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AN E-LEARNING ENVIRONMENT FOR INFLUENCING CHILDREN'S ATTITUDES TOWARD ULTRAVIOLET PROTECTION

Sotiroula Theodosi and Iolie Nicolaidou
Department of Communication and Internet Studies, Cyprus University of Technology
P.O. Box 50329, Limassol 3603, Cyprus

ABSTRACT

This paper describes a work in progress to design and evaluate an e-learning intervention that utilizes the Internet of Things (IoT) to increase awareness of the dangers of ultraviolet (UV) radiation exposure and promote sun protection practices early in life. The authors' previous work in a pre-test post-test control group study (Study 1) involved children in using IoT devices to collect and analyze real-time UV radiation data. Preliminary data were promising in this small-scale study, but the latter did not use a validated instrument to measure children's UV knowledge, attitudes, and behaviors. This second study has a dual aim. First, it reports on the results of a systematic literature review that aimed to identify validated questionnaires that a) measure attitudes toward UV light protection, b) are appropriate for primary school, and c) are suitable for evaluating e-learning prevention interventions if they are used as a pre-test and post-test. Second, it describes how the intervention of Study 1 will be re-enacted through an e-learning platform that allows for deepening student understanding and engagement through gamification and allows for visualizing students' understanding in real-time.

KEYWORDS

e-Learning Environment, Ultraviolet (UV) Protection, Children, Attitudes, Validated Instruments, Systematic Literature Review.

1. INTRODUCTION

Prolonged exposure to ultraviolet radiation (UV) is linked to skin cancer, and children are considered a more vulnerable group to UV harmful effects than adults. The most proactive and effective way of preventing skin cancer is through education. Increasing awareness of the dangers of UV radiation exposure and promoting sun protection practices early in life through prevention interventions is essential (Cercato et al., 2013) particularly for countries with a high UV index year-round.

This paper describes a work in progress to design and evaluate an e-learning intervention that utilizes the Internet of Things (IoT), specifically UV light sensors, to collect data that reflect real time environmental conditions. IoT technologies are not yet applied in primary education for data collection, processing and visualization and their potential benefit and impact in the learning process has not yet been realized. The authors' previous work involved designing an intervention for 6th-grade children in a STEM inquiry-based learning environment following a sequence of four eighty-minute ultraviolet radiation and protection course. During the course students studied multimodal sources, experimented with UV beads, and utilized commercially available sensors connected to tablets for precise measurements of UV radiation levels in their schoolyard (Study 1). Data sources included questionnaires on UV knowledge, attitudes, and behaviors administered pre- and post-intervention. Preliminary results of this first pre-test post-test control group study with 31 participants were promising, as statistically significant learning gains, and positive behavioral changes were found only for the experimental group (Theodosi & Nicolaidou, 2021).

However, Study 1 did not use a validated instrument to measure children's UV knowledge, attitudes, and behaviors. In fact, most of the studies that focused on measuring young children's sun-related attitudes followed a survey design (Aquilina et al., 2004; Wright et al., 2008; Saridi et al., 2012) and used questionnaires that were not tested for validity (Koster, 2017), which is a limitation in the literature. Moreover, most prevention behavioral interventions for increasing sun-protective attitudes were not technologically supported.

Prevention interventions designed and delivered through e-learning platforms are expected to have significant benefits. These include having all learning activities in one place, providing the teacher with real-time visualization of students' understanding, and the ability to enhance interventions with gamification elements. The purpose of this study is twofold: a) to identify validated questionnaires that measure UV sun exposure habits and participants' propensity to increase sun protection through a systematic literature review, and b) to describe added pedagogical affordances which will be made possible in a second enactment of the intervention using an e-learning delivery platform to increase children's awareness of UV protection.

2. METHODOLOGY

This study's first aim is to identify validated questionnaires, which measure UV sun exposure attitudes and participants' propensity to increase sun protection, through a systematic literature review. The framework used by Neira (2017) for conducting systematic reviews was followed. Google Scholar was used to enable a broad search for scientific studies across various disciplines.

For the studies to be selected, inclusion criteria were set as follows: (a) peer reviewed and fully accessed papers, (b) empirical studies following a survey design and addressing UV exposure attitudes and participants' propensity to increase sun protection and (c) have students as participants. Throughout the searching procedure, the following keywords were used "UV questionnaire AND attitudes AND children", "UV instruments AND attitudes AND children", "UV exposure AND students' attitudes", "Sun exposure attitudes AND primary school", "validated questionnaire AND UV attitudes", resulting in 126 relevant studies. Selection criteria were applied to each study, with the final number of studies, summing up to 70. Fifty-six studies were excluded as follows: duplicated studies (n=15), reviews (n=13), PhD theses (n=4), irrelevant studies (n=1), not fully accessed papers (n=1), theoretical articles regarding UV radiation (n=2), papers developing questionnaires (n=1), studies applied in a general population (n=19). Data was analyzed quantitatively following thematic content analysis regarding each study's research aim, number of participants, educational level, and the use (or not) of validated questionnaires for data collection. All data was coded in these categories and imported in a Microsoft Excel coding sheet.

For the study's second aim, a critical comparison was performed between activities included in Study 1 (Theodosi & Nicolaidou, 2021) and enhanced activities that will be included in its re-enactment in Study 2, in which a commercial e-learning platform (Nearpod) will be used so students can access their learning materials online and work at their own pace.

3. RESULTS

Literature searches resulted in 70 relevant studies that met inclusion criteria. Nine out of 70 studies used a descriptive research design aiming to investigate sun protection behaviors adopted by students of different age groups. With the focus in this paper being placed on studies conducted in primary education, the previously mentioned studies were excluded from any further analysis. An overall analysis was performed with respect to participants' educational level to the remaining 61 studies. As the literature review revealed, studies were conducted at all educational levels with 18 studies in total focusing on students' attitudes and behaviors regarding sun protection in primary education. Specifically, 7 studies were conducted in early childhood, 21 in secondary education and 15 in higher education.

Results focusing on primary education (n=18) are presented in this paper. Six surveys aiming to investigate both parents and their children's sun exposure habits and sun-protective behaviors with data deriving from questionnaires completed by parents were excluded from the present review (Balato et al., 2007; Cercato et al., 2012; Dixon et al., 1999; Nyiri, 2005; Stanganelli et al., 2019; Thoonen et al., 2019). Out of the remaining 12 studies, eight of them stated the use of validated questionnaires for measuring UV attitudes. Five studies used Cronbach's alpha to assess the reliability and internal consistency of the questionnaires used (Ergul & Ozeren, 2011; Hewitt et al., 2001; Kubar & Hoffman, 1995; Saridi et al., 2012; Saridi et al., 2014). Cronbach's alpha for the attitudes scale ranged from 0.62 (Hewitt et al., 2001) to 0.85 (Kubar & Hoffman, 1995).

Validated questionnaires were used both to record UV attitudes and sun protective behaviors of primary school students (Ergul & Ozeren, 2011; Kubar & Hoffman, 1995; Saridi et al., 2012) and to record a change in knowledge, attitudes, and sun protective behaviors before and after an educational intervention aiming at higher knowledge and healthier attitudes and behaviors (Duarte et al., 2018; Geller, 2003; Hewitt et al., 2001; Rouhanni et al., 2009; Saridi et al. 2014). The number of participants used for validation purposes was stated in four studies (Duarte et al., 2018; Ergul & Ozeren, 2011; Geller, 2003; Saridi et al., 2012; Saridi et al. 2014) ranging from 50 participants (Duarte et al., 2018) to 1472 participants (Saridi et al. 2014).

For instance, Duarte et al. (2018) conducted a survey to compare primary school students' sun-related knowledge and behavior during school and holiday periods. A questionnaire about sun exposure and behavior was given to 2114 students after educational sessions were held with educators, and an educational activity book regarding sun exposure and protection was administered to all participants. The questionnaire contained: (a) demographic questions, (b) questions on sun-exposure behavior during school and holiday periods, and (c) seven true or false questions to test their knowledge. The questionnaire was designed specifically for children following a review of the relevant literature and was validated with 1,472 students in 2003.

Similarly, Geller (2003) conducted a survey aiming to evaluate the Sun Wise School Program in 102 primary schools in 42 states with a validated questionnaire derived from other studies, revised by educational and child development experts, and pilot-tested for readability and length. The questionnaire included demographic questions and items assessing knowledge, attitudes, practices, and intended practices before and after a paper-based intervention. Rouhanni et al. (2009) followed the same method for evaluating an educational intervention, focusing on sunscreen's use. Similarly, Saridi et al. (2014) used a questionnaire to evaluate the Sun Smart program in Australia, aiming to address students' knowledge, attitudes, and behaviors. Contrary to the previously mentioned interventions, Hewitt et al. (2001) assessed effectiveness of the "Sun Safe" computer-supported intervention by measuring the change in knowledge, attitudes, and behaviors prior and after the intervention. A critical comparison of instruments selected in this review, including an evaluation of their difficulty level for completion by primary school students, will identify an instrument for validation in the children's native language as part of future work.

For the study's second aim, the e-learning platform that will be utilized in the second enactment of the learning environment to increase awareness of the dangers of ultraviolet (UV) radiation exposure (https://nearpod.com/) will allow for several added affordances, including interactivity and increased student engagement. Students will be able to easily access and study multimodal sources of information focusing on the question "Why is the sun dangerous?" which will be uploaded by the teacher in the structured environment of the platform (Lesson 1). Students' individual responses to this question, as well as students' observations regarding UV radiation (Lesson 2), will be available to the teacher in real-time, a functionality that allows for visualizing students understanding in real-time and using insights from formative assessments to guide the teaching and improve student outcomes. Students can input their measured UV radiation levels collected using sensors during the lesson and asynchronously in the e-learning platform (Lesson 3). Students can be scaffolded to interpret sensor-collected data regarding UV radiation levels at their school. They can input their suggestions of products and actions they consider sun-protective through collaborative work in small groups, and participate in gamified activities in the platform (Lesson 3). Students can present the results of their testing of sun-protective products using sensors to determine their level of protection through the e-learning platform (Lesson 4), allowing the teacher to adapt instruction or address misconceptions during lessons based on feedback from real-time data.

4. CONCLUSION

This study's primary contribution refers to identifying several validated instruments measuring attitudes towards UV protection that can be used to evaluate the effectiveness of e-learning prevention interventions aiming to affect young children's attitudes towards UV protection. Future short-term research steps will focus on validating a selected instrument in the children's native language and designing the intervention in a specific commercial e-learning platform (Nearpod) for increased interactivity, engagement, the addition of gamified activities, and the ability to adapt instruction based on real-time data. Long-term research goals include using the validated instrument in a pre-test, post-test control group design with a larger sample of students who will participate in an e-learning re-enactment of the prevention intervention to positively affect children's attitudes towards UV protection.

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