Πανελλήνιο Συνέδριο της Διδακτικής των Φυσικών Επιστημών και Νέων Τεχνολογιών στην Εκπαίδευση

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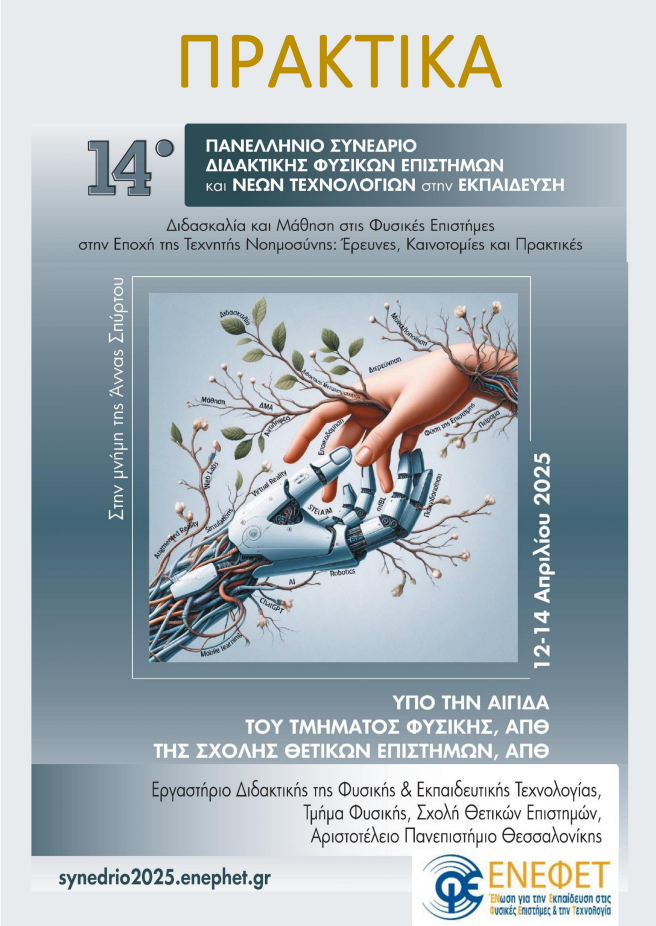

Climate Knowledge and Engagement in Primary Education: Insights from an Audience Segmentation Approach

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Climate Knowledge and Engagement in Primary Education: Insights from an Audience Segmentation Approach

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Abstract

This study examines the knowledge, alternative conceptions, and attitudes of 5th and 6th-grade primary students regarding climate change, utilizing the Six Americas Short SurveY (SASSY) audience segmentation tool developed by Yale University. The findings indicate that while most students fall into segments characterized by heightened awareness, alternative conceptions remain widespread. Notably, older students exhibit more misconceptions compared to their younger peers. The study underscores the need for targeted educational interventions to enhance understanding and foster environmental consciousness.

Keywords: audience segmentation, climate change, primary education, SASSY tool

Γνώση και Εμπλοκή με την Κλιματική Αλλαγή στην Πρωτοβάθμια Εκπαίδευση: Συμπεράσματα από μια Προσέγγιση Τμηματοποίησης Κοινού

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Περίληψη

Η παρούσα μελέτη εξετάζει τις γνώσεις, τις εναλλακτικές ιδέες και τις στάσεις των μαθητών/τριών της Ε' και ΣΤ' Δημοτικού σχετικά με την κλιματική αλλαγή, αξιοποιώντας το εργαλείο τμηματοποίησης κοινού Six Americas Short SurveY (SASSY), του Πανεπιστημίου Yale. Τα ευρήματα δείχνουν ότι ενώ η πλειονότητα του μαθητικού κοινού εντάσσεται σε τμήματα με αυξημένη ευαισθητοποίηση, οι εναλλακτικές ιδέες παραμένουν ευρέως διαδεδομένες, ενώ οι μεγαλύτεροι/ες ηλικιακά μαθητές/τριες εμφανίζουν περισσότερες παρανοήσεις σε σχέση με τους/τις μικρότερους/ες. Η μελέτη αναδεικνύει την ανάγκη για στοχευμένες εκπαιδευτικές παρεμβάσεις, για την ενίσχυση της κατανόησης και της περιβαλλοντικής συνείδησης.

Λέξεις κλειδιά: πρωτοβάθμια εκπαίδευση, εργαλείο SASSY, κλιματική αλλαγή, τμηματοποίηση κοινού

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Introduction

Climate change education is challenging, particularly for younger audiences. Despite the growing global focus on developing appropriate educational interventions, children often struggle with conceptual understanding, hold misconceptions, and show varied responses to climate issues.

To explore this interaction, we used the Six Americas Short SurveY (SASSY) developed by Yale University was used. SASSY is a tool that segments individuals into six groups—Alarmed, Concerned, Cautious, Disengaged, Doubtful, and Dismissive—using a 4-item questionnaire that assesses the varying degrees of awareness and engagement based on self-reported beliefs, concern levels, and personal connection to climate change (Chryst et al., 2018). In this study, SASSY was adapted to classify Greek 5th and 6th-grade primary students.

Segmentation Types in Children's Climate Perspectives

Audience segmentation is a popular method for identifying different subgroups. When it comes to student audiences, segmentation based on climate perspectives has been done in a variety of ways.

(i) Demographics

Misconceptions about climate, such as confusing ozone depletion with the greenhouse effect, are widespread across all age groups (Leščešen et al., 2024). Older students typically demonstrate greater understanding, but younger ones often show more concern and willingness to act than older peers (Nepras et al., 2023). Gender differences have also been observed, with girls typically showing higher levels of perceived risk and are more likely to engage in adaptive actions (Nepras et al., 2023).

(ii) Emotional Engagement

Eco-anxiety, driven by feelings of fear and helplessness, can hinder children's ability to act. However, fostering constructive hope emphasizing actionable solutions while acknowledging the severity of environmental issues, can empower children to transform concern into positive action (Demetriou et al., 2024).

(iii) Psychographic Segmentation

Children can be grouped into four distinct profiles, based on how they perceive risk and self-efficacy: indifference (low risk, weak efficacy), proactive (low risk, strong efficacy), avoidance (high risk, weak efficacy), and responsive (high risk, strong efficacy) (Mead et al., 2012).

(iv) Cognitive-Affective Segmentation

A strong correlation exists between climate knowledge and pro-environmental attitudes and behaviors. Students with higher levels of climate knowledge are more likely to exhibit positive attitudes towards the environment and engage in sustainable practices (Karpudewan et al., 2015).

Methodology

The study focuses on the following research questions:

RQ1. How are 5th and 6th-grade Greek primary students distributed across the SASSY segments?

RQ2. What is the overall climate knowledge of 5th and 6th-grade primary students, and in what ways do their SASSY segments correlate with their understanding?

RQ3. What is the effect of demographic factors, including age and gender, on primary students' understanding of climate issues, misconceptions, and classification within the SASSY segments?

Participants and Setting

The study involved 66 students from two primary schools in the Athens region: 33 5th graders and 33 6th graders.

Tools

The questionnaire administered was structured into three sections:

(i) The demographic section collected information about the participants' gender and grade level.

(ii) The SASSY section contained four validated questions from the Six Americas Short SurveY, designed to classify respondents into one of six audience segments regarding climate change: Alarmed, Concerned, Cautious, Disengaged, Doubtful, or Dismissive. These four questions assess climate change concern, perceived personal and societal risk, and issue importance (Chryst et al., 2018). To ensure linguistic and conceptual clarity, the questions were first translated into Greek and then back-translated into English to validate consistency with the original survey instrument, ollowing best practices for cross-cultural survey adaptation (Teixeira et al., 2024).

(iii) The climate knowledge section, comprising four multiple-choice questions which assessed students' understanding of key climate science concepts:

- **Greenhouse Effect**: Assessed comprehension of how certain atmospheric gases trap heat.
- **CO_2 Increase Since the Industrial Revolution**: Evaluated awareness of historical changes in carbon dioxide concentrations.
- **Global Temperature Change Since the Industrial Revolution**: Measured understanding of observed global temperature trends.
- **Scientific Consensus on Climate Change**: Tested knowledge of the level of agreement among scientists regarding human-caused climate change.

These items were adapted from established climate literacy assessments to ensure age-appropriate content and validity (Karpudewan et al., 2015).

Procedure

The questionnaire was distributed in the classroom setting, with students completing it under supervision. No personally identifiable information was collected in order to ensure anonymity. Data was analyzed using a combination of descriptive statistics, correlation analysis, and segmentation-based comparisons.

Results

SASSY Segmentation Patterns

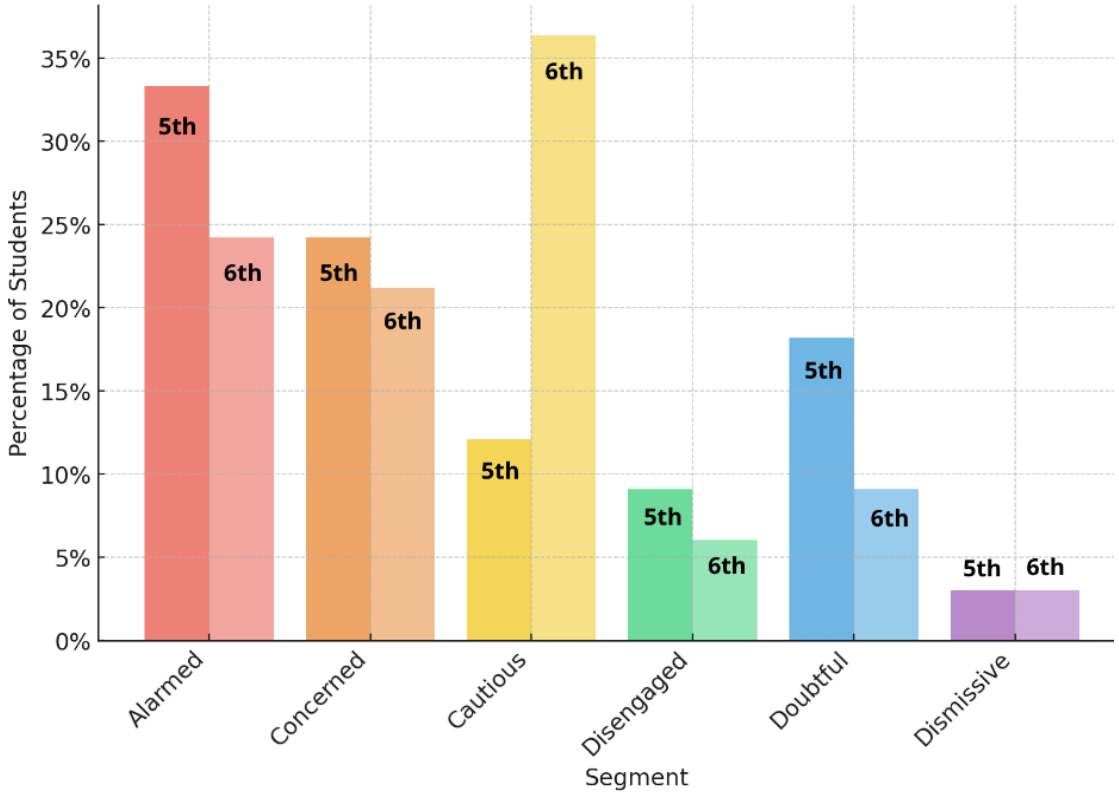
Analysis of the Six Americas Super Short Survey (SASSY) segmentation indicates that 76% of the total students fall into the "Alarmed", "Cautious", and "Concerned" segments, while 24% fall into the less engaged segments ("Doubtful", "Dismissive"). More specifically, the "Alarmed" and "Concerned" segments have a relatively even distribution across both 5th and 6th graders while the "Cautious" segment is significantly larger among 6th graders (36%) compared to 5th graders (12%). Smaller proportions of students fall into the "Doubtful" (18% of 5th graders, 9% of 6th graders), "Disengaged" (9% of 5th graders, 6% of 6th graders), and "Dismissive" (3% in both grade levels) segments (Fig. 1).

Climate Misconceptions

A significant observation across all segments was the confusion between ozone layer depletion and the greenhouse effect. This misconception is prevalent across segments, not only among less engaged ones, like "Disengaged" (60%) or "Doubtful" (44%), but in "Alarmed" (47%) as

well. No misconceptions were reported among the "Dismissive" group, though this may be influenced by the small sample size of this segment. (Fig. 2).

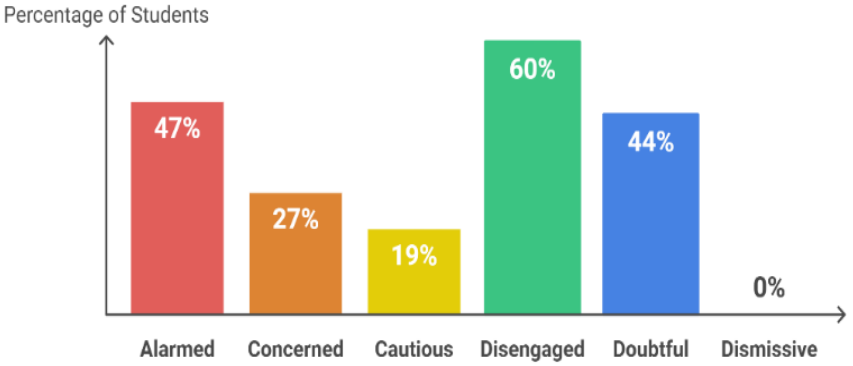
Figure 1. SASSY segmentation of the student population by age



Assessment of Climate Knowledge

Regarding the “climate knowledge” questions, two-thirds of the students correctly identified the increase of CO_2 levels since industrialization, while one-third underestimated it. Similarly, while 41% recognized the temperature rise since the Industrial Revolution, the rest either underestimated it or held misconceptions about temperature stability. Finally, 36% of students accurately identified the percentage of scientists who agree that human activity is the primary cause of climate change.

Figure 2. Ozone misconception percentages by segment



Statistical Analysis and Interpretation

The Kruskal-Wallis H test confirmed no statistically significant differences in ozone misconceptions across SASSY segments (H = 6.31, p = .277. However, the Kruskal-Wallis test revealed significant differences by age:

- **CO_2 Increase Knowledge**: Significant differences were observed (H = 4.05, p = .044), with older students demonstrating a better understanding of the rise in CO_2 levels since the Industrial Revolution.
- **Scientific Consensus Awareness**: Older students showed greater awareness of the scientific consensus on human-caused climate change (H = 6.88, p = .009).
- **Ozone Misconceptions**: Older students exhibited more misconceptions about the ozone layer (H = 14.79, p < .001), indicating that increased age does not necessarily correlate with accurate understanding in all areas.

Correlation Analysis

The relationship between age and climate change-related variables was explored with a Pearson correlation analysis. The results indicate a moderate-to-strong positive correlation between age and misconceptions about the ozone layer, $r(64)$ = .477, p < .001. Additionally, self-reported knowledge on climate change showed a significant positive correlation with age, $r(64)$ = .403, p < .001. Scientists' consensus also correlated positively with age, $r(64)$ = .296, p = .016. A weak negative correlation was observed between age and knowledge about CO2 increase, $r(64)$ = -.253, p = .041. Other variables did not show statistically significant correlations with age.

Gender Analysis

Correlations between gender and key variables within the sample are weak. Both male and female students demonstrated similar levels of knowledge and misconceptions across most climate-related topics.

Discussion

Most students in this study were categorized within the "Alarmed," "Cautious," and "Concerned" segments, indicating a general awareness and concern about climate change (RQ1). However, misconceptions were prevalent across all segments, not just the less engaged ones. While "Disengaged" (60%) and "Doubtful" (44%) exhibited high levels of ozone misconceptions, similar trends were observed among the "Alarmed" group, so the assumption that higher engagement correlates with accurate understanding is not supported.

The Kruskal-Wallis analysis confirmed that SASSY segments did not significantly differ in climate knowledge or misconceptions (RQ2). In terms of age differences, the Kruskal-Wallis test and correlation analyses revealed that while older students demonstrated a better understanding of CO2 increase and scientists' consensus on climate change, they also held significantly more misconceptions about the ozone layer compared to their younger peers. This contradiction suggests that misconceptions about climate concepts like ozone depletion can persist or even increase over time. The observation that some students who correctly identified the greenhouse effect also selected the ozone-related answer suggested that their understanding is not entirely incorrect but still influenced by misconceptions.

Gender was found to have minimal influence on climate knowledge or misconceptions, suggesting that educational strategies should be inclusive and designed for the entire student population rather than targeted at specific gender groups (RQ3).

Conclusions

This study set out to explore how 5th and 6th-grade Greek students perceive and understand climate change through the lens of the SASSY segmentation model. Most students were

classified in the "Alarmed," "Concerned," or "Cautious" segments, suggesting that awareness and concern are indeed widespread at the primary level. However, this engagement did not necessarily translate into a more accurate understanding of key climate concepts. Misconceptions (especially the confusion between ozone depletion and the greenhouse effect) were found across all segments, including among those most engaged. This challenges the assumption that high concern always goes hand in hand with solid scientific understanding.

The results also highlight an age-related paradox: older students showed stronger knowledge on some topics (such as CO_2 rise and scientific consensus) yet were more likely to hold persistent misconceptions about ozone. Gender appeared to play a negligible role in shaping climate understanding or misinformation. These findings point to a need for better targeted educational interventions that raise awareness and also clarify foundational concepts that remain vulnerable to confusion, even in motivated learners.

Limitations

The sample (66 students from two schools in Athens) offers a useful snapshot but limits how far the findings can be generalized to other regions or educational contexts. Additionally, while the SASSY tool has been validated in broader populations, its use with younger learners in Greece, even with careful translation, may need further cultural and developmental validation. Finally, because the study was cross-sectional, it cannot trace how student knowledge or segment affiliation changes over time or in response to instruction.

Future Research Directions

Building on this study, future research should broaden its scope—both in terms of sample size and context. Including schools from different regions or socio-economic backgrounds would enrich the findings. A longitudinal approach would also allow us to follow how children's segment identity and knowledge shift over time or after exposure to targeted climate education. There's a strong case for deeper diagnostic tools that go beyond multiple-choice formats to uncover how students reason through misconceptions. It would also be valuable to examine the role of teachers, curriculum content, and media exposure in shaping these understandings.

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