

Greek contribution

Primary school pupils' representations of computers: an exploratory study

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Aim and purpose of the research

This research is aimed to explore Greek primary school pupils' representations of computers. The present research is anticipated to provide us with insights on pupils' verbal and pictorial representations of computers. This would further help us identify important aspects of such representations, focus our future research on this issue and provide us with better understanding of the ways pupils may more effectively use computers in school.

The participants

In order to investigate the above a class of 24 pupils was engaged in a series of research activities. The teacher of the classroom was informed about the purpose of the research and he actively participated in the implementation of the research activities. During the research activities the teacher was the one who undertook an active role giving instructions and help where needed. The researcher was merely observing the activities. The children were fifth grade pupils, aged between 10 and 11, attending the 6th Primary School of Rethymno. Twenty pupils were Greeks, and four were Albanians (two of them were of Greek origin). All of the albanian pupils were fluent in Greek having already attended Greek schools for some years in the past.

The research context

The research activities took place in a classroom of the 6th Primary School of Rethymno. Information about the school can be found in our earlier report on the schools participating in the project. However, it should be mentioned here that by the time this research took place no computers were installed in the 6th Primary School of Rethymno. Nevertheless, the school is going to have its own computer room by the beginning of the next school year. It will be equipped with 12 computers, a local area network and Internet access. The pupils are well informed on this prospect and as we were told by the teacher are eagerly waiting to work with computers.

The research tasks and data collection

The pupils were asked to produce, within the limits of a school-hour (about 50 min.), a drawing of a computer and a short text about the usefulness of the computer in two A4 white sheets of paper. All pupils responded enthusiastically to the tasks.

The texts and the drawings were collected by the teacher and the researcher during the break. A third research activity was also planned, namely the conduction of interviews with individual pupils (six in total). The teacher, however, suggested that this is a very uncommon practice in everyday school life and it would be more closer to pupils' experiences if a class discussion was organised instead. The teacher also stressed that it would be difficult to choose some pupils for interviews given the willingness and enthusiasm of all of them to participate in the activities. Given the above we decided that we should proceed with the class discussion.

The classroom discussion was arranged to take place two days later because it was decided that a thorough examination of pupils' drawings and texts would help us better design and direct the classroom discussion. It was agreed with the teacher that this discussion would be tape-recorded. The pupils were also informed and agreed. The classroom discussion was designed to provide us with data about pupils' computer experiences and their views regarding the usefulness of computers in school teaching and learning. The actual discussion lasted about 40 min.

Data analysis procedures

The drawings were analysed on a table on the basis of categorisations regarding a) the colour(s) used, b) the number of the computer parts that the pupils included in their drawings, c) the actual parts, d) whether there were connections or not between these parts, e) what is drawn on the computer screen, and f) whether there was any user included in the drawing or not. An additional column for further comments made by the researchers was also included in the table (see Table 1).

Similarly, the texts were analysed on a table on the basis of categorisations regarding a) the number of words used, b) the number of sentences used, c) the significant, for the purposes and focus of the present research, names mentioned in each text, d) the

significant adjectives, and e) the significant verbs. A seventh column containing a brief description, made by both the researchers, of the main argument presented in each text is also included in the table (see Table 2).

The tape-recording of the discussion was transcribed and put on a four column table containing the number of each utterance, the name of the speaker (the pupils were asked to say their names before taking the floor during the conversation), the utterance transcription, and the researchers' comments on what was said. Our analysis was based on the communication level (what is meant).

Data analysis and discussion

First we will focus on the analysis of the data collected during the classroom discussion. It should be mentioned that the talk was of an Initiation-Response-Feedback type of talk where the teacher or the researcher initiated a topic, one or many students together responded, and the teacher or the researcher provided feedback followed by another initiation etc (see example below):

Ut.No.	Speaker	Utterance	Comment
50	Teacher	Let me ask you something more. What kind of help do you think would you need to use a computer?	
51	Kostas	How to access the Internet	
52	Irinini	Every one of us wants this	
53	Teacher	Anything else?	
54	Dimitris	I don't understand the keyboard sir	
55	Teacher	Do you mean you want it to have only Greek characters?	The keyboards in Greece usually have both Greek and Latin characters but sometimes they only have only Latin.
56	Dimitris	No, I don't mind. I just found it confusing	

Although the classroom talk was not aimed to follow this pattern it actually did for reasons the identification of which, we think, may be proved relevant and helpful. It seems that the major reason is that although the talk did not took place in the context of a typical classroom lesson, the teacher and the students assumed their typical classroom roles. Such roles are expecting from the teacher to initiate and direct the

talk, as well as assess what is said by the students, and from the students to provide the answers to the teacher's questions. Such a talk pattern, as in fact any other pattern, unavoidably affects what is said or can be said during the talk. For example, during the talk we are presently analysing there are not any clear initiations of talk made by the pupils. The pupils did not make any particular question or statement that resulted in a change in the subject of the talk. Although we do not have any data which would provide us with detailed information about how such talk patterns may affect the ways pupils represent computers "in general", we do think that it would be interesting to explore this issue, especially how pupils may represent the use of computers in school contexts.

We now turn to what was actually said by the students. As it was already mentioned one of the goals of the talk was to provide us with data regarding the pupils' computer experiences. As it was revealed during the talk four pupils have computers in their homes, mainly used by their parents for their work. These four pupils have limited access to these computers, mainly for game playing. Twelve other pupils mentioned that they have computer experience in computers located either in the workplace of their parents or in relatives' homes. Again game playing and the computer as a game console is the most popular experience shared between the pupils. Eight pupils said that they never had direct access to and experience of computers. Among them there are the 4 pupils whose parents come from Albania.

Although just one of the pupils reported that had browsed in the Internet, most of them expressed a high interest in doing so:

Ut.No.	Speaker	Utterance	Comment
12	Teacher	Yiannis, what computer programme interests you most?	
13	Yiannis	Internet	
14	Teacher	Do you have any experience on the Internet?	
15	Yiannis	No	
16	Dimitris	Well, we have seen on the TV how it is to use the Internet	
17	Teacher	If you had to choose among computer games and the Internet what would you choose?	
18	Kostis	The Internet	

19	Teacher	You all seem to prefer the Internet. Why?	
20	Kostis	Because it has many other programmes. Because you can see what is happening in the world	
21	Dimitra	I have never accessed the Internet but I would like to because I can see news from all over the world, the children, different countries	
22	Maria	About the war in Yugoslavia	

The above utterances also suggest that although the pupils do not have any Internet experience they seem to prefer Internet access to game-playing, one of the most common computer experience among them. Possibly this is because of the "hype" surrounding the Internet. It is also interesting that hardly recognised any particular usefulness of computer usage in school courses. For example, when asked by the teacher in what school courses they think computers could be used the pupils failed to directly identify any and they had to be given examples to find some.

In the following sub-chapter the analysis and discussion of the pupils' drawings is presented.

Analysis and discussion of the pupils' drawings

The table that follows offers a "summary" of the pupils' drawings¹:

TABLE 1: ANALYSIS OF THE DRAWINGS

A/A	COLOUR	No OF PARTS	PARTS	CONNECTION	SEEN ON SCREEN	USER	COMMENTS
1.	YES	6	MAIN, SCR, KEYB, MOU, LOUD, PR	YES	COLOUR	NO	
2.	YES	10	MAIN, SCR, KEYB, MOU, LOUD, EARPH, MIC, PAD, PR(2)	YES	FOREST WITH A GIRL AND FRUITS	NO	
3.	YES	4	SCR, KEYB, MIC, MICROCHIPS	NO	WORD "INTERNET"	NO	KEYBOARD KEYS WITH LETTERS
4.	YES	5	MAIN, SCR, KEYB, MOU, PHOTOCOPIER	YES	WORD "INTERNET"	NO	
5.	YES	6	MAIN, SCR, KEYB, MOU, LOUD, PR	NO	COLOUR	NO	COMPUTER ON LIBRARY DESK
6.	NO	7	MAIN, SCR, KEYB, MOU, PAD, LOUD, PR	NO	BOAT	NO	KEYBOARD KEYS WITH LETTERS
7.	YES	6	MAIN, SCR, KEYB, MOU, PAD, LOUD	NO	"WINDOWS" INTERFACE	NO	
8.	YES	5	MAIN, SCR, KEYB, MOU, PAD	NO	WORD "PEACE"	NO	
9.	YES	7	MAIN, SCR, KEYB, MOU, PAD, LOUD, PR	NO	LINES	NO	
10.	YES	8	MAIN, SCR, KEYB, MOU, LOUD, MIC, EARPH, PR	YES	FLOWERS, SUN	NO	
11.	YES	6	MAIN, SCR, KEYB, MOU, PAD, LOUD,	YES	WORD "INTERNET"	NO	
12.	YES	5	SCR, KEYB, MOU, PAD, PHOTOCOPIER	YES	WORD "INTERNET"	NO	
13.	YES	7	MAIN, SCR, KEYB, MOU, PAD, LOUD, PR	YES	BOAT	NO	
14.	YES	7	MAIN, SCR, KEYB, MOU, PAD, LOUD	YES	MAN PLAYING BASKETBALL	NO	
15.	YES	7	MAIN, SCR, KEYB, MOU, PAD, LOUD, PR	YES	COLOUR	NO	COMPUTER ON OFFICE DESK WITH CHAIR
16.	YES	3	MAIN, SCR, MOU	NO	WORD "GREECE"	NO	
17.	YES	5	SCR, KEYB, MOU, PAD,	YES	VIDEOGAME	NO	

¹ For a sample of digitised images of pupils' drawings see Appendix 1 in page 16.

			LOUD				
18.	NO	4	SCR, KEYB, MOU, PAD	NO	BLANK	NO	
19.	NO	6	MAIN, SCR, KEYB, MOU, PAD, LOUD	NO	A COUPLE UNDER THE SUN	NO	COMPUTER ON OFFICE DESK
20.	NO	4	SCR, KEYB, MOU, PAD	NO	WORD "GREECE"	NO	
21.	NO	4	SCR, KEYB, MOU, PAD	NO	BLANK	NO	
22.	YES	7	MAIN, SCR, KEYB, MOU, PAD, LOUD, PR	NO	FOOTBALL	NO	
23.	YES	7	MAIN, SCR, KEYB, MOU, PAD, LOUD, PR	YES	A WORM	NO	
24.	YES	5	MAIN, SCR, KEYB, MOU, LOUD	YES	BLANK	NO	

As seen on the Table above the majority of the pupils used colors in their drawings (19 out of 24). On average, the pupils that participated in the research have included 6 computer parts in their drawings. The most common parts are the main unit, the screen, keyboard, mouse, mouse-pad and loudspeakers. Half of the pupils have also drawn lines for connections between different parts of the computer. Furthermore, a variety of drawings can be seen on the computer screen. While no pupil included in his-her drawing person(s) using the computer, some of them (3) have put the computer on a desk.

It is remarkable that the 4 out of the 5 black and white drawings belong to the pupils that have come from Albania. Three of them represent a computer covering the 25% of the page, which is mainly assembled by a monitor, a keyboard and a mouse. The main unit is nowhere seen. On the contrary the fourth drawing is one of the richest we took back, despite the fact that it is black and white. It covers the full surface of the paper and represents a computer situated on a desk. The desk on its surface has the main unit, one loudspeaker a keyboard, a mouse on a mouse-pad and a monitor that has a picture of a man and a woman hand in hand, a flower on the ground and a sun on the upper right side of it. Behind the desk there are depicted some faint office furniture.

Nine pupils in their effort to produce an as much accurate picture of the computer have used a ruler, in order to draw straight lines. Four of them are black and white and in two of them there is an image on the screen (one screen with the word "Greece" on

it and one screen with a sailboat). The other five are coloured, four with images on the screen of the computer (one with a worm, one with the word “Greece”, one with a well known image of a computer game and one with the common ‘Windows95’ desktop on it, with banners for the menu bar and for most of the elements of the desktop. The same drawing has also banners for the ‘turbo’, ‘reset’, and ‘power’ buttons on the surface of the main unit, as well as the place where the computer makers’ firm is located). From these drawings, two have a printer depicted. This category of drawings could be said that reveals a tendency for accuracy. There is an effort to keep the basic proportions of the devices as they actually are. The banners are as detailed as possible (for example, in a drawing the switch between the Greek and the Latin characters is pointed on the surface of the screen; in other drawings the keyboard characters can be seen).

The other category of drawings comprises of 15 drawings depicted computers in a more abstract and creative way. Only one of them is black and white. In this category although there are drawings with many details, there is not particular interest for depicting accurately the proportions of the devices, or each device on the right place, or all the devices that form a computer system. Three of them do not have banners at all. However, apart from two, the drawings cover the full surface of the paper. Four of them have the word ‘Internet’ written on the monitor, 2 depict sailboats, one has the word ‘Peace’ on the screen, two drawings depict computer games on the screen (one football and one basketball game) and one has a field with multicolor flowers on the screen. There is also one case where the computer is depicted with the screen and the main unit not facing the spectator of the paper, but on the side in a 90° angle.

Given that pupils were simply asked to produce a drawing without any further guidance on how to do it, makes difficult the task to speculate on these two distinct categories of drawings. Several assertions could be made on that finding. Among these are the ones that assert that pupils have different skills on drawing, or that drawings represent a different state of familiarisation between children and computers or even different abstraction levels on what is a computer, or merely a more or less artistic approach to the subject. A unique explanation is not possible at this exploratory stage.

A first comment that can be made is that pupils' drawings regarding the visible computer parts are essentially complete i.e., they include all the parts that are needed to work with a computer (main unit, screen, and an input device such as a keyboard and/or a mouse).

It is also interesting that they also included in their drawings loudspeakers which suggests either that pupils consider multimedia accessories a necessary part of computers or, which is rather more preferable explanation, that since most pupils use computers as game consoles, they need loudspeakers to have the sound effects available.

Nevertheless, the fact that half of them didn't include connections between different parts of the computer they draw indicates that either they did not know how they are connected or they did not find it necessary to draw the connections. The most consistently connected computer device is the mouse. It is the only device of the computer that usually has a visible connection and its use affects the operation of the computer. In the cases of other devices, it is possible that since the cables connecting the other computer parts are often hidden under the desk and, furthermore, because they do not have an "obvious" result, they go unnoticed. Another explanation could be that these pupils never have personally encountered, or have never seen other persons encounter connection problems while they were using a computer. The same applies for the Internet. Although almost all of them in the texts they produced have written about the Internet and its actual or intentional use, none of them have pictured interconnected computers. Obviously, this is, like in the case of the other parts except of the mouse, something beyond their representational horizon since none of them have ever worked on a multicomputer environment, or has actually used interconnected computers for file interchange.

Another interesting finding is that the pupils did not draw any people using the computer. The most obvious explanation that can be given is that this was not demanded by the task (pupils were asked to draw a computer and describe its parts). The above, however, is not fully satisfactory. This is because there were a few pupils who also draw a desk and a chair; one of them also drew library shelves next to the computer. This can be seen as an attempt on behalf of these pupils to situate a

computer in a certain context. In a way their drawings suggest that they have developed a context-sensitive representation of computers.

Such representations however, as we already mentioned, did not go so far as to include themselves or other people. Possibly this is because they do not often use a computer. A hypothesis that can be made is that pupils would include themselves or other people in their drawings if they used computers in school or their home more often. This however cannot be yet confirmed or rejected at this stage of the research.

Analysis and discussion of the pupils' texts

TABLE 2: ANALYSIS OF THE TEXTS

A/A	No of Words	No of Sentences	Significant names	Significant adjectives	Significant verbs	Main Argument
1.	19	1	Internet	-	Learn	Computers are useful for learning, games and internet access
2.	26	2	Internet	Clever	learn, enjoy	Computers are useful for learning, enjoyment and internet access
3.	20	2	-	-	Learn	Computers are useful for learning
4.	43	2	-	-	Paint, write, play	Computers are useful for school courses, writing, painting
5.	32	1	Internet, CD	Useful	Learn, write, play	Computers are useful for learning, writing, painting, games and internet access
6.	40	1	Internet	Clever	Communicate	Computers are useful for communication, information access via the internet and enjoyment
7.	33	2	Internet	Important	Write, enjoy, communicate	Computers are useful for writing, internet access and communication with other children throughout the world
8.	45	1	-	Clever	Learn	Computers are useful for communication with children from other countries, learning interesting things about other countries and information access
9.	75	3	Internet	-	Learn, play, write	Computers have a different usefulness for everyone. Computers are useful to me because I can learning, access information through the internet, play games and write
10.	22	1	Internet	-	Paint, communicate	Computers are useful for writing and communication with other children through the internet
11.	12	1	Internet	Clever	Explore	Computers enable us explore, and makes us more clever
12.	37	1	Internet	-	Communicate	Computers are useful for painting and communication with people from other countries through the internet
13.	29	2	Internet	-	Communicate	Computers are useful for writing and communication with other children through the internet
14.	28	1	-	-	Play	Computers are useful for playing Fifa'99
15.	49	3	Internet, CD-ROM	-	Communicate, learn, enjoy	Computers are useful for communication with people from other countries through the internet, learn many things about the world and enjoy using various CD titles
16.	30	1	Internet	-	Learn	Computers are useful for learning many things about the world
17.	36	1	Internet	-	Communicate, learn	Computers are useful for communication with other children throughout the world

						and learn new words
18.	84	4	Internet	-	Learn, work, play, communication	Computers are useful for learning and working. Computers make life easier. Many people use them for enjoyment and communication with other people
19.	95	5	-	Clever	Learn, express	Computers make life easier. People become more clever because they learn to express their thoughts and feelings, and later find a job. They can also send peace messages.
20.	38	3	-	Clever	Communicate, learn, play	Computers are useful for communication with people, learning and play
21.	37	2	-	-	Learn	Computers are useful for many things but mostly to learn about children from other countries especially children from Serbia and Kosovo
22.	27	1	-	-	Play, paint, write	I use the computer for playing games, painting and writing about poets
23.	20	1	-	-	Paint, communicate	Computers are useful for communication with children from other countries and painting
24.	31	1	CD	-	Write, paint, play	I use the computer for writing about poets, painting and playing games

The pupils that participated in the research when asked to describe what is the usefulness of computers, wrote on average 38 words in two sentences. The significant name mentioned, almost exclusively, in their texts was “Internet”. No other name related to computers or informatics (apart from CD in three cases) was mentioned.

The SYNTAX issue

Pupils tended to use the future tense to describe their activities with the computer i.e. [*computers' usefulness for me will be to learn to write texts, drawing, playing games*], although they use a present tense verb, however quite abstract such as *like*, to describe its usefulness for them [*ie (...) computer is very useful to me* (cases 4, 5, 10, 11, 19)].

Another type writing is using an abstract way or referring to computers [*a computer is a clever box built by humans either to communicate... or getting information ... or for both adults and young to have fun with it* (case 6, 12)].

In few cases pupils use present tense and are referring to themselves consistently, writing that [*(computer usefulness to me is that it enables me to write more quickly*

and easily. It helps me drawing better pictures and it connects me to the Internet ... (case 7), I can save texts in the computer... (case 13), I don't use the computer for my schoolwork but only for playing games (case 14, 24), or, I use it to write for poets, and some times to use them [for typing reasons] because I can't write beautiful letters (case 22, 9)].

In most of the other cases the technique used is that of the second or the third person [*the usefulness of the computer [to me] is that you can travel and be acquainted with children around the world... (case 8, 12, 17, 18, 23)*], quite often mixed with a 'soft' personal involvement [*computer is very useful to me. In the computer there are lots of stuff someone can learn about the earth's and the peoples' problems... or [someone] even can have fun with CD's or other diskettes (case 15, 16)*].

The usefulness issue:

The pupils used few adjectives. The most common adjective was "clever" which mostly was used to describe an inherent computer property. In their effort to describe the usefulness of the computer to them, pupils used, on average, two significant verbs, most common of which was the verb "learn" (in 13 cases). The verbs that described the actual use of the computer were "write", "paint", "play" and "communicate".

The findings indicate that the vast majority of pupils' writings about the usefulness of computers gave emphasis on Internet access. It is important that many of them (around 12) went further to stress that by accessing other computers through the Internet they can either get information and even learn about other people and countries or communicate with other children throughout the world (see "main argument" column above). This suggests that pupils tend to represent the computer as a medium through which they can gain access to the "world community" and become active members of it. However, it is interesting that although 12 pupils have written about the importance of the Internet, during the class discussion came out that only one of them has actually used Internet, mainly to browse game sites under the guidance of an older cousin. All the others have a rather indirect experience on Internet, mainly from the TV broadcasts on Internet and periodicals of various subjects specialised in their age.

Along with this potential “socialising” element of pupils’ perceived computer usefulness, comes another one which has to do with more “personal” elements, such as special interests like painting or writing, as well as game-playing.

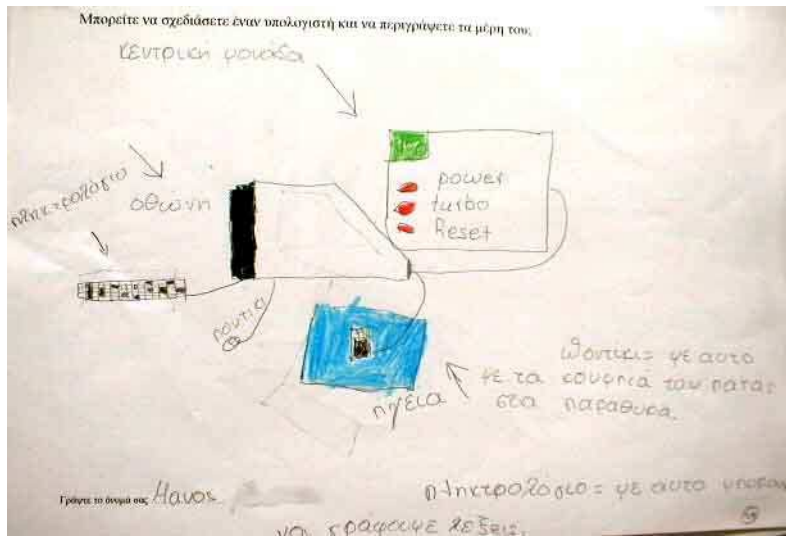
Students’ concern is on the development of the respective skills demanded by the object of their interests (for example painting), and, on the other hand, the skills needed to master the use of computers to enable them to reach this goal.

The findings also suggest that the pupils do not directly relate computers with *school* teaching and learning, something which was also discussed in the talk analysis. It is characteristic that only one pupil wrote that computers are useful for the teaching-learning of school courses. This may be due to the fact that the particular pupils engaged in the research have not yet any experience of using computers in school courses. It is worth mentioning that the one pupil who actually related computers with school courses has such an experience from attending an English language course in a private foreign language school. It is also interesting that only two pupils related computers with future occupational prospects. These two pupils are members of economic refugee families that have recently migrated from Albania. It is possible that they put a high emphasis on the relation between computers and future jobs because they assume that the better they develop their skills and knowledge in school the easier they will find a job in the future.

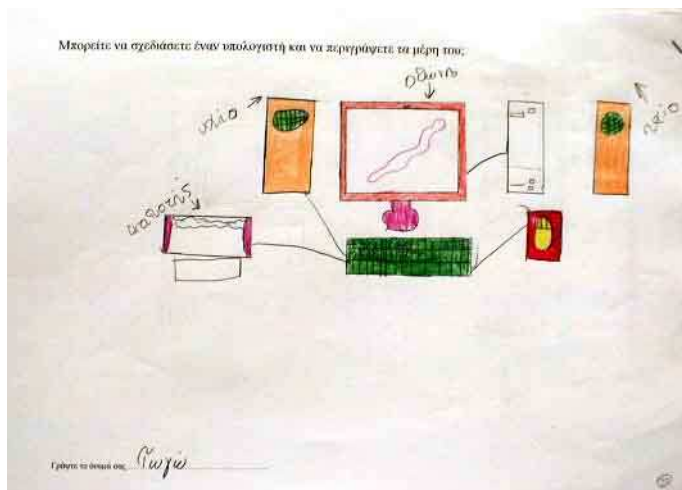
On the other side, just three pupils wrote that computers and specially the Internet are useful for information access. The reason why the vast majority of the pupils did not consider information access as a worth mentioning, useful affordance of computers, could be the fact that information access is not a crucial element of everyday school teaching and learning. As it has already being stressed out in our report on the Greek educational system, schoolbooks, which are distributed to teachers and pupils each year, are the basic medium through which curricula are being applied in every-day school activities. Given the above, information access is commonly not a demanding activity. Most of the information needed for the teaching and learning of school courses can be found in the teacher and pupils’ books. A hypothesis that can be made is that the pupils would have considered information access as one of the most useful

affordances of computers if everyday school teaching and learning was more demanding on accessing information which cannot be found in schoolbooks. If the above hypothesis is generally true, this could suggest that pupils' representations of computers' usefulness is not solely depending on their perceived computer affordances (what one can do with computers) but also, or even more crucially, on the curriculum demands and the everyday teaching-learning practices.

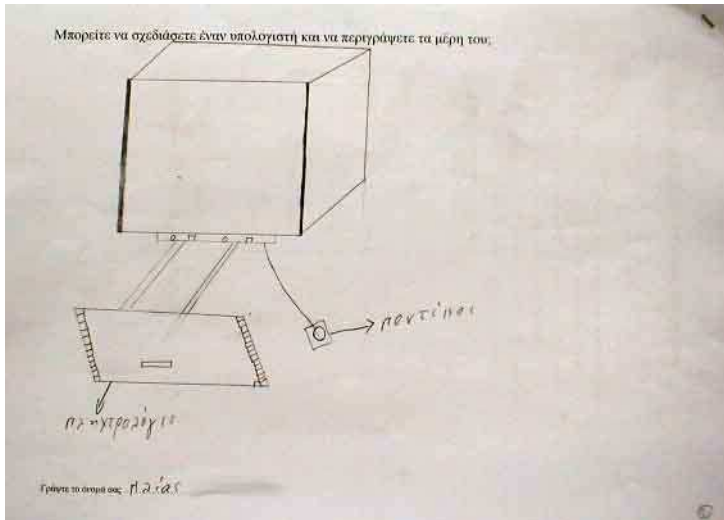
APPENDIX 1: SAMPLE OF PUPILS' DRAWINGS



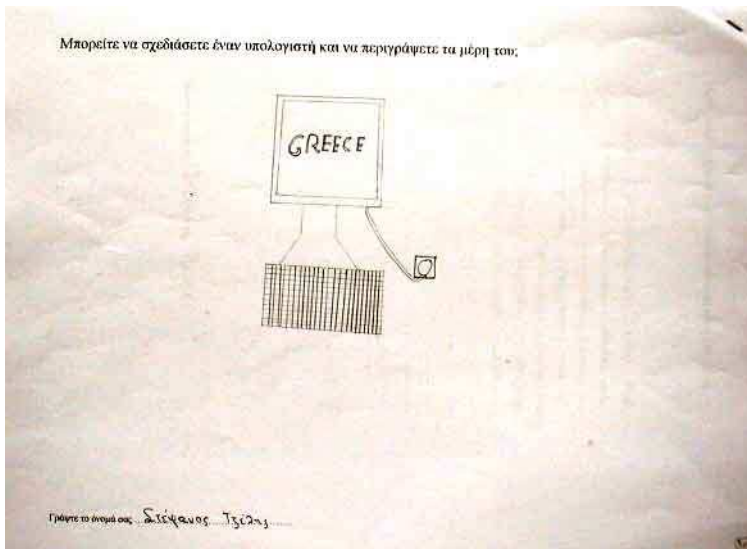
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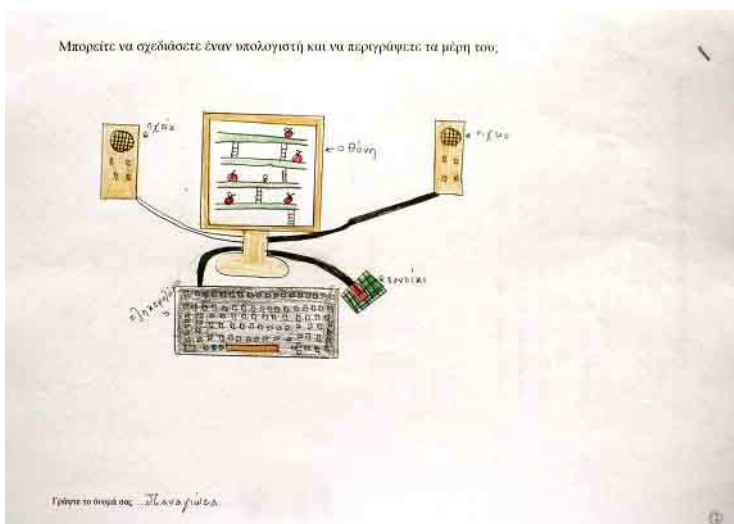
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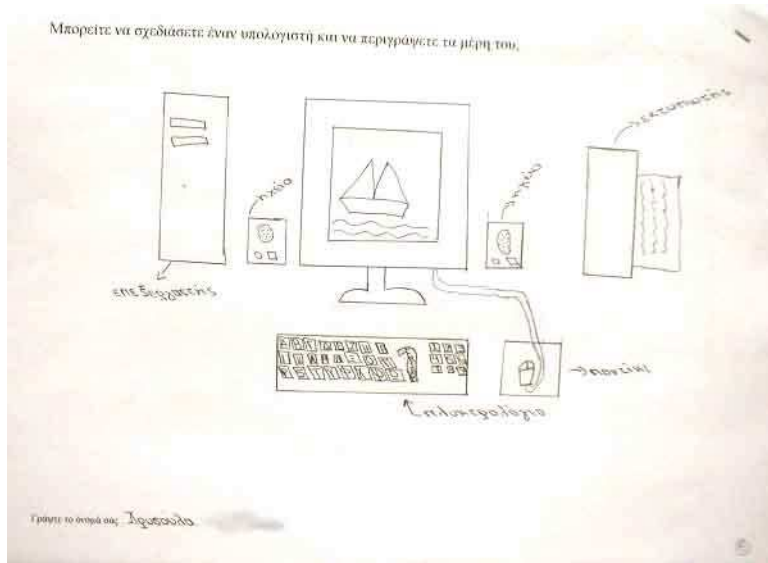
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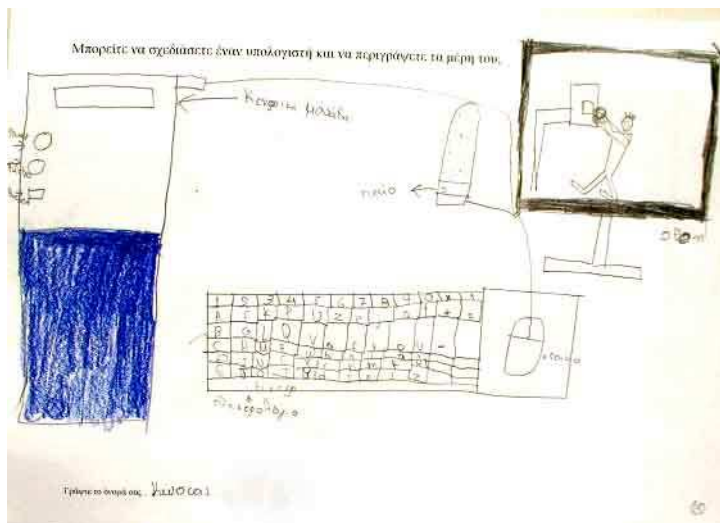
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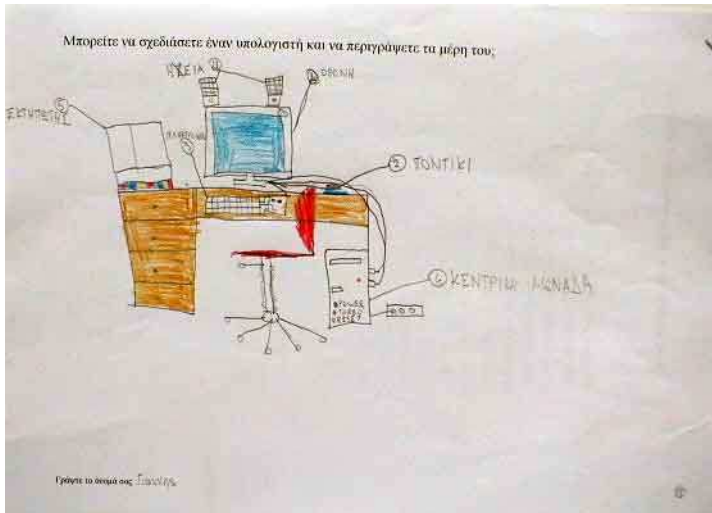
Drawing No.17



Drawing No.6



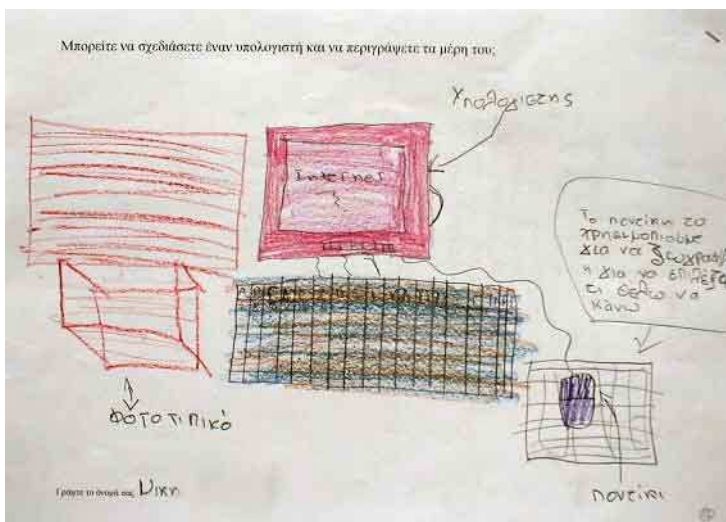
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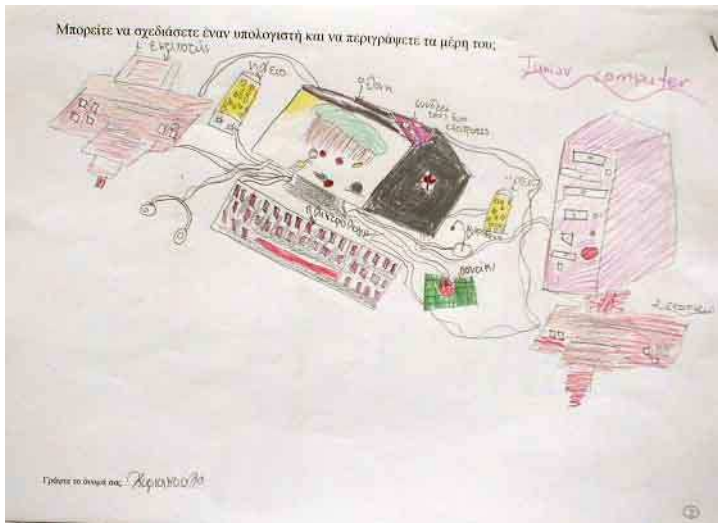
Drawing No.15



Drawing No.22



Drawing No.12



Drawing No.2



Drawing No.19