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# THE USES OF TECHNOLOGY IN GIFTED EDUCATION: A SYSTEMATIC REVIEW

Dissertation submitted in part fulfilment of the requirements for the degree of Master of Inclusive Education:
Research, Policy and Practice
School of Education,
University of Glasgow

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# Abstract

This study focuses on the ways that technology is used in the field of gifted education. The aim of this research is to collect evidence-based data related to the integration of technology in the education process of gifted and talented primary students. Although many studies have examined the role of technology in education, there is limited research focusing directly on technology and gifted learners. For this reason, a systematic review of the literature was conducted to collect data on the ways that technology is applied in the field of gifted education, focusing on highly able students aged from 5 to 12 years old.

This review offers evidence-based data from different studies that focused on this topic and met the inclusion criteria. The studies that met none of the exclusion criteria were examined in-depth. Three main categories emerged from the in-depth review and were analysed further. These categories were focused on the curriculum and instruction planning, the professional development of the gifted students' teachers, and the development of this group of learners and their learning environment.

Although the focus of the study was the gifted and talented students, was noticed that the uses of technology in the field of gifted education do not differ a lot from the integration of technology in general education. However, more research should be conducted in order to create a more challenging curriculum for the gifted learners by using technology tools. Moreover, it would be beneficial to focus on developing more efficient ways to utilise technology in gifted education and examining the gifted learners' attitude toward educational technology.

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# Chapter 1

## Introduction

Technology is a vital part of the life in the 21st century and many researchers have examined the role of it in the development of students. Software programmes, the Internet, computers, tablets, online learning, online libraries, discussion forums and blogs are some of the technology tools that are applied in education. However, limited studies are focused specifically on the group of gifted learners and the ways that technology is used in the field of gifted education. This study will examine the ways that technology is integrated in the learning process of gifted and talented students and will gather information and evidence related on this topic through a systematic review of literature. Before that, some information about giftedness and educational technology are given below.

### 1.1 Historical Development of Giftedness

Over the course of the last centuries, great interest has developed about giftedness and gifted education. Specifically, the inception of the field of gifted education took place in the early 20th century as an extension of the new field of educational psychology (Jolly and Kettler, 2008). Historically, giftedness for many years was seen as a generic, inherent ability of a person that could be recognised and disclosed through cognitive assessments like the IQ test (Robinson, Ziegler, & Gallagher, 2000 cited in Subotnik *et al.*, 2011). Nevertheless, the definition of giftedness has undergone significant change over the last two decades (Horowitz, Subotnik, & Matthews, 2009; Moon & Dixon, 2006 cited in Mcclain and Pfeiffer, 2012). For instance, Subotnik *et al.* (2011) argued that even if many schools rely on general ability tests and IQ tests to identify gifted learners, giftedness is not only related to general abilities and intelligence, but it also has to do with "talent development along with domain specific abilities, psychosocial skills, motivation, and opportunity" (Subotnik *et al.* 2011:14). Thus, for Subotnik *et al.*, (2011) giftedness is the result of the merge of biological, pedagogical, psychological, and other social factors

which can characterise people that do not have just an above average ability but have extraordinary abilities. However, there are other definitions about giftedness that focus on different variables.

For instance, according to Renzulli (2011) giftedness is the result of the interaction of above average general abilities with high levels of task commitment and creativity. More specifically, Renzulli (2011) argued that gifted and talented students are learners that are capable of developing these three characteristics or how already possess them and apply them to any valuable field of human performance. In order to support these learners, Renzulli (2011:87) pointed out the need for "a wide variety of educational opportunities and services that are not ordinarily provided through regular instructional programs". Moreover, through his model, he recognised that the intellectual abilities of a gifted student and the psychological factors, both affect their socioemotional development. Nonetheless, Gross' opinion (1993) differs as she claimed that intelligence and creativity are not always interrelated. Thus, she argued that an academically highly able student does not have to be highly creative too in order to be identified as gifted and talented. In addition, Renzulli acknowledged the intellectual and the psychosocial factors of gifted children's development but did not take into consideration any external factors that could influence their task commitment or their creativity. Hence, Gross (1993) noted that Renzulli's model of giftedness does not allow underachieving gifted students to be identified because even if they have above average intellectual and psychosocial skills, they might be affected by external factors that does not allow them to show these skills and get identified.

On the contrary, Tannenbaum (Passow and Tannenbaum, 1976) asserted the influence of the environmental and other external factors on gifted student's development. In particular, according to Tannenbaum's psychosocial model there are five components of giftedness that convert early potential abilities into extraordinary contributions in adulthood (Subotnik *et al.* 2011). These five components involve general abilities, special or domain-specific abilities, as well as psychosocial or non-intellectual abilities, chance and environmental/external factors (Passow and Tannenbaum, 1976). Hence, Tannenbaum recognised that the development of a highly able learner is affected by both

his /her intellectual abilities and other external factors like his personality or for example the environment that he lives. Tannenbaum also noted that there are several main obstacles on a gifted student's trajectory, which he/she could overcome by having interpersonal skills, motivation, and perseverance (Subotnik *et al.* 2011). Thus, according to Tannenbaum (1976), by supporting, motivating and encouraging underachieving gifted children, and by altering the chance and the environmental/external factors of their life, it is possible to help them be identified.

In a similar vein, Gagné (2007) acknowledged the impact of personality, environment and motivation on the development of highly able learners. Precisely, he claimed that there are four elements, which affect the process of talent-development of gifted children and cam be expressed as their intellectual, creative, socio-affective, and sensorimotor abilities (Gagné, 2007). In particular, for Gagné giftedness is "a superior ability, while talent is a superior performance" (Gross, 1993:26). Environmental and interpersonal factors work as catalysts for the transformation of an extraordinary ability into an extraordinary performance. On the other hand, Gardner's theory which relates to giftedness, is based on seven different types of intelligence. These seven types of intelligence are the linguistic, the logical/mathematical, the spatial, the bodily kinaesthetic, the musical, the interpersonal and the intrapersonal intelligence (Ford and Grantham, 2003). Gardner (1993), likewise Tannenbaum and Gagné, claimed that intelligence appears as a genetic hostage, which is influenced by external factors and exist in various ways in various cultures.

However, there are many definitions, approaches and models regarding giftedness, although there is not a commonly accepted definition. Mcclain and Pfeiffer (2012:78) pointed out that "a lack of consensus among policymakers and educators in how to define a gifted student" continuous to exist in the field of giftedness. Nevertheless, in this study, it is considered that giftedness is based on the existence of intellectual and cognitive abilities and can be flourish when is influenced by external variables. These variables could help the identification of highly able learners and enhance their academic and socioemotional development.

### 1.2 Educational Techonology

As mentioned above, according to Tannenbaum (1976), Gagné (2007), Gardner (1993, 2004) and other researchers, giftedness is connected with intelligence but is also influenced by other factors as well. Creativity, motivation and persistence are some of the elements that enhance the development of gifted children (Subotnik *et al.* 2011). Thus, it is important to develop and use alternative ways to motivate and encourage gifted children, enhance their creativity and support their needs. Regarding to this theory, new domains relating to educational technology have arisen during the last decades and "create additional opportunities for the manifestation and development of talent and eminence" (Subotnik *et al.* 2011:8).

The pressure in Western countries to get differentiate and survive in a changing competitive world actuated governments to support technology in education and include it in schools (Lowyck, 2014). More specifically, in the late 1970s, the constantly growing use of technology and the challenges of an information society created a new debate about the combining of computers and technology with education (Dillemans *et al.* 1998, Mandinach, 2009 cited in Lowyck, 2014). At the time, Western countries innovated and introduced national programmes to present new technologies in schools (Kozma, 2003 cited in Lowyck, 2014) while during the 1980s they attempted to orient education in order to increase worldwide competition in industry, science and technology (Lowyck, 2014).
At the present time, the role of educational technology is more crucial than ever as we live in a technology driven world (Eckstein, 2009). In particular, today's students have grown up with innovative devices such as mobiles, computers and tablets as part of the global community of internet and thus, is vital for their education to keep up with their interests and progress in technology (Periathiruvadi and Rinn, 2012). Moreover, students need to be able to collect, integrate and present data as well as use a variety of software applications (Siegle, 2004) in order to reach out to the world outside the classroom and be prepared to survive in a technological world. Thus, the role of educational technology is important for the development of all the students.

However, the term educational technology has a double meaning. Is related both with the application of scientific know-how and with tools and equipment (Glaser, 1965; Molenda, 2008; Reiser and Gagné, 1983, cited in Lowyck, 2014). In particular, Warner *et al.* (2018:3) defined educational technology as "a tool, both physical and cognitive, to help solve problems" under the condition that its users are equipped with critical thinking and creativity. There are different variates of technology that could be used in an educational setting. For instance, there are educational uses of technology such as the research on the Internet, the creation of presentations, the collaboration and communication between students and other learning tasks that give the opportunity to learners to actively use technology in practice (Zimlich, 2015). Hence, educational technology could bring great curricula based on real-world problems, provide scaffoldings to enhance learning, give opportunity to students to test their performances and expand their horizons by networking and communicating with interesting people (Kozma and Voogt, 2003).

Moreover, Siegle (2004) claimed that technology could also be used effectively in the education of gifted students. Students, and specifically gifted and talented students, learn more when they use technology than when they do not use it as part of their educational process (Siegle and Foster, 2001 cited in Zimlich, 2015). In addition, Siegle (2004) noted that the educators of gifted students labour to provide curricula with complexity and depth and they are trying to organise, analyse, synthesise and communicate large amounts of information, something that can be facilitated with the assistance of technology. Furthermore, by using technology as part of their educational process, gifted students have the opportunity to explore their interests in depth while practicing their technology skills that are essential for the 21st century (Siegle, 2004).

Furthermore, technology helps gifted students to enhance some of their skills and applies them in real-life situations. More specifically, Renzulli *et al.*, (1997, cited in Siegle, 2004) argue that highly able students who use technology have the ability to apply their learning for different circumstances and understand intricate materials by developing their reasoning abilities. Additionally, educational technology increases students' motivation enhances their critical thinking skills and their creative productivity (Siegle, 2004). However, as Stolurow and Davis (1965, cited in Lowyck, 2014) noted, machines on their

own cannot bring any change. Thus, attention has to be given to both sectors, and more precisely has to focus on how technology is applied on the field of education and on the ways that it impacts on highly able student's achievement and motivation.

**1.3 Significance of the Study**

As mentioned above, technology is an important part of human life in the 21st century. Periathiruvadi and Rinn (2012:153) argued that technology in the field of education "not only allows teachers to provide differentiated instruction for gifted children and adolescents, but also serves as an educational and creative outlet for some of the best and brightest minds in the world". Also, according to Housand and Housand (2012:709) "because gifted students are capable of achieving at high levels and growing at a pace that is often accelerated compared with their same-age peers, the challenges they encounter need to escalate with a rather steep trajectory to maintain continual growth". Technology, provides outstanding opportunities for gifted students by providing access to acceleration and enrichment options that could enhance their achievement and motivate them to improve themselves (Housand and Housand, 2012). Thus, the use of technology in the educational process of gifted and talented students is a field that should be explored further in order to discover the best possible ways to support the academic and socioemotional development of these learners.

Although, there are many studies about the inherent motivating elements of technology, whereas there is not much research focusing directly on the relationship between the Internet and communication technology (ICT) with students' motivation and satisfaction (Bekele, 2010, cited in Housand and Housand, 2012). Periathiruvadi and Rinn (2012) noted the need for more research on using technology tools and on their effectiveness in educating highly able pupils. Specifically, they asserted that technology affects the daily life of today's learners and more research in this area will build a strong and better quality of education for gifted pupils of the 21st century. In addition to this, Housand and Housand (2012) pointed out that there are few studies about educational technology focusing on specific groups of learners such as gifted and talented students. Finally, Zimlich (2015:102) confirmed "A growing body of research sheds light on various implementations of educational technology, but such research needs almost constant re-

evaluation to keep up with the non-stop development of technology". Hence, this systematic review about the impact of technology on the achievements and motivation of gifted and talented students will bridge the gap between older and more recent studies relating to this topic.

### 1.4 Research Question

This systematic review is trying to explore the field of gifted education and the role of technology on it. In particular, this study aims to answer the following question: In what ways is technology used in the field of Gifted Education? So, we will seek answers on how technology is applied on gifted education, if it affects gifted and talented primary students and if the use of technology in gifted education differs from the one in general education.

### 1.5 Aim of the Study

The aim of this research is to review the literature that focuses on the ways that technology is used in the field of gifted education. In particular, this study aims to review and discuss the use of technology in the learning process of gifted and talented students, and also to provide collected information and data on this topic.

# Chapter 2

## Methodology

Systematic reviews have been developed mostly in the last decades and have allowed researchers to access the literature in a more comprehensive and transparent way (Pettigrew and Roberts, 2006, Torgerson *et al.*, 2012). More specific, in the past, the volume of research was smaller, and the studies were less specialised, thus people were relying on the opinion of experts based on the literature review of previous research. However, according to Chalmers (2003, cited in Gough and Thomas, 2016) the opinion of experts and the literature reviews that were produced by them, were not reflecting the diversity and the width of the phenomena in question. Consequently, more than 100 years ago the methodology of systematic review was first reported, while in the last 20 years the use of it has increased and especially on the field of healthcare, education and social studies (Torgerson *et al,.* 2012).

### 2.1 Systematic Review

A systematic review is a methodology of research that examines the existing literature in order to answer a research question. Bearman *et al.* (2012) described systematic reviews as a type of literature review by using a specific methodology that produce a synthesis of available evidence concerning a research topic. However, contrary to the traditional literature reviews, systematic reviews are seeking to include the "totality" of the studies related to a specific question and providing organised gathered data (Torgerson *et al.* 2012). In particular, a systematic review brings together and links the findings of primary research, which follows standard methods and stages. Additionally, it aims to reduce hidden bias and is "accountable, replicable, updatable and sustainable" (Newman and Dickson, 2012:141). Likewise, Torgerson *et al.* (2012) asserted that this methodology is a transparent and comprehensive search strategy because is based on pre-specified inclusion and exclusion criteria and explicit methods for collecting, coding and synthesising the studies that have been included on it. Hence, the key features of

systematic reviews assure the clarity of it and allows access in the literature of a topic in an unbiased and comprehensive manner (Torgerson *et al.* 2012).

Furthermore, systematic reviews offer the readers the opportunity to examine and evaluate by themselves the latest evidence research (Harden and Thomas, 2005). More specifically, Bearman *et al.* (2012) highlighted that this research methodology allows the readers to access many studies, even the ones that are not easily accessible or well known. In addition to this, the readers have the opportunity to read critically and in-depth a big variety of collected studies and make their own judgments on the quality and the meaning of the evidence. Another advantage of using systematic reviews as a research methodology is that many "gaps" in the literature can be identified and evidence-based education can be enhanced as well (Torgerson *et al.* 2012). In a similar vein, Mallett *et al.* (2012) claimed that this methodology indicates the methodological inconsistencies and weaknesses of a research field and thus identify future research priorities and implications.

Additionally, systematic review spans research, practise and policy by providing policy-makers and teachers with evidence-based answers related to educational issues. Through a systematic review, someone can detect, what is functional appropriate or what is better for the operation of work and to adjust policy to solve practical problems in the field of education (Hammersley, 2001). Consequently, Bennett *et al.* (2005) pointed out that teachers are encouraged to combine practise with evidence-based research. Taking into consideration that systematic reviews examine and gather data from many different studies, then can be deduced that this methodology is valuable for the policy-makers and the teachers who are trying to keep up with the latest research and apply new teaching strategies in their teaching process.

Although systematic reviews provide some important elements on the trajectory of research, they have been criticised and defined as controversial by some researchers. For instance, in a systematic review the researcher decides the inclusion and exclusion criteria of the research and choose the studies that will be examined in depth and as a result he/she has under his control the development of the study. Thus, as Gough and Thomas (2016)

noted, this research methodology can be accused as a guided action and becomes vulnerable to critics. In addition, most of the included studies in the review, have been chosen based on their abstracts and titles (Andrews, 2005). Therefore, there is always a possibility for some studies to be excluded even if ultimately they were relevant to the research question and could have been used on the systematic review.

Another practical problem with the conduction of a systematic review is the time and money that it is needed. More specifically, systematic reviews require access to a wide range of databases, something that could be expensive and practically difficult for some researchers (Mallett, 2012). Also, when there are many researchers collaborating for the systematic review, then each of them maybe understands and applies the inclusion and exclusion criteria from a different point of view (Mallett, 2012). Moreover, Whitty (2006, cited in Gough and Thomas, 2016) noted that there is the anxiety of danger about the possibility that some academics would "shape" their work based on the needs of a government.

However, the quality of all the types of research could vary and not only the quality of systematic reviews. Additionally, "the main criticisms of systematic reviews in education generally concern wider issues about the nature and purpose of educational research" (Gough and Thomas, 2016:96) and are not specific to the nature of systematic reviews. Besides that, as it was mentioned above, the systematic reviews follow specific stages and are explicit so as the reader has the opportunity to judge for themselves the quality of the research. Hence, after taking into consideration the benefits and the challenges of the systematic review, this methodology has been chosen to answer the research question of this study regarding the uses of technology in the field of gifted education.

**2.2 Ethical considerations**

As mentioned above, the used methodology in this study included a systematic review of the literature related to the uses of technology in the field of gifted education. Thus, an ethics approval from the governance was not required for this study, as it was not based on direct or indirect contact with people. However, this research designed and undertaken to ensure the integrity and the quality of the findings. In particular, the studies that were

included for in-depth review examined accurately and fairly. Almost, half of the included studies were defined as highly qualified, based on the number of their sample and the given details about the participant's background as well as the research strategy that they followed. The rest of the included studies were also examined carefully and with clarity to avoid the existence of bias. Hence, this systematic review acknowledged the importance of the research ethics, following a well-structured methodology and ensuring to its readers the quality of the findings that they have access to.

# Chapter 3

## Methods

This study aims to find answers to this research question: In what ways is technology used in the field of Gifted Education? For the purpose of the study, a systematic review was conducted through the research of 8 online databases including ERIC, Education Abstracts, British Education Index, Professional Development Collection, Pro Quest, Learning & Technology Library, Google Scholar and Library Genesis. In total 349,912 articles were identified as being relevant to the research question. This result was based on the following key-words: Gifted and Talented (or Giftedness, Gifted Education, Highly Able) and Technology (or ICT, Educational technology, computer, tablet, internet and online learning). These words were selected because the whole review is focused on Gifted students and Technology. Some alternative key-words like Giftedness or Highly Able, ICT or computer and online learning selected to expand the area of the research and detect relevant to the topic studies that were not easy to be located based on the primary key-words.

The next stage of the research was the screening of these articles using the inclusion and exclusion criteria that had been developed to ensure the quality of the study. The cut-off date of 2003, was selected because the field of educational technology is a topic of research that flourished in the last decades. Thus, many studies of a great importance were carried out during this 15-year period. Moreover, in 2004 some changes in the legislation of the Scottish educational system took place about the assistance of students with additional support needs, including gifted pupils, their inclusion in the learning process and the integration of technology in it (e.g. Additional Support for Learning, Act 2004 and Curriculum for Excellence). Consequently, was considered that by delimiting the year-range of the included studies of the last 15 years, will allow important research to be identified and reviewed in-depth. Moreover, it was decided to focus on articles that were written in English because most of the studies are carried out in this language, although

this decision may mean that some articles that cover this topic but are written in different languages will be excluded. Finally, the research question is keen to elicit they ways technology is used in the classroom, so evidence-based studies were conceded to be of primary importance.
The role of the inclusion and exclusion criteria was to specify the limits of the research and are as follows:
Inclusion criteria
1. Evidence-based studies.

2. Studies written in English.

3. Studies written after 2003.

4. Studies focused on the teaching and/or learning process of gifted students aged 5 to 12 (primary/elementary students).

5. Studies focused on gifted students AND technology.

Exclusion criteria
1. Articles that were not evidence-based studies

2. Studies that were not written in English.

3. Studies that were written and published before 2003.

4. Studies that were not taking into consideration pupils aged from 5 to 12 years old (primary/elementary gifted students).

5. Studies that were not focused on gifted education or gifted students AND Technology.

6. Studies that were not empirical or evidence-based.

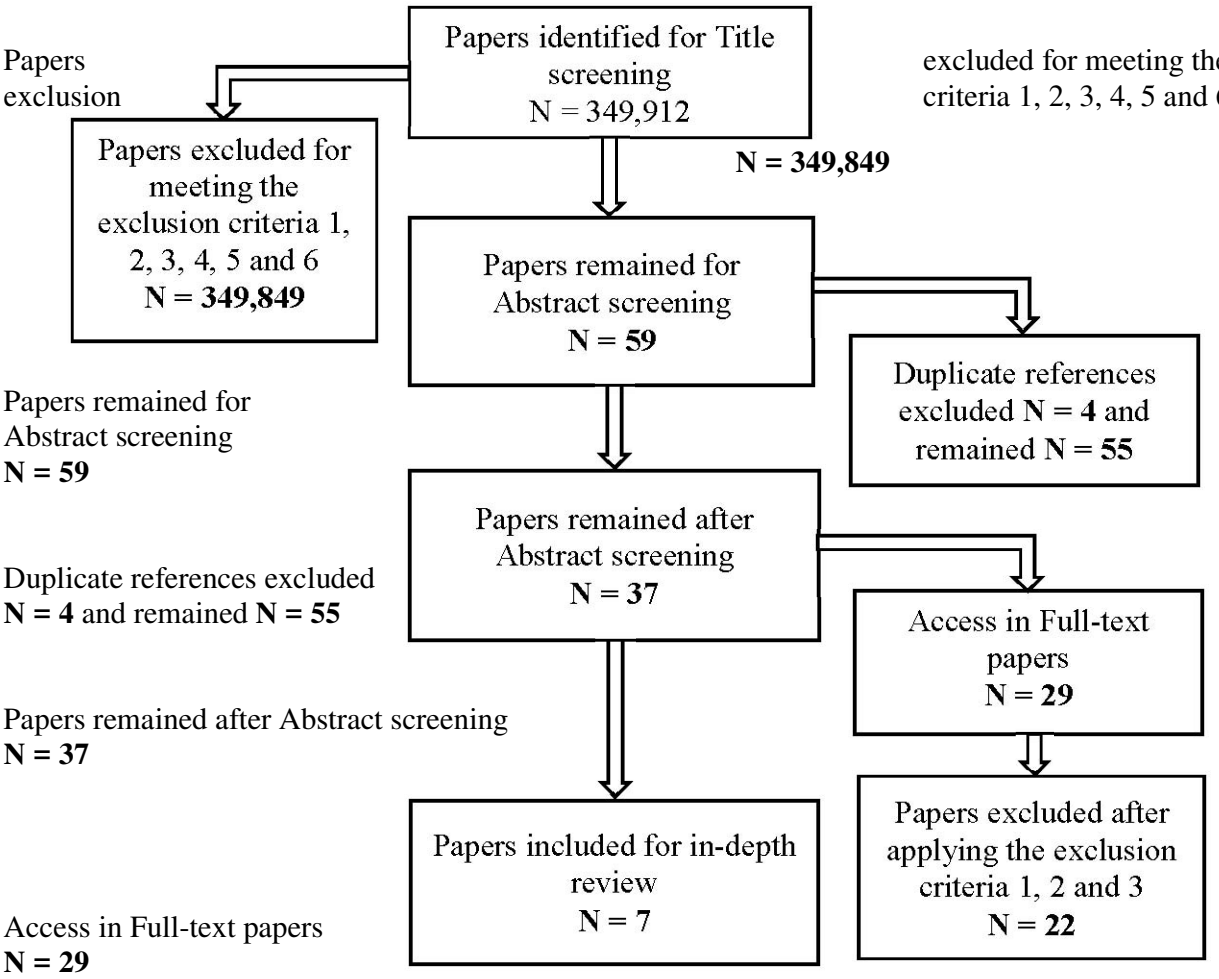
Based on these inclusion and exclusion criteria, 59 studies were selected for further screening with 349,839 being rejected. After screening the titles and removing the duplicates, 55 articles remained. The next stage of the research was to read and screen carefully the abstracts of these articles and choose the ones that were meeting the criteria and were matching with the aim and the rationale of the systematic review. Subsequently, 37 abstracts met the criteria for the research but 8 of them were not accessible because they were not available on the university library or other online libraries. At this point in the research, some extra exclusion and inclusion criteria were applied while the Full-texts of 29 studies were screened. The studies that were excluded from the in-depth
review met the following exclusion criteria:

Exclusion criteria for in-depth review
1. Studies that were not matching the rationale of the systematic review.

2. Studies that were not focusing on the learning or teaching process of gifted students.

3. Studies that were not specifying the age of the participants.

After the final screening of the Full-texts, 22 articles were excluded and 7 articles were included for in-depth review. The Figure 1. presents the stage-by-stage synopsis of the process of searching and screening studies relevant to the research question of this systematic review.




Papers identified for Title screening
N = 349,912

Papers exclusion
**N = 349,849**

Papers excluded for meeting the exclusion criteria 1, 2, 3, 4, 5 and 6
**N = 349,849**

Papers remained for Abstract screening
**N = 59**

Duplicate references excluded
**N = 4** and remained **N = 55**

Papers remained after Abstract screening
**N = 37**

Access in Full-text papers
**N = 29**

Papers included for in-depth review
**N = 7**

Papers excluded after applying the exclusion criteria 1, 2 and 3
**N = 22**

**Figure 1. The process of screening the papers for the systematic review**

At this point, it is important to point out that the research process disclosed a strong difference between the number of empirical research articles and the number of descriptive articles. In particular, there was a big number of descriptive articles that were focused on different forms of the use of technology in the gifted education and how and

why this affects the gifted students. These articles through their implications, were offering to the readers the opportunity to explore the gaps in the research literature of giftedness and the role of technology. Nonetheless, this study is reviewing only evidence-based studies and for this reason, the descriptive articles were excluded.

More specific, the exclusion and inclusion criteria that are mentioned above were developed to reduce the number of studies that were not related to the systematic review or were not matching with the rationale of the study. In particular, for this systematic review only evidence-based studies that were focusing exclusively on the uses of technology in the teaching or learning process of the gifted students were included. Consequently, 139,719 studies were eliminated from the review because they met the exclusion criteria 4 and 5. Specifically, 103,778 papers did not have participants between 5 and 12 years old. In this case, these studies had as participants middle school, high school and university students and so were excluded based on the 4th exclusion criterion. In a similar vein, 35,941 studies were excluded at the first stage of the systematic review because they were not focused entirely on the uses of technology in the field of gifted education.

In more detail, some of the excluded studies mentioned the uses of technology such as spreadsheets, web tools, e-books, e-libraries and online forums. However, they were not focused on the teaching or learning process of gifted students. For example, the research of Ahmad *et al.* (2014) was focused on gifted students and the development of their talents throughout their life via ICT, but it was not related to the teaching or learning process. Another example is the study of Down (2006) that was about catering for gifted and talented students. This study was examining if the teachers of gifted students adjust their teaching within the technology curriculum.

However, the focus of Down's research was not on the uses of technology within the gifted education but on the fact that teachers do not dedicate enough of their teaching time on using technological tools. Therefore, although some studies were including the key-words which used for the research and were connected to the study, they were not fully

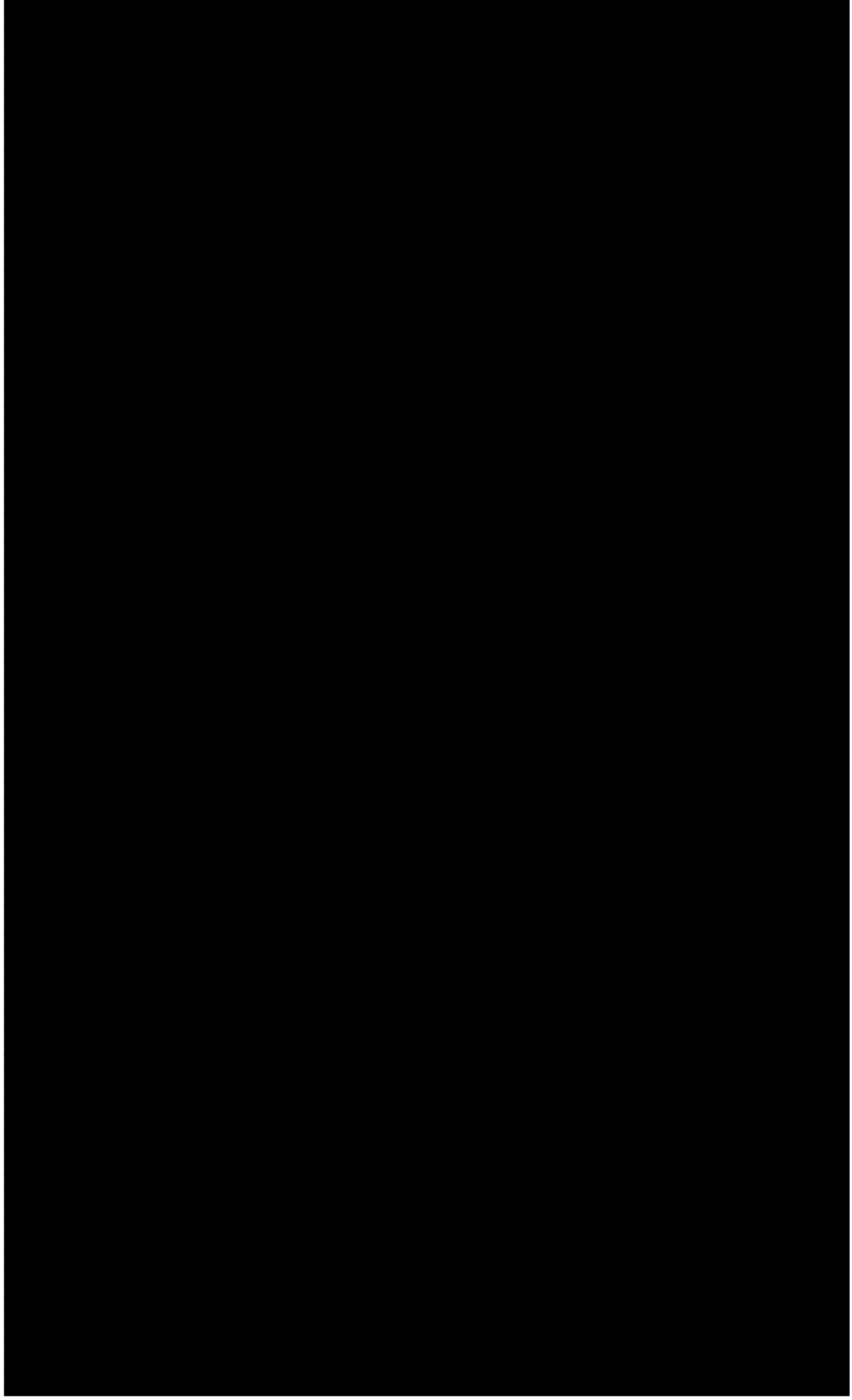
meeting the inclusion criteria of the systematic review. Nevertheless, seven studies met all the inclusion criteria. These studies will be examined in the following chapter.

# Chapter 4

## Findings

As mentioned above, only seven studies met none of the exclusion criteria and were included for in-depth review. The aforementioned studies were evidence-based studies, written in English and after the year 2003. Moreover, they were related to primary (elementary) gifted and talented students, aged from 5 to 12 and were focused on the uses of technology in the teaching and learning process. The table 1. shows the details of the studies that were included for in-depth review.

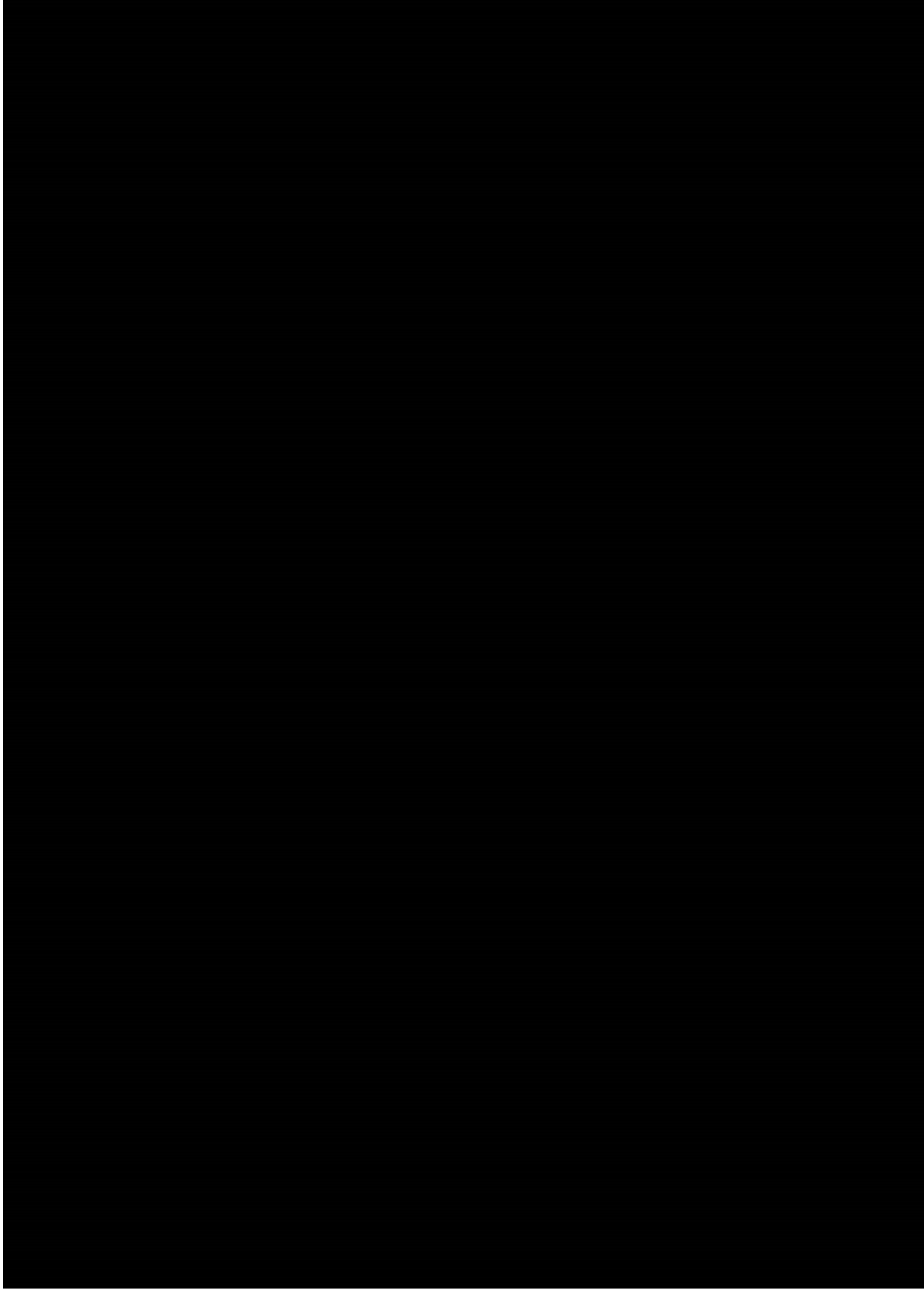
**Table 1. Studies identified for in depth review.**



### 4.1 Characteristic of the Studies

The seven studies that were included for in-depth review were heterogeneous and their characteristics are presented in table 2. In particular, the studies had been conducted in different ways, had different approaches on the topic and found different results. For instance, only two studies (Riska, 2010, Wallace 2009) had an almost balanced percentage of female and male participants, while four of them did not specify the gender of the sample at all.

**Table 2. Extracted information about the studies.**



Nonetheless, one study had almost exclusively female participants. In particular, the sample of Shaunessy's study (2007) which is relating to the teachers' attitudes toward

technology, was not balanced as the majority of the teachers that participated were females (93%) and only 7% were males.

The social background of the participants was stated only in one study. Michelle (2009) stated that the 41 gifted students that participated on her research, 4 students were home-schooled, 13 were living in poverty, 17 were residents of rural areas and seven were underachieving in their current situation. The rest of the studies did not give any clues about the social or the economic history of the participants. Additionally, the studies had a great variety of ethnicity. Almost in the majority of the studies that were examined in-depth, participated students and teachers from different racial groups. Most of them were American while there were also Asian, Hispanic and multi-racial participants as well.
The above-mentioned sample consisted not only of gifted students but also by teachers and parents of gifted children. Specifically, Zimlich's (2015) and Shaunessy's (2007) research were focused on teacher's attitudes toward technology and gifted students. In both studies, the findings revealed that teachers' perception about the uses of technology in gifted education was positive and that their attitude influenced the way that students value and use technology. Furthermore, the majority of the studies was stated that they are informed by existing theories and research. For instance, the enrichment model of Renzulli mentioned in Riska's (2010) and Michelle's (2009) studies. Moreover, Vygotsky's theory about the Zone of Proximal Development (ZPD) was reported in Dove's and Zitkovich's (2003), Heald's (2017) and Riska's (2010) studies respectively.

Another significant characteristic of the studies was the definition of the gifted students. Almost all the studies are using the term "gifted students" to describe children with high intellectual abilities. In particular, all the studies used the term gifted, while the term "highly able" is not used in any screened study. In addition, some of the studies that were examined in-depth used the term "gifted and talented". Shaunessy (2007) in her study about the teachers' perception of technology, gave a detailed definition of the term "gifted" students and "teachers of the gifted". According to her, "teachers of gifted" are the teachers that have a certification in general education and are also certified to teach intellectually gifted children. Likewise, "intellectually gifted" are the students that their

intelligence quotient is 120 or greater based on an individually administered intelligence test, and participate in the intellectually gifted program of a southeastern state.

**4.2 In-Depth Review**

**Dove, M.K. and Zitkovich, J. A. (2003). Technology driven group investigations for gifted elementary students.**

The study of Dove and Zitkovich (2003) examined the uses of advanced technology in order to personalise the curriculum in the needs of gifted and talented students. This research was focused on the uses of technology by gifted elementary students as part of a science project and the assessment of their ability to use these advanced technologies. This science project took place on Lake Erie. The participants were 24 gifted elementary students in the fourth, fifth and sixth grade, living in northeastern Ohio. They were defined as gifted students based on their ability, achievement and performance, as that had been specified by the State of Ohio, Department of Education.

In more details, the science project was included an excursion to Lake Erie and was designed so as to meet the gifted learners' need for a differentiated curriculum. The students had the ability to develop and practise their science knowledge, their research skills, their technology skills, their independent inquiry skills and their group investigation skills. In order to succeed that, they had access to technology tools like laptops, computers, digital cameras, microscope, micro projectors and water quality sensor kits. Moreover, before the expedition to the Lake Erie, the students had already done their own research related to topics of ecological vulnerability and sustainability of the lake, using the internet. Thus, the gifted students had the chance to use technology to expand their knowledge, improve some of their skills and personalise the curriculum according to their needs.

The study consisted of questionnaires. This gave the students the opportunity to rate their abilities to the digital technology on a scale from one to five. The majority of the students rated their ability to use all the given technology tools as good or very good. When they were asked with an open-ended question which was the best part of being an investigator on the science project at the lake, more than 75% answered the use of technology. The

creativity of students in the use of technology included PowerPoint presentations and software programmes like Adobe PhotoShop, Microsoft Photo Editor, Microsoft Excel Spreadsheets and Elmo visual presenter interfaced with a television monitor. Also, they used search machines to do web research and emails to gather and exchange information.

Dove and Zitkovich (2003) argued that their study proved that gifted elementary students can successfully use advanced technology tools to enhance their learning process and personalise the curriculum according to their interests and their needs. Moreover, this study gave various examples of the uses of technology in the field of gifted education and explored how the gifted students perceive their abilities to use technology tools to enrich their learning background. However, the sample comprised students from six different schools, the age range was limited from fourth to sixth graders and all the students were living in northeastern Ohio. Additionally, the social and economic background and the racial origin of the participants are not specified. Hence, the quality of the study cannot be rated as high, as the range of the sample was limited and there was not enough information about the background of the participants that would make the findings entirely trusted.

**Heald, S.B. (2017). Curriculum Differentiation for Gifted Learners Using Instructional Technology: A Multiple-Case Study.**

In a similar vein, 14 years later, Heald (2017) did her own research about the differentiation of the curriculum for gifted students by using instructional technology. In particular, Heald (2017) tried to examine how the use of instructional technology could support gifted students and provide them innovative methods in order to engage them with more challenges and ameliorate their skills. Furthermore, she acknowledged that gifted learners were not always receiving instructions that could foster their learning. Thus, she did a qualitative study to examine what curricular strategies related to instructional technology were used by teachers of gifted students. Precisely, she focused on the ways that teachers differentiate the curriculum in a heterogeneous classroom to meet the needs of their gifted students. The sample of the study was 16 teachers of gifted students on the fourth, fifth and sixth grade. The teachers were selected by two different schools in south Alabama. An important detail was that both schools had available

computers for every student. Moreover, both open-ended interviews and observations were used to collect the data that were analysed in the study.

According to Heald (2017), many of the teachers' interview responses about the uses of instructional technology, were focused on Internet-based software and sites. In more details, teachers were choosing to use Internet-based software and sites because the gifted students were having the ability to move on to the next level only if they were reaching a specific score. Thus, the lesson was more interesting and challenging for them. Furthermore, Internet-based sites like Compass Learning and IXL were some other choices of the gifted students' teachers, which were reinforcing the mathematics and language art skills of the students. According to the teachers, another use of instructional technology for the differentiation of the gifted student's curriculum was the Moodle. This online course software was giving the opportunity to the teachers to provide examinations, classwork and additional resources to their gifted students. Other uses of technology for gifted students were the Moby Max, an Internet-based curriculum, and the Portaportal, a web-based bookmarking utility. The second part of the Heald's study (2017) was based on observations. According to Heald, the teachers used interactive whiteboards, web-browser and laptops for the presentation of a lesson or for giving instruction for the student's homework. The third and last part of the study was the collection and examination of 183 work samples of the gifted students. According to this part of the study, the students used software programmes such as Scratch, PowerPoint, Word, Keynote and Pages.

The findings of this study were mainly demonstrating that teachers perceived instructional technology as a useful tool to enhance gifted learner's academic success. In addition, according to the study's results, the instructional technology could provide a visual, auditory and kinaesthetic approach of learning to gifted students. Nevertheless, even if this qualitative study examined the use of technology relating to the curriculum and instruction planning by the view of the teachers, it did not include a wide range of participants. Moreover, the researcher did not mention any details about the nationality, the social and the economic background of the teachers that were participating. The only given detail about them was related to their schools.

**Riska, P.A. (2010). The Impact Of SMART Board Technology On Growth In Mathematics Achievement Of Gifted Learners.**

On the contrary, Riska (2010) on her study about the use of interactive SMART Boards as an instructional tool to enhance the mathematical achievement of gifted students, specified the background of the participants. She apprised her readers of the age of the participants, their gender and their racial origin. More specific, in Riska's study (2010) participated 173 fourth grade gifted students, from six different elementary schools from a suburb in North Carolina. The 51% of the sample were females and 49% males. Thus, the gender distribution of the participants was relatively balanced. Another given information about the sample of the study was the racial statistics of the participants. In particular, 80% of the gifted students that participated in the study were white, 13% were Asian, 4% were multi-racial, 2% were Hispanic and 1% were African American.

In more details, Riska's (2010) quantitative study aimed to distinguish if the use of interactive SMART Boards in the curriculum of fourth grade gifted students, would increase their mathematics achievement. The instrument that was used for the evaluation of the student's achievements before and after the use of SMART Boards, was the End-of-Grade mathematics test for the fourth grade. This test was authorised by the state and was used to measure the progress of the students, assess the development of their individual skills and specify the school effectiveness. According to the hypothesis of the research, it was expecting that Riska's study would prove that the use of SMART Board technology increases significantly the mathematical achievements of the participants.

Nonetheless, after gathering the data and evaluating the results of the pre-test and the pro-test that the participants gave, the findings showed that SMART Board Technology did not provide an important rise on the mathematical achievement of the gifted students. The difference between the performance of the gifted students that used the interactive SMART Boards and the performance of the gifted students that did not have access to SMART Boards was not significant. Consequently, the primary hypothesis of the study was rejected based on the findings. However, the second hypothesis of the study was relating to the improvement of the mathematics achievement of the gifted students

between their pre-test's and their pro-test's scores. Indeed, the data revealed that the performance of the students was increased significantly before and after their EOG tests. Therefore, the mathematics achievements of the gifted students increased between the EOG tests but it was not due to the use of interactive SMART Boards.

In any case, this study revealed another creative way to use technology in the field of gifted education. Interactive SMART Boards are touch-sensitive screens with various capabilities. They are designed for a whole-class approach of teaching and promote a collaborative work environment based on group interaction. Moreover, students have the chance to combine their cognitive and physical abilities by interacting with the SMART Boards, developing creative and engaging presentations, improving their critical thinking skills and getting motivated and challenged (Riska, 2010). Finally, teachers can use the SMART Boards to capture gifted student's attention, to access the Internet, to create diagrams and download lesson plans.

Riska's (2010) study, was a high-quality one. It had a big range of sample consisted of 173 gifted elementary students, from six different schools. Additionally, the study was rigorously conducted and evidence-based. Also, the researcher chose carefully her sample in order to have a relatively balanced percentage of females and males gifted students, with different racial origin. In this way, she carried out the study and examined the validity of her hypothesis, coming to the conclusion that the use of interactive SMART Boards is a creative way to differentiate the curriculum for the gifted learners. However, the impact of them on the performance of the students was not significant. Consequently, by conducting a well-planned research and choosing a big and balanced range of sample with almost the same number of female and male gifted students from different primary schools, Riska ensured the quality of her study.

**Michelle, E. (2009). The Gifted Kids Network: 2008 Pilot.**
Michelle in 2009 conducted a study regarding a programming model for gifted and talented students. The Gifted Kids Network was a web-based gifted model of programming, influenced by a framework which was using technology tools to engage gifted students. The aim of the Gifted Kids Network was to encourage students to express

themselves, engage with the learning content, think critically and creatively, being enquirer with what was presented to them and work productively to enrich their knowledge.
The sample of the study was 41 gifted students. Of the 41 participants, only the 20 were elementary students and the rest were middle school students. In addition, the participants were from California, Colorado, Kansas, Iowa, Massachusetts, Michigan, New Mexico and Utah. Also, the gifted students that took part on the pilot program were either home-schooled, either living in a rural location either in poverty or were underachieving in their current situation, while some of them were meeting more than one of these categories. Consequently, the social, economic and academic background of the participants had various diversities and increased the significance of the study and its findings.

The technologies that were used on this web-based program was included discussion forums, PowerPoint presentations, online management systems, e-mails, web-based resources and blogs that could encourage the students to work either individually or in a group and develop their social, emotional and intellectual skills. In particular, Michelle (2009) highlighted in her study that web-based programs like the Gifted Kids Network, supported the social and emotional needs of the gifted students. According to her, an academic online social network works positively in the development of the gifted and talented students as they have the opportunity to connect with other gifted peers in online communities of intellectual children. This way, gifted students had the chance to expand their skills of social networking in a safe environment. Additionally, at Michelle's (2009) study was pointed out the uses of technology within the Gifted Kids Network. In particular, the participants were used wikis, blogs, podcasting, Voicethread, and video creation software. Likewise, teachers had the opportunity to participate in workshops and discussion forums, to explore blogs, wikis and quizzes and use them in their lessons. Moreover, all the students and the teachers had access to a computer with high-speed Internet access.

By using all these technology tools through the Gifted Kids Network, gifted and talented students enhanced some of their abilities. More specifically, this study had four outcomes. The first outcome was related to the development of the technological skills of the

participants. As part of the pilot program, the students exposed to new technologies and became more comfortable to use them. The second outcome was that through this web-based pilot program gifted students connected with other gifted children and improved their social skills. Gifted students had the possibility to communicate with other students from different geographical locations and share their experiences of growing up as a gifted child. The third outcome of the study was the fact that students demonstrated mastery in benchmarks by participating in student projects, quizzes and exams. The last one was the improvement of the research and writing skills of the participants.
However, the researcher acknowledged that this online model did not work for all the gifted and talented students. Students with lack of discipline and motivation to keep up with the program did not show any progress. Moreover, the Gifted Kids Network was a web-based program so it was essential for the students to have the will to log in and participate to the program. Otherwise, the teacher did not have a way to communicate with them. Thus, the researcher presents both the positive and negative aspects of using technology as an educational tool. Moreover, the range of the sample and the appropriateness of the research design, define this study as a high-quality study.

**Zimlich, S. L. (2015). Using technology in gifted and talented education classrooms: The teachers' perspective.**
The qualitative study of Zimlich (2015) was mainly focused on the role of teachers regarding the use of technology in the classrooms of gifted and talented students. The aim of this study was to examine from the teachers' perspective, the ways that the teachers of gifted students used and applied technology to their lessons. The participants of this research were six elementary teachers of gifted and talented students. All the teachers had obtained a Gifted and Talented Education Certificate through a master's program from the University of Alabama. Three of the schools that the participants were taught, were in rural areas and three in the suburbs. Moreover, all the teachers had at least 4 years of teaching experience with gifted and talented students.

The researcher collected the data by analysing lesson plans, interviewing the teachers and doing classroom observations. In more details, Zimlich (2015) gathered information related to the teachers, the technology equipment and factors regarding the students. A

general finding of the study was the fact that teachers shaped the experiences of gifted students on technology, through the way that they used the technology equipment and the pedagogical decisions that they made. Students, according to the teachers' answers, learnt to work independently and explore technology with curiosity. Moreover, the teachers pointed out the role of technology in the careers and the future of the gifted students.
Another finding related to the use of technology in gifted education was that the relationship and the bonding between the teachers and the gifted students improved. Thus, the gifted students felt safer to use technology and engaged with the learning process. Finally, this study highlights the willingness of the teachers of gifted students, to learn new equipment and new applications of technology in order to support their students. So, according to this study, the use of technology in the field of gifted education was deeply influenced by the teachers and their attitudes toward technology. Also, the findings revealed that technology was used firstly by the teachers of gifted students and then, they passed their knowledge and their skills to their students and helped them to develop their skills and get positively affected by technology tools.

Zimlich's (2015) qualitative study was based on three different sources of data. The researcher used lesson plans, interviews and observations to collect data. This fact raised the weight of evidence of the study and the validity of the findings. However, the range of the sample and the fact that all the participants had obtained a certificate of Gifted and Talented education through a master's program by the same University in Alabama, affected the overall weigh of the evidence.

**Shaunessy, E. (2007). Attitudes toward information technology of teachers of the gifted: Implications for gifted education.**

Shaunessy on 2007 carried out a study focused on the teacher's attitudes toward technology in the field of gifted education. More specifically, through her research Shaunessy (2007) pointed out that it is essential for the teachers to acknowledge the values of technology in order to use it effectively and support their gifted students. Also, she argued that the curriculum should be designed appropriately to meet the needs of gifted pupils. For this reason, this study examined how the teachers of gifted students, recognise and use various technologies in their classrooms. To be more precise, the study

focused on the accessibility of teachers to technology, their training and their attitudes toward information technology.

In this study, the term information technology was defined as computers, e-mail, World Wide Web, multimedia and technology infusion. Moreover, the intellectually gifted students were defined as students with intelligence quotient equal to 120 or higher, on anon an individually administered intelligence test and who were attending in the intellectually gifted program in a southeastern state (Shaunessy, 2007). Additionally, teachers of gifted students were defined as teachers that had obtained a general education certification as well as a certification to teach intellectually gifted students since it was required by the states. The sample of the study was 418 teachers of gifted students of grades 2 through 6. The majority of the teachers were females (93%) and more than the half of them had a master's degree.

The findings revealed that the teacher's training affected their attitude toward technology. The participants were asked about their perception of using e-mails, World Wide Web, multimedia and computers. Also, they have been asked about the attitudes of their students toward these technology tools. In addition, the study showed that the training of the teachers plays a significant role in the use of information technology by their gifted students. According to these data, the way that teachers valued and used the information technology was positive and was affecting positively the attitude of the gifted students toward technology as well. Thus, likewise the study of Zimlich (2015), this research also pointed out that the use of technology in gifted education is strongly connected with the teachers' perception about technology. Their professional development in combination with their willingness made them plan a curriculum (or based on technology) that will meet the needs of their students with the assistance of technology.

The number of the participants in this study was high. In total 418 teachers that taught gifted students from the 2nd through the 6th grade took place on this research. Furthermore, the research design of the study was well structured. Consequently, the findings were trusted. Nonetheless, the focus on the specific topic and the systematic

review were not completely relevant and this fact affected the overall weigh of the evidence.

**Wallace, P. (2009). Distance learning for gifted students: Outcomes for elementary, middle, and high school aged students.**
The study of Wallace (2009) focused on distance learning and its potential for gifted students. The purpose of this study was to examine the effectiveness of online distance learning on gifted students in different dimensions. Three different age groups participated in the study but specific attention was given to the elementary students, as there were not many information and research about distance learning at this age. In particular, the aim of the study was to investigate the reasons that gifted students enrol on distance courses, how they and their parents evaluate their experience as well as how this learning approach affect them.

For the needs of the study, 690 gifted students participated in the research by enrolling on the Johns Hopkins University Center for Talented Youth (CTY) distance education program. The majority of these gifted students (94%) were living in the United States and the rest 6% were residents of 16 other countries. In addition, from the 690 participants, the 140 were elementary students. The findings revealed that all the age groups had a positive attitude toward distance learning and especially the elementary students.

In more details, the elementary gifted students seemed to be positive on distance learning before and after attending the online courses. More than the half elementary students were very interesting on the subject that they chose even before participate in the distance program. Furthermore, they claimed that the courses met their needs having right length and appropriate level of challenge. The majority of the elementary students (79,3%) answered that they usually or always enjoyed their courses. Finally, their opinion about the online courses after finishing their distance learning remained positive and the 60% of the elementary age-group increased their interest in the subject that they had chosen.

The findings revealed that the potentials of distance learning on gifted students are high, as the impact of the online courses on the participants was significantly positive. At the

same time, Wallace (2009) highlighted the need for more research on the field of distance learning in relation with elementary gifted students as according to other studies (Setzer and Lewis, 2005 cited in Wallace, 2009), less than 1% of the students that enrolled in online courses, were from elementary schools. Moreover, as part of the online courses, many technology tools were used like interactive Whiteboards, e-mails, online discussion forums, virtual classrooms and telephone. The use of these technology tools improved the collaboration skills of the gifted students, as they rated very positively their interaction and collaboration with their instructors.

Additionally, this study suggested that online distance learning could be an efficient way to accelerate or enrich the academic development of the gifted students (Wallace, 2009). It introduces an innovative curriculum on new learning and teaching styles. Although distance learning is mostly connected with home-schooling, and can also be used in school settings. The researcher supports that distance learning can be beneficial to gifted learners since they can access to courses that might be not offered at their school. Also, in this way, gifted students can be influenced and followed an individualised curriculum that will meet their needs and provide them online learning opportunities.

This study offered high-quality data and useful notes as well as implications for further research. The range of the sample was large, with 140 elementary gifted students (690 gifted students in total) and with an approximately balanced percentage of female and male participants. Finally, the research design and the focus of the study was appropriate and relevant to the rationale of this systematic review, for that reason was chosen as an in-depth review.

# Chapter 5

## Discussion

Through the in-depth review of the seven studies, emerged some categories that concern the uses of technology in the field of gifted education. These key issues are related to a) the curriculum and instruction planning, b) the professional development of the teachers, c) the learning development of this group of learners and their learning environment. These three categories will be discussed below.

### 5.1 Curriculum and Instruction Planning

The majority of the studies made a reference on the curriculum and the integration of technology in it. The main point of the studies was that the gifted students can be positively affected by enriching the curriculum and the instruction planning with innovative uses of technology. An efficient way to succeed that was the creation of a learning environment with more challenges, for the gifted pupils, by using technology tools (Dove and Zitkovich, 2003; Heald, 2017; Riska, 2010).

According to Heald (2017), instructional technologies could be part of an advanced curriculum that would provide various learning opportunities and inquiry-based lessons, relevant to the interests of the gifted students. Moreover, with an individualised curriculum and the use of technology, the learning process of gifted pupils can be more flexible ensuring the appropriate level of challenge for them. For instance, Heald (2017) claimed that many Internet-based software programs, allowed the students to pass on the next level once they reach a certain score. As a result, once they reach their goal they are encouraged to move on and develop new skills. Hence, software programs that fit gifted students' skills and needs can challenge them and enhance their learning development. However, this kind of educational technology can be beneficial for all the students without exception (Robinson, 1993) since they can enhance their critical thinking, problem-solving and research skills (Hickman, 2016).

Another example of how technology can be integrated into the curriculum is the one that Dove and Zitkovich (2003) examined in their study. According to them, a high-powered science curriculum that includes technology tools and requires gifted students to use them collaboratively can help students to engage with complex projects. In their study, gifted students had the opportunity to meet and collaborate with other gifted pupils and scientists who were specialised and interested in topics based on participant's choice. The findings of the study revealed that instructional learning and technology-based curriculum allowed gifted students to expand their knowledge and develop their cognitive and social skills. Consequently, when technology becomes part of the curriculum, gifted students are challenged and receive the help that they need to improve themselves.

Furthermore, teachers can use technology as a tool to build a more creative and flexible learning environment for the pupils. Instructional technology assists the teachers to provide their gifted students with a greater number of educational tasks and reach beyond the expected level of learning. Internet, software programs, online learning, spreadsheets and other uses of technology work as a stimulus for the development of gifted students. Regarding that, Heald (2017) highlighted in her study that technology within an advanced curriculum supports the curiosity of the gifted students and gives them the chance develop their critical thinking skills by exploring new sources of knowledge.

Nevertheless, technology is not beneficial only for the gifted learners but for all the students. In particular, Porton (2013) pointed out that integrating technology into the curriculum of students with or without learning difficulties, prompted the learners' interest. Moreover, their performance was improved since technology enhanced their critical thinking and collaboration skills in every content area. Websites, blogs, wikis, online forums, discussion boards, and social networking sites are some of the uses of technology that help students improve their writing and communication skills (Boudjadar, 2015). In addition, Boudjadar (2015) highlighted that the students who had access to computers, had the opportunity to interact with pupils from different geographical areas and take feedback from a variety of audiences, except their teachers. Also, they had the motivation to be creative and participate in an interesting and innovative learning manner, different from the one that they had used to be part of.

### 5.2 Professional Development

Two of the studies considered teachers' perception of technology as an important factor in how technology is used in gifted education. More specifically, the findings of Zimlich's (2015) and Shaunessy's (2007) studies, showed that teachers' professional development and their attitude towards technology affected the way that gifted students valued and used the technology. For example, Zimlich's (2015) study revealed that the student's attitude towards technology was the reflection of how their teachers approached technology. In this case, the teachers approached technology with a sense of curiosity and encouraged students to work independently. Thus, their students learnt to work mostly by themselves with various technology tools and recognise technology as a source of information that they had the will to explore.

Shaunessy (2007) in her study came to the conclusion that teachers' training plays a significant role in their attitude towards technology and the way that they integrate it into their teaching manner. In particular, teachers that had received and provide more hours of training from and by their colleagues showed a more positive perception of using technology tools in their classroom (Shaunessy, 2007). Also, students that had teachers who were spending more time using technology during their lessons, seemed to be more positive and confident about using it (Shaunessy, 2007). Hence, as Zimlich (2015) suggests in her study, teachers need more training and technical support to learn how to use technology and how to introduce it to their gifted learners. Hickman (2016) asserts that all teachers without exception, should be supported with ICT training because through them students learn to use technology and understand its benefits. This training will be primarily technical rather than pedagogical and will help teachers to become more comfortable with digital tools (Hickman, 2016).

In a similar vein, Riska's (2010) findings showed that the need for encouraging teachers to understand the value of technology and use it for the benefit of their gifted students, cannot be disregarded. According to the post-training data from Riskas' research, the professional development of the teachers and the appropriate training to utilise technology, influenced significantly the gifted students' development. Likewise, according to Heald (2017), teachers who understood better the instructional technology,

had more possibilities to engage their gifted students and academically challenge them. For example, when some teachers from Heald's (2017) study trained to use Moodle, post assignments, related videos, projects and any relevant paperwork there, imparted their knowledge with more excitement to their gifted students. In addition, their students learnt to be more inquisitive and engaged in their tasks. Thus, these studies highlighted that teachers of gifted pupils need to be trained and keep developing their professional skills in order to meet the needs of their students by using technology. However, according to other studies (Robinson, 1993, Hickman, 2016, Porton, 2013, Boudjadar, 2015) this applies to all the teachers and not only the ones that have gifted and talented students.

**5.3 Learning Development of Gifted Students and Learning Environment**

Another key issue emerged from the studies that were examined in-depth, was the learning development of the gifted students and their learning environment. All the studies acknowledged that the use of technology in gifted education affected the academic and social development of the students (Dove and Zitkovich, 2003; Heald, 2017; Riska, 2010; Michelle, 2009; Zimlcih, 2015; Shaunessy, 2007; Wallace, 2009). In particular, Michelle (2009) claimed that an online nurturing environment such as the Gifted Kids Network supported both the intellectual and socioemotional development of the children who participated in it. Consequently, the exposure of gifted students to technology tools can enhance their creativity, productivity, collaboration and organisation skills (Michelle, 2009).

Furthermore, gifted students could improve their social skills by using the internet and software programs that allow them to communicate with other gifted pupils. For example, the pilot program named "Gifted Kids Network" (Michelle, 2009) provided access to discussion forums, group projects, online lessons, workshops, quizzes, simulations and online blogs to the gifted students that participated in it. The participants had the opportunity to meet intellectually gifted peers from different geographic regions, network with them and share their experiences. Simultaneously, they had access to distance learning and online workshops. The findings of the study revealed that the participants in the pilot program enhanced their social and emotional development and practised their creativity and critical thinking skills (Michelle, 2009). Similarly, Yousefi (2014) in her

study found that video-mediated software and internet blogs allowed students to interact with each other adopting a range of cognitive and social learning skills. Moreover, students felt more comfortable and less threatened to share their thoughts and collaborate with other pupils (Yousefi, 2014). Hence, according to the studies above, both average and gifted students are positively influenced by the use of technology in their learning procedure that allows them to interact and collaborate with other learners.

Another use of technology that can affect positively the gifted learners are the online lessons. Wallace (2009) examined the outcomes of distance learning and found out that distance education can be an efficient approach for acceleration and enrichment. According to this study, online lessons could be used by home-schooled gifted students who seek to expand their knowledge outside the expertise of their parents or tutors (Wallace, 2009). Moreover, distance learning can be useful for students who want to enrich and advance their curriculum either because their school does not provide them with advanced studies or because their school is closed during the summer months. Wallace (2009) also claimed that gifted students inside the school settings could use online learning. In this case, students have the opportunity to access courses that are not provided in their school or expand their options and attend on courses that have the appropriate level of challenge for them.

Consequently, the findings of Michelle's (2009) and Wallace's (2009) studies revealed that technology's uses like web-based programs, discussion forums, workshops and distance learning can enhance the academic and social development of the students and expand their knowledge in a creative learning environment. Technology also can provide various and challenging learning opportunities to the gifted students and allow them to develop their skills in a flexible learning environment (Michelle, 2009, Wallace, 2009). The studies that examined in-depth were focused on gifted and talented students, however many other studies such as Robinson's (1993), Hickman's (2016), Porton's (2013), Boudjadar's (2015) and Yousefi's (2014) referred to all students without exceptions. The above-mentioned studies had similar findings regarding the ways that technology is used in the field of education and the fact that it impacts positively on the learners' development.

# Chapter 6

## Conclusion

Living in the 21st century, technology has become a part of the daily life for many people, especially for the new generations. Thus, many researchers examined the link of technology with education. However, there are limited studies that have focused on the educational technology coupled the gifted and talented students. To be more precise, gifted education is a field that flourished in the last 20 years and focused on learners with above average intellectual abilities and talents. In this study, giftedness was considered as the combination of intellectual and cognitive abilities of a child that thrive influenced by external variables. The aim of this study is to find out the ways that technology is used in the field of gifted education and collect data from evidence-based studies related to the topic.

In order to answer the aforementioned question of the study, the methodology of systematic review was used. In more detail, after screening studies from 8 different online databases, only 7 studies were included for in-depth review. The screening of the titles and the abstracts of the studies was conducted based on the inclusion and exclusion criteria that have been defined at the beginning of the review. These 7 evidence-based studies met all the inclusion and none of the exclusion criteria and focused on the uses of technology and gifted primary students.

After examining in-depth these studies, some key-findings emerged. In particular, it was noticed that three of the studies focused on the technology and the improvement of the curriculum that is used for the gifted and talented students. According to Dove and Zitkovich (2003), Heald (2017) and Riska (2010), technology can be used to advance the curriculum and enhance the gifted students' abilities. More specifically, technology provides gifted pupils with the appropriate level of challenge that motivate and encourage them to improve their skills (Zitkovich, 2003; Heald, 2017; Riska, 2010). Two studies

focused on the professional development and the training of teachers who specialised on gifted students. More precisely, Zimlich's (2015) and Shaunessy's (2007) studies found that the attitude of teachers towards technology, influenced the way that gifted students value and use technology. Thus, both studies highlighted the importance of support teachers, by providing them the appropriate equipment and training in order to integrate these methods in their classroom. Finally, the findings of Michelle's (2009) and Wallace's (2009) studies showed that technology can improve the learning environment of the gifted students and enhance their cognitive and socioemotional development. Distance learning and online discussion forums and blogs are some of the uses of technology in gifted education that allow the students to communicate with other gifted pupils from different geographical regions, collaborate with them and improve their social and intellectual skills.

However, the findings of these studies that were focused on gifted students do not differed from the findings of studies that focused in general education. More specifically, Robinson's (1993), Hickman's (2016), Porton's (2013), Boudjadar's (2015) and Yousefi's (2014) studies about technology and education, found out that technology in general education affected positively the students by enhancing their cognitive, social, critical thinking and collaboration skills. Similarly, Dove and Zitkovich (2003), Heald (2017), Zimlich's (2015), Shaunessy's (2007), Michelle's (2009) and Wallace's (2009) evidence showed the same positive impact on the development of gifted students. Nevertheless, Riska (2010) concluded that the SMART Board technology did not improved the gifted students' performance but it had a positive impact on their social skills. Hence, after examining in-depth the aforementioned studies, it can be deduced that technology is beneficial for both gifted and average ability students. Furthermore, the role of teachers in the students' attitude towards technology is significant in both student groups. All the studies that examined in this review, pointed out the need to support and train teachers to use technology efficiently and introduce it appropriately to their students.

### 6.1 Limitations of the Study

This study was conducted carefully with coherence and impartiality. Nevertheless, there are some limitations that should be considered by the readers. This systematic review was

carried out by only one person, thus the amount of literature in combination with the amount of available time was a factor that influenced the size of the study. Moreover, the findings of the studies that examined in-depth, revealed the ways that technology is applied in gifted education as well as the possibility of affecting positively gifted students. However, this systematic review included studies written only in English and consequently, there is the possibility other studies written in different languages to be excluded even if they were related to the topic and had important evidence to offer in this review. Finally, was noticed a lack of previous research, regarding this topic. Both the field of educational technology and giftedness have arisen the last decades and so there are not many studies that combine these two fields. Hence, this systematic review detected some gaps in the existed research about the uses of technology in the learning process of gifted students.

**6.2 Recommendations**

As mentioned above, this study revealed some gaps in the research regarding gifted education and technology. More specifically, the findings of this systematic review implicated the need for further research about the integration of technology in the curriculum. Dove and Zitkovich (2003), Heald (2017) and Riska (2010), pointed out that in most cases, the curriculum is not enough challenging for the gifted and talented students. Thus, researchers could examine further innovative ways of using technology in the learning process of gifted students and provide them with the appropriate level of challenge that would encourage them and help them to improve their skills. Also, further research could be conducted on the frequency that technology should be used in a classroom, since in some studies the amount of time that was spent on using technology tools during the lesson, was limited.

Moreover, further research is needed on finding efficient ways to integrate technology in the educational system in a manner that would be affordable by the schools. In particular, Michelle (2009) pointed out that it stills a need of finding new ways to increase the use of technology tools but keep low the cost of purchasing them. Similarly, Wallace (2009) suggested the conduction of new researches focused on how to integrate and tailor new technological material in the school environment and prepare the teachers and the

students for this change. Finally, based on the findings of this systematic review, it would be important to investigate further the use of technology and focus on the view of the gifted students and not only their teachers'. Almost half of the included studies were based on the teacher's attitude towards technology and what teachers believe on the gifted student's perspective. However, there are not many studies which are focused exclusively on the perception of gifted students and how they feel about learning with the assistance of technology.

To conclude, the fields of educational technology and gifted education are still new and unexplored in comparison with the fields of general education and technology. Thus, there are many unanswered questions and gaps, which should be examined further. For these reasons, researchers should continue the current research and focus on the field of gifted education and the integration of technology on it.

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