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Greek Teachers' and Scientific Experts' Perceptions of Student Motivation to Learn Chemistry

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Abstract

This study investigated scientific experts' and teachers' perceptions of student motivation to learn chemistry. The participants were 5 researchers from 5 different Institutions and 11 teachers (3 in primary and 8 in secondary education) from 9 schools in Greece. Data were collected via workshop activities which aimed at addressing the participants' perceptions regarding a) supportive teaching resources b) students' general motivation and c) motivating practices. Qualitative data were analyzed by the constant comparative method. Five motivational constructs and three motivational factors related to chemistry learning were drawn from the participants' comments. Namely the identified motivational constructs were the following: i) interest, ii) self-regulation, iii) self-efficacy, iv) teachers' expectations on student performance, and v) extrinsic motivation. The three identified motivation factors were i) the curriculum design, ii) the teacher and iii) students' family. Implications for educational policy and classroom practice are discussed.

1. Introduction

Motivation to learn is "a student tendency to find academic activities meaningful and worthwhile and to try to derive the intended academic benefits from them" [1]. Two types of human motivation have been identified by psychologists: extrinsic and intrinsic motivation [2]. Motivation to perform an activity for its own sake is intrinsic, whereas motivation to perform it as a mean to an end is extrinsic [3]. The constructs of arousal, anxiety, interest, and curiosity all have been found to play important roles, particularly in the creation of intrinsic motivation [4]. Typically, students who are intrinsically motivated to learn a science concept do not require physical rewards, because the process itself is inherently motivating. On the other hand, when students learn concepts only to earn grades or avoid detention, their motivation is primarily external [5].

The extent to which science students are intrinsically motivated was found to be influenced by how self-determined they are, by their goal-directed behaviour, by their self-regulation, by their self-efficacy, and by the expectations that teachers have from them [5]. Self-determination is the ability to have choices and some degree of control in what we do and how we do it. Deci, in his theory of self-determination, suggested that students in particular need to feel competent and independent [6]. He explained that intrinsically motivated activities promote feelings of competence and independence, whereas extrinsically motivated activities can undermine these feelings.

A science objective or outcome that students pursue is a goal, and the process of pursuing it is referred as goal-directed behaviour, an important component of goal theory [3]. Goal setting is an aspect of self-regulated learning [7]. Students who are self-regulating know what they want to accomplish when they learn science and they adopt appropriate strategies to bear and continually monitor their progress toward their goals. On the other hand, Bandura defined another construct of motivation, self-efficacy, as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" [8]. When science teachers use the term, they refer to the evaluation that a student makes about his or her personal competence to succeed in a field of science. Students' judgments of their self-efficacy in particular areas of science have been found to predict their performance in these areas. For example, Zusho, Pintrich, & Coppola found that students' self-efficacy was found to be the best predictor of grades in an introductory college chemistry course, even after controlling for prior achievement [9].

Although students are usually motivated in some way and in varying degrees, the challenge for teachers is to find out which factors are most motivating. As teachers learn what factors students perceive as motivating,

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they will be better able to develop a classroom environment that increases motivation. Teachers' perceptions related to their students' motivational characteristics influence their choice of strategy [10], both the *effort* they expend, and *interventions* they use [11]. What teachers do influences students' learning [12], and teachers' knowledge of students' academic motivation influences their motivating practice [8]. In this work, we aim at identifying the motivational constructs and factors that are relevant to the Greek educational reality by analyzing the views and personal experiences expressed by Greek teachers and scientific experts.

2. Methodology

2.1 Participants Three primary school teachers, eight secondary school teachers and five scientific experts participated in a workshop that was coordinated by the second author of this work. The participants were asked to divide in groups of four people each so that each group contains one or two scientific experts. Subsequently, the participants were given a maximum of one minute each to present themselves to everybody. Finally, the coordinator made a short presentation of the workshop (goals, activities, anticipated results). The starting point of the workshop activities was the database of the "Chemistry Is All Around Network" project freely available on the Internet. This project, funded by the European Commission in the framework of the Lifelong Learning Programme (Comenius Subprogramme – Multilateral Networks), intends to promote the learning of chemistry providing among others access to:

(a) Reviews of motivating teaching resources for chemistry.

(b) Papers, reviews of publications and conference reports on the topic of student motivation

2.2 The activities of the workshop The four groups of teachers and scientific experts participated in three activities during the workshop. In all activities the participants were given a specific amount of time (ca 25-30 minutes) to freely interact with the other members of their group and discuss the theme of the activity. At the end of this free interaction, each group was asked to present the summary of their in-between discussion via one spokesperson for a maximum period of 10 minutes.

During the first activity, there was a discussion on the content of the database of the "Chemistry Is All Around Network" project. All participants had already been asked to search thoroughly through the portal database and make two comments on either papers or publications or teaching resources. They had already completed this task and were familiar with the content of the database. In the second activity, the aim was an analysis of the current situation in Greece in respect with students' motivation to learn chemistry, by taking into account the personal experiences of the participants. The coordinator made a short presentation of the recent research bibliography related to factors that influence student motivation to learn in order to introduce the participants to the activity. In the last activity of the workshop, the aim was to try and make proposals for overcoming the problem of lack of student motivation to learn chemistry through participants' conceptions.

3. Results and Discussion

In this section the main results emerged by groups discussions during the workshop activities are presented. Five motivational constructs: interest, self-regulation, self-efficacy, teachers' expectations on student performance, and extrinsic motivation, and three motivational factors: the curriculum design, the teacher, and the students' family, were drawn from the data (participants' comments).

What motivates students to learn chemistry? The in-between discussions of the five scientific experts and eleven teachers during three workshop activities elicited their perception about five motivational constructs on learning chemistry (Table 1). All participants agreed that both grades and job opportunities are the main dimensions of student **extrinsic motivation** in different educational levels. Below we present two representative participants' comments:

- "… *Ph.D. students in research centers are interested in getting a Ph. D. degree in order to gain some additional bonus points in their search for getting a permanent job in the public sector…*

- "*We note also that especially in upper secondary school, students are very often interested only in their grades…*"

The students' **interest** was referred as a motivational construct by a half of the participants. Their comments illustrate their perceptions.

- "… *Students want to learn about things which are related with their everyday life and which show the usefulness of chemistry*…"

- "*The curriculum content is not very big but it is not very interesting for the student…"*

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Table 1. The identified motivational constructs

Motivational constructs	Activity 1	Activity 2	Activity 3
Extrinsic motivation	Group 1 Group 3	Group 2 Group 4	Group 2
Interest	Group 1	-	Group 3
Self-regulation	-	Group 1 Group 2	Group 3
Self-efficacy	-	Group 1 Group 3	Group 3
Teachers' expectations	-	Group 4	-

Three of the groups offered comments about their perceptions of the **self-regulation** construct. One representative comment is for example the following:
- "…*University students tend to have a higher degree of self-regulation. This means that they have the ability to set goals and do their best to achieve them…"*
Two groups commented on the motivational construct of **self-efficacy** as presented below:
- "*Students tend to be indifferent towards the subject and fear that they will not be able to perform well…"*
- "*Students' self-efficacy and self-regulation should be built up*…"
Finally, only one group mentioned the **teachers' expectations** on student performance as motivational construct:
- "…*In several cases, teachers themselves have very low expectations from their students and they are not interested in motivating them*"
Which factors influence students' motivation to learn chemistry? All participants agreed that the **curriculum design** and the **teachers** are the main factors influencing students' motivation (Table 2). Reference to the role of the family of student was also made by one of the four groups:
- "…*The family environment can cultivate a specific learning culture and value system and help the child develop special interests"*

Table2. The identified motivational factors

Motivational factors	Activity 1	Activity 2	Activity 3
Curriculum design	Group 3 Group 4	Group 1 Group 3	Group 1 Group 2 Group 3 Group 4
Teacher	Group 1 Group 3 Group 4	Group 3	Group 1 Group 2 Group 3 Group 4
Students' family	-	Group 2	-

The factor "curriculum design" includes dimensions like the content of the chemistry courses (abstract concepts), the teaching resources, and the instructional context, such as emphasis on rote learning, on teaching theoretically without practical experimentation, or by making no links between chemistry and everyday life. The factor "teacher" includes dimensions like the personality, the training and the motivation of the teacher.
In an effort to examine the perceptions of the four groups more holistically, we conclude that the emotional and cognitive dimensions of learning are inextricably entwined. Chemistry learning experiences that are fun and personally fulfilling are likely to foster elevated motivation toward chemistry learning and lead to improved

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achievement. Attention to student motivation in chemistry curricula will prompt policy makers to become advocates for assessing affective outcomes of learning. Professional learning opportunities should be provided for teachers in order to help them put in practice successful techniques for encouraging unmotivated chemistry students.

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