and provide examples of suggested uses of existing computer games in educational settings, but do not provide any evidence that motivation to play games for entertainment necessarily leads to motivation to use games for learning.

Games provide an excellent environment to explore ideas of thinking. The fact that many games are available both in a non-computerized and computerized form, helps to create this excellent learning environment. Learning games can help students to contextualized and apply lesson content to themselves in real life. A modern education prepares pupils to be productive and responsible adult citizens in a word which mind/brain and computer working together is a common approach to solving problems and accomplishing tasks as mentioned from an online article ([pages.uoregon.edu](http://pages.uoregon.edu)).

Puzzle as a game that a person plays against themselves. Focuses on describing how multiple actors in given situations interact with each other, either socially or competitively. One of the great successes of



puzzle is a description of how good higher-level strategies can emerge from a low-level description of the rules or setup of the game. The player or the solver can never see very clearly beyond the first few jumps away from their current position. Instead, the solver must try to move in the general direction of the solution, without seeing precisely where the moves will lead them. In order to do this effectively, the solver must somehow generate ideas which positions of the puzzle are closer to the solution state than others, and which moves are likely to result.

According to Charsky (2010) describe how edutainment and instructional computer games were touted as the savior of education because of their simultaneously entertain and educate. From this observation we can deduce that the purpose of using educational games according to Charsky (2010) is too educated. This is also the case according to Gullien-Nieto and Aleson-Carbonell (2012) and Purushotma (2015), who both agree that educational games aim to be able to further say something about the effectiveness of the educational provided by an educational game.

Mitchell & Savill-Smith, 2005; de Freitas, (2007) There is an identified need for a greater number of rigorous studies investigating the use of game-based learning. In this sub-section, a number of studies that have taken place in recent years are presented and discussed. It examines some of the empirical N J Whitton 2 Review of literature on learning and games 41 evidence that is available as to the educational



value of game-based learning. The studies selected here aim to provide a representative sample of the type of research that is being carried out in the area and the issues that commonly arise. The studies described here also provide an overview of the data collection and analysis methods that are commonly used in the area, and highlight some of the methodological issues. Examples are used from (non-computer) game-based learning, and computer game-based learning in schools, Higher Education and continuing education.

### **Objectives of the Study**

The study aimed to develop an Android Figure Puzzle Game for children's intended for Grade 4 to Grade 6 pupils. Specifically, this study sought to:

1. To observe on how the children solve the puzzle.
2. To design and develop an educational game.
3. To test the usability of the developed game.

### **Scope and Limitation**

The developed Android based Figure Puzzle Game intended for Grade 4 to Grade 6 pupils is expected to provide math and science lessons in an informative manner. This educational game can run on an android phones only. The game runs on android device that has 480 x 320 size of screen. The game is divided into two categories Math and



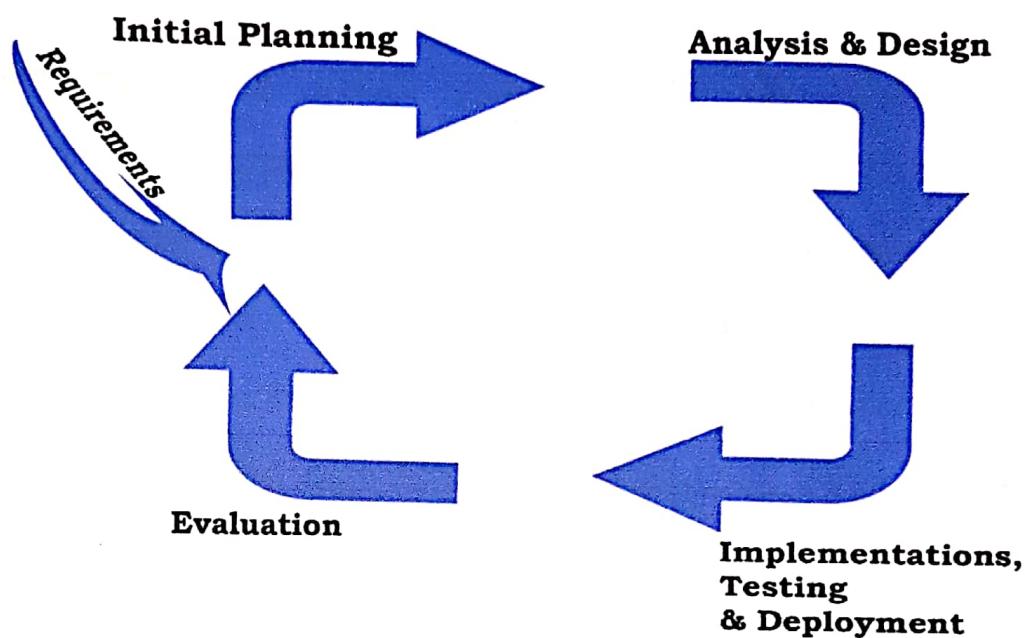
Science. Math has 3 sections: addition, subtraction, and division. And science has 2 sections: easy and moderate.

The game has no scoring, player name, recording of score, and it also doesn't have time limit of the game. In the science category the hard mode is not included due to time constrain.



## METHODOLOGY

### Iterative Model



**Figure 1. Iterative Model**

Rouse, M. (2012) is a way of breaking down the software development of a large application into smaller chunks. In iterative development, feature code is designed, developed and tested in repeated cycles. With each iteration, additional features can be designed, developed and tested until there is a fully functional software application ready to be deployed to customers.

Typically iterative development is used in conjunction with incremental development in which a longer software development cycle is



split into smaller segments that build upon each other. Iterative development contrasts with a traditional waterfall method in which each phase of the software development life cycle is “gated”. Coding doesn’t begin until design of the entire software application is complete and has gone through a phase gate review. Likewise , testing doesn’t begin until coding is complete and has passed necessary phase gate reviews.

**Requirements and Initial planning.** In this phase, the researchers gathered information and preference for creating the android applications. Researchers collected some software application development and choose what the developer compatible with. The proponents reviewed the project, to gain approval to begin the next phase. This is also the creation of the design and the concept of the game.

**Analysis Design & Implementations.** The proponents made a new design, or an extension of an earlier design for welcome screen/main menu for navigation and selection.

**Test and Deployment.** In this phase, the proponents do running and re-running the system in case where bugs can be found in the system and it has to be corrected so that the system would be hassle free through using test cases (Alpha, Beta, & RC Test).

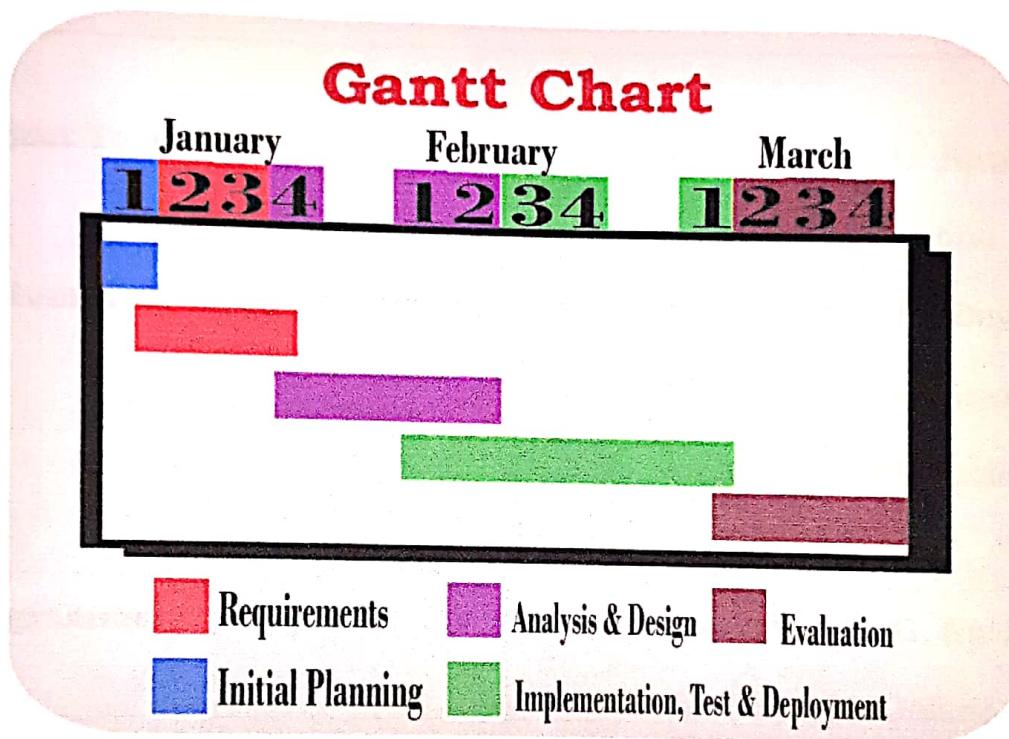
**Evaluation.** In this phase, the researchers reviewed the current requirements, and changes and additions to requirements proposed. In



this phase, proponents ensure that the code meets the security and privacy tenets the proponents established in the previous phases.

Eventually a point will be where the requirements are complete and the software can be delivered, or it becomes impossible to enhance the software as required, and a fresh start has to be made.

### Project Plan



**Figure 2. Gantt Chart of Activities**

Figure 2 shows the timeline of activities in the completion of the project. It can be seen from the figure that requirements requires the least time among the five phases where the proponents gathered only information and preferences for creating the Android application. The proponents found that the Adobe Flash CS6 is game development that is capable of developing Android games.

**Project Team Assignment**

The requirements and responsibility of the members of the team can be seen below. It can be inferred from the table that the role of each members are different from the others.

**Table 1. Project Team Assignment**

PROJECT RESPONSIBILITY	LEAD PERSON
<b>Project Team Leader</b>	Maria Cecilia G. Navarro
	April Lyn M. Galano
<b>System Analyst and Designer</b>	Christine Joy M. Davin
	Maria Cecilia G. Navarro
	Jayson Carl W. Pacleb
<b>Programmer</b>	Maria Cecilia G. Navarro
	April Lyn M. Galano
<b>QA / Tester</b>	Christine Joy M. Davin
	Jayson Carl W. Pacleb
<b>Documentation / Technical Writer</b>	April Lyn M. Galano
	Christine Joy M. Davin



Table 1 shows the respective assignments of each member of the group. Each of the proponents was designated as Analyst and Designer, Programmer, Tester and documenter/Technical Writer. Each member would be working closely together for the completion of the project. The analyst and developer would be working with the development of the system while the documenter will be responsible in taking note of the progress of the project and will be the one responsible in the write up of the manuscript.

### **Data Gathering Procedure**

Different methods of gathering data were employed in the project to come up with factual information.

**Internet Surfing.** The proponents gathered relevant researchers especially foreign and local literature needed in the study.

**Survey.** The proponents conducted a survey among the pupils of Elementary (2 Grade IV, 2 Grade V and 2 Grade VI), Faculty Members(3) and IT Experts (3) using SUMI questionnaire. Software Usability Measurement Inventory (SUMI) is a questionnaire method for analyzing products or prototypes in the terms of usability and quality of use.

Mean was used to determine the level of usability of the system to be created.



**Interview.** Introspection was conducted to the teachers to know the different educational innovations used by the teacher in delivering the lessons and how these innovations applied in classroom setting.

**Library Research.** The proponents gathered information from books, magazines and research manuscripts related to capstone project.

**Table 2. Data Categorization**

Scale	Statistical Range	Descriptive Rating
1	<b>1.00-1.79</b>	<b>Strongly Disagree</b>
2	<b>1.80-2.59</b>	<b>Moderately Disagree</b>
3	<b>2.60-3.39</b>	<b>Agree</b>
4	<b>3.40-4.19</b>	<b>Moderately Agree</b>
5	<b>4.20-4.99</b>	<b>Strongly Agree</b>

**5 – Strongly Agree**

**4 – Moderately Agree**

**3 – Agree**

**2 – Moderately Disagree**

**1 – Strongly Disagree**

Table 2 shows the statistical range as average percentage result of the survey inclined to the descriptive rating which reflects the performance level of the system.



**References**

**BIBLIOGRAPHY**

**Unpublished thesis**

Chan et.al 2014, Android Brain Booster Application

**Online sources**

Burkeman, O. (March 15, 2011). "She's Playing Games With Your Lives." New York Times. Retrieved 14 March 2015

Davis, K. (March 27, 2010) Virtual gamers a 'human resource' in real world's epic of survival (archived), The Vancouver Sun Retrieved April 2, 2010.

Hartlaub, P. (4 March 2012). "Jane McGonigal: Game in with 'SuperBetter'". San Francisco Chronicle. Retrieved 11 April 2018.

John M. D. Hill , February 2003 Puzzles and games: addressing different learning styles in teaching operating systems concepts.

Josh Spear presentation at Zeitgeist Europe 2007. Youtube.com. Retrieved 2013-12-10

Kipke, David. "A Millennial's Digital Marketing Worldview"  
[www.adknowledge.com](http://www.adknowledge.com). Retrieved 1 March 2015.

Lijedal, A. (2010). Mobile games. Design Implication for Context Aware Mobile Games <http://www.enactive.com/publication/liljedal-thesis.pdf>

Mathew, Thomas (1903) Account of the O'Dempseys, Chiefs of Clan Malire



McGonigal, Jane (2011). Reality id Broken: Why Games Make Us Better and How They Can Change the World. Penguin Books.p.8. ISBN 978-1-59420-285-8.

Pawel (2011). Beginning Android for Game Development.

<https://www.safaribooksonline.com/library/view/beginning-android-4/9781430239871/s001-001.html> (Mario Zechner, 2011)

Prensky, Marc. "From Digital Native to Digital Wisdom" (PDF).marcprensky.com Marc Prensky. Retrieved 4 April 2015.

Prensky, Marc (October 2001). "Digital Natives, Digital immigrants". On the Horizon. 9 (5): 1\_6.doi:10.1108/10748120110424816

Rouse, M (2012). Agile programming. Iterative Development  
<http://searchsoftwarequality.techtarget.com/defenition/iterativedevelopment> (Margaret Rouse, 2012)

Stolzer, J.M. (January 1, 2007). "The ADHD Epidemic in America." Ethical Human Psychology and Psychiatry. 9 (2): 109-116.doi:10.1891/1152315007782021204.

Strickland, Eliza. (July 31, 2007) Play Peak Oil Before You Live It Archived 2018-12-31 at the Wayback Machine., Salon.com. Retrieved April 2, 2010

Syer, M. D. (2013). Emperical Studies of Mobile Apps and their Dependence on mobile platforms.  
[http://sail.cs.queensu.ca/Downloads/2013\\_EmpericalStudiesOfMobileAppsAndTheirDependenceOnMobilePlatforms.pdf](http://sail.cs.queensu.ca/Downloads/2013_EmpericalStudiesOfMobileAppsAndTheirDependenceOnMobilePlatforms.pdf) (Mark D. Syer , 20143).

Wilson, David Mckay, "Jane McGonigal: Real Gamer"(PDF).  
Fordham.edu. Retrieved 2 October 2012