

# Multimedia Literacy in Preschool and Primary Education

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*Abstract:* - In this paper, we summarize the necessary elements of multimedia literacy education, its key stakeholders and emphasize its role in the early years of life. We also discuss approaches, similarities, differences, advantages and issues of introducing multimedia literacy education in preschools and primary schools in different countries of the world. Finally, we present results of the empirical research on the sample of 6<sup>th</sup> graders in order to determine the use of ICT and the level of information and multimedia literacy of school children in Croatia.

*Key-Words:* - multimedia literacy, early years, preschool, primary school, teachers, educators, parents

## 1 Introduction

Multimedia literacy represents a set of skills enabling individuals to effectively find, interpret, use, evaluate and even create multimedia. It encompasses abilities needed to process and exploit all components of multimedia: text, sound, image, animation, video and interactivity.

According to UNESCO, alphabetic literacy (the ability to identify, understand, interpret, create, communicate, compute and use printed and written materials associated with varying contexts) is a human right and the foundation of all learning. It is also a skill that begins in infancy and continues to grow over the lifetime.

But, today's children are not limited to written materials; they are frequent consumers of multimedia, surrounded by video games and dynamic media with a high level of interactivity. They prefer the content presented by graphics,

sound and video more than written materials and are impatient for the traditional slow systematic transfer of the learning content. Therefore, they must be taught to construct meaning from multiple modes of presentation of the learning content and to evaluate the multimedia.

The next two sections will define multimedia literacy and summarize the necessary elements of multimedia literacy education.

Parents, caregivers and educators all play a role in building the foundation for multimedia literacy. The need for multimedia literacy education puts forward new requirements to caregivers, parents and educators, who are expected to become multimedia literate lifelong learners. On the other hand, preschool and primary school literacy education still tends to focus on alphabetic literacy and traditional approach that does not take into account the wealth of knowledge children acquire through everyday contact with constantly evolving multimedia

environments. Although they recognize the importance of children to be multimedia literate, a large percentage of preschool and primary school systems in the developed world still does not include multimedia literacy into the obligatory curriculum. If a curriculum combines multiple instructional tools (text, sound, video and images), it is possible to attract children's attention and deepen their learning experience.

In the fourth section we will discuss the key stakeholders of multimedia literacy education in the early years of life (i.e. preschool). We will summarize approaches, advantages and issues of introducing multimedia literacy education in preschools in different countries of the world.

Finally, in the last part of the paper we will present the results of the empirical research performed in primary education in Croatia, to reveal the children's use of ICT and multimedia at school and home.

## 2 Multimedia literacy

Literacy in general refers to the traditional skills of writing, reading and numeracy, skills needed to use the knowledge contained in books (i.e. in printed form).

The concept of literacy is linked to fundamental, basic, alphabetic literacy, which emphasizes skills that prevail in analog, printed, Gutenberg galaxy, where information are created and presented by analog media [1].

Today, the knowledge is accumulated in other media and literacy implies different environments.

Literacy can be generally defined as a set of skills that we must possess in order to obtain information and thus survive in the society [2].

In order to make education more responsive to students in the 21st century, the need to respond to constant changes in media technologies and resources used in the world outside the classroom has been recognized in different educational circles. Thus, different terms have been used for *literacy* and *literacy education*.

Bawden [3] mentions new literacies relevant to today's information and communication environment: digital literacy, media literacy, library literacy, ICT (computer) literacy, internet (network) literacy and information literacy, as an umbrella term. Information literacy is defined as a set of skills that an individual should have to recognize a need for information, to identify, locate, evaluate, and effectively use that information for the issue or problem at hand [3].

Although computer literacy represents an irreplaceable part of information literacy, it is

important to separate and distinguish the concept of computer literacy from the information literacy. Information literacy refers to content and communication, it includes the creation of copyright material, finding and organizing information, researching, information analysis, assessment and evaluation. Given the large amount of information that is now contained in electronic form, before we talk about information literacy, it is necessary to be ICT or computer literate. Computer literacy represents the ability to use computers, but also understanding of tools that allow the user to interact with the technological infrastructure [4].

Computer literacy also contributes to the acquisition of knowledge and skills to use ICT and thus assumes a higher level of general literacy.

However, computer literacy cannot assume information literacy, since technological competence that excludes the possibility of assessing the quality and relevance of information and critical thinking is not sufficient, especially when it comes to education.

Without information literacy, the use of a large volume of information is not useful because these information do not become a relevant source of knowledge.

Technology enables communication and access to information which leads to the development of new evaluation and critical thinking skills that characterize information literacy. Therefore, acquisition of both types of literacies should happen simultaneously. These two literacies are certainly not synonymous, but together they contribute to a better education.

In addition to information and computer literacy, terms such as visual literacy, media literacy and critical literacy are increasingly used in order to spread the concept of literacy to visual, electronic and digital forms of expression and communication [5].

Many of these literacies coincide with the concept of information literacy, but one should emphasize that information literacy retains a certain conceptual breadth because, apart from information in electronic form, it also refers to information available in printed form.

Due to the large consumption of information obtained through the mass media (TV, internet), the notion of media literacy emerged. Media literacy refers to the popular mass media, but also has a major role in education.

In the U.S., education on media literacy is partially affected by British, Canadian and Australian teachers and scientists who emphasize teaching practices encouraging children and young

people to critically analyze mass media messages and pop culture.

But, competencies required for the basic education of a completely new generation of children (which learns and acquires knowledge in a different way) involve the understanding of the multimedia literacy concept.

It is important to distinguish the multimedia literacy from media literacy, i.e. to distinguish the use of mass media from the content covered by multimedia.

Bawden [3] classifies multimedia literacy under the digital literacy that is actually a generic term for a group of literacies: network literacy, Internet literacy, and hyper-literacy. But digital literacy generally refers to the understanding of information on the web.

Gilster [6] defines digital literacy as "the ability to understand and use information from different sources, in different forms, on the computer as a storage medium and on the Internet as a medium for the distribution and publication of information." Digital literacy involves the use of information via the Internet, but it also refers to the use of digitized materials, with emphasis on the ability to manage images, text and audiovisual content in the form of nonlinear dynamic hypertext. By this definition, digital literacy would be almost synonymous with multimedia literacy.

Whichever literacy is being mentioned in the literature, it usually represents the ability to read and write, the ability to understand information and express ideas in a concrete and abstract way, often assuming the text as a medium.

Multimedia, as equally as text, allows the development of concepts, abstraction and comparison, but simultaneously employing more senses in those processes and offering interactivity as a key factor.

Unlike text, which is written and read, multimedia is created, constructed, investigated and managed. Multimedia usually occurs as a result of cooperation and teamwork. The integration of text, images, sound and animation in multimedia document creates a unique language, which can successfully be implemented in teaching and education.

Multimedia literacy aims to help users to develop a critical understanding of the nature of multimedia, multimedia techniques and their impact on the end user.

### **3 Multimedia literacy education**

Multimedia literacy education introduces changes in the roles of educational institutions, schools,

libraries and a completely new form of teaching. The traditional role of teachers has changed; he is no longer the main source of information, but plays a mediative role. The current teaching aids are changed; they are being replaced by the information available through the network.

The multimedia literacy aims to increase students' understanding of how media work, how they produce meaning, and how they are being organized and constructed in the reality. It also aims to provide students with the ability to create their own multimedia materials. Literacy in multimedia requires basic computer literacy since multimedia information are most frequently transmitted via computer. (Although one might claim that multimedia literacy also refers to a book that has sounds attached to it, the contemporary concept of multimedia material goes beyond the printed book and necessarily involves some kind of interactivity.) Visual and media literacy education, which is not integrated in the traditional education system, is also necessary for the multimedia literacy education.

Although the use of media and technology in education and the development of literacy synthesize ideas about multi-literacy, the goal is to introduce them in the classroom as a tool for teaching literacy and as a support for the development of measures for assessing students' learning progress.

In the modern society, with the rapid changes in the way of creating and distributing information, children and young people should be able to find, select, understand and evaluate information.

Contemporary teachers emphasize the development of language skills, but it is also important for students to learn how to use a system of symbols that include images, sound and music as a way of self-expression and communication that makes an integral part of the modern life.

Children's interest in mass media and popular culture governs their computer and information literacy education (use of websites and interactive online communication).

Students are encouraged to create their own messages using visual, electronic and digital media tools.

There is a growing number of teachers in primary schools who use technology to enable their students access to online newspapers, magazines, audio files, narrative films and television documentaries, blogs and other multimedia sources that allow students to build critical thinking skills, communication skills, creativity and ability to solve common problems [5].

Students need to learn how to integrate the information coming from multiple sources and in

different formats such as text, music, animation, digital resources and the Internet, how to think critically and thereby acquire new knowledge [7].

Due to the wide availability of multimedia materials and the beginning of the era of personal media development (where everyone can produce multimedia materials), it is necessary to educate students to use already available and produce their own multimedia materials.

#### **4 ICT and multimedia literacy in the early age**

The early and preschool education represents a particularly interesting area to explore multimedia literacy as it offers the opportunity to observe the relationship between the formal and informal learning as well as the opportunity to discover a balance between child-centered learning and teaching focused on adults.

However, questions about the systematic implementation of multimedia literacy in the preschool education are rarely asked or acted on, since the role of ICT in the children's early education still represents a controversial topic. Critics of this topic argue that technology consumes time, money and childhood [8, 9], while advocates believe that ICT and interactive media (when used appropriately), have tremendous potential to nurture early learning and development [10, 11].

However, since children use the available modern technology on a daily basis, the question is how teachers and parents can take advantage of its power to enhance the learning and development of children and avoid potential problems.

Global changes in the 21st century created new needs, as well as a new concept of education and lifelong learning.

Children who are now attending institutions of early and preschool education belong to the generation that was born in a completely computerized environment that grows up with computers, the Internet, mobile phones, MP3 players, iPads, video games, social networking applications and YouTube.

Researchers [12] claim that these children learn, work, write and communicate in a different way from their predecessors; they prefer reading a blog than newspapers and are more likely to meet online than in person.

Some researchers [13] argue that not only the behavior of today's children that changed, but that their brains evolved, making them permanently and biologically different from their parents and ancestors.

On the other hand, civilization and technological progress inevitably changes the living standard, the value of life and ways or methods of education. As a consequence, pedagogical responses to these new challenges in the institutions of early and preschool education are being sought for. The current research indicates that it is necessary to educate a child from an early age, because self-motivated and active learning takes place exactly at that age [14].

During the preschool period, children develop creativity, exploring the ability to create using different media and through creative movement. Digital technologies provide one more channel for them to demonstrate their creativity and learning.

Although information and multimedia literacy represent important competencies defined by modern preschool curriculums throughout the world, the results of research in preschools give controversial results.

In Australia, researchers identified a low use of computers in preschools settings [15]. In Finland, 66% of the preschool institutions use computers on a daily basis as part of their regular program [16], while in Hong Kong [17] parents expect children to acquire multimedia literacy skills already in the preschool setting.

It is evident that there is a great deal of progress in the implementation and development of multimedia computer literacy education in the preschool sector, but resistance to the introduction of computers in many preschools is caused by the attitude of educators and the wider community, who believe that computer use in preschools tends to be inappropriate and irrelevant [18].

Such attitudes are associated with their attitude on "appropriate childhood" [15].

A large study among Turkish educators showed that educators believe that computers have a negative impact on the child's social development [19].

Furthermore, looking for quality practice in preschool education [20], researchers found out that concrete activity is valued as being synonymous with the quality practice. Given that the digital environment is not concrete by nature, it is less valued by default.

Another reason for the underuse of computers in the preschool setting are scarce financial resources. Downes et al. [21] point out that the lack of funds represents only part of the problem and that the professional development of educators should be considered as equally problematic [22].

Furthermore, there are important studies that document the potential of ICT in creating innovative learning opportunities for children. In a well-

designed curriculum [23] children working in pairs on computers are more engaged than when working with puzzles on the floor.

Yelland [24] investigated the use of computers at home and reported that computer games have significant potential for supporting mathematical learning. Studies have also found out that the work on the computer creates opportunities for the development of social skills [25].

Finally, studies [26] have shown that different types of multimedia educational software for children have quite different influence on the child's development.

While some types of software offer an intuitive and motivating learning environment, others are confined to drill exercises and games that have no educational effect.

Finally, the latest research project in United Kingdom, project Interplay [27] revealed that even young children (age 3 and 4) seem comfortable with computers and other ICT equipment.

The results showed that young children may learn ineffectively when using computers on their own and that adult guidance is the key to successful preschool learning with ICT and multimedia.

The study included eight different preschools. The project results proved that guided interaction can create opportunities for learning with (ICT) for children aged three and four and concluded that computers are not suitable for activities by children of such a young age.

They concluded that technologies such as digital cameras, electronic keyboards and toys that simulate laptops provide better support for collaborative use, promote confidence, are more affordable and give children the opportunity to build on competences and knowledge that they may develop in the home setting.

## 5 Empirical research on a sample of sixth graders

Analyzing the school curriculum we decided to carry out the testing on 6th graders, because the primary education informatics curriculum for the sixth grade introduces multimedia literacy as a teaching unit.

Survey was completed by 429 students from 10 primary schools in Zagreb<sup>1</sup>. The sample consisted of elementary schools 6<sup>th</sup> graders.

<sup>1</sup> The majority of elementary schools in Croatia are public, e.g. the capital town Zagreb has only one elementary private school.

Therefore, age differentiation was not required, only the structure of the sample with respect to gender.

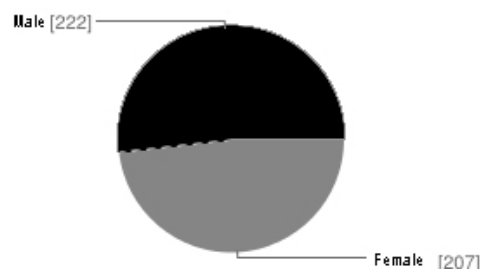


Fig. 1. The structure of students' sample with regard to gender

Such structure of the sample provided necessary conditions for the first research task – to discover whether students possess a computer at home. According to the results, only six respondents do not possess computer at home.

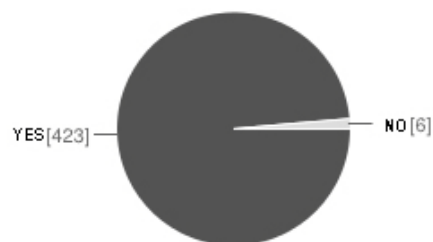


Fig. 2. Students owning a home computer

Pursuant to the ownership of home computers, we wanted to determine the age at which they started using computers. Answers to that question indicate that a large number of children started using computers as early as preschool (46%). The rest of the children started using computers at the lower primary school - 1<sup>st</sup> to 4<sup>th</sup> grade (48%). Only 6% of children started using computers in the higher primary school – in the 5<sup>th</sup> grade.

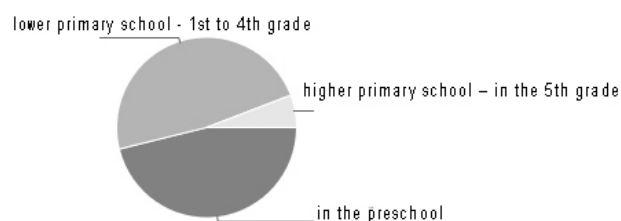


Fig. 3. The initial use of computers with regard to age

The next question referred to the students' interest in using computers. The obtained result was expected - the largest number of students showed interest, as

many as 448 students which makes 97% of the total number of students.

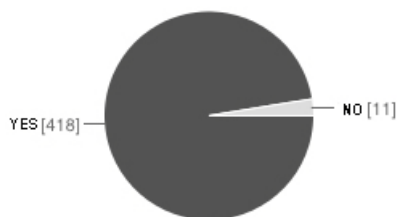


Fig. 4. Student interest in computers

Considering students' interests, one of the most important tasks was to determine the level of students' knowledge and ICT skills necessary to work on the computer. For this purpose, self-assessment methods were used. Students were offered four levels that could be considered to best reflect the level of their knowledge and skills and they had to choose the appropriate level. In most cases, students believed they possess good knowledge and skills to work on the computer (62%). Only 8% of students considered to possess insufficient ICT knowledge and skills, while 18% of students considered to possess sufficient knowledge and skills to work on the computer. The same percentage of students considered to have excellent ICT knowledge and skills.



Fig. 5. Student self-evaluation of knowledge and skills necessary to work on the computer

Since students frequently value their ICT knowledge and computer skills pretty high, they were offered multiple responses to the question of how they acquired the current ICT knowledge and skills. The obtained result shows that the majority of them acquired ICT knowledge and skills at school, but it also shows that it is equally likely for pupils to acquire this type of knowledge and skills independently (at home or somewhere else). Because of the possibility of multiple responses to this question, Fig. 6 shows the ranked display of students' answers according to their frequency.

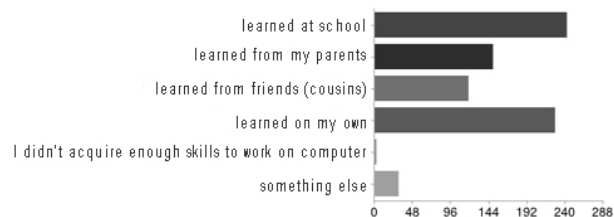


Fig. 6. Methods of acquiring ICT knowledge and skills

The other important task was to determine for which activities students use computers in schools. Students were offered five activities that were consistent with the assumed level of their current knowledge, based on the analysis of teaching units in informatics classroom. Due to the possibility of multiple responses to this question, Table 1 gives the ranked display of students' answers according to their frequency.

	Number (n)	Percentage (%)
Creating tables, graphics / illustrations	281	66
Searching for information on the Internet	236	55
Use of educational programs (software)	230	54
Writing papers, essays ...	202	47
Writing e-mail	103	24

Table 1. Activities and the use of computers in the classroom

	Number (n)	Percentage (%)
Watching YouTube videos	340	79
Access to social networks (Facebook, twitter, etc.)	323	75
Searching for information on the Internet	269	63
Recording or listening to music	229	53
Writing e-mail	150	35
Something else	132	31
Recording video or video processing	87	20
Writing papers, essays ...	86	20
Use of educational programs (software)	73	17
Creating tables, graphics / illustrations	56	13



Creating webpages	35	8
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Table 2. Activities and the use of computers outside the classroom

Since a large percentage of students (53%) claimed that they acquire ICT knowledge and skills independently (outside the classroom), we wanted to examine which activities they perform on computers outside school. Students were given the opportunity of multiple responses. Again, due to the possibility of multiple responses to this question, Table 2 gives the ranked display of students' answers according to their frequency.

The next set of questions pertained to students' understanding of the importance of the use of computers for learning and knowledge acquisition. These questions also served to examine students' opinions and attitudes regarding the influence of computers on the learning process: they had to state whether they find it easier and / or faster to learn with the help of computers.

	Num (n)	(%)	Num (n)	(%)
	YES	YES	NO	NO
The computer should be used for learning	335	78	91	21
I use multimedia, CDs and DVDs learning aids?	226	53	203	47
The use multimedia facilitate learning	247	58	168	39
It is easier to learn using computer	320	78	109	25
I learn faster using computer	278	65	151	35

Table 3. The importance of computers and multimedia for the learning process

Although it was assumed that most students will respond affirmatively to questions stated above, results in Table 3 show a considerable number of students who think that the computer is not suitable for learning as well as those who think that it is not possible to acquire represented knowledge faster or easier with the help of computers.

The fact about Croatian primary school computer equipment is pretty devastating, since a large number of students, as many as 34%, replied that there are not enough computers in the school.

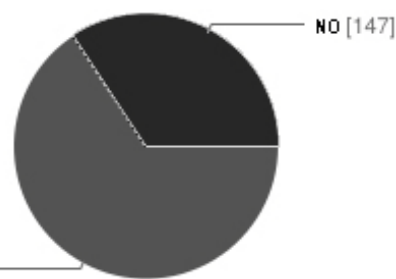


Fig. 7. Student assessment of the schools' computer equipment

But the most disconcerting fact was student's reply to the question about the use of computers in the school library. According to these responses, very small number of students used a computer in the school library, only 18% of them.

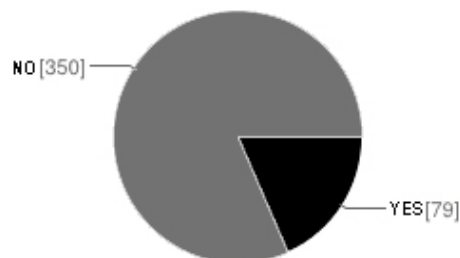


Fig. 8. Student use of computers in the school library

Apart from the analysis of information technology that children use in everyday life (that does not refer exclusively to computers), we wanted to analyze the use of modern communication devices, mobile devices, iPads and iPhones, as well as ways of using the above mentioned devices.

According to the possession and use of these devices, we concluded that some students use more devices in their everyday life.

Due to the possibility of multiple responses to this question, Fig. 9 gives the ranked display of students' answers according to their frequency.

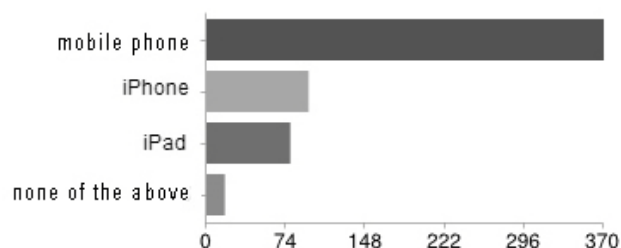


Fig. 9. Student use (ownership) of modern communication devices

As possible reasons and modes of use of modern communication devices, six multiple answers were offered to students. Their replies show almost equal

representation of all the available modes of use of these devices.

According to results, almost the same number of students uses modern communication devices for conversation, listening to music, watching videos and browsing the Internet, while only slightly less number of students uses it for reading e-mail and accessing social networks.

Due to the possibility of multiple responses to this question, Fig. 10 gives the ranked display of students' answers according to their frequency.

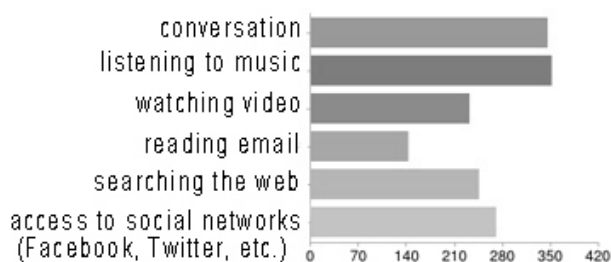


Fig. 10. The representation of activities on modern communication devices

Because of the general popularity and use of video games among children and young people, students were asked about playing video games in online and offline environment.

Again, since they had a possibility to offer multiple responses to this question, Fig. 10 gives the ranked display of students' answers according to their frequency.

	Number (n)	Percentage (%)
Do you play online video games on your own?	248	58
Do you play offline video games on your own?	245	57
Do you play online video games with more players?	213	50
Do you play offline video games with more players?	127	30

Table 4. Popularity of video games among students

## 6 Conclusion

This paper presents the concept of multimedia literacy, the role of multimedia literacy education in the early years of life as well as during the elementary education. The necessary elements of

multimedia literacy education are summarized, in addition to different approaches and issues of introducing multimedia literacy education in preschools in different countries of the world (Australia, Finland, Hong Kong, Turkey and United Kingdom).

Generally, we can conclude that children use computers and modern technology from the early age, but there is no indication of quality of the ICT usage unless ICT skills are systematically taught and effectively assessed within preschool and elementary school education. Children have access to information and communication technology on a daily basis and therefore they need to learn how to use it effectively.

Finally, results of the empirical research on the sample of school children in Croatia (6<sup>th</sup> graders) are presented in order to reveal the current use of ICT and the level of information and multimedia literacy of primary school children in Croatia.

### References:

[1] Špiranec, S.; Banek Zorica, M. Informacijska pismenost: teorijski okvir i polazišta. Zagreb: Zavod za informacijske studije, 2008.

[2] ALA - American association of school librarians; Association for educational communication and technology. Information literacy standards for student learning: standards and indicators, 1998. URL: [http://www.ala.org/ala/mgrps/divs/aasl/aaslarchive/pubsarchive/informationpower/InformationLiteracyStandards\\_final.pdf](http://www.ala.org/ala/mgrps/divs/aasl/aaslarchive/pubsarchive/informationpower/InformationLiteracyStandards_final.pdf) (30.11.2013)

[3] Bawden, D. Information and digital literacies: a review of concepts. *Journal of documentation* vol. 57, 2 (2001), pp. 218-259.

[4] Lynch, C. Information literacy and information technology literacy: new components in the curriculum for a digital culture. Coalition for networked information, 1998. URL: [http://old.cni.org/staff/cliffpubs/info\\_and\\_it\\_literacy.pdf](http://old.cni.org/staff/cliffpubs/info_and_it_literacy.pdf) (30.11.2013)

[5] Hobbs, R. Multiple visions of multimedia literacy: emerging areas of synthesis. In: McKenna, M., Labbo, L., Kieffer R., Reinking, D (eds.). *Handbook of literacy and technology, Volume II*. International Reading Association. Mahwah: Lawrence Erlbaum Associates, 2006. pp. 15–28. URL: <http://mediaeducationlab.com/sites/mediaeducationlab.com/files/Hobbs%20final%20PDF%20Literacy%20and%20Technology%20Vol%202.pdf> (30.11.2013)



- [6] Gilster, P. *Digital literacy*, John Wiley, New York, 1997.
- [7] Unić, D., Mikelić Preradović, N., Boras, D. The Importance of Teachers in Multimedia Literacy Education. In: Recent advances in information science. 17 (2013), pp. 231-237.
- [8] Cordes, C., Miller, E. (eds) Fool's gold: a critical look at computers in childhood. College Park, MD: Alliance for Childhood, 2000.
- [9] Healy, J. Failure to connect: how computers affect our children's minds. New York: Simon & Schuster, 1998.
- [10] Herron, K. *Supporting Digital Kids in the Early Education Years*, 2012. URL: <http://www.common sense media.org/educators/blog/supporting-digital-kids-early-learning-years> (30.11.2013)
- [11] National Association for the Education of Young Children and Fred Rodgers Center. *Technology and Interactive Media as Tools in Early Childhood Programs Serving Children from Birth through 8*. 2012. URL: [http://www.naeyc.org/files/naeyc/file/positions/PS\\_technology\\_WEB2.pdf](http://www.naeyc.org/files/naeyc/file/positions/PS_technology_WEB2.pdf) (30.11.2013)
- [12] Palfrey, J., Gasser, U. Born Digital: Understanding the First Generation of Digital Natives. Basic Books, 2008.
- [13] Small, G., Vorgan, G. iBrain. New York: Collins Living, 2008.
- [14] Fullan, M. The intriguing nature of sustainability (pg 13-29). In Fullan, M. *Leadership and sustainability; Systems thinkers in action*. Thousand Oaks, CA: Corwin Press, 2005.
- [15] Diaz, J., Beecher, C., Arthur, L. Early Literacy. Congruence and incongruence between homes and early childhood settings. *Languages of Learning. Changing communication and changing literacy teaching*. Common Ground, 2001.
- [16] Kankaanranta, M., Kangassalo, M. Information and communication technologies in Finnish early childhood environments. In *Childhood Education* 79:5 (2003), pp. 288-293.
- [17] Leung, W. M. The shift from a traditional to a digital classroom – Hong Kong kindergartens. *Childhood Education*, vol. 80, no. 1 (2003), pp. 12-17.
- [18] Pramling Samuelsson, I. & Sheridan, S. Preschool Quality and Young Children's Learning in Sweden. *International Journal of Child Care and Education Policy*, 3(1) 2009. pp. 1-11.
- [19] Bayhan, Olgun, P., Yelland, N.Y. A study of pre-school teachers' thoughts about computer-assisted instruction. *Contemporary Issues in Early Childhood*, 3(2), 2002. pp. 298-303.
- [20] Creasey, G., Jarvis, P., Berk, L. Play and social competence. In Saracho, O., Spodek B. (eds.) *Multiple perspectives on play in early childhood education*. Albany, NY: State University of New York Press, 1998. pp. 116-143.
- [21] Downes, T., Arthur, L., Beecher B. Effective learning environments for young children using digital resources: An Australian perspective. *Information Technology in Childhood Education*, 1(1), 2001, pp. 129-143.
- [22] Judge, S., Puckett, K., & Cabuk, B. Digital equity: New findings from the Early Childhood Longitudinal Study. *Journal of Research on Technology in Education*, 36(4), 2004, pp. 383-396.
- [23] Sarama, J., Clements, D. H. Learning and teaching with computers in early childhood education. In Saracho, O. N., Spodek, B. (eds.). *Contemporary Perspectives in Early Childhood Education*. Greenwich, CT: Information Age Publishing, Inc., 2002. pp. 171-219.
- [24] Yelland, N. J. Playing with ideas and games in early mathematics. *Contemporary Issues in Early Childhood*. 3(2), 2002. pp. 197-215.
- [25] Lau, C. How I learned to take turns: And other important early childhood lessons helped along by computers. *Teaching Exceptional Children*. 32(4), 2000. pp. 8-13.
- [26] Haugland, S. Children's home computer use: An opportunity for parent/teacher collaboration. *Early Childhood Education Journal*, 25(2), 1997, pp. 133-136.
- [27] Plowman, L., Stephen, C. Guided interaction: exploring how adults can support children's learning with technology in preschool settings. *Hong Kong Journal of Early Childhood*. 12 (1), 2013. pp. 15-22.