2 Chapter 2: Theoretical Foundation

CHAPTER 2

THEORETICAL FOUNDATION

2.1 Theoretical Foundation

Children, especially as young as kindergarten students need something more interactive, exciting and magical. Their creative minds need stimuli, active minds need challenge and flexible minds crave to be shaped. A great childhood growth ensures a great grown individual. Having difficult clients (these children) to satisfy, this project then should look at all foundations that are important to support the outcome of the proposed educational game. What should the game be based on? What theories are taken into consideration in designing the game? These questions would be answered bellow.

2.1.1 Theories of Education

Education is defined as activities that impart knowledge and skills; the gradual process of learning; knowledge acquired by learning and instruction [http://wordnet.princeton.edu/]. Since education is critical and essential, it is no wonder that many studies education itself and creates theories on education. Although theories on education are numerous and all are equally important, we only would be discussing a few theories that are related to this topic research. They are the theories of development in

learning, psychology of child development and visions on game based learning. This section of the paper will talk more of education, game and how these two combined will support the proposed educational game as well as a brief summary on recent conditions of today's educational games in the market.

2.1.1.1 Theories of Development in Learning

There are three theories of development and learning for children as young as three years old. They are the Maturationist Theory, environmentalist theory and constructivist theory.

Maturationist theorists believe that development is a biological process that occurs automatically in predictable, sequential stages over time (Hunt, 1969). Maturationist followers assume that their children will acquire knowledge naturally and automatically, provided they are healthy. Parents and teachers who are maturationist followers believe that their children should practise reciting alphabets and numbers while the parents patiently wait until the children are ready for school. I believe this theory is still used in some parts of the world. In some primary schools, it is forbidden for children aged less than six years old to enter 1st grade, even though they are capable of learning and they are ready. In maturationist theory, if any child's performance is below their peers, maturationists might suggest referrals to

transitional kindergartens, retention, or holding children out of school for an additional year (DeCos, 1997).

Environmentalist theorists believe the child's environment shapes learning and behavior; in fact, human behavior, development, and learning are thought of as reactions to the environment. Environmentalists believe that children are ready for kindergarten when they are able to respond to their environment appropriately such as following the rules and regulation, group activities, good behaviour, etc. They believe that children learn best by rote activities such as reciting alphabets over and over, copying letters, tracing numbers, etc. At home, parents who follow environmentalist approach usually gives their children workbooks with colouring, tracing and other activities that require very little interaction between the children and their parents. To environmentalists, when children have problems responding appropriately to their learning environment, these children are labelled with some form of learning disability and are tracked in classrooms with curriculum designed to control their behaviour and progress. I believe this theory is quite evident in some kindergartens and schools where children are asked to memorize alphabets, colour and trace while the children are really dependent on teachers to initiate any activities in the classrooms.

Last but not least is the constructivist theory. Constructivists believe that children are ready for learning when

they can initiate many activities with the people and environment around them. This is because constructivists believe that children learn from interaction with environment and they are active participants in the learning process, thus they need interaction with environment to learn and develop. Constructivists lean a lot on interaction and interactivity so they pay close attention to early childhood classroom, its curriculum and physical environment. The classrooms, according to constructivists, should be equipped with toys that children can play with and manipulate. Proper activities that constructivists believe to support good development of children are reading, story-telling activities, picture books with large prints, puzzles such as building blocks that stimulate interaction, etc. Constructivists usually have direct communication with children and encourage children to be involved in daily household activities that helps introduce children to numbers, counting and letters. When a child gets left behind, constructivists give him/her special attention and customize learning materials to help the child overcome his/her difficulties. I believe there are only very few kindergartens or school that apply constructivist theory, although there are more and more researchers that understand and view constructivists as a good theory for child development and learning, their views are not brought into practise yet.

Having explained the three theories of development, I could notice that the theory is practised in order of time. Maturationist theory is practised way back in the old days of around 1980s, while environmentalist theory is practised from then on until today. However, constructivist theory is practised now by very few educators' organization and is viewed as a modern way of learning.

2.1.2 Theories of Child Development in Psychology

Psychology study started to produce theories of development when a boy was found in France on January 8th, 1800. Similar to Tarzan[1], he did not understand speech, spurned prepared food, tore clothes people tried to put on him. He was probably abandoned by his parents or lost his parents at a very young age but the time of the loss was uncertain. He was then called Victor and was sent to a school in Paris for children who were deaf and mute. At 1800, a time of intellectual and social ferment, when a new scientific outlook was beginning to replace mystical speculation, philosophers debated questions about the nature of human beings – questions that would become central to the study of human development. Victor, appearing during that time, was turned over to Jean-Marc-Gaspard Itard, an ambitious practitioner of the emerging science of psychiatry. Itard took Victor to his home and in the next five years gradually 'tamed' Victor with the use of methods that were far ahead of

[1] Disney character: a boy who grew up with gorillas.

their time. Although Victor's progress was remarkable, he never learned to speak and later live with the house's housekeeper until his death in his early forties in 1828. In this study, Itard's methods to educate Victor showed to be one of the very first systematic attempts to study human development. Source of information about the wild boy of Aveyron are Frith (1989) and Lane (1976).

By right, children not isolated or are suffering from autism, should have the correct development progress marked by most psychology study on human development. Any children could be late a step or two in the chart but should not be far behind the supposed mark of progress. The theories of development in psychology are important to be considered in this paper as theoretical foundation because the implementation of an educational game does not only look at education progress of children but at the whole development progress. This also helps game designers to be able to introduce 'flow'[1] by knowing the children's development in physical, neurological, cognitive, language, emotional, social, self/gender/identity and moral.

[1] Also known as pleasures of game play characterised by Malone (1980)

Taken from: Human Development by Papalia, Olds, Feldman. Tenth Edition McGraw Hill

Age	Physical Development	Neurological Development
3-4	Child can copy shapes and draw design	Brain is about 90 percent adult weight
	Child can pour liquids, eat with silverware and use toilet alone	Handedness is apparent
	Child dresses self with help	Myelination of pathways related to hearing is complete

Table 2 – Age 3-4 Psychology development: Physical & Neurological

Age	Cognitive Development	Language Development
3-4	Child understands symbols	Vocabulary, grammar and syntax are improving and more complex
	Autographical memory may begin	Emergent literacy skills are developing
	Child engages in pretend play	Private speech increases
	Child can do pictorial calculations involving whole numbers	
	Child understands fractional quantities	

Table 3 – Age 3-4 Psychology development: Cognitive & Language

Age	Emotional Development	Social Development
3-4	Negativism peaks; temper tantrums are common	Child shows increasing interest in other people
	Little explicit awareness of pride and shame	Pretend play has sociodramatic themes
		sibling conflicts over property are common

Table 4 – Age 3-4 Psychology development: Emotional & Social

Age	Self/Gender/Identity Development	Moral Development
3-4	Children play with others of same sex, reinforcing gender-typed behaviour	Altruism and other prosocial behaviour become more common; motive is to earn praise and avoid disapproval
	Self-definition focuses on external traits	Guilt and concern about wrongdoing peaks
	Thinking about self is all-or-none	Moral reasoning is rigid

Table 5 – Age 3-4 Psychology development: Identity & Moral

Table 2 to table 5 show the developments of children categorized into types of development. It makes it easier for us to study the developments. In my opinion, based on the developments occurring at the age of 3-4 years old, those traits that could be related or taken account into making the proposed educational game are that child shows increasing interest in other people, understands symbols, autographical memory begins, engages in pretend play that has socio dramatic themes, motive is to earn praise and avoid disapproval and that emergent literacy skills are developing.

These traits of development at this particular age range should be taken into account when making any educational game. Therefore, aside from being fun and teaching children, games could be made to really fit the children according to their studied developments.

The above are the developments of children from three to four years old. Below I would list the developments of children from five to six years old. Although sometimes we could not really see what the

differences are anyway, studies have shown that developments are quite different for each age group to another. By understanding the different traits and key characteristics and behaviour; and how developed children are to becoming adults, it would then be easier to adjust educational games to fit into the children and induce 'flow'.

Taken from: Human Development by Papalia, Olds, Feldman. Tenth Edition McGraw Hill

Age	Physical Development	Neurological Development
5-6	Child can descend stairway unaided, hop, jump and change directions	Brain is almost adult size, but not fully developed
	Child dresses self without help	Cortical regions connected with language are maturing
	Primary teeth begin to fall out, replaced by permanent teeth	

Table 6 – Age 5-6 Psychology Development: Physical & Neurological

Age	Cognitive Development	Language Development
5-6	Theory of mind matures; child can distinguish between fantasy and reality	Speech is almost adultlike and spoken vocabulary is about 2,600 words
	Encoding, generalization and strategy construction begin to become more efficient	Child understands about 20,000 words
		Child can retell plots

Table 7 – Age 5-6 Psychology Development: Cognitive & Language

Age	Emotional Development	Social Development
5-6	Negativism declines	Patterns of bullying and victimization may be established
	Child recognizes pride and shame in others, but not in self	

Table 8 – Age 5-6 Psychology Development: Emotional & Social

Age	Self/Gender/Identity Development	Moral Development
5-6	Sense of competence is developing	Moral reasoning is becoming less inflexible
	Self-concept links various aspects of self, mostly in positive terms	
	Gender constancy is achieved	

Table 9 – Age 5-6 Psychology Development: Identity & Moral

2.1.3 Relation of digital game based learning with related theories

2.1.3.1 The Theories of Development related to games

Development of children could be divided into three categories to make it easier to explain. They are social development, intellectual development and emotional development. Our children are indeed precious and they are like clays, ready to be moulded. We do all know that children learn anything faster. However, how fast children learn depends on what theories of development and learning we implement.

I believe by implementing constructivist theory, children can learn better and develop faster than their peers who learn and

develop with other theories of development; that is to say maturationist and environmentalist theories. Children love to play and indeed when playing, they are interacting and by interaction, learning is enhanced and children can pay attention or focus better because they enjoy the process. Educational computer games today bring children the pleasure of play as well as the lessons they need. Even if the computer games do not fall into the genre of educational, I still believe children still have much to learn from these games.

How constructivist theory relates to games is the way constructivist learners and game players behave the same way.

Designers of constructivist learning take into account: [Robinson, 98] ➢ To provide an experience with the knowledge construction process ➢ To provide experiences encouraging appreciation of multiple perspectives ➢ Embed learning in realistic and relevant contexts ➢ Encourage ownership of the learning process ➢ Embed learning in social experience ➢ Encourage multiple modes of representation ➢ Encourage self awareness of the knowledge construction process

Table 10 – Constructivist learning

I will explain all the points of the above and relate the similarity of constructivist learning and game playing.

Constructivist learning provides experience with the knowledge construction process. In games, this is very much the case as well. Game players, complex games specially, need to gather knowledge as they advance in the game, use the knowledge to construct a solution to win the game or overcome a problem they face in the game. Just the same with how constructivist learning should be, the game indeed gives players the experience with knowledge construction process. A clear example is the game "Lost In Blue 2"[1] that is a complex game and it certainly provides the players with the experience of knowledge construction process [10]. In the game, players are required to survive on an island. They need to have the knowledge that in order to survive the players need to eat and drink. As they play the game further, clues will be given to them as to where they can sleep in, how to cook, how to hunt, etc. The players, however, should use all the knowledge/clues given, to overcome hunger, thirst and energy levels. The players will learn that if they eat chicken, they can stay out of hunger longer, if they just eat coconut they will get hungry easily [6]. In this game, the players gain the experience with knowledge construction process.

Providing experiences encouraging appreciation of

[1] A survival game produced by Konami.

multiple perspectives is considered in constructivist learning. It is also provided in games. Some games have good side and evil side, especially complex games. In most complex games with storyline, the story tells the good side and evil side and sometimes the bridge becomes the grey area (most commonly the evil side turns out being forced into evil, etc). Game players, following the story would be exposed to the multiple perspectives of these sides in the game. Although whether or not the players manage to appreciate the multiple perspectives is beyond the game's power of decision, the game certainly encourage the act by having to either forgive the evil character at the end or let the character live or so on. A very good example of a game that provides the experiences that encourage appreciation of multiple perspectives is the "Final Fantasy"[1] series. The games are famous for the great storyline, game play and the tale that tells the story from two sides.

Constructivists believe in interactivity, therefore, it is a must for constructivists to embed learning in realistic and relevant contexts. Games also rely heavily on interactivity. A good game is a game that interacts with the players. To learn in realistic and relevant context, in my opinion, there is no other better tool than games; of course the games have to be simulation games. Some simulation games appear very real; being made with great graphics, exact physics calculation, great Artificial Intelligence

[1] A fantasy game produced by Square-Enix

(AI), etc. In most simulation games, players get to learn in a very realistic and relevant context. A good example is "Sims City"[1]. In the game, players need to build their own cities. They need to learn to balance all variables in the game such as money vs. building management, time, etc. Sims City represents the real learning in realistic and relevant contexts.

In constructivist theory, ownership of learning process is encouraged. What better way to encourage ownership of learning process than games that let you name the whole save slot your name or let you name the character in the game your name? Most games that have multiple slots of save-data lets you name your character or the save slot any name you'd like. This way, automatically, the players are made to feel ownership of their game which can be considered as learning process.

Constructivists believe in social experience as a way of learning. Games that could be played online or more known as online games provide social experience. Online games have been a hot topic or issue for many educators, some fear for over exposure to children, some are amazed at how networked children can be when online on the internet. Online games are a great way of learning based on social experience. Although some may argue that it is in virtual world, we could not deny that children that are online meet real people and have real conversation, although they

[1] A city-building simulation game produced by Maxis, EA games.

converse about which castle they should attack, etc. Learning in online games truly is embedded into social experience. A good example is any online games that require players to communicate, form together tactics, play together to achieve the same goal, group together and all sorts of communication that can build social experience that lead players to learn.

Encourage multiple modes of presentation is considered in constructivists and it is certainly materialize in most games. In games, 3-D games specially, presenting the game graphics comes in many modes for the players to choose. Aside from parading its “eye-candy”, games have multiple modes of presentation to make the players feel comfortable and customized. A good example is “The Sims”. In the game, the players can choose to view the game from above, sideways, or from the front.

When constructivists encourage self awareness of the knowledge construction process, the games do the same. The sentence above is more known as ‘reflection’. Although some games lacked reflection, there are still many games that reflect on the progress or process of the players after each stage or step is completed. The experience of the knowledge construction process earlier explained above came with an example of a game titled “Lost in Blue 2”. This game also encourages self awareness of the knowledge construction process. At the end of each day the player manages to survive, the game lets the player know of how many

food, tools he/she has in stock. Reflection is also visible in the game “Sims Theme Park” where at the end of each day in the game, players are shown how much they earned, their parks’ condition and what the crowd thinks about their theme parks.

Now that I have elaborated the listed common similarities between constructivist theory learning and what players are faced with in games, I would like to conclude that games indeed teaches or make players learn according to constructivist theory, although the players are barely aware of it. Constructivist learning depend so much on interactivity, the same way games do and that is why besides bringing children so much fun, the constructivist learning has been proven to be effective [21]. Therefore, by following constructivist designs that are listed and explained above, educational games would be fun to play with and at the same time are able to provide effective learning. Although examples explained so far are complex games, the thesis’s field project would take into account all the designs of constructivist learning into making the proposed educational game that accompanies this paper.

2.1.3.2 Literacy - how games help

There are many philosophies and reasons as to why human are of a more superior species on Earth. One of the most

important factors is communication through language. This is why, language is very important although sadly, only our grammar and language teachers seemed to be the only ones determined to stress the importance of language.

The development of language starts in babies as young as 9 months old as a form of survival instinct in human society. The fact is supported by Dr. Robert C. Titzer[22] who also found multi-sensory ways to teach infants how to read. Without realising the process, babies grow from no means of communication other than cries and gurgles to understanding voice intonation and finally to being able to understand command and speech. Further than this, are reasoning skill, social skill and intellectual skill. Language is embedded into and needed to form these basic skills.

Many know the importance of language. And many know to improve one's language they need to read books, take language lessons, have good language teachers and have parents who speak the language. However, many don't know that many computer games (not all) give great language lessons indirectly to players.

There are a few mini games that help develop good language vocabularies. The game "My word Coach[1]" that is played in Nintendo DS Console is a good educational game in literature. The game teaches players tonnes of new vocabularies, even to the most difficult and rarely seen vocabularies. When this

[1] An educational game developed with linguist by Ubisoft

game is obvious in its purpose of educating language, there are other games that educate children subconsciously. These types of games are much more preferred by children because they secretly educate.

Take into account a mini game such as "Wedding Dash[1]". The game specifies all kinds of food, bouquet of flowers, places of honeymoon the couple wants and the player have to pick the right combination. The players of course have to understand the instructions given by the game to advance better in the game. This is taken into 'comprehension' part of our regular language classes. Even though in this particular mini game comprehension is not so complex, there are other games that provide complexity which gives children a more complex comprehension. The games are called complex games.

Complex games are the ones that give most benefit. Complex games are not trivial (like the ones played in the old days). Complex games, like the name suggest are games that require understanding and manipulation of highly complicated system and "microworld" in order to win it. And in the process of winning the game, the players are required to finish sets of quests (depends on genre of complex games). The sets of quests of course give instructions that are complex and require more than what mini games require. The players have to understand the

[1] A wedding planner game that requires multi-tasking from players

instructions to be able to complete the quest. This gives the players comprehension skill and expands the players' vocabularies. The vocabularies of course depend on the type of complex game the children play. If the complex game is one about doctor, they would get to know a lot of new words in medication world, the one about building civilization would teach the players new words like terrain, plunder, civil, carapace, etc.

2.1.4 Other Theories of Games and Education

To include almost all theories mentioned or formed or even those supported by evidence in experiments would be too much, so I will only include some that I find convincing and appropriate for this paper.

A theory of learning by playing, especially computer games, is made concrete in many of the famous Marc Prensky's[1] theories, books and thesis. 'Learning by playing' researches have been growing rapidly although remaining novel; not many educators implement electronic games into education streams yet. As there are quite a lot of thesis, theories, books and papers that support the fact that electronic games help learning by playing[26], I will not be elaborating much on this but I will be giving a few quotes, theories and statements from a lot of researchers. This will further support and explain this paper's aim greatly.

[1] *Marc Prensky is an internationally acclaimed speaker, writer, consultant, and designer in the critical areas of education and learning.*

I will start with a book titled '"Don't Bother Me Mom – I'm Learning"' by Marc Prensky. In Part I of his book, 'Games are NOT the enemy', Prensky explained a lot on how playing video or electronic games helped children know better, gives them more benefits to be successful in working life when they are adults and so much more. According to Prensky, schools' curriculum puts a strait jacket on children's minds when they enter first grade and it will get worse when students go up the grades. This is because when children play games, they understand a lot of complex information, gets results (because games are interactive) and they can do so much more interesting fun things in the game. But being in school, in my opinion, where learning is done in conventional way, children feel restricted because they no longer have the freedom to express themselves, they do not experience the 'flow' that they usually do in games, they do not get to do 'trial and error' part that they usually do in games and information is not sought by themselves but taught by teachers, usually in a dictating way.

A paper by FutureLab [23] contains many theories others have made on games and education. "Certain researchers have focused on children's interactions with individual games in order to attempt to identify 'what children have learnt' from playing. Since games are often haracterized by a trialand- error approach to overcoming challenges or obstacles, commentators have suggested that these games can support the development of logical thinking and problem solving skills (Inkpen et al1995; Higgins 2000; Whitebread 1997). Much of this research has

focused on ‘strategy or adventure games’, which encourage students in exploratory quest-like scenarios with a high degree of control over their progress (Malone 1983; Russell 1990)” quoted from one recent paper work titled “Literature Review in Games and Learning”. Clearly, games and its effects have caught attention even in the fields of learning and education and this draws researchers into doing research in the bridge of games and learning. This paper however is different as it includes a proposed educational game that supports the thesis and research and comparative analysis.

2.2 Theoretical Framework

Many kindergartens practice different approaches of the theories of development and learning explained above. However, there are common grounds for the kindergartens for children development measurements. Most kindergartens have curriculum that defines what children should be able to do in order to pass to the next level or considered ready for learning in the first grade. Although the proposed educational game for this paper could be played by any children from 3-8 years old, the theoretical framework would look closely at kindergartens only. This would be easier since by seven years old children usually would have entered first grades and mastered simple sight words. Below is the curriculum example taken from a kindergarten in United States. Although not only language art or writing skills are needed in kindergartens, I will only discuss those skills appropriate to the title and content of this paper. Also, I have

chosen this particular syllabus of the kindergarten because it is easy to understand and is complete.

We could see that there are plenty of skills that kindergarten children need to master and kindergarten teachers need to teach. No mater the styles or theories used, these skills need to be mastered by kindergarten children in order to be ready for first grade. In my opinion, the right game could help the children in not only coping with the learning progress but enjoy learning and mastering the language art skills faster than his/her peers.

Error!

Language Arts Skills

- Follows multi-step directions
- Recites and writes the alphabet in capital and lowercase letters
- Identifies capital and lowercase letters in random order
- Matches capital and lowercase letters
- Identify sounds made by letters
- Develop phonemic awareness by using rhyming activities
- Read, write, and spell some basic sight words
- Understands that reading progresses from right to left
- Identifies characters, setting, problem, and solution in a story
- Predict the events of a story using pictures
- Retell a story using beginning, middle, and end

Writing Skills

- Dictates a sentence about a picture
- Writes from left to right
- Leaves spaces between words
- Writes some words independently
- Writes a sentence using sounds
- Uses punctuation in sentences
- Writes independently responding to writing prompts
- Writes first and last name

Taken From: http://www.evers.cps.k12.il.us/kindergarten_webpage.htm

Table 11 – Expected Kindergarten skills

In kindergartens, language skills are taught by teachers and the skills are combined with other skills such as mathematics and art. It is no doubt that teachers or caregivers play an enormous role in language by social interaction. However, in order for children to be able to read, they need to memorize letters, memorize how they sound when put together, memorize some basic sight words, etc. Some children enjoy memorizing while some others need a little persuasion.

Especially in today's world, where media fill the rest of the days of toddlers outside of kindergarten, children would probably prefer to watch television (a deadly double-edged sword in my opinion) than read a book. Watching television could improve their verbal language or understanding skills but indeed almost all TV programme come without subtitle except an educational TV programme that some children find boring, therefore, not really helping in teaching children how to read.