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# Teachers' evaluation of preschool educational software: the case of probabilistic thinking

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**Abstract**

Nowadays, children interact in formal and informal settings with technology from their very early age. As a result, a wide range of software has emerged with diverse purposes, usages, and applications. One such category is the software that is designed to assess children's prior knowledge and skills concerning a particular subject area. In this study, software testing children's abilities to make estimations and judgments based on probabilities was evaluated by preschool teachers. This pilot study took place in Greece, during 2009-2010, in a self selected group of in-service teachers ($N$ = 45). After personal interaction with the software, educators filled in a questionnaire with their opinions. Further analysis was made in order to discriminate the criteria of great importance that comprise software as developmentally appropriate. The results revealed that not only the design but also the content, the process and the purpose of preschool software should be taken into consideration when implementing pedagogical software in Preschool Education.


*Keywords: software evaluation; preschooler education; probabilistic thinking*

## 1. Preschoolers and ICTs

Numerous early childhood programs worldwide have integrated ICTs and educational software in everyday practices. In this sense, computers support the teaching and learning process by enhancing knowledge, skills and abilities in many ways (Clements & Sarama, 2003; Haugland & Wright, 1997; Siraj-Blatchford & Siraj-Blatchford, 2006; Stephen & Plowman, 2005; Yelland, 2005). Recent research has supported that children at young ages show advanced cognitive capacities through computer-based activities as, they develop their memory (Haugland, 1992), their attention (Green & Bavelier, 2003), their literacy abilities (Kamil et al, 2000), their language abilities (Toki et al, 2010), their mathematical thinking (Sarama & Clements, 2009), the development of their concentration and motivation to learn (Fredricks et al, 2004), their problem solving capacities (Reiser, 2004) and consequently their school achievement (Flintoff, 2002).

According to Haugland (2000) in developmentally appropriate settings there are many choices regarding when

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and how long children may use learning resources. Thus, the existence of computers and software is not sufficient in and of itself (Woodrow, 1989). Playful contexts, investigation, problem solving, creativity, communication and interaction are features that should be activated while young children are engaged in computer-based activities. Additionally, the role and the opinion of the teachers are of great importance in whether and how ICTs will be applied in classrooms. The teacher technology competence varies in terms of factors such as the number of years of teaching, the role as leader or assistant teacher, the home computer access and the duration of in-service training (Chen and Chang, 2006).

## 2. Software for preschoolers

Usually, the educational software addressed to preschoolers has particular characteristics compared to software for general use. This software mainly relies on pictures, animation, sound, and the absence or minimal existence of texts (Childress, Lee, & Sherman, 1999). According to Haugland (1999), the educational software for preschoolers should prioritize the process rather than the product and provide opportunities for learning and intrinsic motivation.

A category of educational software of great importance is the one that is used for evaluating preschooler's prior knowledge and abilities on a specific topic. Prior knowledge, according to Jonassen and Gabrowski (1993) is considered as the knowledge background, skills, or ability that a student brings to the learning process.

Under these lines, the current study aims at investigating teachers' opinions on assessing a probabilistic game designed by the researchers. The software under assessment engages children in a game where they are asked to make probabilistic estimations. At the same time, through this software teachers have the opportunity to understand whether children posses certain statistical skills or not. In this study, in-service teachers, as evaluators of the software, expressed their attitudes through a questionnaire based on Haughland's criteria for educationally appropriate software (1997). The analysis depicts the criteria that teachers prioritize while evaluating preschool educational software that targets children's estimation on probabilities. Children's evaluation of the software is not part of this study, thus it is taken into consideration in further research that is in progress.

## 3. Material and Methods

The sample consisted of 45 self-selected in-service teachers, aged 23-46 years old from the Northern part of Greece. Participants were greek native speakers with a common background in Early Childhood studies. The research took place in the Laboratory of New Technologies and Distance Learning, Department of Early Childhood Education at the University of Ioannina, during the spring semester of 2010.

### *3.1 The software under assessment*

The probabilistic software under evaluation was produced by the researchers and tested the prior knowledge young children have for the likelihood of events. Specifically this software examined whether children can predict the most likely outcome, based on diverse information every time. One of the most common software evaluation scales intended for preschoolers is the one developed by Haugland (1997), based on the ten following criteria: age appropriateness, the ability of the child to remain in control and set the pace and the flow of the events, the clarity of the instructions, the increasing difficulty levels, the ability for the child to work independently, the non-violent content, the process orientation of the program, the connection of the program with the real world, the technical features and finally the transformations in terms of cognitive accomplishments. These proposed evaluation criteria were taken into account while software was created in order to engage children in a probabilistic game. Through this software users had the opportunity to interact and get actively involved in a problem solving situation where guessing and deciding on which is the most probable outcome are assessed.

The software allowed users to repeat the game as many times as they wanted. The responses were not saved electronically and the involvement of an adult at a first point was critical as the narratives and the explanation of the process were not recorded. Interaction may occur in groups or individually and there was a progressive level of difficulty among tasks. The context was non-violent, the stimuli were driven from real life situations and children could control and interact within a playful environment.

### *3.2 The procedure*

According to the procedure of the research, at a first point teachers had a personal interaction with the software either independently or in couples in the Lab room. As soon as they completed this engagement they were asked to fill in a questionnaire individually so as to express their attitudes and ideas on whether the precise software can be useful, functional, child-oriented, goal-directed and adequate. There were in total 17 questions; two of them referring to demographic data, two of them referring to teachers' views concerning the utility and the pedagogical applications of the particular software and the rest of them referring to participants' judgements concerning elements of functionality, context, ease of use, technical features, accessibility and future educational potential. The final 13 questions were based on the 10 criteria of the developmentally appropriate software as proposed by Haugland (1997). The criteria 'technical feature' was divided in 3 subcategories – questions: use of mouse, quality of graphics, and quality of video-animation. Answers were used for further analysis on SPSS 18.0.

## 4. Results

By analyzing the data it was found that 88.8% of in-service teachers consider this sort of software useful in educational practices. They expressed their opinion that by exploring their student's prior knowledge in certain topics may assist them in programming and carrying out teaching activities.

Cronbach's Alpha was conducted in order to test the reliability of the 13 criteria. Alpha was .68, which is high and indicates strong internal consistency among the 13 items of the questionnaire. Essentially this means that respondents who tended to select high scores for one item also tended to select high scores for the others and the other way round, respondents who selected low scores for one item tended to select low scores for the other items too.

Principal component analysis was used in order to identify the factors that underlie the evaluation criteria according to the participants' opinions. There were 5 subscales that dominated and they can be coded as:

- Subscale 1, eigenvalue = 3.34: use of mouse, quality of graphics, quality of video-animation
- Subscale 2, eigenvalue = 2.24 : independence, ease of use, clarity of instructions
- Subscale 3, eigenvalue = 1.48: real world stimuli, interaction, motivation
- Subscale 4, eigenvalue = 1.41: levels of difficulty, desired goals, motivation
- Subscale 5, eigenvalue = 1.14: clarity of instructions, desired goals, accessibility

The 1st subscale contains technical elements and according to the reliability analysis, a = 0.73. The 2nd subscale stresses the ease of use related to the clarity of the instructions and the independence in use, a = 0.66, the 3rd implies that interaction and motivation are dependent on the content and whether it represents real world situations, a = 0.65. The 4th subscale depicts that the motivation of participation relates to the levels of difficulty and the desired goals, a = 0.6 and finally the 5th subscale takes into account accessibility, instructions and the desired goals, which in this case relate to assessing children's prior knowledge, a = -0.39.

## 5. Discussion

Participants stressed a great importance at the presentation and the delivery of the software. Through their answers it was evident that the graphics, the video, the animation quality as well as the mouse use were considered to be crucial whereas at the same time they considered essential the independence, the ease of use and the clarity of the instructions. Another important component in preschool software according to the sample was the stimuli correspondence to real world and the degree of interaction and motivation. The desired educational goals were grouped with accessibility and the clarity of instructions on one hand and on the other hand with the increasing of difficulty levels and the user's motivation.

All criteria comply with the Haugland Developmental Scale (1998) by entailing that preschool educational software should be selected in a sensible and cautious way. Experiences with computers need to be developmentally appropriate, providing children opportunities to manipulate, experiment with, and discover. Such experiences are enriched by software, through the combination of the visual displays, the animated graphics, the ability to provide feedback, the chance to explore and the support of individualisation, according to Clements (2002).

Thus, not all uses of computers are beneficial and it depends a lot on the teacher whether and how to implement technology effectively in the educational settings (Wright, 1998). It is suggested that learning with ICT considers a balance between learner-centered and adult-directed activities (Plowman & Stephen, 2005). The teachers' attitudes,

opinions and knowledge on handling computers and making the right decisions on how to develop intellectual and creative experiences for young children are important aspects in the classroom practices (Pange, 2003). It is subjective how teachers accept and teach technology. If they appreciate the role of computer technology in developing children's learning and are in the position to select developmentally appropriate software, they will be more likely to integrate technology into their early childhood programs, and the other way round.

Another aspect of the current study has to do with the nature of the software under assessment. The particularity of the current software relates to its purpose; it investigates children's prior knowledge. The importance of prior knowledge and informal experiences on learning and perceiving the world has been stressed by many researchers (i.e. Piaget, 1970; Vygotsky, 1986; Roschelle, 1995). Prior knowledge is an important aspect of the learning process that should be taken into consideration while designing studies and assessing performance. As it is impossible to progress without prior knowledge, teachers should evaluate students' prior experiences and beliefs through teaching and learning practices. By viewing learning as an active procedure, instruction should be designed so that to lead to deeper and longer lasting understandings (Jones & Brader-Araje, 2002).

In this sense, computers and educational software can contribute significantly. Software should be carefully designed by allowing children to play and exercise their creativity (Nikolopoulou, 2007) and at the same time develop flexibility, control, and skills and construct concepts in a concrete and meaningful way (Clements & Sarama, 1997). Preschooler's software should allow children to repeat their activities and reflect on what they already know and be presented with effective feedback that encourages discovery rather than direction. Concisely, this contribution may be maximized when computers are used as a tool by knowledgeable, supported educators working with research-based curricula and software (Clements & Samara, 2007).

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