Localization and Application of Poisson Rouge's digital games in Pre-school Education

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Abstract

The paper presents (a) the process of localizing into Greek selected digital games from the Poisson Rouge[1] website as well as (b) the pilot application of this digital game based learning material for learning basic language and maths concepts in a preschool educational setting. Participants were 20 preschool age children from an urban kindergarten in Athens. Preliminary test-based evaluation of the children's skills identified 3 levels for maths and 3 levels for Greek, from which 5 homogeneous and 5 heterogeneous pairs were composed. They

[1] http://www.poissonrouge.com/

played with Poisson Rouge's digital games in a series of 12-15 minute sessions, 2 days per week over a period of 4 weeks. A post-test was given in order to investigate the impact of using Poisson Rouge games in teaching language and maths topics; video recordings were made in order to study the kinds of verbal interactions that occurred amongst students when working in both homogeneous and heterogeneous groups and an open-ended questionnaire was administered at the end of the 4 weeks in order to assess the impact the games had on students' motivation while playing with them.

Results from data analyses indicate that students within the lower level group made larger improvements than students in other level groups. In heterogeneous groups the strong students supported weaker students' efforts to achieve learning success, explaining or giving them instructions about the game, whereas in homogeneous groups students worked together in such a way that they helped, supported and inspired each other. Finally, digital games activated students' interest in learning and increased their learning motivation.

1. Foreword

Kindergarten is the first organized learning environment in which children study systematically and for this reason, it can contribute substantially to developing students' skills, improving learning motivation and preventing learning difficulties. In Kindergarten, a successful combination of games and learning is very important, as through games students can experiment and collaborate with each other by interacting with their classmates. In the past few years the challenge of Digital Game Based Learning implementation in education has been intensified[2]. According to Papert[3], the computer can play an important role in preschool education, because children see it as a game in itself. Students of this age do not feel that the computer is something complex to be dealt with; on the contrary they feel that it is a part of daily play and that through it they can enjoy new experiences so that they *act* and learn simultaneously. Digital games today are an integrated part of children's play activities. At school, if games are properly designed and developed, they can be very powerful educational tools. Well-designed games can provide an opportunity for learning by offering stimulating mental and emotional development.

[2] Dafermou, Ch., Koulouri, P., Basagianni, E. Kindergarten teachers Manual: *Educational planning creative environments of learning*, Athens: OEDB, 2006, p. 18

[3] Papert, S.. *Mindstorms. Children, Computers and Powerful Ideas*. New York: Basic books, 1980

After a brief review of the literature on the subject, we will give a presentation of the Poisson Rouge website and explain why we chose to base our study around it. We will then describe the process of localizing some of the activities within Poisson Rouge into Greek and finally give details of the study conducted over 4 weeks within a preschool educational setting in an inner city kindergarten in Athens.

1.2 Literature Review

In the last few years gaming at large has gotten into a new sphere of continuous observation and has become the object of thorough analysis and research for many disciplines such as education, communication, psychology and sociology. One of the most significant factors for this evolution has been technology and with it the birth of digital games. Indeed, digital games have gradually become the most popular form of play and entertainment in contemporary culture. Since the 70s digital games have changed the way young people learn, play and socialize. In turn, digital games have gained attention as tools for facilitating learning in different sectors of society including but not limited to military, health, and education.

Characteristics of digital games such as "challenge", "fantasy", "curiosity"[4] include interaction and instant feedback to the player[5] which makes them uniquely strong tools for teaching and motivating pupils who dedicate a great deal of their time playing with them. Digital games can be separated into many categories depending on each criterion[6]. The focus of our study is the educational digital game (DGBL). In the literature, there are arguments in support of as well as against digital games and their educational usefulness. Regarding the positive effects of digital games, it has been argued that education has much to learn from them, as they include a number of learning principles that can also be applied in other frameworks besides pure gaming. Gee[7] derived 36 different learning principles from his study of the complex, self-directed learning each game player undertakes as he encounters and masters a new game. He suggested that adherence to these principles could transform learning in schools, both for teachers

[4] Malone, T. W. (1981). *Toward a Theory of Intrinsically Motivating Instruction*. Cognitive Science, 5(4), pp 333-369.

[5] Prensky, M. (2007), *Digital game-based learning*. New York: Paragon House

[6] Kirriemuir, J., & McFarlane, A. (2004). "Literature review in games and learning: A Report for NESTA Futurelab." Retrieved from: http://www.futurelab.org.uk/resources/documents/lit_reviews/Games_Review.pdf (accessed: March 2010).

[7] Gee, What video games have to teach us about learning and literacy. ACM Computers in Entertainment, vol. 1, no. 1, 2003

and, most importantly, for pupils. In the literature, digital game based learning often contradistinguishes from formal learning in school in a way that makes the particular characteristics of DGBL distinctive. For example, while in traditional teaching methods symbols, significances and processes tend to be broken away from the whole, in games they become usable parts of that whole. Moreover, when interacting with digital games, pupils participate in social practices and are able to experiment while learning through interlinking knowledge and action[8]. Digital games allow pupils to participate in a virtual world in which they learn, think, speak and act in new ways.

Some teachers and parents, however, have a more sceptical view of the implementation of digital games in education[9]. Specifically for pre-school education the controversy is very intense, in fact, the absolute removal of the computer from pre-school education has even been suggested[10]. Admittedly, with the knowledge that we have, it is impossible to draw definite conclusions as to the usefulness of digital games in education. However, the potential that digital games offer education is too important to ignore.

Given the existence of relatively few empirical research on the effectiveness of digital games, particularly in pre-school education[11], the mixed results of existing studies[12],[13] and the methodological flaws prohibiting solid conclusions to guide research and practice[14] there is great need for further rigorous empirical study to help researchers

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[8] Shaffer, D.W., Squire, K.R., Havelson, R. & Gee, J.P. (2005). Video games and the future of learning. Phi Delta Kappan, vol. 87, no. 2, pp. 104-111.

[9] Mitchell, A., & Savill-Smith, C. (2004). The use of computer and video games for learning. A Review of the Literature. London: Learning and Skills Development Agency.

[10] Cordes, C., & Miller, E. (Eds.). (2000). *Fool's gold: A critical look at computers in childhood*. College Park, MD: Alliance for Childhood.

[11] Hays, R.T. (2005). *The effectiveness of instructional games: A literature review and discussion. Naval Air Warfare Center Training System Division (No. 2005-004*). Retrieved from: http://adlcommunity.net/file.php/36/GrooveFiles/Instr_Game_Review_Tr_2005.pdf (accessed: February 2010).

[12] Randel, J.M., Morris, B.A., Wetzel, C.D., & Whitehill, B.V. (1992). *The effectiveness of games for educational purposes: a review of recent research*. Simulation and Gaming, 23(3), 261–276.

[13] Harris, J. (2001). *The effects of computer games on young children – a review of the research*. RDS Occasional Paper No. 72. London: Research, Development and Statistics Directorate, Communications Development Unit, Home Office.

[14] Vogel, J. J., Vogel, D. S., Cannon-Bowers, J., Bowers, C.A., Muse, K., & Wright, M. (2006). *Computer gaming and interactive simulations for learning: A meta-analysis. Journal of Educational Computing Resea*rch, 34(3), 229-243.

reach better conclusions about the effects of digital games. As suggested by Van Eck[15], digital games would likely experience widespread development and use if persuasive examples of empirical studies could show the enhancement of learning by using instructional games.

1.3 Purpose of the study

The paper presents (a) the process of localizing into Greek selected digital games from the Poisson Rouge website as well as (b) the pilot application of this digital game based learning material for learning basic language and maths concepts in a preschool education setting. The purpose of the research is to contribute to empirical evidence in the digital game based learning literature by analysing the results of a research performed during December 2009 – February 2010.

In the first part of the paper, the process of localizing selected digital games from the Poisson Rouge platform is presented, highlighting important issues in their adaptation for use in a specific target country setting (Greece) and audience (preschoolers). In the second part of the paper, a report of an application of DGBL material on language and maths topics is presented, highlighting important issues in the design and implementation process, issues raised during the overall gaming experience as well as a number of findings.

1.4 Research Questions

For the study, three research questions were formulated:

(a) Can games of the Poisson Rouge platform help improve students' skills development in language and maths topics?

(b) What kinds of verbal interaction occur amongst students when working in both homogeneous and heterogeneous cooperative groups and how does this affect students' learning and motivation?

(c) Can digital games of the Poisson Rouge platform create a learning environment that activates the students' interest in learning and increases their learning motivation?

2. The process of localizing for a Greek audience selected digital games from the Poisson Rouge website

[15] Van Eck, R. (2006). *Digital game-based Learning. Educause Review, 2*(K), pp. 6-22

A large portion of the time devoted to the study was preparing the material to be used in the classroom, in particular the localization of language based activities, namely: an interactive alphabet and a visual and interactive glossary of everyday terms and objects. While the glossary was a fairly straight forward translation task (as described in the Wikipedia definition by its etymology from the Latin *translatio* made up of the preposition *trans* (across) and the participle *latum* (to carry), so literally "to carry across"). The alphabet, however, demanded a proper localization treatment. The term "localization", according to Anthony Pym[16], was first used in commerce and marketing and refers to the process by which a product is adapted to the needs of a country or region, that is to say to make it "local".

According to this definition, the process of localization seems to follow the functional translational theories and to incorporate the process of translation respecting the rules that govern this process. Translation is just a part of the whole process of localization, which is included in a wider intercultural interaction and which includes the transfer not only of verbal but also of visual and audio elements, constituting sometimes a process of complete redesign of the software or the website. Indeed, in order to make the Poisson Rouge Alphabet "local", some of the activities had to be redesigned, and some others had to be created from scratch.

The process of localizing selected digital games of Poisson Rouge's website included the following steps:

- Analysis of the material received and evaluation of the tools and resources required for localization
- Cultural, technical and linguistic assessment
- Creation and maintenance of terminology glossaries
- Translation and adaption into Greek of the linguistics elements and embedding them into the source code of the games
- Recording the audio elements into Greek and embedding them into the source code of the games

[16] Pym, A. (2003) Localisation and the Training of Linguistic Mediators for the Third Millenium, *Proceedings of the Interrnational Conference on The Challenges of Translation and Interpretation in the Third Millenium,* Beirut: Notre Name University, Louaize. pp. 23-30.

- Proofreading and testing the localization.

3. Research Methodology

3.1 Participants

The sample was composed of 20 pre-school (4 to 5 years old) students (13 boys and 7 girls) in an urban public kindergarten located in Athens. The students hadn't had any access to computer activities within the school before our study. During the study, students worked in pairs, in a separate room with a laptop computer, while their schoolmates were in the classroom with their teacher doing their daily activities. A video camera was focused on the pairs of children as they played the games and was recording both the game action and the interactions between the students while they played.

3.2 Materials

Poisson Rouge is an interactive website which contains fun and educational games and activities for children. There are cubes with numbers and alphabets with animations, puzzles, colouring games where you learn colour mixing, a variety of toys, a piano to learn music and much more. In this digital playground children can play music, be introduced to numbers and words in their own language or in others. What makes the site promoting creativity and exploration for children is that there are no instructions as to how to use anything on the site. Through exploring the site children can find what to do and this process promotes children's exploring minds, avoiding any written instructions and keeping games purposefully simple and intuitive.

The following Table 1 shows the digital games used for treatment and the skills and understanding that students are expected to develop during the study[17],[18]

Poisson Rouge games	**The skills that students should develop**
Greek Alphabet	Become familiar with letters of the alphabet
School of Greek	Become familiar with objects of daily life

[17] Pedagogical Institute, (2003). A cross-thematic curriculum framework for Kindergarten, Athens: OEDB.
[18] Dafermou, Ch., Koulouri, P., Basagianni, E. Kindergarten teachers Manual: *Educational planning creative environments of learning*, Athens: OEDB, 2006, p. 20

Bugs! - Numbers	Learn math symbols- Match objects to numbers
Bugs! - Counting	Read numbers and put them in order
Dot to Dot	Read numbers and put them in order
Board Game	Counting - Numeral identification
Numbers	Become familiar with numbers up to 9
Toy Chest - Shapes	Group and distinguish objects in categories by shapes or colours

Table 1: Games and skills that students should develop

3.3 Methods of data collection

In order to assess the effects of using Poisson Rouge games, different instruments were used, aiming at different assessment dimensions (see Table 2). The main objective was to evaluate the effects of using these digital games for students' learning, specifically, basic language and maths concepts. This was studied using a linguistic and a mathematical test as pre- and post-test. In order to identify intervening variables that could explain and differentiate the effects of digital game use over traditional methods of teaching, observation protocols were conducted and video-recording was used as students were carrying out their tasks. Furthermore a students' preference survey was conducted at the end of the study in order to assess the taste for digital games compared to other activities they get involved in on a normal day at school. It is to be noted that the study was the first opportunity these children had to use the computer in a classroom setting. These tools for data collection have helped the researcher to define a characterization of students in school, their interaction with the game and their schoolmates in the classroom, as well as student motivation towards digital games.

Instrument	**Variables investigated**	**Test Method**	**Moment of assessment**
Linguistic test	✓Reading skills ✓Writing skills	Individual test	Pre test
Mathematical test	✓Maths skills	Individual test	Pre test
Observation protocol	✓Verbal interaction	Group observation	During the implementation

	✓Motivation		
Preference Survey	✓Motivation	Individual	After the implementation
Linguistic test	✓Reading skills ✓Writing skills	Individual test	Post test
Mathematical test	✓Maths skills	Individual test	Post test

Table 2: Description of instruments used, variables investigated, and moment of assessment

3.4 Design and Procedure

Preliminary test-based evaluation of the children's skills identified 3 levels for maths (7 students in high level, 6 in middle level and 7 in lower level) and 3 levels for Greek (6 students in high level, 7 in middle level and 7 in lower level). From these children's skill levels, 5 homogeneous (2 pairs from high level, 1 pair from middle level and 2 pairs from lower level) and 5 heterogeneous pairs (2 pairs from high and middle level and 3 pairs from middle and lower level) were composed for each subject.

The Poisson Rouge's play activities were then presented in a series of 12 -15 minute classroom sessions, 2 days per week over a period of 4 weeks, after which students were reassessed in order to investigate the impact of using Poisson Rouge games in connection with their starting skill level in language and maths topics. We decided to proceed in such research without the presence of a control group as a basis for comparison, because we couldn't ensure that children of both groups could work under the same conditions.

Although Poisson Rouge's digital games are better used when children explore them freely, for the purpose of our study we insisted that they play with specific games each time in order to fulfil our predefined conditions.

4. Results

4.1 Students' skills development in language

A comparative study of the linguistic skills assessments pre- and post-study shows us that the use of Poisson Rouge's digital games had a positive effect on specific reading and writing skills.

Indeed, when we compare initial and final measures revealed that all students improved their linguistic skills after the sessions. As indicated in Table 3 and Figure 1, the higher level students made the slighter improvement (19.58%), while the middle level students improved to non-negligeable levels (41.25%) and lower level students made the greater improvements (60.54%).

		Linguistic skills		
Students' level	Assessment	*Mean score by group*	*Improvement (I- F)*	*Percentage improved* $\frac{I-F}{F}\times 100\%$
High level	Initial score	76.89		
	Final score	91.94	15.06	19.58 %
Middle level	Initial score	43.52		
	Final score	61.48	17.95	41.25 %
Low level	Initial score	31.86		
	Final score	51.14	19.29	60.54 %

Table 3: Students' skills development in language

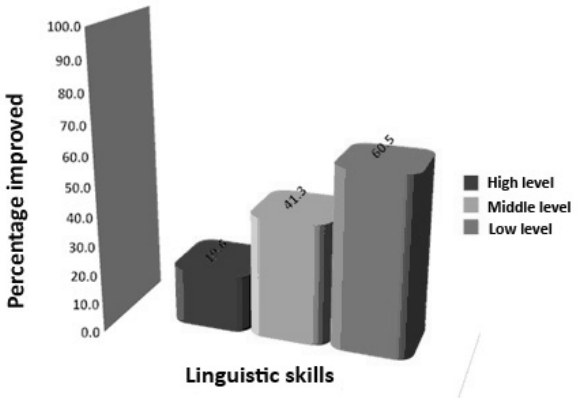

Figure 1: Students' skills development in language

4.2 Students' skills development in maths

A comparative study of the maths skills assessments pre- and post-study shows us that the use of Poisson Rouge's digital games had a positive effect on specific mathematical skills.

Again, when we compare initial and final measures revealed that all students improved their mathematical skills after the sessions. As indicated in Table 4 and Figure 2, scores increased for all three levels. The higher level students made the slighter improvement (4.01%), while the middle level students improved somewhat (19.43%) and the lower level students made larger gains (74.10%).

		Mathematical skills		
Students' level	Assessment	*Mean score by group*	*Improvement (I-F)*	*Percentage improved* $\frac{I-F}{F}\times 100\%$
High level	Initial score	96.14		
	Final score	100.00	3.86	4.01 %
Middle level	Initial score	74.42		
	Final score	88.88	14.46	19.43 %
Low level	Initial score	32.68		
	Final score	56.89	24.21	74.10 %

Table 4: Students' skills development in maths

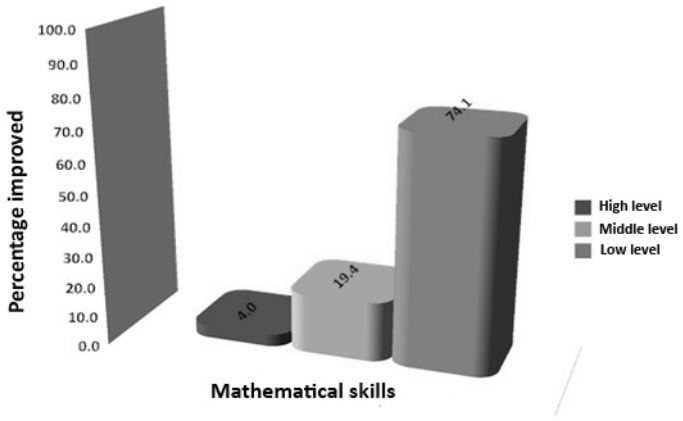

Figure 2: Students' skills development in maths

4.3 Verbal interactions amongst students

The figures below present the characteristics of verbal interactions amongst students from heterogeneous groups (students with different abilities and skills) and those from homogeneous groups (students with similar abilities and skills) as per the video-recording made while they where playing with Poisson Rouge's digital games.

The figures (Figures 4 and 5) below indicate that:

- In heterogeneous groups, both for linguistic and mathematical games, roles amongst students were easily identifiable. Strong students more often adopted the role and the function of Vygotsky's[19] "More Knowledgeable Other" (4.5 interactions – 0.7 interactions for linguistic and 7.2 interactions – 1.7 interactions for mathematical games), explaining or giving instructions about the game to the weaker students, supporting their efforts to achieve success and raising the level of the groups. Weaker students asked more questions to stronger students about the content and the processes of the games (0.5 interactions – 2.4 interactions for linguistic and 0.3 interactions – 1.3 interactions for mathematical games), giving to stronger students the opportunity to answer their questions thus allowing the latter to feel confident about their own skills and knowledge.

- In homogeneous groups roles amongst students were not so easily identifiable. None of the students managed to adopt the role of the Vygotsky's "More Knowledgeable Other". Rather, both students tried to adopt this role (3.4 interactions – 3.4 interactions for linguistic and 5.8 interactions – 5.5 interactions for mathematical games), mostly engaging in collaborative interactions and on rare occasions within higher level pairs, engaging in a more competitive interaction.

[19] Vygotsky, L.S. (1978). *Mind and society: The development of higher mental processes*. Cambridge, MA: Harvard University Press.

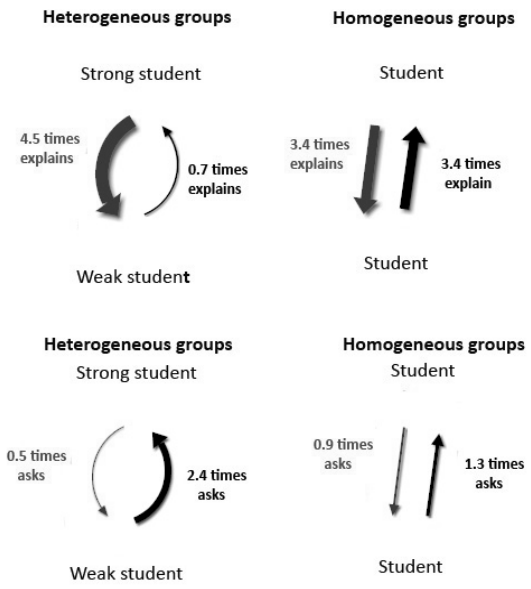

Figure 1: Verbal interactions among students while playing with linguistics games

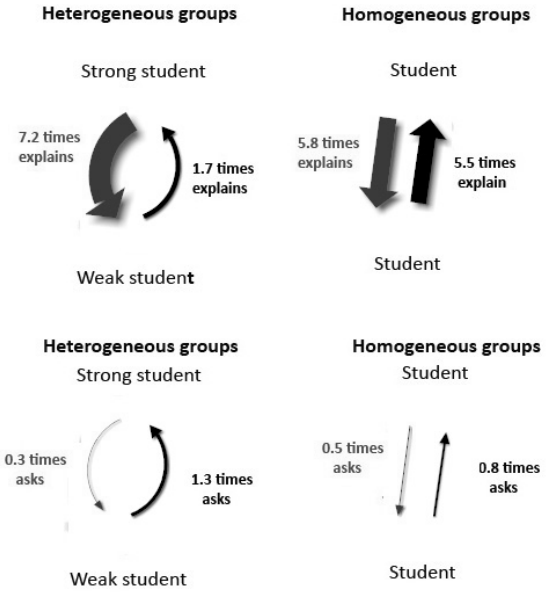

Figure 2: Verbal interactions among students while playing with Maths games

In conclusion, both for linguistic and mathematical games we can say that in heterogeneous groups strong students supported weaker stu-

dents' efforts to achieve learning success, explaining or giving them instructions about the game, making them feel more confident and experience success.

In homogeneous groups none of the students adopted the role of the "More Knowledgeable Other", but students worked together in such a way that they helped, supported and inspired each other and on rare occasions within higher level pairs, students engaged in a more competitive interaction.

4.4 Impact on students' motivation

The impact of Poisson Rouge's digital games on students' motivation were assessed after the 4 week period through a simple open-ended preference survey amongst the possible activities that may be carried out during a school day.

Table 5 and Figure 6 below show the activities that students prefer to carry out during their school day.

Activities	Number of responses	Percentage
Digital games	7	35 %
Playing in the schoolyard	6	30 %
Homework	1	5 %
Singing	3	15 %
Drawing	3	15 %
Total	**20**	**100 %**

Table 5: Students' proffered activities

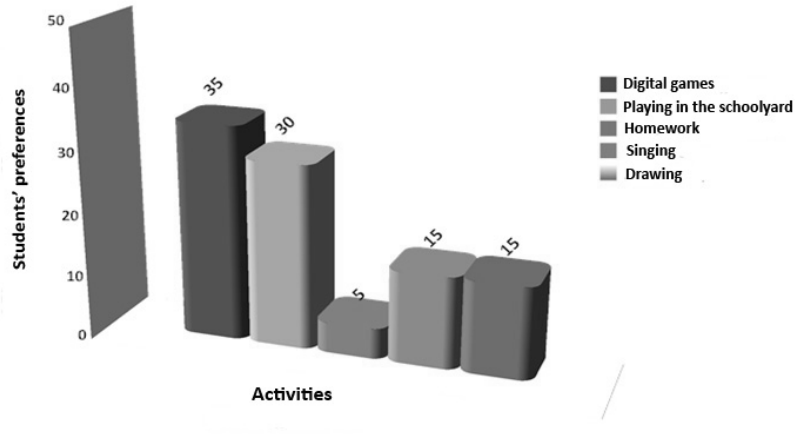

Figure 6: Students' proffered activities

From the table and figure above we can notice that during a school day since the introduction of the computer, 35 percent of them showed a preference for digital games, 30 percent for playing in the schoolyard, 15 percent for singing and drawing and only 5 percent for learning letters and numbers.

Considering how much children this age enjoy to be engaged in spontaneous free play with their friends in the schoolyard, where they have the opportunity to move, climb, jump, run, relax, explore the surrounding area and develop friendships, and even if we take into account the possible impact of the novelty of having a computer "in the classroom" for these children, we realize the potential of Poisson Rouge's digital games in activating children's interest in learning and in increasing their motivation to learn specific skills.

5. General Conclusions and Considerations

5.1 Poisson Rouge and school learning

The findings of this study allow us to come to the conclusion that the use of Poisson Rouge's digital games in education has positive effects. According to the results obtained from the experimental study, all students improved their performance in language and maths topics after the intervention.

Students who achieved lower scores in pre-test made larger improvements both in language and maths topics, students who achieved medium scores in pre-test achieved less but non-negligeable improvements. Finally, students who achieved higher score in pre-test made little improvement, but improvement nonetheless.

These results confirm and strengthen those of previous studies which have looked at the effectiveness of digital games in students' cognitive development, and specifically in linguistic and maths skills improvement[20],[21],[22] Nevertheless, these findings differentiate from those in other studies[23],[24] which showed no improvement in the math area.

Of course, an experimental research which would compare the results of the experimental group to those of a control group that would work in the classroom without digital games would give us clearer indication as to the impact of the variable "digital game", which is one of the tools used in this research.

5.2 Poisson Rouge and verbal interactions

The recording and analysis of verbal interaction amongst students makes it clear that most students developed aspects of cooperative learning while playing with the games, and tried to develop their abilities and skills through interaction with other group member striving for the common good.

In heterogeneous groups we noticed that strong students supported weaker students' efforts to achieve learning success, explaining or giving them instructions about the game. Weaker students began to feel more confident, experienced success with all the positive effects on learning and social behavior. This promoted cooperative learning and helped all the students, especially the weakest.

In homogeneous groups we noticed that students played together in such a way as to help, support and inspire each other. This framework includes oral explanation of problem solving, sharing knowledge with one another and testing their understandings. In very few cases it cre-

[20] Segers, E., & Verhoeven, L. (2002). Multimedia support of early literacy learning. Computer & Education, 39, 207–221.

[21] Rosas, R., Nussbaum, M., Cumsile, P., Marianov, V., Correa, M., Flores, P., Grau, V., Lagos, F., Lσpez, X., Lσpez, V., Rodriguez, P., Salinas, M. (2003). *Beyond Nintendo: design and assessment of educational video games for first and second grade students*. Computers and Education, 40, 71–94.

[22] Laffey, J. M., Espinosa, L., Moore, J., & Lodree, A. (2003). Supporting learning and behavior of at-risk young children: Computers in urban education. *Journal of Research on Technology in Education, 35*(4), 423-440.

[23] Shute, R., & Miksad, J. (1997). Computer assisted instruction and cognitive development in preschoolers. *Child Study Journal*, *27*, 237-252.

[24] Din, F.S. & Calao, J. (2001). The effects of playing educational video games on kindergarten achievement. *Child Study Journal*, 31(2), 95-102.

ated a more competitive environment, mostly for pairs who achieved highest scores at pre-test.

An experimental research which would compare verbal interactions of the experimental group's students while playing with digital games to those of the control group's students that would work in the classroom without digital games would give us clearer indication as to the impact of the variable "digital game", which is one of the tools used in this research.

5.3 Poisson Rouge and motivation

The potential of digital games to motivate children to play with them – sometimes to the point of devoting too much of their free time! - was one of the main reasons that led us to use Poisson Rouge's digital games in the kindergarten curriculum.

At the light of the students' preference survey and the observation and video-recording of their verbal interactions while they played with the games, we come to the conclusion that Poisson Rouge's digital games can activate students' interest in learning and can increase their motivation for learning. These findings come to confirm those of previous studies which have showed high levels of concentration and attention during the engagement of children with digital games.[25]

6. Concluding remarks and points for further research

The general conclusion that can be drawn from the study is that the use of Poisson Rouge's digital games has had positive effects on student learning and on their motivation. So the results are promising, but the study conducted has its limits - the period of the research was relatively short, no long-term effect has been recorded, the setting was a specific school in Athens, there was no control group working on the same elements without the use digital games and there was no comparison with other computer-based material - and so does not allow for extensive generalization to be drawn from its results. However, the work described in this paper is a good starting point for a larger project, involving: (a) an external control group in order to compare

[25] McFarlane, A, Sparrowhawk, A and Heald, Y (2002). Report on the Educational Use of Games. TEEM (Teachers Evaluating Educational Multimedia). Retrieved from: www.teem.org.uk (accessed: March 2010).

results and draw clearer indication as to the variable “digital game", (b) a long term intervention in order to investigate the effectiveness of Poisson Rouge’s digital games when it is part of everyday life in the classroom, (c) conducting similar research in a variety of socio-economic environments and (d) the use of other similar digital games in order to record the effectiveness of Poisson Rouge’s digital games over similar digital material.

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Din, F.S. & Calao, J. (2001). The effects of playing educational video games on kindergarten achievement. *Child Study Journal*, 31(2), 95-102.

Harris, J. (2001). *The effects of computer games on young children – a review of the research*. RDS Occasional Paper No. 72. London: Research, Development and Statistics Directorate, Communications Development Unit, Home Office.

Hays, R.T. (2005). *The effectiveness of instructional games: A literature review and discussion. Naval Air Warfare Center Training System Division (No. 2005-004*). Retrieved from: http://adlcommunity.net/file.php/36/GrooveFiles/Instr_Game_Review_Tr_2005.pdf (accessed: February 2010).

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