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CREATIVITY AND EDUCATIONAL FREEWARE CHOSEN BY FUTURE EARLY CHILDHOOD EDUCATORS

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Abstract:
This research aims to study the prospects of cultivating creative thinking of pre-school children from the perspective of the use of educational software by potential pedagogues of pre-school children. The survey involved 104 future educators who chose freeware spontaneously in order to utilize it in the pre-school children's learning process. They analyzed, evaluated and prioritized the software in their discretion through an assessment grid developed by the researcher. In this context, the prospects for the cultivation of children's creative thinking in the development of the use of technology by future pedagogues were studied. According to the results, the potentially positive perspective of cultivating creative thinking of children is examined in view of the intention of educators to exploit learning software. It seems that the spontaneous choice of freeware aims to cultivate children's creativity. The pursuit of creative thinking seems to be one of the main criterion for educators' software selection. They, also, estimate positively the software which is designed to practice creativity. Moreover, future educators seem to identify and recognize the added value that new technologies offer in cultivating creative thinking of pre-school children.

Keywords: digital pedagogy, creativity, early childhood education, pre-school, learning software, freeware

1. Introduction

Creativity, from early enough and through time, has been approved as one of the "core values" of society (Faure, 1972), an essential competence (Beghetto, 2007) and its

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contribution is considered to be decisive to the development of the knowledge society (Markkula, 2006; EC, 2009). Its cultivation and development is a challenge for education (Faure, 1972). It is increasingly recognized that creativity is a crucial issue for society, economy, technology and consequently education (Craft, 2010). The meaning of creativity is often associated with that of innovation (Fischer, 2005). Innovation is considered as the consequence of the creative process, something which arises from the application of new, creative ideas into concrete contexts and which is recognized as valuable by the society.

Creativity is regarded as a complicated issue, is difficult to define clearly, and seldom appears as a direct observable ability (de Klerk 2008; Ferrari et al. 2009). According to the approach taken by Gardner, creativity is approached as a cognitive process in which various forms of intelligence are working in harmony (Gardner, 1999). It has been supported by Torrance that creativity can be defined and measured in a framework of three dimensions originality, fluency, and flexibility (Piffer, 2012). Solutions to problems that are merely 'reproductive' and common are defined as convergent thinking. However, new, unusual and innovative solutions, using lateral thinking and productivity that are not included in the conventional thought, are characterized as divergent thinking (Gardner, 1999).

Loveless (2000), echoing Bruner's ideas, argues that creative thinking involves the representation in meaning derived from a dialogue between children and their work. Moreover, the concept of creativity and the concept of reflection are interdependent. Reflection is seen as a manner for transferring knowledge across contexts, to examine a given problem and adapt to it, applying knowledge from one context to another, thereby forming the basis for the creative implementation of knowledge onto new problems (Baterson, 1972).

The ability of creativity today is mainly about being able to use knowledge across contexts, applying knowledge fruitfully to contexts for which it wasn't meant (Seltzer & Bentley, 2000). In order to cultivate creative thinking, the ability to apply knowledge cross-contextually needs to be developed, meaning to be able to think outside the topics and boxes that knowledge normally is organized in.

The development and evolution of creativity have been studied from the early stages of childhood education and even from the age of pre-school children (Smolucha & Smolucha, 1985; Urban, 1991; Daugherty, 1993; Chae, 2003).

Some of the practices that enhance creativity are considered to be the activity of problem-solving, encouragement of improvisation patterns, reasoning skills, strategies used to solve a specific problem, the reflective approach to thinking ad generating ideas and their evaluation (Muller & Perlmutter, 1985).

It is supported that actions which help creative thinking aim to enact suitable strategic solutions. Also, as favorable to creative thinking is recognized the ability to combine ideas, link concepts, the incitement of curiosity, the receptive attitude towards new solutions and finally the capacity to look at what is being done, judge it and encounter suitable reactions. It is accepted that creativity is favored through exploration via emphasizing discovery, interaction engagement, experimentation, reflection, imagination, and collaboration (Price et al. 2003).

By interacting with teaching materials, children consider alternative ways in which they can complete a task or project. However, research has shown that different pedagogical practices influence creativity development in various ways (Besancon & Lubart, 2008). A form of the potential for creative expressions could be closely related to instances which children can explore the digital technology in playful ways and where a progression in use moves from the child's exploration to mastery of the technology (Brooks & Brooks, 2014). This concerns the type of technology that the child is the master, technology is subordinate and in that way the child is being offered digital creativity potential and specific play values (Brooks & Brooks, 2014).

Interaction with the game can be creative, particularly when it comes to the way the player perceives the play activity (Lieberman, 1965). Creative abilities can be enhanced through the exploitation of new technologies, as it enables children to feel in control of their learning, while the use of multitask settings allow children the option to withdraw from problem-solving temporarily to pursue other useful activities (Wheeler et al. 2002).

Technology could stimulate the development of creativity, conform one's potential, and lead to innovation (Shneiderman, 2000). Research has shown that the use of technology can help children's creativity by speeding up the process's completion time and the variety of results in their work (Saxon et al. 2003).

Research already supports what techniques are considered to be useful to trigger and enhance creativity (Csikszentmihalyi, 1997; Hewett, 2005). As a result, there have been significant expectations about the exploit of digital technology to support creativity in different practices (Loveless, 2007; Shneiderman, 2007). One of the attribute and advantages of using interactive technology in education is that it often draws the children's attention and stimulates their interest in learning. Either in the closed frame stating how the participant should act within the game, encouraging them to stick to it or in the open frame thus allowing a broader array of solutions, technological means could contribute to the learning process.

Appropriate use of computers enables the development of creative thinking to be enhanced (Edmonds et al. 2005; Lubart, 2005; Johnson & Carruthers, 2006). Meanwhile,

further research efforts are being developed that focus on the development of digital tools for the cultivation of creative thinking (Tzanavari et al. 2008; Sielis et al. 2009).

2. Research Framework

Given that the expected exploitation of new technologies in the pre-school children's learning process will happen, the question that arises is as to what extent the prospect of cultivating the capacity of creative thinking in preschoolers exists. The present study examines whether the exploitation of new technologies in the learning process could support and foster, between other cognitive abilities, creative thinking of pre-school children.

This survey also investigates whether future educators recognize the potential cultivation of creative thinking ability through the software they choose to use in the learning process. That is whether future educators estimate that the use of relevant software could contribute to the cultivation of children's creative thinking.

In this context, the following research questions are posed:

- What skills could be developed in pre-schoolers from the range of software that future educators choose?
- From the hierarchy of the range of their choices, which criteria are referred to as the most decisive from the software they choose to use?
- Whether, the cultivation of creative thinking constitutes a criterion for potential educators when they choose software for the learning process of pre-school children. In other words, to what extent does spontaneous selection of software by prospective pedagogues include applications that could contribute to the cultivation of creative thinking of pre-school children?
- What other abilities are associated with the cultivation of creative thinking based on the relevant software chosen?
- To what extent is this software open or closed in terms of learning activities to conform to children's creative way of thinking?
- To what extent does this software hold elements of structured teaching or playful features?
- To what extent do future educators recognize the potential cultivation of creative thinking ability in the software they choose to exploit in the learning process?
- To what extent do future educators accept that the use of relevant software could contribute to the cultivation of children's creative thinking?
- Finally, to what extent do future educators recognize the added value that new technologies provide and foster the creative thinking of children?

3. Methodology

The survey involved 104 students in the field of pedagogues for early childhood education, who attended the third year of undergraduate studies of the department of Early Childhood Care and Education of Technological Educational Institute of Thessaloniki in Greece.

Each potential educator was asked to find seven different educational software on the web and to make use of it in the planning of a corresponding number of learning activities. The software they would exploit should be free or Open Source Software while that could be online or installable. The aim was to select the most appropriate from a range of software that could potentially be available to any educator who would seek to use technology in the learning process. It should be noted that in the past, during their studies, subjects related to the use of technology in pre-school education were taught.

Students were challenged to take advantage of the software they have chosen by designing a successful learning activity plan for pre-schoolers without further guidance or clarification. That is, they did not know that they should purposely pursue interventions of which the main feature would have been creativity. The aspiration of the research was the educators to use the software according to their own judgment in order to achieve the best possible learning outcomes for pre-school children, not aiming or focusing on creativity. The purpose of the research was to detect whether the spontaneous use of software by potential educators could enhance creative thinking of early childhood children.

In addition, students were asked to prioritize the seven software they chose to exploit. Each of them stated the importance of each software between the seven software she/he chose. The main criterion of the hierarchy was the importance they gave to the software as to its value as a teaching material. The purpose of this hierarchy was to detect the sign of the tendency regarding the potential of the software, that was chosen, to cultivate creative thinking. This is an efficacy indicator for the learning process according to the assessment of the pedagogues. This personal hierarchy of each student is exploited in this research as an additional indicator of the tendency of whether the use of software by future pedagogues could foster creative thinking of children.

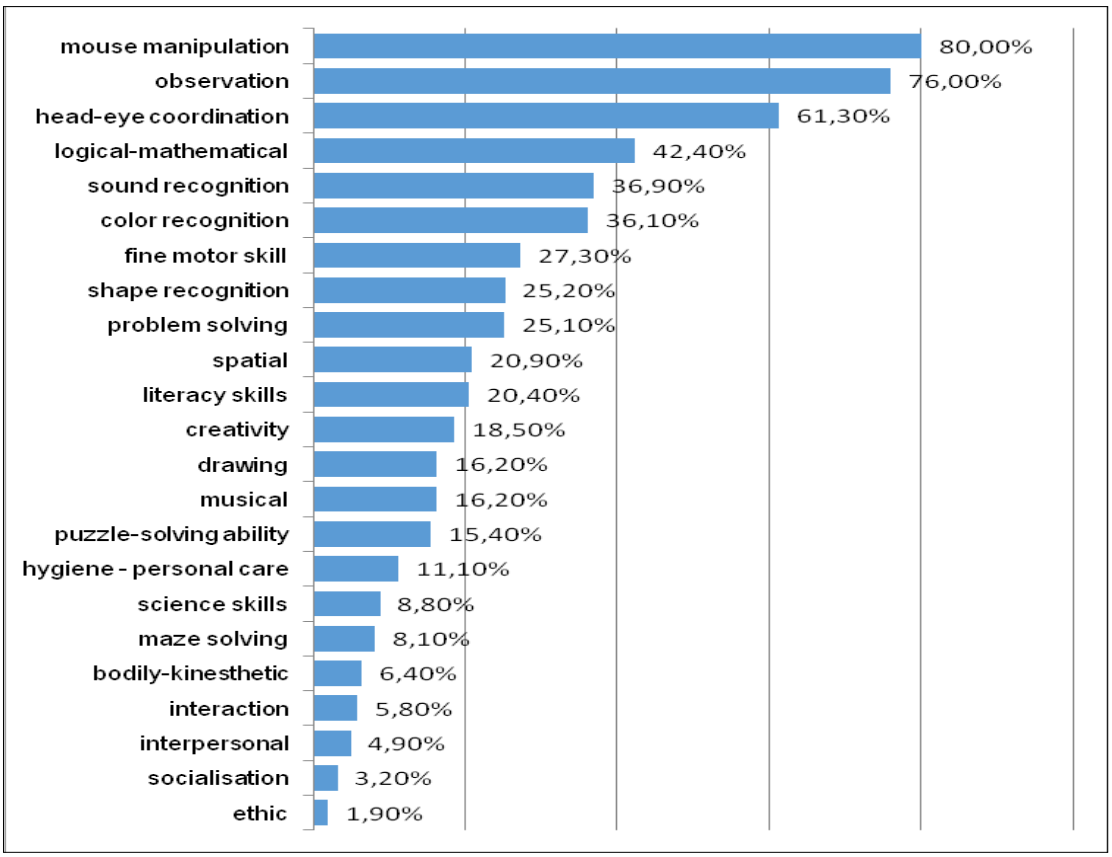
The software selected and proposed by the participants was analyzed under the approach of an assessment grid, the criteria of which are developed under this article. This kind of rubric was created by the researcher for the purposes of this research and is based on relevant literature (Hong et al., 2009; Barr et al. 2007; Klabbers, 2003; Prensky, 2003). In order to check the reliability of variables that contained Likert-type questions,

Cronbach's statistical analysis was applied. Cronbach alpha value was found as 0.71, a level that was considered satisfactory (Cronbach, 1990). To detect relationships between variables, the statistical technique of the correlation between two variables (Crosstabs) is implemented. Statistical control was applied according to Pearson's x2 criterion, and measures to link the strength of the correlation the index (r) (at level r≥.30 and p≤0.05) and for the direction of the relation the sign of the index (r). In addition the Z-scores statistical indicator was used to check the coexistence of cultivation of creative thinking with other abilities.

4. Research's Results

From the range of software that students have chosen to make use of, is clear that it aims to cultivate a multitude of abilities of pre-school children (Table 1). The majority of software cultivates computer-related skills such as mouse manipulation, head-eye coordination, and observation. To a remarkable extent, the software refers to the cultivation of competencies traditionally covered by pre-school educational objectives such as logical-mathematical, sound recognition, color recognition, fine motor skill and shape recognition. With a distinct percentage were also chosen other famous abilities like spatial, literacy skills, musical, drawing and puzzle-solving ability (NAEYC, 2017).

Figure 1: Abilities exercised by the software, according to the estimates of the educators



In general, educational software is selected based on criteria derived from the implementation of the traditional role of the early childhood educator. It is noted that software designed to grow extroversion skills is selected by future pedagogues at a limited rate, indicating the abilities of interaction, interpersonal, socialization and ethics. It is assumed that in the above cases educators prefer to use activities beyond the screen.

Through the detection of correlations in the ranking order, it is clear that future pedagogues prefer the freeware that distinguishes the suitability of the software for the age of pre-school children (X2=129.69, df=24, γ=-.34*). Also, decisive preference criteria for the chosen software are both its educational feature (X2=138.95, df=24, γ=-.35*) and the extent to which they could provoke children's interest (X2=135.54, df=24, γ=-.34*) (Table 1).

Table 1: Correlations between variables

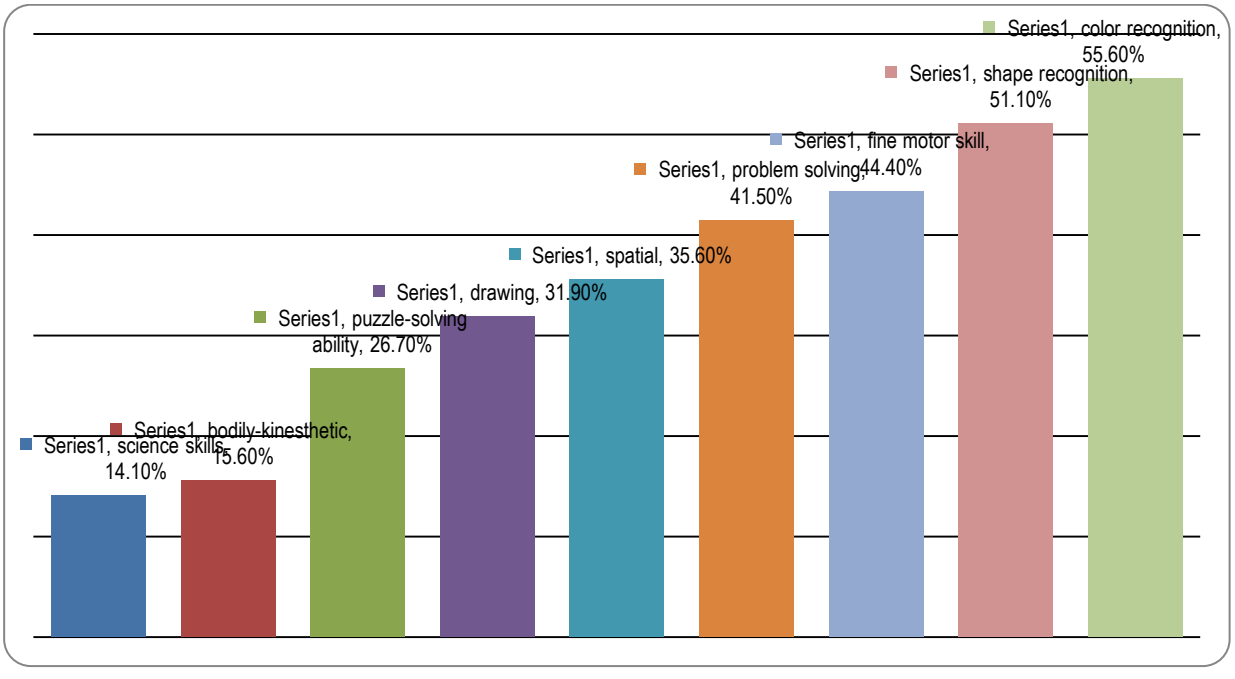
		X^2/df/γ
		evaluative ranking
Evaluative ranking By variables	educational feature	138.95/24/-.35*
	appropriateness for preschool children	129.69/24/-.34*
	exciting for prescholer's interest	135.54/24/-.34*
		Creativity
Creativity By variables	open learning activities	28.97/5/.36*
	exciting for prescholer's interest	10/4/.26*
	order of preference	8.22/6/.27*
	value as learning resources	21.22/4/.27*
Creativity By abilities that freeware develop to children according to future educators	cognitive skills	7,98/1/.29*
	social	6,15/1/.27*
	physical	20.32/1/.44*
	arts	45.22/1/.58*
	emotional	33.88/1/.59*
	culture	3.54/1/.31*
Creativity By categories of freeware	strategy	7.9/1/.31*
	adventure	13.7/1/.46*
	simulation	10.9/1/.32*
	role play	6.8/1/.33*
	skill exercise	10.1/1/.33*

* $p < 0.05$

Software aiming to cultivate creativity covers 18.5% of the software selected to be exploited in the learning processes. Even more frequent, at the level of 25.1% , applications related to the relative problem-solving ability are encountered (Figure 1).
The software chosen for the cultivation of creativity tends to openness regarding its classification, as to whether it is related to open or closed learning activities (X2=28,97, df=5, γ=-.36*) (Table 1).

Noteworthy is the observation that, when selecting software aiming at creativity, it is placed in the top positions of the series of preferences (Z=2). Generally, there is a correlation between the software related to creativity and the sequence of choice by students (X2=8.22, df=6, γ=-.3*). It seems that it is perceived and makes an impression on the students the importance of software designed to cultivate creativity. In parallel, students interpret the above software as an educational material (X2=10, df=4, γ=.3*). This observation supports the assumption that in the above software future educators recognize its importance for the learning process. Also, according to the students' assessment, this kind of software is related to activities that could stimulate the interest and participation of children in the learning process (X2=21,22, df=4, γ=.3*). It is worth noting that in the creativity software, future educators do not recognize their educational feature, i.e., their concept is not in line with teaching but is characterized by alternative activities (Table 1).

Figure 2: Abilities whose cultivation is combined with creative thinking in Freeware, according to the estimates of the educators



There is a tendency for programs aiming at creativity to be combined with the cultivation of the following competencies according to the order of priority: shape recognition (z=7,7), drawing (z=5,5), color recognition (z=5,3), fine motor skill (z=5), problem-solving (z=4,9), bodily-kinesthetic (z=4,8), spatial (z=4,7), puzzle-solving ability (z=4,1) and science skills (z=2,4) (Figure 2).

Regarding the development domains, it is observed that the practice of creativity is more intimate in software related to the areas of arts (z=6.7), emotional (z=5.8), culture (z=3.4) and physical (z=4.5) and less in areas such as social (z=2.5) and cognitive skills (z=2,8) (Figure 2).

About the categories of software, creativity tends to be more common in kinds of freeware such as simulation (z=3,3), skill exercise (z=3,2), adventure (z=3.8), strategy (z=3,1) and role play (z=3), whereas this relation is not distinguishable in kinds such as lucky games, knowledge, action and sports (Figure 2).

As to whether the software could contribute to developing the ability to which it relates, potential educators consider that they could efficiently cultivate creative thinking of children ($X2=21,22$, $df=4$, $\gamma=.48$).

Through the analysis of the justifications given by future educators for their preferences regarding the software, the following indicative references were made: “offers many choices to satisfy children's particularities and wants”, “at the same time exercises many abilities”, “the child practices on issues that could hardly be cultivated without the computer”, “the child has the ability to test many alternatives”, “it has a wide variety of combinations”, “it cultivates their imagination”, “children have fun while expressed through art”, “exercises parallel more inborn trends of children such as curiosity, observation, and comparison”, “the software is tempting children and drives their attention”, “appears more like a game than teaching”, “lets children free and enables initiatives and participation”, “gives a huge variety of choices and kids will not get bored easily”, “activates children's thinking with a pleasant way”, “it gives space and time to the imagination of the child”, “the child can make mistakes and learn from them”, “can correct and then improve the picture”, “it can experiment with many colors without losing time”, “it simulates a situation that the child could hardly experience”, “always gives a reward to continue the effort”, “it offers a wide range of materials”, “gives the child freedom to pursue in his own pace and does not restrict it”, “it offers a large number of representations and stimuli”, “becomes acquainted with reality before experiencing it”, “it offers a wide variety without delays and cost”.

The above-mentioned data are findings in which potential educators recognize the added value of new technologies in cultivating creative thinking in pre-school age children. All these highlight the conscious choices of future educators focusing on practicing skills that create creative thinking. They describe software facilities that could

cultivate creative thinking such as the variety of choices, combinations, and options they offer, the ability to continually improve and make amendments, the variety of alternative representations they provide and the scope for alternative solutions to problems. After the statements of future educators is the fact that they realize the advantages of software in relation to the traditional learning methods, regarding cultivating the creative thinking of children.

5. Discussion

Exploiting new technologies in the learning process is useful and efficient (Clements, 1994; Haugland, 1996; McCarrick & Li, 2007). Although the use of technology in education has evolved rapidly in recent years, early childhood education still has reservations (Plowman & Stephen, 2003; McCarrick & Li 2007; Hill, 2010). These reservations, which preserve pre-school teachers, seem to be weakening, especially if they are provided with appropriate training during their studies (Zaranis & Oikonomidis, 2014). It is supported that the use of new technology in the education of pre-school children broadens the range of interactive activities and offers alternative learning activities (Plowman & Stephen, 2007). It is argued that technology can foster the development of creative thinking of children (Brooks & Brooks, 2014).

In view of the underlying dissemination of technology exploitation in pre-school education, in this paper we are looking at whether the cultivation of creative thinking would have a positive outlook. That is, to what extent future educators, in their intention to use software in their learning activities, would support the practice of creativity in pre-school children. This is initial research evidence that helps investigate the relationship between creative thinking of children and the use of technology in education.

6. Conclusion

In the perspective of utilization of new technologies for pre-school children education it seems that the cultivation of creative thinking has positive prospects. Freeware features seem to be perceived by educators as ones that can foster the development of creative thinking in children.

As it arises from the research's results, future educators appear to be able to recognize, and they intend to exploit the additional opportunities offered by new technologies for the cultivation of creative thinking of children. It seems that they recognize the potential of technology that favors the development of activities that enhance the cultivation of children's creative thinking. They are able to focus on the

specific advantages that technology provides for the practice of creative thinking of children.

At the same time, it is noted that the possible use of software by prospective teachers could enhance the development of creative thinking of pre-schoolers. Also, in the context of the use of new technologies in pre-school education the practice of creative thinking is one of the leading criteria for the selection of educational software by future educators. Moreover, creative thinking of pre-schoolers is an ability that educators aim at when they are about to use technology for educational purposes.

It follows from the combined interpretation of the above points that the prospect of spontaneous exploitation of new technologies in the education of pre-school children would be a condition that could improve the creative thinking of children. This positive outlook that appears allows deducing the mark under which the use of technology for learning is positively correlated with the cultivation of creative thinking of pre-school children.

6.1 Limitation

The concept of creativity, while is a pursuit in modern education systems, requires further conceptual definition and clarification. So, the research on creativity requires additional theoretical identification. It is also pointed out that this study is about future pedagogues and potential impacts according to their estimates, without having studied their application to real learning conditions in early childhood education. Finally, the sample of the research was limited, referred only to the geographical area of Greece, and its results could hardly be generalized.

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