

## 1.2. Improving learning in technological-advanced societies

### SP - (19979) - TRAINING PRE-SERVICE ELEMENTARY TEACHERS TO TEACH NATURAL SCIENCES THROUGH ACTIVE PRACTICES: IMPROVEMENT OF ACADEMIC EMOTIONS AND LEARNING

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#### Short Abstract

##### Introduction

Reaching STEM literacy in society require teachers adequately trained in science. However, elementary teachers in training usually have low levels of scientific competence. Additionally, they often feel negative emotions (worry, frustration, nervousness...) about teaching science and describe it as costly and not related to daily life (Mellado *et al.*, 2014). Considering this, it is necessary to improve initial training. Active learning resources could be used to this purpose, but their influence in emotions and learning is still unexplored (Cooper and Brownell, 2020).

##### Research Question

Analyse, in a sample of pre-service teachers, changes in science knowledge and academic emotions after the implementation of active teaching of Biology; as well as examine interactions between both variables.

##### Methodology

The sample consists of 255 pre-service teachers, students enrolled in a Biology Education subject of the Degree in Primary Education (University of Extremadura, Spain). Participants attended to several interventions following different active didactic models (inquiry guided, analogies, Science-Technology-Society approach and interdisciplinary approach) (Marcos-Merino, 2020).

Participants voluntarily and anonymously completed two instruments, one for measure emotions and other for science knowledge. For academic emotions, we use a simple and fast quantitative self-report test informing about ten academic emotions (joy, trust, satisfaction, enthusiasm, fun, worry, frustration, uncertainty, nervousness, boredom). These emotions were rated on a Likert scale from 1 "not experienced" to 5 "intensely experienced". This test was previously validated through its internal and external consistency (Marcos-Merino *et al.*, 2022). Regarding science knowledge, fundamental concepts were assessed through multiple-choice questions about common misconceptions in Secondary school and questions from TIMSS (Marcos-Merino and Esteban, 2017). Participants completed both questionnaires: i) before the intervention (to determine previous knowledge, pretest, and anticipatory emotions) and 2 weeks later (to determine learning outcomes, posttest, and emotions participants really feel during interventions). Learning was calculated as the difference between posttest and pretest in a subset at or below 75th percentile of pretest.

KaleidaGraph (version 4.1) and JASP (version 0.13) were used for Wilcoxon test to compare groups and to calculate Spearman correlations and network analysis (MGM estimator) of the interactions among emotions and learning.

##### Results

Interventions were effective since there are significant differences between pretest and posttest marks ( $p$ -value $<0.001$ , Wilcoxon test). In addition, implemented practices modified academic emotions: participants felt, compared to their anticipatory emotions, more positive emotions and less negative ones ( $p$ -value $<0.05$ , Wilcoxon test). Spearman correlation and network analysis reveal that emotions interacted with posttest and learning (positive interactions for positive emotions and negative interactions for negative emotions). Results suggest that those students who feel higher

intensities of positive emotions, and lower intensities of negative emotions during active practices, are those who got better learning outcomes.

### **Final Considerations**

Results provide additional evidences of the effectiveness and motivating role of active teaching, as well as of emotions as modulators of achievement (Pekrun, 2014). These practices could be used to improve Biology Education initial training of elementary teachers. This training could be key to strengthen STEM literacy and motivation towards science learning since elementary school (Mellado *et al.*, 2014).

### **References**

#### **References**

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