Educational Software Use in Kindergarten

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Introduction

Although Information and Communication Technology (ICT) use and particularly computer use in early childhood educational settings is under-examined in comparison to other educational levels (e.g., primary and secondary education), the debate is no longer one of should we or should not we use computers in early childhood settings. Electronic culture is already an integral part of early childhood experience for many youngsters (Parette & Blum, 2013). Research studies (Clements & Sarama, 2003; Haugland, 2005; McCarrick & Li, 2007; McKenney & Voogt, 2012; Siraj-Blatchford & Siraj-Blatchford, 2006; Stephen & Plowman, 2003, 2008; Yelland, 2005) reported that computer can be used as a tool to support learning, and assist communication, collaboration, creativity, and language development in young children. Judge, Puckett, and Cabuk (2004) reported that it is increasingly important for early childhood educators to introduce and use computers in their settings, particularly for those children who do not have access at home. They assert that offering access to computers in early childhood settings helps to reduce the digital divide. The essential role of early childhood teachers in the improvement of children's computer/ICT related experiences has also been reported (Stephen & Plowman, 2008). Kindergarten teachers are, for example, responsible for selecting educational software and deciding on the ways of its use. The aim of this research study was to investigate educational software use by young children in kindergarten classes.

For the purpose of this paper, specific terms used are briefly explained. Initially, the term *computers* is used as synonymous and as more preferable to the terms *ICT* (Information and Communication Technology) and *technology*. Apart from computer software, a number of products that incorporate some aspects of ICT are available to

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young children such as electronic-musical keyboards, programmable interactive toys, and digital cameras. However, practitioners define ICT more narrowly as computers and printers and this view is very influential (Stephen & Plowman, 2008) till now. Moreover, this study focuses on computers and software that runs on computers as, for the present, this is the predominant technological device for those kindergarten classrooms in Greece that have access to technology. The term *educational software use* refers to children's computer related activities, as well as the observation of such activities. The term *early childhood settings* is used as synonymous to the terms *kindergartens* and *preschools*. This term refers to kindergarten classrooms (formal educational settings) that attend children above 3 years old.

Theoretical Background

Educational Software Usage in Early Childhood Settings

Regarding educational software usage in kindergarten classes, different software programs/applications have been used such as interactive multimedia environments, games, painting/drawing programs, Word processing, and Logo programming (Chera & Wood, 2003; Clements, 2000; Labbo, Sprague, Montero, & Font, 2000; Sung, Chang, & Lee, 2008). The boundaries between different software applications produced for young children are not necessarily fixed, as different applications are presented in a form of play designed to attract and sustain children's attention. For example, both commercial and educational CD-ROMs incorporate the play component, which should not be seen solely for recreation or fun purposes (Verenikina, Herrington, Peterson, & Mantei, 2010). Early childhood educational software contains activities which quite frequently focus on early development skills such as sorting–classifying, matching, following instructions, and spatial reasoning (Stephen & Plowman, 2003). Regarding its usage in early childhood educational settings, McKenney's and Voogt's study (2010) showed that children 4–7 year old reported playing games, practicing words/maths, and drawing as the most frequently activities done in kindergarten classrooms. Marsh et al. (2005) reported frequent use of painting/drawing packages and rare use of the Internet.

Although there are a variety of educational software programs used by children in kindergarten classes, there is limited empirical evidence on how educational software is used in classrooms. For example, Ljung-Djärf, Åberg-Bengtsson, and Ottosson (2005) reported that computer can be used, among others, as an available option or as an essential activity. Computer use is often something that may be allowed between planned or adult-led activities, which means that it is typically used during the time that is organized as free play (Howard, Miles, & Rees-Davies, 2012; Ljung-Djärf, 2008). In America, the National Association for the Education of Young Children and Fred Rogers Center for early learning and children's media (NAEYC – FRC 2012), in their position statement regarding the role of technology in preschool classrooms, state that (a) technology and interactive media tools must

be used appropriately, and (b) technology integration is effective when integrated into the environment, curriculum, and daily routines. When computer use takes place within kindergarten classes, the role of teacher/adult intervention in supporting and extending children's experiences has been emphasized (Nir-Gal & Klein, 2004; Stephen & Plowman, 2003). For example, McKenney and Voogt (2009) found that teacher intervention elicited young children's engagement with literacy concepts and that children were able to work independently with the computer program after a few instruction sessions. Other studies have shown that children are largely left alone at the computer with the teachers seldom to participate in what goes on there (Plowman & Stephen, 2005) and, in particular, when children played computer games there was lack of teacher intervention (Ljung-Djärf et al., 2005; Vangsnes, Økland, & Krumsvik, 2012).

In Greece there are a few empirical studies regarding educational software or Internet usage in kindergarten classes (Chronaki & Stergiou, 2005; Fesakis, Sofroniou, & Mavroudi, 2011). For example, Chronaki and Stergiou (2005) compared computer use in two kindergartens, carrying out interviews with teachers and children. This paper presents research findings regarding educational software use in kindergarten classes in Athens, Greece. Fesakis et al. (2011) carried out an experimental case study of a learning activity meant for teaching preschoolers geometric concepts, via the use of communication tools from the Internet. The results of this study constitute part of a research project regarding ICT use–integration in kindergarten classes in Greece. Thus, some information about ICT in early childhood education in Greece is provided below.

ICT in Early Childhood Education in Greece

The Greek educational system is centrally organized and the main bodies of educational policy and planning are the Ministry of Education (YPEPTH) and the Pedagogical Institute (PI). Until recently, there was a lack of a central plan for the introduction of ICT. The Pedagogical Institute has published a framework for the introduction of ICT in teaching and learning, the so-called "Cross-Thematic Curriculum Framework for ICTs." For early childhood education, it sets directions for programs regarding planning and development of activities in the context of the following subjects: language, mathematics, environmental studies, creation/expression, and computer science (YPEPTH – PI 2003). These programs are not considered as independent subjects, but it is suggested to be taken into account when planning and implementing meaningful and purposeful activities for the children.

Among the essential prerequisites for computer integration in early childhood education are the placement of the computer/ICT in class (i.e., the so called "computer corner") and its inclusion in kindergarten's daily teaching practice (Komis, 2004). In order to successfully implement the curriculum, it is essential for teachers to be provided with the appropriate training and for early childhood classrooms with the appropriate resources. Regarding resources, many kindergartens have lately

acquired computers for use by the children. However, those kindergartens with a computer in their classrooms have, more or less, similar technology facilities (i.e., predominantly one or two computers). There are no computer labs in kindergartens. Regarding teachers, they are responsible for translating into practice the expectations/visions of curricula planners. The "Teachers' training on ICT in Education" program (YPEPTH – PI 2009), which is the most widespread in Greece, included the training of early childhood teachers as well. The first phase of the program included training in technical skills and has been attended by the majority of early childhood teachers. The second phase of the program which is dedicated to providing teachers with the pedagogical skills for ICT integration in the classrooms has been attended and is currently being attended by a number of teachers (the actual number is not known yet, as it forms part of internal evaluation of the program which still takes place). This large scale inservice training aims, among others, to familiarize teachers with appropriate educational software and the skills to adopt–integrate ICT in their everyday teaching practices. Within the Greek context, there is currently poor uptake of computers in early childhood settings (Nikolopoulou, 2009).

Method

Objectives of the Study

As stated earlier, the aim of this research study was to investigate the use of educational software in kindergarten classes. Three basic parameters of the study were as follows: (1) the presence of at least one computer in the kindergarten classroom and its use by preschool children, (2) the voluntary participation of kindergarten teachers, and (3) the study to be carried out without artificial intervention by the researcher (i.e., into the "natural" classroom environment). For the purpose of this research, official permission was provided by the research department of the Greek Pedagogical Institute and all kindergarten schools and their participants were treated anonymously. The objectives of this study were:

1. To identify the educational software commonly used by children in kindergarten classes.
2. To investigate how educational software is used in kindergarten classes.
3. To find out possible difficulties children face in the use of educational software.

Sample

Seventeen state kindergartens from Athens, in Greece, participated in this study and their teachers agreed to voluntarily participate in the research project. All kindergarten teachers were women (age range: 26–55), most of whom had attended the first phase of the "Teachers' training on ICT in Education" program (i.e., introductory

training in ICT skills). However, none of them had attended the second phase of this program which regards pedagogical training in the use of ICT in classes (this phase has started only recently, see YPEPTH 2012). All schools were committed to the same National Curriculum guidelines. The ages of the children ranged from 4 to 6.5 years. However, over 88 % of the children were aged 5–6.5 years old, as kindergarten attendance in Greece is now obligatory for this age group (i.e., the age group that will attend primary school during the next academic year). Table 1 shows the characteristics of kindergartens, as derived from interviews/discussions with the teachers and observations made in classes. In order to maintain the anonymity, the codes N1–N17 (N1: kindergarten 1, N2: kindergarten 2, etc.) were used. Each kindergarten participated in the research with one or more classes (full-day and/or classic class, as shown in the second column of Table 1). Classes held between 13 and 26 children, except those serving children with special needs. Table 1 also shows the number of teachers interviewed, the total number and ages of children, the number of computers, as well as the frequency and the duration of computer use (per child).

One or two computers were available in 15 (out of the 17) kindergartens and this reflects the typical situation in Greek kindergartens. The computer(s) were located in the classroom, they were set up on a table at the computer corner, while each computer had two kindergarten-sized chairs placed before it: to facilitate collaboration and to provide a place for children to sit and watch their peers if they are waiting to use the computer on their own (according to teachers' explanations). In only one school (N9), the teacher had her desk in the classroom and as a result it was the same computer (located on teacher's desk) being used by both the children and the class teacher (for administrative purposes etc.). Computer use appeared to be an established practice during the last 3 years.

Almost all schools (except N17) were located in central semi-urban areas of the Greek capital, in medium (neither high nor low) socioeconomic areas, without variation in ethnic background. Only the school N17 was located in a working class socioeconomic area, around 17 km away from the city center. Around 90 % of the children of the sample spoke Greek as a first language.

Data Collection Process and Research Instruments

The data were collected between January 2009 and June 2010 and consisted of interviews and informal discussions with the kindergarten teachers, observations and field notes of class activities. All data were collected by the researcher and author of this paper. Qualitative approaches seem practical and valuable for early childhood settings, although they include small samples and are not easily generalizable (Nikolopoulou, 2010). The interviews with the teachers were conducted before the observation sessions, they took place in the classroom (after the preschool day ended) and they were recorded digitally and transcribed. Approximately 8 h of interview recordings was collected and transcribed. The semi-structured interviews were based on specific axes related to the research objectives. The following questions were used: What educational software programs are used by children in the class?

Table 1 The characteristics of kindergartens

Kindergarten	Type of class(es)	No. of teachers	No. of children	Ages of children	No. of computers	Frequency of computer use (per child)	Duration of computer use (min)
N1	Full-day[a]	1	23	4–6	2	2–3 Times/week	10
N2	Full-day	1	25	5–6	1	Once/week	10–15
N3	Classic[b]	2	26	4–6	3	Once/week	30 (max)
N4	Full-day	1	13	4,5–6	1	Once/week	5–15
N5	Classic	1	15	4,5–6,5	2	Every day	10
N6	Full-day	2	21	5–6	1	Once/week	8–15
N7	Classic +, full-day	2	28	5–6	2	Once/week	10
N8	Full-day	2	22	5,5–6	1	Once/month	8
N9	Classic +, full-day	2	43	4,5–6,5	2	Once/week	10
N10	Full-day	1	25	5–6	2	Once/week	10–15
N11	Full-day +, 2 classic	2	57	4–6	1	Every 3 weeks	10–15
N12	Classic +, full-day	2	41	4,5–6,5	2	Weekly –once/month	10–15
N13	2 Full-day	2	49	5–6	3	Once/week	10–20
N14	Classic	1	23	5–6	1	Once/month	10–15
N15	Classic	1	22	5–6	1	Once/week	10–20
N16	Special needs	1	4	4–6	1	Once/week	10–20
N17	Special needs	1	4	4–6	2	Weekly/bi-monthly	10–20

[a]Full-day class: children attend kindergarten from 8:30 a.m. to 4 p.m.
[b]Classic class: children attend kindergarten from 8:30 a.m.to 12:30 p.m.

How are these programs being used? Do children face difficulties when using specific software programs? All teachers were confronted with the same set of core questions, while follow-up questions were formulated in order to offer teachers the opportunity to introduce unexpected ideas and thoughts. The interviews also addressed areas such as demographics and computer availability/access.

In parallel with the interviews, in each kindergarten were conducted two or three observations of computer use (i.e., two or three sessions, each one in a different day), of total duration of 1.6–3 h. All observations took place from January (2009 or 2010) onwards, after negotiation with class teachers. This time period, being 3 months after the commencement of the academic year, was proposed by the teachers because they wanted their children to be initially acquainted to the new kindergarten environment before any research took place. The observations were naturalistic observations of the children's and teachers' activity in the classroom. As the researcher was also an observer, she sat close to the computer corner and she needed to be mindful of her position in the classroom (e.g., as a researcher observing children using computers there was a challenge of supporting their engagement). During the observations, a small number of children (two or three) sat at the computer corner, while the rest of the class was engaged in other free play activities. Children did engage with the computer activities in ways that suggested that they were comfortable with the researcher's presence. The observations involved the writing of detailed field notes (what took place around the computer etc.) during and immediately after the observations. As field notes were reviewed memos were recorded to document emerging thoughts, feelings and questions regarding the observations. Informal discussions with the teachers took place during and mainly immediately after the observations (e.g., for clarifications on various actions).

In order to investigate the first research objective, the data were collected via interviews with the teachers. For the investigation of the second and third objectives, interviews and observations/field notes were used. As a main parameter of the study was to be carried out without an imposed intervention by the researcher (i.e., in the natural environment of the everyday practice), it was the teachers who decided on the timing of the observations, as well as on the software used. There was also negotiation with the teachers with regard to the number of sessions observed (i.e., two or three sessions).

Data Analysis

The qualitative data gathered (from interviews, observations, field notes) were each analyzed using classical content analysis. All the data sources were analyzed to find codes that could be organized into categories. The codes were produced deductively and then included as descriptive information about the data (Leech & Onwuegbuzie, 2007). Results derived from one source of data were supported by other data sources. Some of the interview statements most strongly supporting the categories are presented.

Ethical Considerations

Regarding ethical considerations, kindergarten teachers were informed about the nature, duration, and the aim of the research study. Ethical issues arise when investigating dependent, vulnerable members of society such as young children in early childhood education settings (Morgan, 2010). Gaining informed consent from research participants is widely regarded as central to ethical research practice and in institutional settings such as schools, access tends to be mediated by teachers, managers, etc. (Heath, Charles, Crow, & Wiles, 2007). Issues of anonymity and confidentiality are also included in ethical considerations, thus the above parameters were assured in this study (i.e., all kindergartens and participants were replaced with codes). Additionally, initial and ongoing consent with teachers was negotiated and participants were informed about research outcomes.

Results and Discussion

This section describes and discusses the results in three subsections, according to the research objectives, with parallel presentation of indicative excerpts from the interviews. This is done because direct quotes from the interviews can help readers to acquire a more complete view of the events and situations (Forman & Hall, 2005). The findings are presented for all schools, descriptively.

Educational Software Commonly Used by Children in Kindergarten Classes

Table 2 shows the educational software/programs most commonly used by young children in classes, as reported by kindergarten teachers: the MS Paint, the commercial series Ram Kid/Kide Pedia (which include many games), followed by the use of

Table 2 Educational programs commonly used in kindergarten classes by children

	No. of times mentioned
MS Paint (and painting/drawing programs such as TuxPaint)	13
Ram Kid, Kide Pedia (commercial series that include many games)	11
Educational CD-ROMs (e.g., "My class")	9
Word processing (MS Word)	8
"Explorer of the computer—Electronic Postman" (educational software distributed to most all-day classes (by the Greek Ministry of Education)	5
Internet	5
Digital games (commercial)	3
MS PowerPoint	2

educational CD-ROMs (e.g., "My class," "Salto and Zelia," "On the road safely") and the MS Word. The programs "MS Paint" and "MS Word" are included in every computer as parts of the Microsoft Office, and thus, there is no extra cost for the kindergartens. Taken into account the limited school budgets, such open ended software is suggested to be embraced in kindergarten classrooms (and as a consequence, it is interesting to investigate examples of good practice and what actually children learn). Additionally, the educational software "Explorer of the computer—Electronic Postman" (contains language and mathematics learning activities) has been distributed recently, during the academic year 2008–2009, by the Greek Ministry of Education in most full-day kindergarten classes without any cost. Some kindergarten teachers use this software in their class and characterized it as particularly interesting. For example, in N4 (full-day class) it is used as a supporting tool for language and mathematics, while the teachers in N7 (classic and full-day classes) use it systematically during the hour of free play activities. However, other teachers (in N1, N2) who have this software in the kindergarten, do not use it in their class because they do not consider it as appropriate for the children. For example, "I do not consider it (the software) appropriate as to its design–placement of specific buttons on screen—because the children can be easily lost" (teacher in N1), or "It has a long introduction and the kids get bored…" (teacher in N2).

Some programs (especially the commercial series Ram Kid/Kide Pedia and the educational CD-ROMs) are frequently brought in classes either by the teachers (e.g., in kindergartens N2, N10, N11, N12, N14) or by the parents (e.g., in N3, N9, N10, N11, N12). Table 2 reveals a limited range of programs used in classes and this may be attributed to the tight school finances. The findings are in some agreement with earlier research. For example, Marsh et al. (2005) reported frequent use of painting/drawing programs and rare use of the Internet, while others (Lee & O'Rourke, 2006) found frequent use of CD-ROMs (e.g., games, talking books). In Greece, Chronaki and Stergiou (2005) found that children carried out educational activities (writing words and numbers, painting), aiming at children's familiarization with the computer. The reasons for using computers with children in kindergarten classes (discussed in another paper) were the development of language and fine motor skills, and the computer's contribution as an incentive in the learning process. In particular, the MS Word was mainly used for the development of language, reading, and writing skills, for emergent literacy skills and in order to support curriculum learning objectives in language—as well as for providing practice in the recognition of the alphabet letters. The Internet (in those kindergartens which had a connection) was reported to be mainly used for downloading/playing games, for carrying out project work and for downloading educational material and photographs.

Independently of the programs used and the tight budgets, the role of the kindergarten teachers was essential because they decided on the program(s) used by their children. An example of an interview excerpt was: "We have some of the Ram Kid series, we intend to buy them with our money. A mother has brought the program 'On the road safely' and when we talk about traffic education we use this very much… We first look at the software, i.e., we see whether the activities included are appropriate for our children. We have found some (programs) that were very nice

but they did not correspond to our children's level and interests" (teacher in N11). Different decisions made by the teachers are mentioned in the following sections of the paper. The crucial role of the kindergarten teachers in the computer environment has been reported in literature (Keengwe & Onchwari, 2009; Nir-Gal & Klein, 2004). The essential role of the teachers in this study is also highlighted in the subsequent sections of this paper.

How Educational Software Is Used in Kindergarten Classes

This section discusses how educational software was used in the classes, and it also includes findings regarding when the software was used. Computer use took place, mainly, during the hour of free activities/play at the computer corner. As most teachers stated, one hour every morning or every afternoon is devoted to computer use. These findings are in agreement with the relevant literature which refers to computer use in kindergarten's daily practice so that children can understand its contribution towards teaching and learning (Plowman & Stephen, 2003), and to that computer use took place during the free play activities (Ljung-Djärf, 2008; Ljung-Djärf et al., 2005). In this study, the frequency of computer use, per child, was found to vary between 2 and 3 times per week and once per month (see Table 1). In most kindergartens, teachers reported that every child was entitled to work on the computer (if s/he wanted) once per week with an average time of 10–20 min. In about half of the kindergartens there was a sort of a systematic way for the children to have access to the computer, such as a reference plan. In cases of a lack of a reference plan, children's use of the computer was not recorded, but some teachers said they did remember which children passed from the computer corner. Educational software was often reported to be used in the context of a project in combination with other non-computer based activities (e.g., in N1, N2, N3, N5), or for producing the class' newspaper (in N1). Computer use is suggested to be combined with off-computer classroom activities, as relevant literature has shown that this way can lead to better learning effects (Haugland, 2000; McKenney & Voogt, 2009). Parette and Blum (2013) discussed elements of technology integration and identified key activities in which technologies can be used across preschool settings. Such activities may embrace the use of educational software in order to support and enhance children's leaning.

Class organization in computer environment was found to, mainly, take place in small groups because as two teachers explained: "It works very well as a group because the other child sits next to it and says 'you haven't seen this!' or 'no, we must not do this', i.e., they discuss, they help each other, the child waits his/her turn" (teachers in N11). An exception to group work constituted the kindergarten N17, which serves children with special needs. In this case, each child works with the teacher's help in order to achieve specific objectives: "The autistic child, who can not interact simultaneously with the screen and the teacher, focuses on the screen… It is important for children with special needs to acquire fine motor skills and to understand the cause-effect relationship. There are difficulties depending on the child, for

example with the mouse. I do help them… Two objectives can be pursued in parallel, for example, development of fine motor and cognitive skills" (teacher in N17).

Class observations revealed that, in most cases, when children were using different programs there was some type of teacher intervention and guidance. For example, when they were using the program MS Word there was an initial guidance from the teachers and afterwards an intervention-assistance when children did not know specific functions (transition to the next line, error erasing, etc.). The class observations (in kindergartens N1, N3, N4, N6, N7, N9, N10) revealed that children, with the help of their teachers, used successfully different functions of the MS Word such as "delete an error" (button "Backspace"), "transfer to the next line" (button "Enter"), "select a color," "drag and drop," and "save a file." Children were happy to write their name, to select-change a color and to change the size of the letters of their name (as well as of other words). It was also observed that children cooperated and helped each other for the successful outcome of a learning activity. In any case, it was the teacher who knew her children in the class and she decided on the type of intervention needed. For example, an interview excerpt was: "Children sit (on the computer) several times on their own and seek help from other children—they believe they know—rather than from myself… I consider it important to sit next to very young children because when they cannot find something they get bored and leave the computer" (teacher in N7). Teacher's guidance/mediation could be broadly divided into three categories, which were also observed to take place in combination: (a) step-by-step guidance for teaching new concepts/skills, (b) initial explanations (e.g., function of specific buttons) provided by the teachers and then independent work by the children, and (c) teacher guidance/assistance whenever children asked for it. These types of teacher guidance are discussed among the recommendations made by researchers (Plowman & Stephen, 2005; Stephen & Plowman, 2008) for more effective computer integration in early childhood settings. Regarding teacher guidance, the use of computer games (the series Ram Kid, Kide Pedia, etc.) constituted an exception, as children played on their own (without asking for help), they often chose activities they had played before and knew in advance the correct answers (they did not even wait to listen to the instructions), and they never asked for teacher's help. Regarding this point, there is an agreement with other research studies (Ljung-Djärf et al., 2005; Vangsnes et al., 2012) which reported lack of teacher intervention when children played computer games. As evidence-based guidelines for computer use in preschool education are limited (Siraj-Blatchford & Siraj-Blatchford, 2006), it is rather uncertain for teachers on how to achieve the visions-claims reported in literature. The issue of teacher guidance when children use different educational software programs in kindergarten classes is suggested for further investigation.

Teachers reported that children's computer work is often displayed in the classroom. For example, children's drawings made with the program MS Paint alternate as a background on the class computer (in N2), children's printed work is displayed at the end of the year (in N9), while all children's computer work is copied onto a CD for the parents (in N10). For example, "There is a computer folder which is given to parents at the end of the year…it includes all work the child has done on

the computer (printouts with names, pictures on Paint etc)" (teacher in N10). In such a way, computer use is considered as an activity carried out in kindergarten's daily practice, an activity like other school activities that may foster the links between school and parents. Additionally, several teachers noted examples of children's evident pleasure during their engagement with ICT (i.e., an aspect of children's preschool experiences that is valued, as promoting a positive disposition towards learning): "After help as to where to click, she was happy to print, a short phrase she wrote using MS Word, independently" (teacher in N4).

The interviews with the teachers also revealed the time period (timing) during which some of the programs are being used in classes. It was shown that computer games are mainly used at the beginning of the academic year, while the word processor is used by the end of the year. Indicative quotes from interviews were: "Computer games are mainly used at the beginning of the year, so that children become acquainted with the use of the mouse, while the word processor is used by the end of the year" (teacher in N3), "Children, especially by the end of the year, recognize the letters of the alphabet, they can make the transfer between lowercase and uppercase letters… thus the word processor is used by the end of the year" (in N7), and "The letters on keyboard are uppercase, while the children in kindergarten learn initially the lowercase letters… the (program) Word is used in spring" (in N9). In another kindergarten where the uppercase letters are being taught first, "Every child who enters the class in the morning is encouraged to sit on the computer to write her/his name on a separate line. They have been taught the uppercase letters and now (month May) we are in the process of teaching the lowercase letters. After March they started to write their name in the Word every morning, as a kind of register –till then they wrote it on a paper" (teacher in N6). It appears that some teachers decide on the learning goals to be achieved in their class before they decide on the type of software, and this decision/sequence is in agreement with earlier research (Haugland, 2005; Lin, 2012). For example, Lin (2012) suggests that teachers can choose the learning objectives and design a series of activities (software use could be among them) in order to accomplish learning goals.

Difficulties Children Face in the Use of Educational Software

The interviews with the teachers in combination with class observations revealed some difficulties children encountered when using the programs MS Paint and MS Word. Interestingly, although the use of MS Paint was most commonly reported (as shown in Table 2), in almost one third of the kindergartens (in N7, N9, N10, N11, and N16) children faced some sort of difficulties. Examples of excerpts from the interviews were: "The children initially preferred games but now they are also using MS Paint with my help, because they have difficulties" (teacher in N10) and "The MS Paint is not used because I find it difficult… in order to get a quality result – painting—it needs time for training" (teacher in N7). One factor that makes the program MS Paint difficult is that some children have not developed the necessary fine motor skills: for example, they have got used to draw a house much easier by

hand using traditional materials, rather than by using the Paint program. Drawing with pencils and other traditional materials is an essential traditional activity and the use of the software does not come to replace it but to support and extend children's experiences. Guided interaction (e.g., demonstrating how to use the eraser/paintbrush, or providing feedback so as to encourage the child's efforts) is a way for helping the children overcome some difficulties. Overall, the role of learning in the use of software programs is important and (as a teacher mentioned) time is needed for children's training and practice.

Regarding the use of MS Word, almost in every class where its use was observed, children faced difficulties in identifying specific alphabet letters on the keyboard—because the Greek and the English characters were both present on some buttons. This difficulty could be overcome by placing on the keyboard, stickers with the Greek uppercase letters, a procedure which was successfully followed in kindergarten N6. Furthermore, another difficulty was that children pressed continually one button, with the consequent need to delete several characters (i.e., by using the Backspace button). In order for the MS Word to be used in class, it is suggested for children to have an initial acquaintance with the alphabet letters: this helps children to identify/recognize the relevant letters on the keyboard. Thus, the time period the Word is introduced in class is very important. It has been mentioned that teachers chose to introduce the program in spring, towards the end of the academic year. The role of learning in the use of MS Word is important. For example, as two teachers reported informally, children are sometimes given text to copy and as their skill and accuracy develop, they are expected to type and print short sentences.

Aspects of observations together with the interviews revealed that some children haven't developed the necessary fine motor skills for the use of the software. At the beginning of the academic year some problems appear mainly with those children who do not have a computer at home, but afterwards all children seem to become accustomed to computer use. Difficulties with the mouse seem to be easily overcome, through practice. Examples from interview excerpts were: "Some children need physical guidance to support their development of mouse control. However, after few attempts they get mouse control and become more confident" (teacher in N8), "Children are more familiar with the mouse—because they play games—rather than with the keyboard. They often press continually the keyboard buttons… I've noticed differences in children's fine motor skills due to computer use at home" (teacher in N7), "We found out that some children do not have computer at home and at the beginning they face difficulties. The computer helps in the development of fine motor skills –the mouse helps a lot…In general, when computer games are carefully selected they help a lot" (teacher in N11) and "Gender differences are not intense, the differences appear due to different access to computer at home and due to the frequency of choosing the computer at school…sometimes, children 4 years old handle the mouse much better than older children who rarely choose to use the computer at school" (teacher in N6). Additionally, in a class with children with special needs there were present some initial difficulties, which were then overcome: "We started with the painting program where children struggled a bit because it did not come out—what they wanted—i.e., what comes out with the hand. They faced difficulties with the use of the mouse…Later on, we put children's names on

the computer and they were encouraged to write them with different characters" (teacher in N16). The interview excerpts reveal the role of learning/practice as well as the crucial role of the kindergarten teachers in the study. Computers have the potential to support young children's classroom experiences, but for this to happen "it is necessary for teachers to carefully plan for, and articulate to children, suitable classroom tasks" (Kervin & Mantei, 2009, p. 30).

Some of the interview excerpts presented in this paper, as well as others not shown here, revealed issues related (a) to the use of computer by children at home and (b) to children's gender. The already developed children's fine motor skills were often attributed to the use of computer at home. Recent research (McKenney & Voogt, 2010; Plowman, McPake, & Stephen, 2008) reported that young children have access to and use the computer/ICT at home and many children had acquired the basic computer skills already from home (before they entered kindergarten). As there are differences regarding the skills children bring to classroom use of computers, it is suggested for teachers to be aware of these skills (in order, for example, to provide support for those children without previous technological experience). Regarding children's gender, the results appeared contradictory. In some kindergartens (in N9, N10, N12), children's gender appears to be related to the frequency of computer use (is higher for boys) or to children's preferences to different types of software. Some teachers reported that boys were more interested in using the computer because they chose it more frequently during the hours of free activities, while the girls preferred to be engaged in other activities. Two interview excerpts regarding children's preferences were: "Girls prefer activities with puzzles, painting" (in N9) and "Boys prefer action games, games that provide scores" (in N9, N12). However, in other kindergartens (e.g., in N6 and N7) no gender differences were reported, as "When it comes their turn to work on the computer all children want – it did not happen a child not to want (the computer) and to choose another activity" (teacher in N7). In literature, gender differences regarded children's preferences towards interface design (Passig & Levin, 2000) and software's characters (Littleton, Light, Joiner, Messer, & Barnes, 1992). In particular, young boys seem to be attracted by movement, "male" characters and action games, while young girls seem to prefer the colorful buttons of a program and "female" characters. However, other studies did not report on significant gender differences when children use computers in class (Hatzigianni & Margetts, 2012; Shawareb, 2011). As a consequence, the issue of gender can be further investigated.

Concluding Comments and Recommendations for Future Research

The research described in this paper provides some useful insight for researchers and teachers about educational software usage in kindergarten classes. The class observations and the interviews with the teachers revealed some issues difficult to be explored through large-scale quantitative surveys. The data derived from the 17

kindergartens cannot be generalized due to the small sample and its origin from one region. However, taken into account that in Greece (as well as in other countries) there is limited empirical research, this study contributes to our understanding of computer use and classroom practices with young children. Concluding comments are presented below.

The most commonly used programs were painting programs (especially the MS Paint), the commercial series Ram Kid/Kide Pedia (which include many games), educational CD-ROMs and the MS Word, while the use of the Internet was rare. For early childhood settings with tight budgets, the use of software programs that are free, low cost or downloadable seems a good choice. In parallel, researchers have emphasized the issue of using developmentally appropriate software, in appropriate ways (Parette & Blum, 2013). Classroom activities designed using appropriate technologies and NAEYC principles (e.g., the technologies should align with the curriculum, the choice of technology should be based on how it serves classroom learning, see NAEYC – FRC 2012) support the developmental learning needs of young learners. It is the case that not all commercial computer games are developmentally appropriate for use by young children. As a starting point, software/games need to be carefully evaluated by teachers (a process facilitated when teachers have attended appropriate training) before any usage in the classroom.

This study found that computer use took place, mainly, during the hour of free activities at the computer corner. "Playing with the computer" designates a series of qualitatively different activities in which children can, for example, engage in drawing, writing or play (Plowman & Stephen, 2005), and computer use in the hour of free play activities is linked to literacy and pedagogy. For example, the manipulation of symbols and images on computer screen represents a new form of symbolic play, and there is potential in the development of children's higher order thinking (Verenikina et al., 2010; Yelland, 2005). Wohlwend (2009) demonstrated that 5–7-year-old children were accessing new literacies through pretend play—to explore iPods and video games— while Morgan (2010) indicated that teachers value and promote "playful" and interactive technology experiences as vehicles for 3–7-year-old children's learning. Appropriate ways for computer/technology integration could include technology-supported learning experiences during the hour of free activities: for example, instances where children are provided with technology support that help them complete tasks in classroom activities. With regard to the third objective, children encountered some difficulties in using the programs MS Paint and MS Word. Some difficulties with the MS Paint were mainly attributed to children's underdeveloped fine motor skills. The role of learning in the use of such programs is important, because these programs support and extend children's experiences.

The crucial role of early childhood teachers, in the whole process of computer use in kindergarten classes, has emerged. Initially, teachers' participation in this project was voluntary and they suggested the timing for the observations, while later they decided on the program(s) used in their classes and on class organization. The essential role of kindergarten teachers in ICT environments, for supporting and extending children's experiences, has been extensively discussed in relevant literature (Kervin & Mantei, 2009; Stephen & Plowman, 2008). Selwyn (2011) proposed the cultivation

of a critical digital literacy approach: for example, the development of creative spaces utilizing digital technologies that bridge formal/informal divide. As young children are entering early childhood settings with dispositions that may not have been part of their repertoire of skills in past decades, early childhood educators need to be aware of this and to develop new learning experiences for young children (Zevenbergen & Logan, 2008). The teachers are the designers and implementers of learning activities for children. The role of the teachers is related to and has implications for teacher training. Teachers' skills, views, and classroom practices have all implications for in-service training in the pedagogical uses of ICT. According to Parette, Quesenberry, and Blum (2010), both preservice education and in-service professional development are important so that early childhood teachers develop and apply skills in integrating and using ICT in classroom settings.

The limitations of this study included the limited amount of time and the limited financial resources. For example, if video recordings were used during class observations, this could have highlighted the interactions between young children and software, as well as the interactions among children (their gestures, dialogues, etc.). It is noted that this study did not investigate the acquisition/development of skills and knowledge through the use of educational software, and this will constitute the focus of another paper.

As there is little empirical evidence on the use of computers in early childhood settings, the following issues are suggested for future research. Investigation of the activities children do on the class computer and the development of specific skills. The research has now moved on from questions about whether ICT can help children learn (Stephen & Plowman, 2008), with the need to investigate further how and whether it makes a difference in young children's learning and development. For example, Haugland (2000) discussed for developmentally appropriate activities, while Yelland and Kilderry (2010) reported that ICT as a resource is being underutilized and children are being denied access to learning opportunities that promote open-ended applications, problem solving situations/tasks that result in varied learning outcomes. The link between early childhood pedagogy and ICT could also be further explored. It is a fact that software and hardware are constantly changing. Whilst this does not necessarily mean that the pedagogical issues of using ICT in early childhood settings automatically change as well, it cannot be assumed that they remain constant either. There is a need, for example, to identify quality practices and appropriate types of teacher intervention. As Parette and Blum (2013) reported, the key challenge for today's teachers is how to use technologies effectively and efficiently in order to support learning experiences for young children in the classroom. Future research could also investigate to what extent the factors "children's use of computer/ICT at home" and "children's gender" impact on children's use of ICT in early childhood settings. Finally, some other broader fields that might be of interest to educators/researchers include teachers' attitudes and motivations to use ICT in kindergartens. Provided that today's children are surrounded by different technological tools, it is worth investigating how teachers embrace and utilize a broader range of technologies, apart from computers, to support young children's learning in classrooms.

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