USING ICT FOR TEACHING PEDESTRIANS' PROPER BEHAVIOR IN KINDERGARTEN: A CASE STUDY

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Abstract

Traffic Education aims at informing the students on road traffic issues, related to pedestrians, vehicle passengers and drivers. The past few years Traffic Education in Greece, even in the younger students, seems to be imperative due to many road accidents. At the same time the use of Information Computer Technologies (ICT) offers children new opportunities in learning using the appropriate software. The current paper studies whether and how ICT contribute to the understanding and assimilation of traffic rules by Kindergarten students, especially the ones addressed to pedestrians, so that they will obey them in real life as well.

Introduction

In Greece, the "Health Education" programs are implemented in Primary Education, providing the children the opportunity to experientially process issues related with their physical and emotional health, such as Traffic Education (Besi & Ziogou, 2010). The latter aimed at informing students about road traffic regulations, assisting them to assimilate the appropriate behavior, as pedestrians, passengers and drivers. Furthermore, the Greek Ministry of Education has formally integrated Traffic Education in the Primary Education curriculum, since 2005 (Panagakos, 2007).

Nevertheless, the numbers related to road accidents in Greece, and in the EU as well, are rather discouraging. According to the World Health Organization (http://www.who.int/), more than 280,000 children as pedestrians are involved in traffic accidents annually, worldwide (Duperrex, Bunn, & Roberts, 2002). Furthermore, the number of children pedestrians involved in traffic accidents is higher than the number of adults, being less experienced (Routledge, Reppeto–Wright, & Howarth, 1974), especially at the beginning of their adolescence, when they circulate unsupervised more often (Tabibi & Pfefer, 2003). Thus, proper training seems to be necessary (Duperrex et al., 2002). In the current paper, a case study deploying an interactive ICT based approach, has been utilized for teaching the rules for pedestrian movement in Kindergarten. ICT allow the simulation of real life conditions, thus immersing 4-5 year old children in realistic situations that are appropriate for engaging them in learning activities related to common social behavior.

The paper is structured as follows: initially the pedestrians' road traffic regulation is presented, followed by an overview of the current Traffic Education status in Greek Kindergarten. Then, the research approach is presented, followed by an overview of the results and a concluding discussion.

Pedestrians' Road Traffic Regulation

The proper pedestrians' behavior is described as part of the national Road Traffic Regulation (RTR) of Greece, fortified by the corresponding legislation. According to RTR, pedestrians should walk only on sidewalks and specially provided areas. Only in special occasions or in the case of lack of pedestrian areas they can use the road surface, taking the proper precautions and ensuring that traffic is not blocked. They are not allowed to overleap structures placed by the authorities, such as parapets of railings. While walking on the road, pedestrians are required to face incoming traffic, thus using the left side of the road in Greece, in order to be easily distinguished by the drivers.

When willing to cross a street, pedestrians should use the existing pedestrian crossings and follow the corresponding traffic lights. If the traffic lights are addressed only to vehicles, then the pedestrians should act accordingly. In the case of traffic policemen present, the pedestrians should follow their directions. In any case, the pedestrians should take into account the vehicles' speed and never cross the street without checking for incoming traffic.

Disobedience is subjected to a fine (RTR, Chapter C, Rule 38, 2007). Especially regarding traffic lights addressed to pedestrians, it is mandatory for the latter to follow the light instructions, unless a policeman is present (in which case his instructions prevail). Disobedience is subjected to fining (RTR, Chapter B, Rule 7, 2007). Furthermore, policemen and school traffic wardens are assigned with the duty of facilitating children's road crossing in school districts (RTR, Chapter D, Rule 45, 2007).

Traffic Education in Kindergarten

Traffic Education in Greece has been established in all school levels since 2005, according to a joint decision of the corresponding ministries. It is an integral part of the Health Education program in the Kindergarten Curriculum, called *Traffic Education and Accidents.* Its content is oriented to (IUCF, 2003):

1. The children's behavior as pedestrians on the street.
2. The use of helmets and seatbelts.
3. The negative consequences of alcohol use before and during driving.
4. Children's behavior in the car.
5. Necessary information for students as motorbike drivers and as passengers in the school busses, airplanes, ships and other means of transportation.

As of 2010, the Greek government decided to intensify Traffic Education in Early Childhood, Primary and Secondary Education, utilizing the Road Safety Parks throughout the country for providing the students with empirical knowledge. The empirical-experiential method is an effective strategy for changing attitudes, perceptions and behaviors in psychosocial situations, while transferring knowledge at the same time (Renaud & Suissa, 1989).

Figure 1. Activities in the Road Safety Parks.

Additional teaching techniques include the construction of city maquettes in class (Figure 2). The latter can be either two-dimensional in paper, where children can play using dolls and toys car, or three-dimensional with materials available in class. In this case children undertake roles, such as cars, traffic policemen or pedestrians, thus learning through acting.

Figure 2. Two- and three-dimensional city maquettes in class.

Furthermore, traffic safety rules can be taught through stories, especially in Kindergarten. A fairy tale with "Mr. RTR" as the main character who is familiar with all the road safety rules and interacts with two cars is available in all public schools. Finally, there is a tight collaboration of the educational system with several public and private bodies, such as Traffic Police directorates and the National Association of Driving Teachers, for the implementation of seminars for children.

Traffic Education in Kindergarten Using ICT

The Greek Ministry of Education funded the implementation of two educational software programs to be available in all public schools, in 2005. The main character of "*On the road safely*" is a taxi, which invites the children to interact with the software through game-like activities in order to learn how to drive through the city and what the traffic signs represent (see Figure 3).

Furthermore, an educational software series called "Kidepedia" is available in the Greek market, including a traffic education section, focusing mainly on the interpretation of the traffic signs. Finally, individual approaches designed by schoolteachers can be found, also through the website of the Ministry of Education, in the form of best practices. These are mainly implemented with presentation software, such as PowerPoint, following a storyboard approach. In all cases, the existing approaches focus on traffic signs and driving habits.

The behavior of the pedestrian is not adequately dealt with through the curriculum and the available ICT solutions. Strangely enough, children are only pedestrians and/or passengers until their adulthood and only the latter (being a passenger) is actually discussed at school.

Figure 3. Home screen of the "On the road safely" software.

Research Approach

Traffic education focusing on pedestrians' behavior can enhance and enrich children's knowledge about city circulation, but amend their erroneous behaviors as well (Duperrex et al., 2002). Furthermore research indicates that simulation, experience-based games, can alter attitudes and modify behavior in the area of pedestrian traffic safety for children of this age (Renaud & Suissa, 1989). Experiential learning is important at this age as children can learn through the symbolic function and action (Kakana, 1994).

This paper describes a case study, implemented in a Greek public Kindergarten, with the participation of 13 children. An interactive computer application was implemented, combined with an experiential role-play activity in class. The aim was to examine whether and to what extent such activities assist students to improve their behavior as pedestrians. The reason for focusing on the pedestrians' behavior derives from the fact that preschoolers circulate mostly as pedestrians.

Technical Environment

Within the scope of the case study, an interactive application was implemented using the Scratch computer-programming platform (http://scratch.mit.edu/). It was selected mainly because of its usability in designing applications, by omitting syntax errors while programming (Maloney, Peppler, Kafai, Resnick, & Rusk, 2008). Furthermore, the integrated support of touch screen as well as the execution of the applications in full screen mode were considered as positive factors for selecting the Scratch platform. Finally, the provision of logo-like commands and functionalities were utilized, as described hereinafter.

Figure 4. Nikiforos is ready to begin his walk in the city.

A game-like application was implemented, focusing on the behavior of the pedestrian, entitled "A walk in the city." The main character is a boy named "Nikiforos the walker." Initially, he introduces himself and the objective of the application to the users. Then, Nikiforos encourages children to go with him for a walk in the city, by choosing one of the three available routes. Having selected the route, the user is transferred to the application's main screen, which was designed to depict a common city portion, including roads, pedestrian crossings, buildings, sidewalks, signs and traffic lights (Figure 4).

An attempt was made to preserve plausibility. Thus, the traffic lights were operable, interchanging between red and green every 10 seconds. If a user tries to cross the street with the wrong traffic light color, then Nikiforos was moved back on the sidewalk and a message appears saying, "We never cross the street when the red light is on." Also, a car appears in order to remind the children that there are many factors to be considered when taking a walk around the city. The car was programmed so that it would "respect" the road safety rules, thus responding to the traffic lights and stopping when Nikiforos attempted to cross the street using a pedestrian crossing.

In order to move the character the children were asked to initially click on him and then "show him the way," using the mouse pointer. Considering that some of the children are not capable of fully controlling the mouse, a laptop with a rotating touch screen with a digitizer pen was used. T hus, the children were required to actually "draw" the path for Nikiforos to follow. While moving, a trace was drawn onscreen, following the Logo language functionality, allowing the detection of errors within the choice of paths (Figure 5).

As mentioned, three different routes were designed. In every route the children were asked to walk in the city, starting from the house, and visit two different buildings/areas. The first building was different for each route and the second one was the same for all of them. The buildings were the school, the super market and the grocery respectively, while the park was the common destination for all three routes.

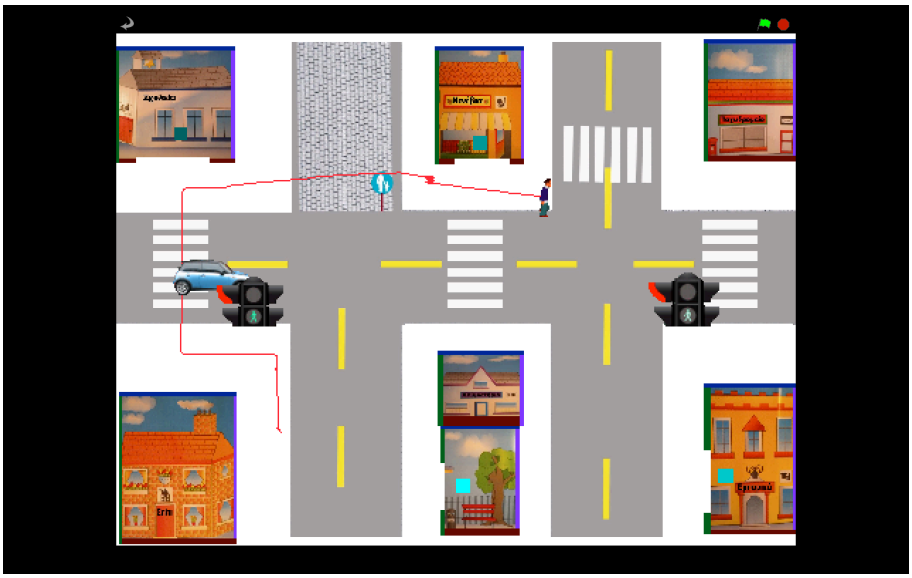

Figure 5. Path trail indicating the character's movement.

Having brought Nikiforos successfully to the park, a rewarding message appeared on the screen. Furthermore, at this point Nikiforos recalls the basic rules of the pedestrian behavior. Finally he challenges the children upon the correctness of the paths they selected, asking them to reflect on them and distinguish any possible mistakes they might have made.

Three-dimensional Maquette

Apart from the computer application, a three-dimensional maquette was constructed in class. It included buildings, streets, sidewalks and streetlights, simulating a city road network. The buildings were made out of cardboards. Windows, balconies and doors were painted in the buildings in order to make them more realistic. Also the size of the buildings was similar to that of the children, for the same reason. The roads, the sidewalks and the pedestrian crossings were made out of blue and white paper, whereas the traffic lights, out of cardboard and they were activated with a torch (Figure 6). It is important to mention that pedestrian crossings existed in some parts of "the city," so that it would require thinking on how to cross the streets.

Figure 6. City maquette in class.

Research process

This study took place at 3rd public Kindergarten in Florina city, Greece, in June 2012. The participants were 13 children (7 girls - 6 boys). Their ages were 5 (8/13) and 4 (5/13) years old. Observation, semi-structured interviews and video recordings were used for collecting research data.

The children were divided into two groups of 7 (Group A) and 6 (Group B) students, respectively, with mixed compositions regarding age and sex. The study was structured in three phases. During Phase 1, an exploratory discussion was conducted with the children in order to record their knowledge and perceptions on the field. In Phase 2, the children formed the two groups. The members of Group A carried one task within the proposed software, individually. After children finished "their walk around the city," the researcher provoked a reflective discussion with them, urging them to identify their mistakes and the correct path, according to the rules of pedestrians' road behavior. During this discussion, they were able to examine a printout of the path they followed, as this was marked through the software. The members of Group B also followed a path individually, but within the three-dimensional maquette. The researcher observed their actions and pointed out their mistakes after the completion of the task.

Finally, in Phase 3 all the children were asked to design and follow a path within the maquette, thus performing an evaluative task. The aim was to examine which feedback method, namely visual from the software or oral from the researcher, facilitated their understanding of the proper pedestrian behavior on the street.

The main research question was "Does the proposed software and the visual feedback mechanism that it proposes facilitate children's understanding of the proper pedestrian behavior?" Additional sub-questions were formulated, such as:

- Is the understanding of traffic rules more effective through ICT-based or experiential activities?
- Is the visual feedback enhancing the assimilation of traffic rules?
- Can the children (Group A) self-assess their performance and identify both their mistakes and the correct path, utilizing the revision of the rules and examining the depiction of their route?
- Is the "A walk in the city" software interesting for the children?

Results

In order to address the research questions, a correlation was made among the video recordings, the discussions with the children during Phase 2 and a comparison was made with the solutions they provided during Phase 3. Initially, it is important to mention that the discussion during Phase 1 revealed that the children were knowledgeable regarding basic traffic rules. They were familiar with the traffic lights, even the ones addressed to the pedestrians and they could explain their functionality (what does every color means and what

the proper actions are in each case). They could also identify the pedestrian crossings and the most common traffic signs. Their knowledge was found to be adequate. One explanation for this was that the children dealt with the traffic education issue with their teacher, during the week before the implementation of the case study.

Regarding the first question "Is the understanding of traffic rules more effective through ICT-based or experiential activities?" a difference was noticed between Group A and Group B. The examination of the routes, followed by the children during Phase 3, revealed that although both groups improved their performance, Group A outperformed Group B. The former was the group that worked with the computer application and reflected upon the printout of their solution. The majority of the members of Group A were flawless during Phase 3. The researcher's observations indicate that Group A members were more careful and thoughtful when designing their path. They tried to distinguish the most appropriate pedestrian crossings, even if that led them to a longer path. On the contrary, Group B members usually crossed the street using the closest pedestrian crossings and often they crossed the road junctions diagonally, thus not obeying to the traffic rules. Furthermore, they paid more attention to the traffic lights. Consequently, the ICT-based activity seemed to be more effective in producing an understanding the traffic rules, than the experiential ones.

Regarding the second question, the visual feedback was obviously more assistive in assimilating the traffic rules. In this case, the children were urged to understand and justify their mistakes. They had the opportunity to carefully examine the path they followed, as it was depicted on the printout. Furthermore, an overview of the city structure was available for them; assisting them to compare their path with the optimal ones, thus better understanding their mistakes. In addition, they had the opportunity to apply the traffic rules upon their printout directly after receiving them from Nikiforos, at the end of the computer activity, taking as much time as they needed. An indicative example of a student's reflective session is as follows:

> **Researcher:** Is this path wrong? How should we have moved?
>
> **C7:** Hmm…like that (indicating a wrong path with his finger, onscreen)
>
> **Researcher**: We started here (pointing at the starting-point). Where can we find pedestrian crossings that we can use?
>
> **C7:** We should have gone this way. Here, then here and here (pointing at the screen and indicating the correct path)

The third question was, "Can the children (Group A) self-assess their performance and identify both their mistakes and the correct path, utilizing the revision of the rules and examining the depiction of their route?" The dialogue with the researcher during the reflective session, utilizing the visual feedback provided by the computer application assisted the children to self-asses their performance. Initially, they were able to identify their mistakes and then decide on corrective actions. Although most of the Group A members initially answered positively to Nikiforos's question, "Did you complete your journey,

obeying to the rules of the good pedestrian?" they easily distinguished their mistakes after the researcher's inducement. The fact that they had just heard a repetition of those rules from Nikiforos facilitated this process. They needed more help, through questions, in order to identify the optimal path, as shown in the following dialogue:

> **Researcher:** Let's see, we had to visit the grocery. Did we follow the rules of the good pedestrian in order to get there?
> **C6:** Yes
>
> **Researcher**: You passed from here. Are we allowed to pass from here?
> **C6:** Yes
>
> **Researcher**: Is there a pedestrian crossing here?
> **C6:** No
>
> **Researcher**: Which path should we have followed then? (Short hesitation).
> **Researcher**: Which path should we have followed? We started from here (pointing at the starting-point). Which pedestrian crossing could we have used?
> **C6:** Here, here and here (pointing at the screen and indicating the correct path)
>
> **Researcher**: When we went to the park did we follow the rules of the good pedestrian?
> **C6:** Yes, we used the crossings
>
> **Researcher**: So what do we have to keep in mind when crossing the street?
> **C6:** To use the pedestrian crossings all the time.

The final question was related to the designed computer application. It was intriguing for the children and it managed to enhance their motivation for participation. Most of the children asked if they could repeat the activity in order to follow all the (three) available routes. Moreover, the children who had finished the computer based task were prompting their classmates to do the same, by stating: "Go, it is a very nice game," "It's fun," etc. They found the use of the digitizer pen very interesting; as it was the first time they used such a technology. They were impressed because they could "write" in the screen, referring to the trail of the character's movement, produced by the software. Overall, the application made a very good impression. They were "playing" a computer game and they felt that they really had to help the character, thus being very involved in the process.

Discussion

The core aim of the case study presented in this paper was to examine if ICT based activities could facilitate traffic rules acquisition by Kindergarten students, emphasizing the pedestrian. Overall, the approach was successfully implemented. Minor problems faced by two 4 years-old students in manipulating the digitizer pen were overcome easily.

The results indicate that the immediate feedback provided by the computer application, during the activity as well as the visual feedback provided after the completion of the activity assisted the children to identify their mistakes and search for optimal solutions. The former feedback mechanism was provided verbally and visually, when the children attempted to cross the street with the pedestrian's traffic light red light on. A message (written and verbal) reminded the children that this was not allowed in a suggestive manner ("We are not allowed to cross the street when the red light is on"). The latter feedback mechanism was provided by the printout of the city structure and the path trail that Nikoforos had followed. The repetition of the basic rules from Nikiforos and the formulation of the question, "Did you obey the rules of the good pedestrian during the game?" was enough to initiate a reflective process for the children. Also, the members of Group A outperformed those of Group B, during Phase 3, indicating that they better assimilated the traffic rules.

A limitation of this case study is the size of the research population and the fact that it was implemented within one day. Repetitions of this approach with larger populations, as well as more available routes for all the students could help reach more concrete results.

There is little research, involving the exploitation of ICT in Traffic Education, especially in Kindergarten. The current study's findings conform with studies conducted with the participation of older (Grade-2) children, in which children who worked with computer software outperformed the ones who completed experiential tasks. Although the researchers ascribed the positive results more to enthusiasm deriving from computer use and the multimedia game-like environment, still motivation and focus were enhanced by the use of ICT. Thus, the approach was successful (Simopoulos & Gkountelias, 2005).

The educational approach followed in this study fully complies with Vygotsky's suggestions about causing cognitive conflicts and facilitating the subject's acquisition of knowledge through communication and reflection. This was achieved mainly by the simple, yet important visual feedback mechanism, implemented through the Scratch Logo-like functionality.

Possible extensions of the current study could include the exploitation of further possibilities of the Scratch environment, which allows physical interaction through sensors. The latter can be custom made, utilizing the ScratchBoard. Another possibility is to exploit the Kinect technology, introduced by Microsoft for the Xbox 360 console, which is operable through the Scratch platform. This would allow movement in a three dimensional space, thus further immersing the children in the activity, in a conjunction of computer-based and experiential activities. Additionally, Phase 3 of the study could have been carried out in a Road Safety Park, providing the opportunity to explore children's performance in larger and more complex routes, thus reinforcing the integrity of the results.

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