# "Supporting sustainability awareness in designing green mathematical tasks"

**Chrissavgi Triantafillou, Nikolaidou Elena, Despina Potari, and Giorgos Psycharis**

NKUA, Mathematics Department, Athens, Greece
chrtriantaf@math.uoa.gr

e.nikolaidou00@gmail.com; dpotari@math.uoa.gr, gpsych@math.uoa.gr

**Keywords:** Sustainability, awareness, green task design, prospective mathematics teachers

**Abstract:** This paper aims to address how two prospective mathematics teachers (PMTs) support students' awareness of the environmental impact of fast fashion industries by designing a Green mathematical task (Green mt). Initially PMTs studied the fast fashion industry parameters (manufacturing and transportation processes, labour cost, environmental impact) and then designed a task scenario and a classroom debate aiming to promote students' awareness on fast fashion.

## 1. Introduction

Many studies argue on the ethical and policy necessities to educate the future generations about sustainability. One way that such necessities are addressed in mathematics teaching is through the design and enactment of green mathematical tasks (Green mts). Existing research on how STEM teachers are designing Green mts aiming to support students' awareness is rather limited. The few relevant studies highlight that teachers encounter several challenges in designing and enacting such tasks (Sterling, 2013**). Promoting sustainability awareness means to allow students, to propose solutions to address the environmental issue in the near future and is promoted by challenging students' stereotypes and personal values.** This paper focuses on how two PMTs support students' awareness of the environmental impact of fast fashion industry in their task design.

## 2. Theoretical ideas and Methods

Salim (2023) introduces a framework for designing green mathematics tasks that integrates sustainability issues with mathematical ideas and students' engagement in problem solving practices and raising students' awareness on environmental issues. **Environmental awareness can be divided into three categories: knowledge and understanding, attitudes and behaviour, and participation and action (Wintz et al., 2020).**

The present study took place in the context of the ENSITE project (https://ensite-project.eu/) aiming to enrich prospective teachers' competences in incorporating SIs in their teaching as well as raising students' awareness about them in their future STEM classrooms. In this context, PMTs in a Mathematics University Department designed 22 Green mts concerned one SI of their choice by working in groups. Subsequently, researchers selected 3 Green mts and semi-structured interviews were contacted with the PMTs who designed them. In the interviews PMTs were asked to: argue on their selection of the specific SI; refer to their inquiry activity while designing the Green mt (resources used; selection of tasks; possible actions in a future classroom enactment; arguments on developing students' awareness). Here we present results of one of the three interviews). The data were grounded analysed and then related to relevant theoretical issues. Specifically, we focus on Petros and Alina's (pseudonyms) designing activity of the SI of 'Fast fashion'. Fast fashion refers to the mass production of low-cost clothing and their quick transporting to retail. *The Fast fashion task scenario:* The task requires school students to explore ways to lower the ecological footprint from fast fashion clothing production.

The task presented: manufacturing data (fabric expenses and labour costs) from three different countries (USA, China, Pakistan); information about carbon dioxide production in manufacturing garments (jeans) in each of the three countries and information about dioxide production in transporting garments from the China and Pakistan to USA. Some task questions were: Count all the jeans you have in your closet. How many kilos of carbon dioxide emissions were released in the atmosphere in your jeans' production and transportation from China and Pakistan to USA? Where would you place the factory for the least economic and ecological impact?

## 3. Results and Discussion

In their task designing process Petros and Alina supported students' environmental awareness through their task design and through their arguments during the interview.

Initially, they developed their own knowledge about Fast fashion by studying relevant academic articles relating to the manufacturing and transportation process of retails and the ecological impact of these issues. Then, they used in their task design authentic statistical data from scientific resources about the labour, manufacturing and transportation costs in different countries. They related these data with the ecological dimensions of the SI by specifying the environmental impact (carbon dioxide emissions) of the manufacturing and transportation processes. They captured students' attention by selecting a very common garment for young people (jeans) and thus, persuading them that they are part of the SI and its solution. They selected two countries that have a massive clothing production and a third one that most of this production is moving to present a clear case on the environmental impact of fast fashion industry; They simplified the arithmetic data to promote all students focus on sustainability dimensions rather than on the mathematical ones during their problem-solving process. Alina's argument: *we simplified the data so that the emphasis to be on the environmental issue*. While formulating the data whey were solving the problem themselves, as Petros claimed: *We had to solve the problem and (re)formulating the data at the same time.* They asked students to engage in a decision-making situation on a socio-political issue. Petros' argument: *Students should realize that there are many unnecessary transports around the planet that maximize industries' profits and the carbon dioxide production*; They asked students to take an action against fast fashion industries. Alina: [*to students] "the jeans you are wearing maybe is one of these products" so students will realize that they could contribute to the solution by stopping buying from the Fast Fashion industrie*s."

In conclusion, PMts actions for raising students awareness were including their own in depth understanding of the problem; the selection of appropriate authentic data from scientific resources to formulate and reformulate the problem aiming to students' focus on the SI itself and not on unnecessary math calculations; their appeal to students' emotions; challenged students to take a socio-political decision; and asking them to take specific action against fast fashion.

### References

Salim, S., 2023, "A Framework for Designing Green Mathematics Tasks", Annual Conference of the Mathematics Education Research Group of Australasia (MERGA).

Sterling, S., 2013, "Sustainable university: challenge and response", In S. Sterling, L. Maxey & H. Luna (Eds), The sustainable university (pp. 43–76), Routledge Press.

Wintz, P., Joong, P., & Wintz, G., 2020, ‘Integrating of environmental education into the mathematics curriculum: “Effects on pupils’ performance and environmental awareness”. Education and Humanities, 99.