4-6 year old children and Digital Media

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What is the impact of Digital Media on our young generation? To what extent is Digital Media changing the way the 4-6 year olds learn nowadays and how can we, as developers, contribute in a positive way to this process?

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I certify that all material in this project which is not my own work has been identified.

Signature:

Abstract

This body of study looks at the impact of Digital Media on our young generation in general, and on 4-6 year old children in particular.

It compares the learning experience in the late 19th/early 20th century with the 21st century and analyses the extent of Digital Media being used in this process in today's educational institutions. A Questionnaire formulated to address this situation, brings valuable insights into the way education is being delivered in the Early Years Foundation Stage of an Infant School[1] in Plymouth, UK.

As an artist and developer myself, making the most of Digital Media throughout the creational process, I find it essential to look at how we, as a professional community, can make a positive contribution to this very important stage in a child's life, when they develop literacy and numeracy skills, as well as social and life skills in general.

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Introduction

In an age when, in any developed country, mobile devices are an absolute normal occurrence in any household, regardless of the social, economic and cultural background, the young generation is exposed to an enormous amount of information, through simply accessing the World Wide Web. We can probably say, that anything an individual might want to know, can be found in one form or another (via images, written text, videos, music files, etc), on the internet.

So, with children having access to this vast amount of information on a daily basis, are they being stimulated by the use of it, are they developing better, more rapidly, than the past generations? Are the 4-6 year old

children of 2014, using and satisfying their natural curiosity and exploratory nature, in the process of developing their literacy, numeracy and social skills, through the use of Digital Media?

This paper, looks at the concept of Digital Media, while researching the impact, this means of communication has, on the development and learning process of 4-6 year old children today.

The way teaching was delivered in the late 19th/early 20th century, is being compared to the 21st century, modern way of implementing the curriculum. Today's children learn in a very different way, in comparison to the older generations, due to the end goal of education having changed. If in the late 19th/early 20th century, students were being prepared to *aid* the *Industrial Revolution*, the 21st century students, are being trained to *sustain and enhance* a *Digital Revolution.*

This paper presents one approach to be considered by Media developers, myself included, for making a positive contribution, to this extremely important stage of a child's growth. At around 4 years of age, children are

being introduced to school and learning, they are buildinging social relationships with peers and teachers and are being encouraged to develop their sense of independence.

As a conclusion, this body of study looks at the role Digital Media plays in the 4-6 year old children's learning, with a focus on the positive contribution, developers can have in this process.

Chapter 1 What is Digital Media?

The term, “Digital Media”, is being used very frequently nowadays and it has started, slowly, to become a very high frequency word for the young generation. In order to answer the question, " What is digital Media?", I have spent a reasonable amount of time researching many websites, databases of words and journals, that contained parts, or entire articles, on various aspects of Digital Media. So, in order to find out about Digital Media, I had to use Digital Media. Somehow, an ironic situation.

In today's society, every person over the age of 16, has got at least one, and others, have got numerous, digital accounts, numerous digital personas: from Facebook[2] accounts, to Twitter[3], LinkedIn[4], Google+[5], SoundCloud[6], deviantART[7], YouTube[8], etc, to the day to day email accounts (which most people have several of, as well) - see Fig1.

Fig1-Cloud of social media examples [34]

According to Oxford Dictionaries[9], Digital Media does not have a definition of its own, but is broken down into its two components:

> *Digital* - "*involving or relating to the use of computer technology" and*
>
> *Media - "the main means of mass communication (television. radio and newspapers) regarded collectively".*
> (http://www.oxforddictionaries.com/)

So, if we analyse these two definitions for *digital* and *media* we can conclude that Digital Media can be considered as a means of mass communication involving computer technology.

The Business Dictionary[10] however, does provide a definition for the collective term of Digital Media, which is perceived as:

> *"Digitised content (text, graphics, audio and video) that can be transmitted over internet or computer networks"*
> (http://www.businessdictionary.com)

This seems a pretty clear and to the point definition: as long as *you* display text (digital letters, stories, memorandums, presentations), graphics (photos, paintings, drawings), audio or video (songs, messages, video recordings), via the internet, or in fewer words, as long as you make any form of information available for others to see, via the internet, *you are creating* Digital Media.

The range of population with access to Digital Media and actually making use of Digital Media, nowadays, in the developed countries, is immense. Children, as young as two, who use their parents' phone for simple games, have got the option to save sticker boards (digital rewards acquired for achievements in the game), or take photos of digital paintings they have done, in order to, later, share them with others, which means they both use and create Digital Media.

Simple day to day tasks, like paying bills or checking bus or train times, has forced the older generation (over 65 years old) to embrace the Digital Media revolution by having at least basic knowledge of the internet.

AgeUK[11], the largest UK charity working with and for the older generation, are actively educating and helping with integration of Digital Media in the daily routine of the over 55s, through a dedicated section on their website[12]. They are also promoting this aspect, through a competition called “Digital champion of the year”[13].

The 16-54 year olds, on the other hand, are the age group that seems to have embraced Digital Media as a normal daily routine, without which, they would probably find it difficult to function.

On the 29th of April 2014, OFCOM[14] has published a report[15] on adults' media use and attitudes, which provides detailed evidence on media use, attitudes and understanding, among UK adults aged 16+. It covers TV, radio, mobile, games, and the internet, with a particular focus on the latter.

This report[15] shows that:

> *Over eight in ten (83%) of adults now go online using any type of device in any location. Nearly all 16-24s and 25-34s are now online (98%), and there has been a nine percentage point increase in those aged 65+ ever going online (42% vs. 33% in 2012).*
> *The number of adults using tablets to go online has almost doubled; from 16% in 2012 to 30% in 2013. While almost all age-groups are more likely than previously to use tablets in this way, use by those aged 35-64 has doubled, while use by 65-74s has trebled; from 5% to 17%.*
> *Six in ten UK adults (62%) now use a smartphone, an increase from 54% in 2012. This increase is driven by 25-34s and 45-54s, and those aged 65-74 are almost twice as likely to use a smartphone now compared to 2012 (20% vs. 12%)."*
> (OFCOM, 2014)

One aspect to be taken away from this report[15], is that the UK population is gradually moving towards the mobile media platforms. In today's society, the easy access to smartphones and tablets, combined with the strength and capacity of the broadband networks, has encouraged the entire population to edge towards using one form or another, of mobile platforms. With smartphones being so accessible, an increasing number of adults are choosing that option, over the traditional phones. And this means that a larger part of the population has constant access to the internet. The new devices have been designed to be very intuitive, appealing to the older generation, hence the interest the 65-74 year olds are showing for these devices (up from 5% in 2012 to 17% in 2014)[15].

So, as a reflection on everything discussed up to this point, I can conclude that the term "Digital Media" refers to a mass form of communication, involving computers, tablets, phones and other forms of technology, adopted and used by the majority of the population, in larger or smaller numbers, depending on age groups.

Chapter 2 - The Learning process - Past and Present

In order to be able to discuss the effect of Digital Media on today's 4-6 year old children, I have looked at the way teaching was being delivered in the late 19th/early 20th century, and compared that, with the way teaching and learning are being implemented in today's schools.

Analysing the main aspects of the teaching process, in the two time periods chosen, a noticeable contrast can be noted, from the way the curriculum was formulated, to the attitude teachers and students have towards the learning process.

Taking into consideration learning theories developed over time, such as: *Constructivism* (Piaget, 1975)*, Socio-Constructivism* (Vygotsky, 1978) and *Constructionism* (Papert, 1991), Anne Shaw, Founder and Director of 21st Century Schools[16], has created a table shown in Appendix 1[17] (Shaw, 2013), where she isolates and compares the key areas of teaching in the 1960s United States of America, with the 21st Century schools.

The key aspects discussed by Shaw (Apendix1)[17] are:

1. the way the information is being presented and conveyed to the students,
2. the source of information,
3. the way the curriculum is being formulated,
4. the student approach and their learning attitude,
5. students individuality,
6. both tutors' and students' expectations

Before discussing each individual aspect in more detail, I would like to compare the backdrop on which education was/is being delivered in the two time periods chosen.

The late 19th/early 20th Century was dominated by an Industrial Revolution, so the education system was tailored to fit the context, children were being simply prepared to fill the jobs waiting for them at the end of their studies.

> *Children were regarded as raw materials to be efficiently processed by technical workers (the teachers) to reach the end product* (Bransford, Brown, Cocking,2000)

Nowadays, we are witnessing the development of a *Global Economy* which requires different skills from the participants and no doubt, the 4-6 year old children who are in education today, will be the ones expanding its horizons.

> *"New technologies are revolutionising the nature of work everywhere. ...New forms of work rely increasingly on high levels of specialist knowledge, and on creativity and innovation. ...Given the speed of change, governments and businesses throughout the world recognise that education and training are the keys to the future and they emphasise the vital need to develop powers of creativity and innovation."*
> (Robinson, 2011)

I will now take each aspect of the learning process listed above and compare the way it was being presented/delivered in the two time periods chosen (late 19th/early 20th century and today).

1. The way the information is being presented and conveyed to the students.

In the late 19th/early 20th century, learning was *textbook driven*[17], the

students had to learn what was presented to them in the books allocated by the school, all being standardised, age appropriate material.

The classroom setup was different as well, with benches being organised in rows, all facing the teacher, as he/she was the *centre of attention, main provider of information*[17]. Peer communication was not encouraged, and in many cases, it was not allowed, as that would distract the student from focusing on the teacher.

Today's classroom is *driven by exploration, creativity and 21st century skills*[17]. With the birth of the internet and the vast amount of information provided through it, today's students have a self directed learning approach, *research driven*[17] where the teacher is a *facilitator/coach*[17]. *Performances, projects and multiple forms of media are used for learning and assessment*[17] encouraging experiential learning, learning through hands on experiences, through trial and error, as promoted by Papert, who was

> *a strong believer in the ideas that momentary losses are a key to learning, and that people are good at using what they don't know as a lever to grow* (Ackermann, 2004)

2. The source of information

In the late 19th/early 20th Century the majority of information was accessed via books and/or teachers. The situation is slightly different in the current period, due to the vast databases of information available, but also due to a different approach taken by educators.

Globalization as the "*the process by which the world is becoming increasingly interconnected as a result of massively increased trade and cultural exchange " (BBC, 2014)*[16]*,* has created a world where teaching is not necessarily classroom based and teacher lead, but it has moved towards independent research, where *learners work collaboratively with classmates and others around the world*[17] being part of and contributors to a *Global Classroom*[17].

The dawn of Massive Open Online Courses[18] and the increase in the number and reputation of providers[19], has led to a young generation of students developing independently in numerous areas of study. This has empowered them and helped the young generation establish their place as unique and invaluable "shareholders" of the Global Economy.

3. The way the Curriculum is being formulated

In the late 19th/early 20th century, the curriculum was *fragmented*, with *lessons focused on the lower level of Bloom's Taxonomy*[17] (see Fig2)

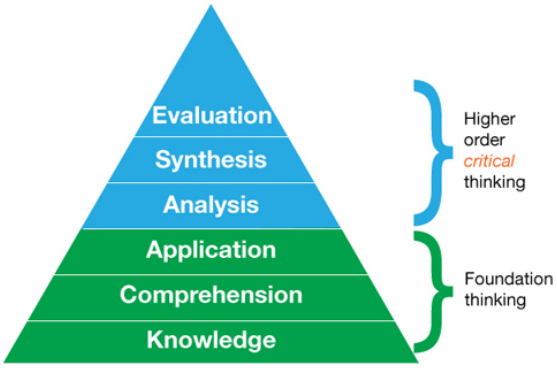

Fig2 - Bloom's Taxonomy - (hierarchy of learning objectives) RMIT, 2012) [33]

The focus of the late 19th/early 20th century education was on *memorization of discrete facts*[17], which led to

> *students spend(ing) most of their time learning facts from a lecture or text and doing the problems at the end of the chapter* (Bransford, Brown and Cocking, 2000)

However, today's educational system delivers an *integrated and interdisciplinary curriculum*[17], which means that students can use the knowledge acquired in one subject for developing projects in completely different areas of study. This caters very well for the unique, personal

development of each individual student. *The curriculum is connected to students' interests, experiences, talents and the real world*[17].

In today's education system, there is a new integral "participant" - technology, which

> *can help to create an active environment in which students not only solve problems, but also find their own problems.* (Bransford,Brown and Cocking, 2000)

Today's curriculum appeals to the students' natural curiosity and imagination, helping them develop essential life skills, such as adaptability, initiative, entrepreneurship.

4. The students' approach and their learning attitude

The students' freedom in the learning process was next to nonexistent in the late 19th/early 20th century. Decisions regarding the way curriculum was delivered, belonged to the educators. That led to passive learning, where children were taught facts and events, out of context, in a very dry manner.

Nowadays children are assimilating a lot more information through active learning, through hands on experiences and experiments. Making the

connections between studies and everyday life, raises today's students' curiosity and interest in the learning system.

Active learning or experiential learning, was at the centre of a few studies along the years, even though it only started being applied in schools in the recent years.

When discussing experiential learning, D.A.Kolb (Kolb, D.A., 1984), talks about a few characteristics that define this process. Analysing the learning process in today's educational system, we will recognise these characteristics as being at the very centre of it. Kolb said that:

- *Learning is Best Conceived As a Process, Not In Terms of Outcomes*
- *Learning Is a Continuous Process Grounded in Experience*
- *Learning Is a Holistic Process of Adaptation To the World*
- *Learning Involves Transactions Between the Person and the Environment*
- *Learning is the Process of Creating Knowledge*

(Kolb, D.A., 1984)

All of these aspects mentioned above, have not been supported by the late 19th/early 20th century education system, that heavily promoted *standardised testing*[17] leading to a very homogenous society.

That has changed however, and today's education system can create very strong links with any sector of the Global Economy, offering students the chance to become the best they can be. In return, the students' interest and approach to the learning experience has changed and they are more actively involved in their education.

5. Students' individuality

In the late 19th/early 20th century, diversity in students was ignored, everyone was treated the same, all the students were part of a generation aimed at fulfilling the scope of the Industrial Revolution. Teaching was delivered based on a factory model, taking into account the needs of the future employers.(Bransford, Brown, Cocking,2000)

This is not to be dismissed, as that was what the society needed, and needs were simply being satisfied.

However, with the evolution of our society, it is absolutely normal that individuality became paramount. If today's young generation is to become the driving force of the ever so rapidly developing Global Economy, it is

absolutely necessary that the 4-6 year old children today, start to develop their own unique skills and personalities from this a young age.
Through Digital Media, 4-6 year old children today, *can mess around with otherwise risky ideas, on safe ground* (Ackermann, 2004), they can test and discover aspects of their personalities, they can develop aptitudes and skills that the children in the late 19th/early 20th Century were not able to do, due to lack of instruments/equipment/media.

6. Both tutors and students expectations

The attitude towards teaching in the late 19th/early 20th century is another aspect that was different. Teachers used to be the main *source of knowledge, and only judge, they were the only ones seeing the students' work*[17]. The gap in knowledge between teacher and student in the late 19th/early 20th century, led to teachers being the *centre of attention and the only information provider*[17], which in return, created very low expectations from them regarding students achievements. Combining this, with the multitude of subjects taught in schools and lacking

relevance for future employment, led to a lack of interest from students and the idea of school being *meaningless and irrelevant*[17].

Learning today is being evaluated by looking at individual progress. If the students have grown as individuals at the end of each stage, the teaching structure and processes involved, are considered to be optimal. The focus is now, on " *what students Know, Can Do and Are Like, after all the details are forgotten*"[17].

With the focus moving towards personal development, the society and the education body has accepted that each child is a unique character with different interests, different capabilities and different motivation. The teacher has become *a facilitator, a coach*[17], while the student becomes the main focus of the educational curriculum.

Research is nowadays at the centre of the learning process, promoting the active learning approach. The majority of work in today's schools is revolving around students' interests, and this promotes the sense of ownership, creating open minded adults, ready to face the world when leaving any Educational Institution.

Due to the *multiple forms of media being used for creating and assessing their projects*[17], today's students (as young as 4) are being introduced to, and forced to drive forward the Digital Media Revolution.

As a conclusion, the late 19th/early 20th Century educational system was standardised and mainly test driven, aspects imposed by the socio economic environment at the time. Schools had the role of preparing the next generation of workforce required by the Industrial revolution.

The development of a Global Economy in the recent years, has led to today's education system nurturing the growth of individuality and uniqueness in its future contributors. The approach taken by the 21st century education, empowers the students to take charge of their learning experience, helping create a generation of passionate, literate, and highly educated citizens of the world.

Chapter 3 - The role of Digital Media in the learning process of 4-6 year old children

In 2001, Barbara A. Wasik and Mary Alice Bond have written an article in the Journal of Educational Psychology regarding a study that has been done on the effects of interactive book reading, on the language and literacy development of 4 year olds from low income families.

> *"The effects of a book reading technique called interactive book reading on the language and literacy development of 4 yr olds from low-income families were evaluated. Teachers read books to children and reinforced the vocabulary in the books by presenting concrete objects that represented the words and by providing children with multiple opportunities to use the book-related words. The teachers also were trained to ask open-ended questions and to engage children in conversations about the book and activities. This provided children with opportunities to use language and learn vocabulary in a meaningful context. Children who were in the interactive book reading intervention group scored significantly better than children in the comparison group on Peabody Picture Vocabulary Test—III* [31] *and other measures of receptive and expressive language. Book reading and related activities can promote the development of language and literacy skills in young children." (*Wasik, Bond, 2001)

What Wasik and Bond have shown us, is that, reading interactive books, in the right environment, (with the adequate supporting staff), will develop the vocabulary of 4-5 year old children (Wasik, Bond, 2001) . A very significant statement, yet it does not fully support the idea that Digital Media is enhancing the development of 4-6 year old children, as interactive books, are but one side of Digital Media.

When analysing the learning process of today's 4-6 year old children, a special mention must be made about Bing Nursery School[20] (part of the School of Humanities and Sciences at Stanford University). The ethos of this unique school, is based, mainly, on learning through play, and it has been since 1966 when it was launched. And with play being considered as *"...the highest expression of human development in childhood for it alone is the free expression of what is in a child's soul*." (Froebel, 1825), it establishes a very nurturing environment for young children.

Jean Piaget, the Swiss developmental psychologist and philosopher known for his epistemological studies with children, supported the idea of

learning through play, putting an emphasis on the fact that children not only learn, but they develop essential skills through autonomous play. According to Piaget,

> *". . .each time one prematurely teaches a child something he could have discovered for himself, that child is kept from inventing it and, consequently, from understanding it completely."* (Piaget, 1970, p.715)

So, children not only learn through play, but that is how they form their personalities, they develop essential transferable skills from a very young age. They take each experience they go through, and add it to their vat of knowledge, storing it, ready to be used in future similar situations, through a process identified as Schema[21].

In today's education system, learning has been accepted as being an active process necessitating hands on experience, and in the case of the 4-6 year old children, this experience is called "*Play*". Piaget has put forward the Theory of Cognitive Development, (Piaget, 1970), according to which, children in the 4-6 year old age group, are part of the Preoperational Stage (of cognitive development). Through observation, it

becomes clear that in this stage, children become capable of using symbols and grow very fond of playing pretend.
Most children in this age category have got an imaginary friend, who they talk to, they will all play princesses and knights, or Mums and Dads, and this aspect of the children's development, underpins the importance of Digital Media at this stage.

Through clever use of digital games and interactive stories, children aged 4-6, will be able to enter the imaginary world of a stuffed toy and live its adventures (in the case of Winnie the Pooh), or learn what it would be like to be a princess in a far away land. This however, does not imply that children should exclusively use this type of Media in the process of cognitive development.

But through Digital Media, children can explore imaginary spaces and test the most innovative and unheard of ideas, allowing them the opportunity to fail and learn from their experience, allowing them to satisfy their natural born curiosity and exploratory nature.

Digital Media can be used as an experimental space for creating and developing new concepts. Children feel more relaxed, they feel empowered when being in charge of testing the boundaries of science, when autonomously studying, for example, the effects of inverting gravity, of flying through space or walking with dinosaurs. These experiences can not be replicated in a real environment, so through Digital Media they explore, discover and develop their interests and personalities, this is how they nurture their passions and most importantly, this is how they can develop into tomorrow's innovators.

> *I claim that computation is by far the richest known source of these ingredients. We can give children unprecedented power to invent and carry out exciting projects by providing them with access to computers, with a suitably clear and intelligible programming language and with peripheral devices capable of producing on-line real-time action.* (Papert, 2005)

And because we said that today's 4-6 year old children learn to develop into tomorrow's innovators, we must mention T Wagner**,** a prominent educator, author and founder of Harvard's Change Leadership Group, who believes that

> *Innovation is today's most essential, real-world skill and what young people need from parents, teachers and employers… (Wagner, 2012)*

In his book, "*Creating Innovators - The making of young people who will change the world*" (Wagner, 2012), Wagner devises 7 Survival skills that the young generation needs, in order to survive in today's society and in order to continue driving forward this development we are experiencing.

Here are the 7 survival skills according to Wagner:

1. *Critical thinking and problem solving*
2. *Collaboration across networks and leading by influence*
3. *Agility and adaptability*
4. *Initiative and Entrepreneurship*
5. *Effective oral and written communication*
6. *Accessing and analysing information*
7. *Curiosity and imagination*

(Wagner, 2012)

If children in the Foundation Stage of Education (4-6 year old) start developing these 7 survival skills, they are on a path to becoming assertive, knowledgeable young people, who will be able to function in any kind of situation.

Digital Media is slowly becoming one of the main channels for delivering and implementing all, or at least some of the 7 Survival Skills through the educational process, in a very fun, enjoyable and innovative way.

To be able to form an opinion on the role Digital Media has in today's learning experience, I have searched for more relevant facts, UK sourced, in order to contextualise them better, from a Geographical perspective. This, has led to an in-depth study of the Statutory Frame for Early Years Foundation Stage as set by the Department of Education UK, in March 2014,(with effect from september 2014).

First of all, I must mention that the Department of Education believes, the Early Years practice should follow 4 Overarching Principles, when delivering the Curriculum for 4-6 year old children:

a. *every child is a unique child, who is constantly learning and can be resilient, capable, confident and self-assured;*
b. *children learn to be strong and independent through positive relationships;*
c. *children learn and develop well in enabling environments, in which their experiences respond to their individual needs and there is a strong partnership between practitioners and parents and/or carers; and*
d. *children develop and learn in different ways and at different rates.* (Dept. for Education, 2014)

Technology is briefly mentioned in this Statutory Frame, saying that

> *"... children recognise that a range of technology is used in places such as homes and schools. They select and use technology for particular purposes ".* (Dept. for Education, 2014)

Not giving clear instructions as to how technology should be used when delivering the curriculum, has allowed teachers to be creative and tailor the process to fit the students' interests.

Through a series of questions(Appendix 3) [38] I have asked academics involved in delivering the curriculum at the Early Years Foundation Stage of an Infant School[1] in Plymouth, UK, I have found that technology is, actually, at the centre of most activities in this particular setting.

When asked what kind of Digital Media are currently being used in their class, the teachers interviewed, have unanimously chosen, all of the following 3: eBooks, Digital Games and Internet (for research purposes). When the question arose whether there were any kinds of Digital Media tested before, in their class, that have not worked, 85.7% answered "No".

The remainder of 14.3% who answered “Yes”, have given “some interactive games” as an example of Digital Media that proved not useful. This however, strengthens the idea that Digital Media has been tested in their teaching process, and even though some forms were not as successful, these educators were not discouraged from using it and implementing the useful ones in their daily teaching process, as the answers to my next question will show.

When asked “What percentage Digital Media holds in the overall learning experience in their classroom”, out of the teachers interviewed,

14.3% answered - less than 25%

28.6% answered - 50%-75%

57.1% answered - more that 75%

This shows that Digital Media has found its way into the teaching process of the educators interviewed, and even though some of them might be slightly timid when integrating it into their daily routine, the majority of them have embraced it.

A very interesting fact, was that Digital Games were unanimously chosen as “the form of Digital Media that have helped the most with literacy,

numeracy and social skills in their class". So all teachers interviewed have agreed that, from their point of view, children in their class benefit the most in their learning journey, through the use of Digital Games.

But did children agree with this, do they show a preference towards this form of learning over others? When asked "Which type of Digital Media seem to be preferred by pupils in your class?" all the teachers interviewed, have given the same answer: "Digital Games".

When analysing Nature and Significance of Play, in his book *Homo Ludens*, J. Huizinga stated that

> ...*As a regularly recurring relaxation, {play} becomes the accompaniment, the complement, in fact an integral part of life in general. It adorns life, amplifies it and is to that extent a necessity both for the individual - as a life function- and for society, by reason of the meaning it contains, its significance, its expressive value, its spiritual and social associations, in short, as a culture function* (Huizinga, 1949).

So even though *Learning Through Play* is not at all a new concept, the Digital Media Revolution seems to have made it much easier for today's generation of teachers to apply this concept and maximise the experience

children get from the education system, transforming it into a more enjoyable, yet much more productive learning experience.

After establishing that Digital Media *is* being used in the teaching process in this particular setting[1], my next question was “Which kind of Digital Media is most frequently used in your classroom?”. Out of four possible options (eBooks, Digital Games, Internet for research and Other), all the the teachers interviewed have answered: “Digital Games”, while 14.3% have also added eBooks and Internet for Teacher’s resources as secondary tools.

So as a conclusion, Digital Games seem to be the preferred form of Digital Media in the Early Years Foundation Stage of the Infant School[1] in question. They are embraced by both teachers and pupils and it seems to be the teaching resource that has got the best results.

In the United States of America a few pioneering enterprises have been set up, with the main goal being, the use and development of Digital

Media in a learning environment. The documentary Digital Media: New learners of the 21st Century[23], analyses and explains the reasons why these initiatives have been developed, it observes the impact Digital Media used in an educational setup has on children, while experts (Dr. Henry Jenkins, Dr. James Gee, Dr. Katie Salen) present the importance of embracing Digital Media and the place this form of communication has in the learning process of the 21st Century.

Gee says that the educational journey should generate students who are

> *…able to solve problems with what [they] know, able to use facts and information as tools for problem solving in a specific context.* (Gee, 2011).

This statement stresses the importance of preparing the young generation for becoming independent, self sufficient individuals, the young innovators of tomorrow.

In 2000, Dr. Wartella, Dr. O'Keefe and Dr. Scantlin have collated a great amount of research on children and Interactive Media into a Compendium concluding that:

> *Children learn and grow socially, intellectually and even physically through playing games (*Wartella, O'Keefe, Scantlin; 2000*)*

Today's children play and learn just as their counterparts did in the late 19th/early 20th Century, however, these activities nowadays, tend to involve, increasingly, the term "Digital Media".

A few pioneering institutions[24],[35],[36],[37] have been set up to promote this way of teaching, which is supported by

> *...exceptional educators [who] are increasingly using digital media and interactive practices to ignite their students' curiosity and ingenuity, help them become civically engaged, allow them to collaborate with peers worldwide, and empower them to direct their own learning.*
> *(*Public Broadcasting Service, 2011*)*

These institutions not only encourage the young generation of students to use Digital Media in the learning process, but also empowers the older generation of educators to become the promoters of this form of learning. Digital Media can play a very significant role in today's education system, where teachers and students can learn together, through the mediating role of it.

When children as young as 5 are being introduced to, and encouraged to use programming software like Scratch Jr[25], (developed by scientists at MIT[26]), through which they *can program their own interactive stories and games*[25], we can posit that Digital Media plays a very important role in today's education system, from a very early stage.

A few other examples of Digital Media products created especially for the Early Years Foundation Stage, and used by teachers as resource material, can be found here [27].

Chapter 4 - How can developers play a positive role in the development of 4-6 year old children?

The partnership between Digital Media and Education would not be possible without the contribution of an extremely large community of developers.

These developers contribute and support, on a daily basis, the Digital Media expansion. However, not all digital products have a positive impact on the development of 4-6 year old children.

There is a strong relationship that needs to be taken into account, between children's developmental stages, as described by Jean Piaget (Piaget, 1970) and Digital Media targeted at this young generation.

And this, leads to the next question: How can we, as developers, contribute in a positive way, to this extremely important stage of a child's growth?

Between the ages of 4 and 6, children are just being introduced to school and learning, they are building social relationships with peers and teachers and most importantly, they are being encouraged to develop their sense of independence.

Digital Media plays a very important role in this process, with the use of it in both homes and educational institutions at present, being rather large.

In 2013, Common Sense Media[28], has conducted a survey on 1463 parents of children 0-8 in the US, asking which media activities their children engage in, at least once per day.

The results shown in Fig3 conclude that nearly 1 in 5 children use mobile devices every day.

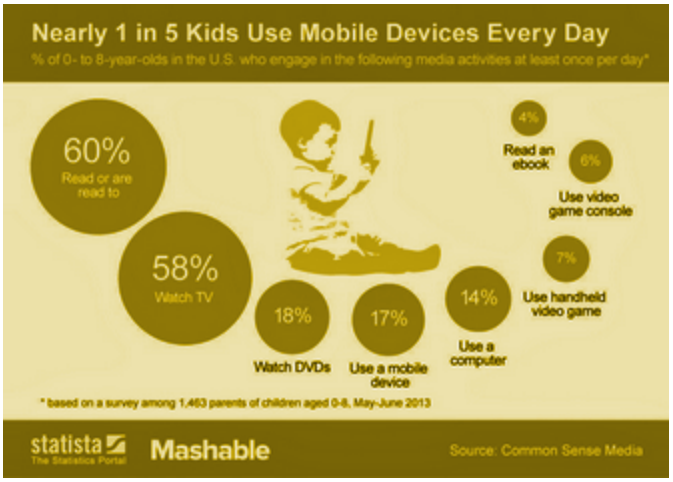

Fig 3 - Common Sense Media,2013[32]

A recent BBC[29] report shows that

> *Almost 70% of primary and secondary schools in the UK now use tablet computers, according to research.*
> (BBC News Education and Family, Dec 2014)

All this data shows that Digital Media is a significant part of a child's life, both at home and in school. However, without developers,there would not be any Digital Media.

This is why, the community of developers designing for this age group, play a significant role in the 4-6 year old children's growth.

Placing the spotlight on developers and making them key contributors to children's progress from toddlers to "big kids", as Debra L. Gelman calls them (Gelman, 2014), might sound like they have all the power. However, as Voltaire once said : "noblesse oblige", or in translation - with great power, comes great responsability.

And this responsibility lying on the developers' shoulders, is to make their contribution, a positive one, one that will help a healthy cognitive development for this very young generation, and one that works hand in

hand with scientific studies proven to stimulate literacy, numeracy and social skills for the very inquisitive 4-6 year old children today.

In her book "*Design for kids. Digital products for playing and learning*" (Gelman, 2014), Gelman has synthesised a few aspects that developers need to take into consideration, when designing for this age group.
In the table presented in Appendix 2[30], Gelman has analysed the main characteristics for this age group (4-6 year old, which she calls "the muddy middle"), interprets in simple words each individual characteristic, and gives a few directions for digital developers aiming their designs at 4-6 year old children, to follow, in order to achieve an entertaining product.

When designing for children, there are quite a few aspects to be taken into account. For example, the audience/end user is not just the targeted age group, meaning that children in the 4-6 year old category, for example, are not able to independently acquire/download any product, they need help/consent from their parents, teachers, or older siblings.

So the digital product does not only need to appeal to the children, but needs to also get the consent of the older generation too.

As a community of developers, we need to make sure that our products appeal to the newly acquired *empathy* skills, *intense curiosity*, *wild imagination and increased memory function*[30] of the 4-6 year olds, without creating too many distractions, as they are *very easily sidetracked* [30] at this age.

One way of doing this, is to follow Gelman's advice and:

1. *Make interactions feel more "social," even if the kids aren't actually communicating with others.*
2. *Set attainable goals for the tasks and activities you create. Provide context-based help and support so kids have an easier time processing information.*
3. *Keep activities simple, short, and rewarding. Provide feedback and encouragement after milestones.*
4. *Make "rules" for play/engagement as basic as possible and allow for a lot of invention, self-expression, and storytelling.*
5. *Include multi-step activities and games, with more than one main goal (for example, touch the red stars and green apples to get points of different values)*.[30] (Gelman, 2014)

When interviewing the teachers of the Infant School[1] in Plymouth, UK, another question put forward, was: “What type of Digital Media would you like to see more of, in your classroom environment?”.

The answers received, are very interesting and exciting at the same time. One teacher replied : “Digital Media that is simple to use and enables children to easily record moving images and sound”, while another would like to see more of “new exciting interactive games covering all aspects of curriculum and not just Literacy and Math”.

With each teacher having an individual approach when implementing the curriculum, the community of developers must make sure that each aspect is being thoroughly researched and satisfied through the digital products they create.

Collaboration between Digital Media developers and educators is a very important aspect to be taken into consideration, if the final products are to support a healthy cognitive development for the 4-6 year old children.

If Digital Media manages to aid each aspect of the curriculum, from Literacy and Math, to Social Skills, Arts and Physical Education, while maintaining the fun and exciting aspects appealing to the children, we will

be able to say that us, as developers, are making a positive contribution to the development of this very young generation.

It is very important to keep in mind the 7 skills for survival, as described by Wagner, (Wagner, 2012) when designing for children, as this will create a sound structure for an efficient digital product.

To conclude what was discussed in this chapter, I believe that us, as a community of developers of Digital Media, play a significant role in the 4-6 year old children's cognitive development. And this leads to a great responsibility to create age appropriate material, products that will support a healthy growth. This can be achieved by thorough pre production research into all aspects related to the cognitive developmental stage (Piaget, 1970) of this "*muddy middle*" (Gelman, 2014) group of children and making it as a main reference point when designing a Digital Product.

Conclusion

This body of study, looked at the role Digital Media plays in today's learning environment in general, and in the learning process of 4-6 year old children, in particular. Through primary and secondary research, we can conclude that Digital Media is a very important contributor in today's classroom environment, starting with the Early Years Foundation Stage (as the main entry point into the education system for children) and all the way up to the end stages of education as well as extracurricular forms of education[24].

The documentary Digital Media: New learners of the 21st Century[23], has shown the significant part played by Digital Media in stirring the young generation's interest in education and empowering them to take charge of their own learning process.

The effect of using Digital Games on children's development, has been the subject of study for many and Hotz has concluded in 2012 that:

> *A three-year study of 491 middle school students found that the more children played computer games the higher their scores on a standardized test of creativity—regardless of race, gender, or the kind of game played.* (Hotz, 2012)

Regarding the contribution from the Digital Media Developers in this very important process of creating and growing young innovators, we can conclude that if the cognitive developmental attributes are being studied and taken into account when designing digital products, their contribution will certainly be a positive one. Also, creating a close bond between educators and media developers, will solidify a path towards healthy integration of digital products into the learning process from the earliest stages of education.

Further research is required before being able to have a conclusive, definitive argument regarding the role Digital Media plays in 4-6 year old children's development, however, one thing is certain:

> *Technology won't solve all of the problems of education. But in the hands of creative, talented and caring teachers and learners, it can help. (Magid, 2013)*

Glossary

[1] Hyde Park Infant School, Plymouth UK, Hyde Park Infant School, Hyde Park Road, Mutley, Plymouth, PL3 4RF, Tel: 01752 225493 http://hydepark-inf.plymouth.sch.uk/ (accessed on 27/01/2015)

[2] Facebook is a online social networking service that enable users to upload photos, links and personal messages https://www.facebook.com (accessed on 27/01/2015)

[3] Twitter is an online social networking service that allows its users to upload short messages (maximum 140 characters long), called “tweets” https://twitter.com (accessed on 27/01/2015)

[4] LinkedIn is an business oriented social networking service, mainly aimed at professional networking https://www.linkedin.com (accessed on 27/01/2015)

[5] Google+ is a social layer of Gmail account holders owned by Google Inc, designed as a form of identity service. https://plus.google.com/(accessed on 27/01/2015)

[6] SoundCloud is an online audio distribution platform allowing its users to create, share and distribute their originally created sounds. https://soundcloud.com/ (accessed on 27/01/2015)

[7] deviantART is an online art gallery and community of artists and art enthusiasts, that allows its users to share various forms of artwork produced and connect with eachother http://www.deviantart.com/ (accessed on 27/01/2015)

[8] YouTube is a video sharing website https://www.youtube.com/ (accessed on 27/01/2015)

[9] Oxford Dictionaries - an online dictionary of British English and American English from Oxford http://www.oxforddictionaries.com/ (accessed on 27/01/2015)

[10] Business Dictionary is a online business glossary with over 20000 terms. http://www.businessdictionary.com/ (accessed on 27/01/2015)

[11] Age UK - UK charity working with and for the older generation http://www.ageuk.org.uk/ (accessed on 27/01/2015)

[12] Technology and Internet - section on the Age Uk website, educating the older generation in all aspects related to technology and the internet http://www.ageuk.org.uk/work-and-learning/technology-and-internet/ (accessed on 27/01/2015)

[13] Digital Champion of the Year - competition launched by the charity Age UK, meant to encourage the older generation to make the "digital leap" and inspire others aged 55+ to do the same. http://www.ageuk.org.uk/work-and-learning/technology-and-internet/digital-champion/ (accessed on 27/01/2015)

[14] OFCOM - The government approved, independent regulator and competition authority for the UK communications industry http://www.ofcom.org.uk/ (accessed on 27/01/2015)

[15] Adults' Media Use and Attitudes Report 2014 http://stakeholders.ofcom.org.uk/market-data-research/other/research-publications/adults/adults-media-lit-14/ (accessed on 27/01/2015)

[16] 21st Century Schools - providers of professional staff development and curriculum design http://www.21stcenturyschools.com/ (accessed on 29/01/2015)

[17] Appendix 1 (see Appendix section of this document, page 55)

[18] MOOC - free non-degree online courses with open unlimited global enrollment to anyone who desires to learn, and regardless of their current educational level. http://www.moocs.co/ (accessed on 28/01/2015)

[19] Khan Academy https://www.khanacademy.org/ (accessed on 28/01/2015)
Coursera https://www.coursera.org/ (accessed on 28/01/2015)
Massachusetts Institute of Technology http://ocw.mit.edu/index.htm (accessed on 28/01/2015)

[20] Bing Nursery School - part of the School of Humanities and Sciences at Stanford University and serves as a laboratory for the Department of Psychology. The mission of the school is to provide a laboratory setting for research where faculty members and graduate students can conduct research in child development, to provide a sound educational environment for young children, to teach undergraduate and graduate students about young children through observation and experience in the classroom, and to partner with both parents and educators in helping to improve the lives of young children and their families.

[21] Schema is a cognitive framework or concept that helps organize and interpret information. Schemas can be useful because they allow us to take shortcuts in interpreting the vast amount of information that is available in our environment. However, these mental frameworks also cause us to exclude pertinent information to instead focus only on things that confirm our pre-existing beliefs and ideas. Schemas can contribute to stereotypes and make it difficult to retain new information that does not conform to our established ideas about the world. (http://psychology.about.com/od/sindex/g/def_schema.htm accessed 23/01/2015)

Schema was first mentioned as a concept by British psychologist Frederic Bartlett (Bartlett, 1932) as part of a

"... *series of studies on the recall of Native American folktales, Bartlett noticed that many of the recalls were not accurate, but*

involved the replacement of unfamiliar information with something more familiar. They also included many inferences that went beyond the information given in the original text. In order to account for these findings, Bartlett proposed that people have schemata, or unconscious mental structures, that represent an individual's generic knowledge about the world. It is through schemata that old knowledge influences new information." (State University.com)

[22] Statutory Frame for Early Years Foundation Stage sets standards for the learning, development and care of children from birth to 5 years old. All schools and Ofsted-registered early years providers must follow the EYFS, including childminders, preschools, nurseries and school reception classes

[23] Digital Media: New learners of the 21st Century Documentary that "...crisscrosses the nation to highlight real-life examples of how digital media is exploding in educational environments. In Manhattan, the innovative Quest 2 Learn public school employs game design to help students explore both academic subjects and human interaction. A Wisconsin classroom uses mobile devices and place-based learning to model civic activity and teach history. Philadelphia's Franklin Institute sponsors The Science Leadership Academy, a public magnet school integrating digital practices into all curricula. Middle-school campers race around D.C.'s museums on a digital scavenger hunt implemented by the Smithsonian Institute. And students on Chicago's South Side gain media literacy, social networking skills, and self-efficacy in a decade-old pioneering multimedia program.

From classroom to library to museum to mall, students are claiming digital media as a means of connecting, communicating, creating, and learning. Digital Media: New Learners of the 21st Century explores this burgeoning phenomenon, interpreting its importance and providing a window into 21st-century education.(http://video.pbs.org/video/1797357384/ accessed 23/01.2015)

[24] Institute of Play is a corporation founded in 2007 by Prof Katie Salen with its mission to promote game design, games and gaming for social and personal development. http://www.instituteofplay.org/ (accessed 29/01/2015)

[25] Scratch Jr is an introductory programming language that enables young children (ages 5-7) to create their own interactive stories and games. Children snap together graphical programming blocks to make characters move, jump, dance, and sing. Children can modify characters in the paint editor, add their own voices and sounds, even insert photos of themselves -- then use the programming blocks to make their characters come to life. http://www.scratchjr.org/ (accessed 29/01/2015)

[26] MIT - Massachusetts Institute Of Technology http://web.mit.edu/ (accessed 29/01/2015)

[27] http://www.earlylearninghq.org.uk/ (accessed 29/01/2015)
http://ictearlyyears.e2bn.org/resources.html (accessed 29/01/2015)
http://www.poissonrouge.com/ (accessed 29/01/2015)
http://www.bbc.co.uk/schools/laac/menu.shtml (accessed 29/01/2015)

[28] Common Sense Media is a non-profit organization that provides education and advocacy to families to promote safe technology and media for children

[29] British Broadcasting Communication

[30] Appendix 2 - see Appendix section of this document, page 59

[31]The Peabody Picture Vocabulary Test, revised edition (PPVT-R) "measures an individual's receptive (hearing) vocabulary for Standard American English and provides, at the same time, a quick estimate of verbal

ability or scholastic aptitude" (Dunn and Dunn, 1981). The PPVT was designed for use with individuals aged 2 ½ to 40 years. The English language version of the PPVT-R consists of 175 vocabulary items of generally increasing difficulty. The child listens to a word uttered by the interviewer and then selects one of four pictures that best describes the word's meaning. The PPVT-R has been administered, with some exceptions, to NLSY79 children between the ages of 3-18 years of age until 1994, when children 15 and older moved into the Young Adult survey. In the current survey round (2010), the PPVT was administered to children aged 4-5 and 10-11 years of age, as well as to some children with no previous valid PPVT score.

[32] http://eaglestrategies.blogspot.co.uk/2013/11/the-digital-generation.html (accessed 29/01/2015)

[33] RMIT University, is an Australian university of technology and design based in Melbourne http://www.rmit.edu.au/ (accessed 29/01/2015)

[34] Edudemic, 2014 - How toUse Social Media as a Learning Tool for Homeschoolers. http://www.edudemic.com/socially-awkward-social-media-educational-tool-homeschoolers/ (accessed on 29/01/2015)

[35] Quest 2 Learn upper and middle school founded by Institute of Play, using the same ethos of developing social and life skills through teh use of social media and gameshttp://q2l.org/ (accessed 29/01/2015)

[36] Chicago's Digital Youth Network- founded in 2006 by Dr. Nichole Pinkard at the University of Chicago's Urban Education Institute, DYN is a project that supports organizations, educators and researchers in learning best practices to help develop our youths' technical, creative, and analytical skills. http://digitalyouthnetwork.org/ (accessed 29/01/2015)

[37]The Science Leadership Academy is a partnership high school between the School District of Philadelphia and The Franklin Institute. SLA is an inquiry-driven, project-based high school focused on 21st century learning that opened its doors on September 7, 2006. https://www.scienceleadership.org/ (accessed 29/01/2015)

[38] Appendix 3 - see Appendix section of this document, page 62

Appendix

Appendix 1

 *USA 1960's typical classroom – teacher-centered, fragmented curriculum, students working in isolation, memorizing facts.*	 *A San Francisco architectural firm establishes an alternative school providing internships for high school students. A perfect example of real-life, relevant, project-based 21st century education.* Photo by Will Fowler from Build San Francisco
Time-based	Outcome-based
Focus: memorization of discrete facts	Focus: what students Know, Can Do and Are Like after all the details are forgotten.
Lessons focus on the lower level of Bloom's Taxonomy – knowledge, comprehension and application.	Learning is designed on upper levels of Blooms' – synthesis, analysis and evaluation (and include lower levels as curriculum is designed down from the top.)

Textbook-driven	Research-driven
Passive learning	Active Learning
Learners work in isolation – classroom within 4 walls	Learners work collaboratively with classmates and others around the world – the Global Classroom
Teacher-centered: teacher is center of attention and provider of information	Student-centered: teacher is facilitator/coach
Little to no student freedom	Great deal of student freedom
"Discipline problems – educators do not trust students and vice versa. No student motivation.	No "discipline problems" – students and teachers have mutually respectful relationship as co-learners; students are highly motivated.
Fragmented curriculum	Integrated and Interdisciplinary curriculum
Grades averaged	Grades based on what was learned

Low expectations	High expectations – "If it isn't good it isn't done." We expect, and ensure, that all students succeed in learning at high levels. Some may go higher – we get out of their way to let them do that.
Teacher is judge. No one else sees student work.	Self, Peer and Other assessments. Public audience, authentic assessments.
Curriculum/School is irrelevant and meaningless to the students.	Curriculum is connected to students' interests, experiences, talents and the real world.
Print is the primary vehicle of learning and assessment.	Performances, projects and multiple forms of media are used for learning and assessment
Diversity in students is ignored.	Curriculum and instruction address student diversity
Literacy is the 3 R's – reading, writing and math	Multiple literacies of the 21st century – aligned to living and working in a globalized new millennium - aural & visual literacy, financial literacy, ecoliteracy, media literacy, information literacy, cyberliteracy, emotional literacy, physical fitness/health, and global competencies.

Factory model, based upon the needs of employers for the Industrial Age of the 19th century. Scientific management.	21st century model
Driven by the NCLB and standardized testing mania.	Driven by exploration, creativity and 21st century skills

This table is printed in Developing the Curriculum by Peter Oliva and William Gordon, Pearson Publishing, The Allyn & Bacon Educational Leadership Series, © 2013, page 251.

Table was created by Anne Shaw, Founder and Director, 21st Century Schools, www.21stCentury Schools.com.

Appendix 2

4–6 year-olds…	This means that…	You'll want to…
Are empathetic.	They're beginning to see things from other perspectives.	Make interactions feel more "social," even if the kids aren't actually communicating with others.
Have an intense curiosity about the world.	They're very interested in learning new ideas, activities, and skills, but may become frustrated when that learning takes longer than they would like.	Set attainable goals for the tasks and activities you create. Provide context-based help and support so kids have an easier time processing information.
Are easily sidetracked.	They sometimes have trouble following through on a task or activity.	Keep activities simple, short, and rewarding. Provide feedback and encouragement after milestones.
Have wild imaginations.	They prefer to create on their own rather than following strict instructions or step-by- step directions.	Make "rules" for play/engagement as basic as possible and allow for a lot of invention, self-expression, and storytelling.

Are developing increased memory function.	Can recall complex sequences of events just by watching someone perform them.	Include multi-step activities and games, with more than one main goal (for example, touch the red stars and green apples to get points of different values).

Table 5.1: Considerations for 4–6-year-olds (Gelman, 2014)

Appendix 3

4-6 year old children and Digital Media

(BA Hons Design for Games Research Paper by Laura Varga.
December 2014 - January 2015)

Questionnaire

What kind of Digital Media are currently being used in your class	eBooks	Digital Games	Internet for research	Other
Are there any kinds of Digital Media that you have tested before in a classroom environment and proved not to be useful?	Yes	No	If yes, would you please list	
Which kind of Digital Media is the most frequently used in your classroom?	eBooks	Digital Games	Internet for research	Other
Which type of Digital Media seem to be preferred by pupils in your class?	eBooks	Digital Games	Internet for research	Other
Which type of Digital Media do you consider to have helped the most, with the literacy, numeracy and social skills, in your class?	eBooks	Digital Games	Internet for research	Other
What percentage would you say, Digital Media hold, in the overall learning experience within your classroom?	less than 25%	25% - 50%	50% - 75%	more than 75%
What type of Digital Media would you like to see more of, in your classroom environment?				

With many thanks in advance, for your help. Kind regards, Laura Varga.

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