

An Innovative Teaching Approach in E-safety Education

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Abstract

The growing concern on children's e-safety constitutes important the need to define innovative teaching approaches on young pupil's education. To this end, we examine the e-safety education provided to young children 9 to 11 years old and we present an analysis of the current e-safety didactic propositions. Based on our findings and the national primary education curriculum, we propose a didactic scenario on e-safety for younger pupils. The proposed didactic scenario constitutes an approach based on the learning theories of constructivism, experiential learning and Vygotsky's socio-cultural theories. An evaluation methodology of the pupils' progress, based on two groups of proposed criteria is presented. Finally, we present and discuss the interesting results from the three years implementation of the proposed approach in a Greek public primary school.

Keywords: e-safety, education, learning-theories, primary-school, ICT.

1. Introduction

Nowadays children keep accessing the Internet at continually younger age (Μπαλής, Ταγκόπουλος, & Σταμούλη, 2013). The Internet has numerous and severe negative aspects associated with it. For example, children can be exposed to harmful and illegal content (e.g. violence, gambling, pornography); they can face attempts of seduction or proselytizing; they can be victims of cyberbullying; they can have their personal information exposed (Γεωργιάδης κ.α., 2000; Πανσεληνάς κ.α., 2014).

As a result, the growing concern on children's e-safety has brought forward the proposition of banning the Internet access for children. However, this goal is infeasible, as children are very likely to seek alternative ways to access the Internet without the consent and supervision of an adult. On the other hand, the Internet offers many educational and psychological benefits, as analyzed by Tynes (2007).

The utilization of the Internet for educational purposes in the class or at home should be based on sufficient training, in order to secure pupils' on-line experiences. Towards this end, formal education is required to play a key role by increasing e-safety awareness and getting pupils and their parents informed on the relevant issues. At the same time, it is observed that researchers studying the field of e-safety have focused more on older children, upwards of age 12 (Henderson-Martin, 2013). Similarly, in Greece from the identified efforts related to e-safety (46 studies), only 15% focus on children downwards of age 13. Additionally, only 9% focus on e-safety education.

Thus, there is an increasing need to study the field of e-safety education, especially for the ages of 7 and 12 years old. We propose new studies to focus on pupil's behavior when using the Internet and on the necessary knowledge, skills and attitudes (KSAs) that have to be adopted by pupils to face the Internet's challenges. Furthermore, new teaching approaches should be considered that will make young children to learn the suitable KSAs.

2. Educational approaches on e-safety

Aiming at the appreciation of the current e-safety educational approaches, we searched the Aesop (a Greek Ministry of Education didactic scenarios' repository at aesop.iep.edu.gr) and we identified five scenarios in the category of computer science/e-safety for young pupils. The learning approaches used in these didactic scenarios embrace active learning and discovery learning theories by incorporating various kinds of educational activities. Such activities include watching videos, seeking information, answering quizzes, playing games, constructing word clouds, creating comics, reflecting on case studies, discussing and constructing concept maps.

Moreover, some didactic scenarios utilize special web sites and portals as resources (e.g., "saferinternet.gr", "cyberkid.gov.gr", "saferinternet.org.uk", "sos.fbi.gov") that contain content, materials, interactive activities and games on e-safety. Such web sites form a suitable environment for pupils' activities requiring navigation, information discovery and gaining of experiences. Subsequently, pupils are typically required to carry out activities of expressing and/or representing their gained knowledge.

A notable e-safety resource is the "Wild Web Woods" game (WildWebWoods, 2009) that is part of the "Building a Europe for and with children" programme (coe.int/en/web/children) of Council of Europe. The "Wild Web Woods" game is an action adventure game aiming at increasing kids' awareness to the negative aspects of the Internet. It emphasizes in speaking a child-friendly language by providing exciting gaming experiences (e.g. choosing a character, collecting mis-

sion coins, opening awareness scrolls, etc.) and using fairy tale characters and narratives combined with e-safety notions, e.g. Rapunzel's addiction in the tower of games, Jack and the beanstalk of viruses, the Dwarf and the cyberbullying mean dwarf-games, etc.

3. Comics in education

Comics is a form of storytelling that consists of several graphic representations and images in a suitable order, framed with dialogues and text. Comics convey information and notions to the reader and cause emotional responses (Smeda, Dakich & Sharda, 2010). Moreover, they constitute a powerful pedagogical tool, as they stimulate pupils' interest quite effectively, especially at younger ages. Comics consist of colorful images and plain and comprehensible text that are attractive to children; they also reduce pupils' anxiety (Yunus, Salehi & Embi, 2012); and they usually have embedded the aspect of humor that arouses positive feelings and engagement in creative thinking activities (DeMichiell et al., 2005). When pupils are involved in comic creation activities, they develop high cognitive and writing skills; they express their thoughts, ideas and feelings; they foster their creativity (Μουταφίδου, Μέλλιου & Μπράτιτσης, 2016); and they comprehend ideas at a deeper level (Azman, Zaibon & Shiratuddin, 2016). In addition, the use of ICT tools has enabled the creation of digital comics. Digital comic creation activities aggregate the benefits of ICT tools to educational activities, such as featuring a suitable environment for collaboration of pupils (Yunus, Salehi & Embi, 2012).

On the contrary, comics may have limitations that hold back their pedagogical value. Digital comic creation activities require a great deal of time. First and foremost, pupils usually need preliminary lessons to familiarize themselves with comic creation software and image editing tools. Subsequently, they need time to seek, edit and create new graphics. Additionally, they need to put a lot of effort on preliminary tasks such as designing the characters, setting the scenery and writing the plot before the actual creation of comics (Yunus, Salehi & Embi, 2012).

4. The Proposed Didactic Scenario

4.1. Scenario Description

The proposed didactic scenario can be implemented in the 4th and 6th grade and it consists of four phases that are described below:

Phase 1. Psychological and cognitive preparation: The educator presents a video on e-safety to stimulate pupils' interest on the subject (e.g. "always ask for help" video in saferinternet.gr). Subsequently, teacher makes a short introduction to the

subject, informs the pupils about the learning objectives and tries to prepare them emotionally. Finally, she separates children into groups.

Phase 2. Case study: Pupils read the case study story. Then, they use the text of the story to create word clouds. The educator uses the word cloud depictions to point out the key notions of the story and she initiates a discussion activity in the class. During the discussion, the educator encourages pupils to share their thoughts and feelings on the story. The educator poses questions in order to make pupils reflect on the characters' mistakes, on the consequences that the characters faced and be concerned on the e-safety guidelines. Finally, the educator asks pupils to answer to the questions placed in a worksheet. During this activity, the educator assesses pupils' work and supports them in assimilating and describing the key notions.

Jack downloads free games all the time. He opens all the email messages in his mailbox, even from unknown senders. When he surfs on the internet, he always clicks on the flashing "click for free games" signs and installs games and programs. But Jack has installed far too many computer games and programs that infected his computer with viruses and other malicious software. The malicious software has grown in his computer like a beanstalk of viruses. The computer has started to stall and freeze. Jack's passwords and personal information have been stolen. Today his computer is not working at all. His poor mother has to buy a new computer for him. But she asks him to promise that he will install antivirus protection and he will download files only from websites that he really trusts. Let's see, will Jack be more thoughtful this time?

Figure 1. Story of Jack and the beanstalk of viruses (WildWebWoods, 2009)

Brainy Smurf is a fourth grade pupil. He enjoys playing a game on the internet. He uses the nickname "Brainy2009". Yesterday, a co-player made a friend request and chatted with him. The co-player told him his name and he asked for Brainy Smurf's real name. As Brainy Smurf knows the negative sides of the internet, he asked the co-player's email address to make sure that his profile was real. The stranger answered to the Brainy Smurf's email and he told him that he was very happy that they became buddies because he is an old friend of his father. He also told him that he wanted to get in touch with his father and asked for Brainy Smurf's home address and telephone number. The stranger pointed out that Brainy Smurf should not to tell his parents because he wanted to surprise them. Brainy Smurf is not sure whether he should give his contact details or not. Should he tell to his patents what happened?

Figure 2. Story of Brainy Smurf and the personal data

Rapunzel loves playing games and surfing on the web. She has a computer with extreme gaming specifications and a game console. She usually does her homework and then she plays on the internet. The teacher advised her parents to keep a diary to see how much time she spends on playing games. Also, the computer and the game consoles should be placed in the communal space of the house. However, since she does her homework, why not to play? Lately, she finds her homework a little boring. She wants to play and surf all day long. She is not answering to her friends anymore. She is crazy about this new game and she does not want any interruptions. She will build a castle of games in her room. None will bother her in her castle. Poor Rapunzell! You like the games and the internet so much that you have been addicted to them.

Figure 3. Story of Rapunzel and her addiction to games (WildWebWoods, 2009)

Phase 3. Comic creation: The educator supplies pupils with a collection of graphics containing almost 400 images with several characters in various expressions (e.g. joy, sadness etc.) and postures (e.g. the character walks, sits etc.), rooms, sceneries, objects etc. The educator asks from children to use the provided graphics to create a still comic story (for fourth graders) or an animating comic story in Scratch (for sixth graders). He encourages pupils to use their imagination and revise the initial story in any way they like. However, educator has to clarify that pupils' comics should highlight the main e-safety notions of the story that have been discussed in the class.

Phase 4. Comic presentation: Pupils present their creations in the classroom and they receive feedback and reflect on their work. Subsequently, they edit and publish their comics on the Internet (e.g. on the YouTube or the Scratch community) to disseminate their ideas (e.g. to teachers, parents and classmates) and get feedback.

Phases 2 to 4 should be applied iteratively for each story of the didactic scenario (depicted in figures 1 to 3).

4.2 Underlying Learning Theories

The proposed didactic scenario is based mainly on the constructivism learning theory (Cunningham & Duffy, 1996). As students are engaged in the scenarios' activities, they gradually build the new knowledge on the existing one. For example, in the beginning of the didactic scenario students gain knowledge on e-safety notions by studying stories that draw elements from well-known fairy tale narratives such as Jack and the Beanstalk and Rapunzel. The proposed scenario embraces active learning (Bonwell & Eison, 1991) as students explore and analyze the stories by building word clouds, participating in discussions in the class and answering assessment questions. The presented didactic scenario is also based on the experiential learning theory (Luckmann, 1996) as students are encouraged to revise the sto-

ry by combining the original narrative with experiential elements, i.e. their experiences, feelings, ideas and aesthetics.

Furthermore, the proposed didactic scenario points out Vygotsky's sociocultural theories (Vygotsky, 1980), as pupils perform activities in groups of two or three. Pupils utilize ICT tools to facilitate their collaboration during the activities. Moreover, they communicate, interact and get support from their teacher and classmates (Vygotsky's cognitive scaffolding). In addition, pupils share their comics by publishing them on the Internet (e.g. YouTube or the Scratch community). Subsequently, they comment and discuss on their comics and they get feedback from their classmates, their teachers and their parents. Thus, they reflect on their work and they capture new ideas that can be applied to improve their prospective creations. This approach refers to the Resnick cycle (Resnick, 2007): imagine, create, play, share, reflect, imagine... Though, the "play" step is mostly compatible with teaching approaches in which pupils are able to experiment with their work, e.g. an animation story developed in Scratch. According to Resnick, such an approach is ideal for fostering 21st century skills and developing creative thinking.

5. Evaluation Methodology

The proposed didactic scenario has been implemented in the ICT course classes of a Greek public elementary school. Since 2014, the proposed scenario is applied to 194 4th graders in classes of 23 to 28 pupils and an educator. The scenario's implementation fulfilled in three iterations, one for each story depicted in figures 1 to 3. Each iteration involved the phases 2 to 4 described in the section "4.1. Scenario Description" and it lasted 4 to 6 hours in the first and second years of scenario's implementation and 3 to 4 hours in the third year. Pupils worked in the computer lab mainly in groups of two and they used a presentation maker, a text editor and a browser.

Aiming at evaluating the pupils' progress and appreciating the effectiveness of the proposed didactic scenario, a number of criteria are proposed on assessing pupils' work for each story. The proposed criteria are organized in two groups. The first group of criteria (Group A) refers to the e-safety notions tailored and communicated in comics' plot, and is listed in Table 1. Pupils' work is assessed against Group A criteria and it is characterized as either "satisfying", "partially satisfying" or "not satisfying". Pupils' work is considered "satisfying" when it exhibits efficiently the stories' e-safety notions in their comics. The e-safety notions included in each story are two improper activities that the characters do (e.g. downloading games from untrusted sites, using birth year in the nickname), the consequence they face (e.g. damage of the computer, disclosure of personal data) and two guidelines that they should have followed (e.g. use of antivirus programs, place devices in communal space). Pupils' work is partially satisfying when it presents e-safety notions inadequately (e.g. one activity or guideline is presented instead of two) and/or in a con-

fusing manner. Pupils' work is considered "not satisfying" when it does not exposes pupils' effort to depict stories' e-safety notions.

Table 1. *Group A of criteria.*

Criteria
I. Does the pupils' work depict two of the characters' improper activities on the Internet?
II. Does the pupils' work depict the consequence that the characters face?
III. Does the pupils' work depict the set of e-safety guidelines provided in the narratives?

The Group B of criteria consists of a set of tokens that reveal the engagement of the pupils to their tasks, and is listed in table 2.

Table 2. *Group B of criteria.*

Criteria
IV. Did the pupils require scaffolding while demonstrating activities related to ICT skills and knowledge in order to instantiate their ideas?
V. Did the pupils enhance their work with their own experiential elements?
VI. a) Did the pupils' work reveal effort to present a complete comic in terms of plot, use of language and technological competence? b) How many different sceneries did pupils' work contain? c) How many slides did pupils' work contain?

6. Results

The results of the proposed scenario's implementations are based on the evaluation of 251 pupils' works and they are summarized in tables 3 and 4. The former contains the results related to group A and an average of pupils' works evaluation that reveal the extent the e-safety notions were assimilated and communicated by pupils.

Table 3. Evaluation results based on group A of criteria

Evaluation of pupils' performance over group A of criteria (I to III)	% of works satisfying criterion	% of works partially satisfying criterion	% of works not satisfying criterion
Criterion I. (<i>Improper activities</i>)	47%	45%	8%
Criterion II. (<i>Consequence</i>)	65%	24%	11%
Criterion III. (<i>Guidelines</i>)	37%	35%	28%
Average	49%	35%	16%

Table 4 contains the evaluation results based on criteria IV to VI that depict the percentage of the amount of pupils that requested teacher's help to achieve a task they could not do without educator's scaffolding, an appreciation of the aspect of experiential learning in the educational process, and an estimation to the engagement of pupils to scenario's activities.

Table 4. Evaluation results based on group B criteria

Criterion IV. Percentage of works of pupils requested scaffolding.		34%
Criterion V. Percentage of works with experiential elements.		95%
Criterion VI.	a) Percentage of works of pupils made an effort to present a complete work.	71%
	b) Average number of different sceneries.	3,9
	c) Average number of slides.	8,3

The results presented above clearly show that the activities of the proposed teaching approach greatly attract pupils' interest, as the submitted comics in 71% form a complete work (criterion VI a), in terms of plot, language usage and technological competence. Besides, the majority of the work submitted contains several elements, e.g. sceneries, slides, objects and characters, showing that pupils devoted the available time to instantiate their ideas. On the contrary, it appears that 29% of the pupils didn't succeed to finish their work mainly due to inefficient time management and lack of time.

Under the perspective of the e-safety, pupils showed some remarkable results. Almost half of the pupils show that they have comprehended the basic e-safety concepts to a satisfactory degree, whereas over the one-third of the pupils show that they made an effort to present them but they didn't achieve to communicate or depict them efficiently. On the other hand, the rate of pupils that did not manage to prove that they perceived the notions of e-safety guidelines is quite high (28% of works did not satisfy criterion III). However, as pupils tend to present the e-safety guidelines at the end of their stories, this metric is probably related to the rate of pupils that did not manage to complete their work due to lack of time.

The vast majority of pupils' work showed that the created comics contains intervention elements, as a result of their experiences, creative thinking and imagination. These elements are usually expressed in their work as an inclusion of new characters and plot revision or adaptation. Finally, criterion IV rate proves that almost the one-third of the pupils required support through the demonstration of new skills and knowledge to instantiate ideas that they envisioned. Though, the presented rate does not reflect the received support on knowledge and skills that were already known to the pupils, but were not recalled in the specific educational environment. Thus, criterion IV rate can only be considered as the estimation of the minimum number of pupils that worked in the Vygotsky's zone of proximal development in the context of the proposed scenario.

7. Conclusion

While e-safety education attracts more attention, new educational approaches have to be developed and tested. In this work, we identified the lack of approaches regarding young pupils' education on e-safety in Greece and in other countries; and we reviewed the didactical approaches provided in the Aesop repository in terms of utilized learning theory and types of activities. Based on our review, we developed and implemented an innovative teaching approach embracing the theories of constructivism, experiential learning and Vygotsky's socio-cultural theories. Finally, we reflected on our observations and results and made assumptions on the utilized learning theories and educational tools. The presented approach can be enriched with supplementary narratives on e-safety issues such as cyberbullying, spamming and privacy; and additional techniques such as concept mapping. Moreover, it can be extended towards different subjects regarding language learning and visual arts.

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Περίληψη

Η αυξανόμενη ανησυχία για την ηλεκτρονική ασφάλεια των παιδιών καθιστά απαραίτητη τη δημιουργία καινοτόμων προσεγγίσεων διδασκαλίας για την εκπαίδευση των μαθητών σε θέματα ασφάλειας. Προς αυτήν την κατεύθυνση, εξετάζουμε την εκπαίδευση που παρέχεται σε μαθητές ηλικίας 9 έως 11 ετών στην ασφάλεια στο διαδίκτυο και παρουσιάζουμε μια ανάλυση των υφιστάμενων διδακτικών προσεγγίσεων. Με βάση τα ευρήματά μας και το πρόγραμμα σπουδών της πρωτοβάθμιας εκπαίδευσης, προτείνουμε ένα διδακτικό σενάριο για την εκπαίδευση μαθητών 9 έως 11 χρονών σε θέματα ασφάλειας στο διαδίκτυο. Το προτεινόμενο διδακτικό σενάριο αποτελεί μια προσέγγιση βασισμένη στις σύγχρονες θεωρίες μάθησης του εποικοδομητισμού, της βιοματικής μάθησης και τις κοινωνιοπολιτισμικές θεωρίες του Vygotsky. Παρουσιάζουμε τη μεθοδολογία αξιολόγησης προόδου των μαθητών στη βάση δυο ομάδων προτεινόμενων κριτηρίων. Τέλος, παρουσιάζουμε και συζητάμε τα αποτελέσματα από την τριετή εφαρμογή της προτεινόμενης προσέγγισης σε ένα Ελληνικό δημοτικό σχολείο (μαθητές Δ' τάξης).

Λέξεις κλειδιά: ασφάλεια στο διαδίκτυο, εκπαίδευση, θεωρίες μάθησης, δημοτικό σχολείο, ΤΠΕ