THE INFLUENCE OF EARLY CHILDHOOD STUDENT TEACHERS' BELIEFS ON THEIR INTENTION TO USE INQUIRY-BASED LEARNING METHODS

In this study, we investigated early childhood student teachers' beliefs (N=81) that might influence their intention to use inquiry-based learning methods due to a six-month science course. The research was carried out in a Department of Early Childhood Education in Greece. Understanding of the inquiry-based method was assessed with an open- and closed-ended questionnaire. Their intention to use the method in their teaching was investigated in the context of the Theory of planned behavior with a 36-task Likert-type questionnaire. According to the Theory of planned behavior student teachers' intention to use inquiry-based learning methods is influenced by social factors (attitude, normative and control beliefs). The results revealed high intention, although differentiated, to use inquiry-based learning methods due to student teachers' participation in the six-month science course. Specifically, student teachers' intention is supported by the positive control estimate of their engagement with the method and impeded by estimates of the opinion of significant others (normative) as well as the assessment of the balance of personal gains-losses (attitude) expected from their involvement with the inquiry-based method.

Keywords: Control of variables strategy, Theory of planned behavior, Early childhood education

INTRODUCTION

Contemporary science education curricula at all levels of education encourage the adoption of inquiry-based teaching and learning environments in which the scientific method/practices are both a learning objective and a means of learning (NGSS, 2013). One of the most important cases of a scientific practice is the Control of Variables Strategy (CVS), i.e., the method for designing and implementing valid experiments aimed at investigating the effect of some variable on a phenomenon (Chen and Klahr, 1999). The conscious and at the same time effective use of such environments by teachers of early childhood education is expected to be enhanced if, during their studies at the pedagogical departments, their science education teaching issues takes place in the context of innovative exploratory environments (Han et al., 2017).

Adopting the framework of the Theory of Planned Behavior (Ajzen and Fishbein, 2000), we hypothesized that the intention of the early childhood student teachers (referred to as student teachers) to use the taught CVS method when they design and implement teaching scenarios for science education issues is influenced by social factors such as personal gains and losses (attitude beliefs), important people that would approve or disapprove (normative beliefs), and personal features that would help or impede them (control beliefs), from using the CVS method. Based on the above, this research focuses on recording student teachers' beliefs regarding the CVS method, on investigating their intentions to integrate it into their teaching practices, as well as on the factors that influence this intention, as a result of their participation in a six-month inquiry-based course.

METHODOLOGY

The research was carried out in a Department of Early Childhood Education in Greece, in the context of a six-month inquiry-based course (N=81). The student teachers attended a six-month, laboratory science education course. They designed and implemented experiments on phenomena that are often discussed with preschool children, e.g., floating and sinking, magnets and air properties. Simultaneously to the experimentation, an explicit introduction to the reasoning of the CVS method was offered (Lorch et al., 2010).

The student teachers' intention to use the CVS method in their teaching, in the first school year they would teach, was investigated in the context of the Theory of Planned Behavior (Ajzen & Fishbein, 2000). In our

case, in addition to the three factors included in the Theory of Planned Behavior (i.e., the attitude factors towards involvement, the normative factors and the control factors of involvement) one more factor was included, which refers to the children and is structured by the views of student teachers, related to the learning gains that the children will obtain from the instruction. Adopting the framework of the Theory of Planned Behavior we focused on the following three research questions:

1. What is student teachers' understanding of CVS method as a result of the six-month inquiry-based course?
2. What is the intention of student teachers to use the CVS method when planning and implementing teaching scenarios for science education issues in the first school year they will teach?
3. How is their intention to use CVS method affected by attitude factors (personal gains and losses), normative factors (opinions of significant others), control factors of involvement (evaluation of personal abilities), as well as by their belief concerning potential gains or losses that their future students will have from the implementation of this method?

CVS method's understanding was evaluated, at the beginning and at the end of the semester, with a questionnaire of eight questions, of which four were open-ended, while the remaining four were closed-ended. Closed-ended questions, contrary to the open-ended ones, revealed the variables in question in advance, due to their form and the ready-made choices. This was a critical difference between the two kinds of questions (closed- and open-ended). However, all the questions aimed to bring the student teachers face to face with problems/questions, the solution of which requires the management of more than one variable.
The student teachers' intention to use the CVS method in their teaching scenarios, in the first school year they will teach, was investigated in the context of the theory of planned behavior. Specifically, at the end of the semester, an Ajzen&Fishbein (A&F) questionnaire comprising 36 closed questions (5-point Likert) was given.

RESULTS

The results from the data analysis showed that a) the student teachers (N=81) understood the CVS method in different ways, b) the intention of student teachers to engage with the CVS method in future lessons at school is high, and c) there are groups of factors that strongly influence the intention of student teachers to use the CVS method in the first school year they will teach, forming as expected differentiated intentions (Ajzen & Fishbein, 2000).

Specifically, concerning the first research question, the factor analysis of the student teachers' answers to the CVS questionnaire separates the students into three groups: Group 1: insufficient answers to all types of questions (6 students), Group 2: insufficient answers to open-ended questions and adequate to closed-ended questions (29 students), Group 3: adequate answers to all types of questions (category 3: 46 students).

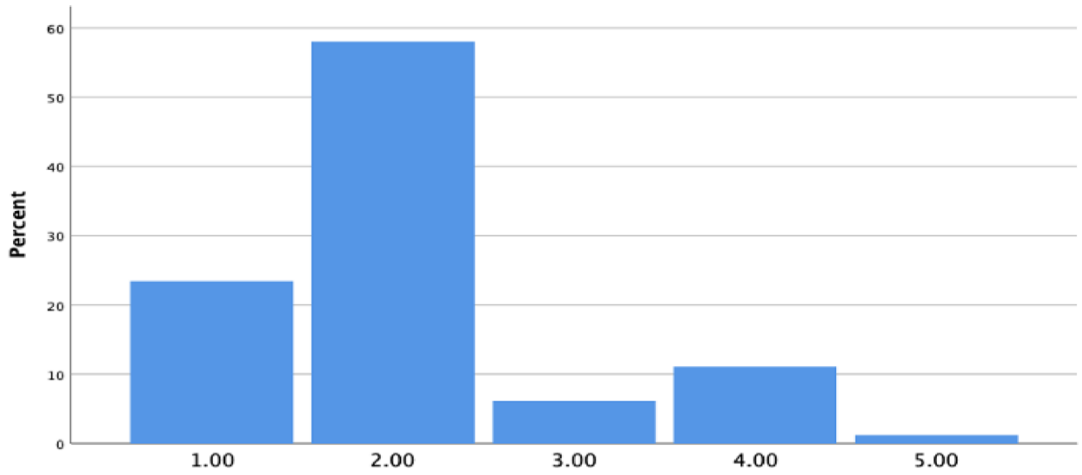

Figure 2. Student teachers' intention to use the CVS method in the first school year they will teach (1=Extremely likely, 5=Extremely unlikely)

Concerning the second research question, student teachers' intention to use the CVS method when planning and implementing teaching scenarios for science education topics in the first school year they will teach, as shown in Figure 1, is high, as a strong majority of participants chose "Extremely likely (1)' or 'Possible (2)' in the corresponding question. This result is repeated when we focus separately on the two main categories of students (groups 2 and 3).

Finally, concerning the third research question, linear regression analysis of the data showed that student teachers' intention to use CVS method:

1. is supported by the positive control estimate of their engagement (B=.305, $p < .001$), but
2. is impeded by estimates of the opinion of significant others on the involvement (B=-.556, $p < .001$), as well as with the attitude, i.e., the assessment of the balance of personal gains-losses expected from the involvement (B=- .205, $p < .05$).

DISCUSSION

The aim of the study was to investigate early childhood student teachers' understanding of CVS method as a result of a six-month inquiry-based course and student teachers' beliefs that could possibly influence their intention to use the CVS method in their teaching in the first school year that they will teach.

Consistent with the relevant literature (Boudreaux et al., 2008; Schwichow et al., 2016), the results showed that the understanding of the CVS method occurs in two distinct ways: a) as a simple rule of managing already predefined specific variables (rule: change one variable and the others remain constant), and b) as a more complex process of simultaneous management of several variables to build complex hypotheses and test them using the CVS method. Based on the above findings, regarding student teachers' education on scientific practices, it appears that the CVS method, as a simple rule, is mastered before the ability to build a complex hypothesis. Furthermore, the results (Ajzen & Fishbein, 2000) showed that CVS method's understanding could create expectations of adequate control of a future teaching in early childhood education; a teaching which, however, is expected to personally exhaust the teachers and bring them face to face with significant others.

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