

PROMOTION OF MIGRANTS IN SCIENCE EDUCATION: AUSTRIAN, GERMAN, BOSNIAN AND TURKISH PERSPECTIVES

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Abstract

PROMISE (Promotion of Migrants in Science Education) was an international project within the 6th Framework Programme of the European Commission. The purpose of the project was to explore the barriers, which hamper especially migrants in science education in order to develop approaches for the realisation of equal opportunities in diversity classrooms. The particularities of PROMISE were the cooperation of countries of residence (Germany and Austria) with countries of origin (Turkey and Bosnia-Herzegovina) and the cooperation of researchers in the field of human rights as well as science education. During the project work three key issues emerged and made cases for further studies: (i) Differences of female role models in science in the 4 distinct countries and their effect on future aspirations of female migrant students, (ii) the relevance of Cognitive Academic Literacy Proficiency (CALP) for success in science education and the awareness of science teachers of the use of different linguistic registers in science classes, and (iii) the derivation of a *human right to science education* from the *human right to education* as well as the consideration of human rights and diversity in science education in the project partner countries. The project PROMISE was first presented at the 12th IOSTE conference, shortly after the project start. At the current 13th IOSTE conference a résumé of the experiences and outcomes of PROMISE is given and recommendations as well as various outcomes are discussed.

Key words: *Diversity, gender, migration, language*

1. INTRODUCTION

Motivated by the PISA 2003 findings of the poor performance of migrant students in science classes we initiated the EU-funded international project PROMISE (Promotion of Migrants in Science Education) (Tajmel & Starl, 2005) as a Specific Support Action within the 6th Framework Programme of the European Commission. PROMISE has been coordinated by the European Training and Research Center for Human Rights and Democracy (ETC), Graz (Austria) and was scientifically and substantially implemented by the Physics Education Department of the Humboldt-Universität zu Berlin (Germany). Project partners were the University of Vienna (Austria), the University of Sarajevo (Bosnia-Herzegovina), Yildiz Technical University of Istanbul (Turkey) and the Employers Association of the German Metal- and Electro Industry (Deutsche Gesamtmetall). The purpose of the project was to provide equal opportunities in science education and in the choice of science careers for female students and migrants. As women and migrants are underrepresented in science, the project activities focussed on these specific groups. The project started in October 2005 and ran until September 2007.

The structure of the project, its objectives and tasks were methodologically developed following the *logical framework approach* (Model AusGUIDELines, 2003). The *Problem Tree* (Fig. 1) is the starting point of our problem analysis. We consider certain causes for underperformance of migrants in science and we identify main problems in a sequence of cause and effect. Thereof we deduce objectives and needs of action to address the deficiencies, which are identified in the Problem Tree. Their logical sequence is shown in the *Objective Tree* (Fig. 2). This allows a differentiated evaluation of all levels of activities, objectives and impacts (EUMC, 2004).

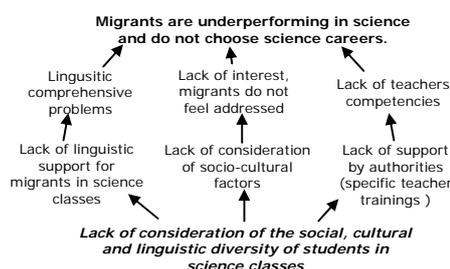


Fig.1 The Problem Tree.

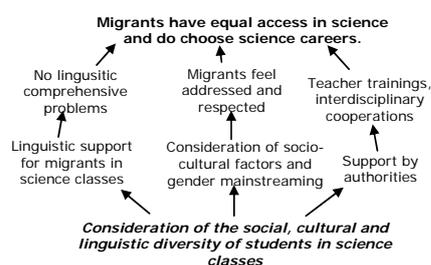


Fig.2 The Objective Tree.

2. PROJECT ACTIVITIES

The objectives of Specific Support Actions are to set activities in order to meet a certain, already detected fact. In our case the facts are first the under-representation and second the underperformance of migrants in science. In accordance with the problem analysis and the deductions of the problem/objective tree approach, all project activities include measures of linguistic support, considerations of cultural diversity and gender mainstreaming.

2.1 Club Lise

Club Lise (CL), named after Lise Meitner, was supposed to act as a direct promotion of talented migrant girls at universities. CL members were female migrant high school students, female university students and female scientists. The university students and the scientists involved acted as mentors of the high school students addressing both gender and diversity issues. CL was established at all partner universities and all Clubs Lise met once a year.

2.2 PROMISE Team

PROMISE Team (PT) consisted of science teachers, language teachers and experts in science and intercultural education. To identify specific situations science classes have been observed. The focus of this investigation was on the specific language in science lessons and on different linguistic registers. In the framework of PT a comprehensive set of teaching material specifically for migrants as second language learners was developed and tested in science classes. PROMISE Teams were established in all project partner countries.

2.3 Institutionalisation of promotion activities

All Clubs Lise and PROMISE Teams met once a year at PROMISE-conferences providing opportunities for discussions between national teams and school- as well as university-authorities. A major outcome of this discourse was the establishment of

specific trainings to raise the teachers' awareness of linguistic barriers in sciences classes as inherent part of the vocational training of German teachers.

3. RESEARCH EFFORTS

The project activities have been accompanied by explorative research efforts to formulate questions for further empirical studies, which are -to some extent- currently being performed.

3.1 International differences of female role models in science

One central research purpose of PROMISE was to enhance the knowledge about the percentage of females in the field of physics and to compare the PROMISE-partner countries concerning this parameter. We found that the proportion of women in physics in Germany and Austria is lower than the corresponding proportion in society. In contrast, the percentage of women in physics in Bosnia-Herzegovina and Turkey was found to be equal or even slightly larger than the respective percentage in society. This demonstrates that women are *underrepresented* in the field of physics in Austria and Germany, which both are *countries of residence* for migrants. Lots of research efforts have been directed at the field of *gender and physics education* since the 1980s (Hoffmann, 1985, Ormerod, 1981) and various guidelines as well as recommendations have been developed on how to equally consider both girls and boys in physics lessons (Herzog & Labudde, 1997, Lorenzo, Crouch & Mazur, 2006). This raises the following question: *Will the situation of under-representation of women in physics change within the next generation?* In our research we focussed on this question and performed a survey among female students of grade 10-13 in Bosnia-Herzegovina (N = 150) and Germany (N = 119) (Tajmel & Hadzibegovic, 2007). Questions of this survey were:

- a) *Which subjects do female students choose in school?*
- b) *What future aspirations do female students have?*
- c) *Who or what influences on their decision?*
- d) *Are there differences between migrants and non-migrants?*

This comparative study is supposed to be a first step to explore future aspirations of young women in physics. We took into consideration the influence of the background of migration, which – to our knowledge- has not been done before in the field of physics education research. Our data very clearly demonstrate that the under-representation of women in physics in Germany will not change within the next generation.

Results

- a) *Which subjects do female students choose in school?*

Only 1 out of 119 female students in our investigation in Germany stated to imagine studying physics. Interestingly, this one specific student had a background of migration. Most strikingly, none of the interrogated non-migrant German students aspired to study physics. In total, science (physics, biology, chemistry) was chosen by 45.2% migrants and by 17.9% non-migrants. Physics was chosen by 11.9% migrants and by 3.6% non-migrants.

In contrast, we found evidence that in Bosnia-Herzegovina the already equal representation of women in science will remain, as for the majority of the questioned students it is an explicit option to study physics. More than 50% of the female Bosnian students choose science as major subject, including physics, biology and chemistry. Out of these three subjects physics was chosen by most of the students (21%) followed by biology (16%) and chemistry (13%).

In the second part of the questionnaire the students were asked if at all and what in specific they would like to study at university. They were asked to give reasons for their choice. We were especially interested if the students feel that their parents support their choice. Table 1 summarizes the results of these questions. Again we distinguished between students who attended German schools, migrants and non-migrants.

c) Who or what influences on their decision?

In Germany the students indicated *the interest in the subject* as the most important reason for their choice (43%), followed by *good results in the certain subject* (38%). In Bosnia-Herzegovina the most important reason was the *usefulness of the subject* for the future career (25%) followed by *the interest in the subject* (18%) and *the "good teacher"* (18%).

d) Are there differences between migrants and non-migrants?

In the group of German female students we distinguished between migrants (students not born in Germany and/or both parents not born in Germany) and non-migrants. Moreover, also the students in Bosnia-Herzegovina exhibit a background of migration. They emigrated during and returned after the war. In average, each student spent 3,5 years abroad. Amongst the Bosnian students there was none, who had a country of origin different to Bosnia-Herzegovina, they were repatriates, hence, we did not categorize them as migrants. The majority of the migrant girls we asked in Germany were of Turkish origin.

If we compare migrants in Germany (most of them of Turkish origin), German non-migrants and Bosnian non-migrants, there appear certain differences: Migrants in Germany seem to be more motivated to enroll and study at university than non-migrants, which is similar to non-migrants in Bosnia-Herzegovina. Migrants in Germany seem to get less approve of their parents for their choice to study than non-migrants in Germany. Parents of non-migrants in Bosnia-Herzegovina seem to approve the choices of their daughter similar to non-migrant German parents.

Migrants and non-migrants in Germany are NOT aspiring to study physics, whereas for Bosnian students studying physics is an alternative.

Table 1 gives an overview of the results on questions b), c) and d).

	Germany	Bosnia-Herzegovina
<i>Do you want to study?</i>	YES Non-migrants: 71% Migrants: 91%	YES 100%
<i>What do you want to study?</i>	Pharmacy, medicine: 19% Languages: 15% Physics: rather NO	Sciences: 56% Physics: rather YES
<i>What are the reasons for your choice?</i>	Interest in the subject: 43% Good results: 38% Good teacher: 8%	Useful for future career: 25% Interest: 18% Good teacher: 18%
<i>Do your parents approve your choice?</i>	YES Migrants: 56% Non-Migrants: 80%	YES 90%

Possible explanations for this finding could be the broad existence of female role models in science in Bosnia-Herzegovina and their lack in Germany.

From our data we conclude that the under-representation of women in physics in Germany will not change unless there emerges a significant influence of female role models in physics. We propose that for a significant increase of their number, institutionalised meetings of female high school and university students should be arranged already within the peer group of students. Supportingly, further international co-operations on student level of countries like Germany and Bosnia-Herzegovina can raise the awareness that there exist female role models in other countries.

3.2 Language(s) in science classes

Language problems in science classes are of various kinds and occur in different situations. One field is the treasury of words and the lack of vocabularies, which hamper migrants. The specific structure of language in science classes, the syntax and the sentence structure can be regarded as further reason for language difficulties. Based on the concept of *registers* or language varieties (Halliday, 1964) and on the distinction between BICS (Basic Interpersonal Communication Skills) and CALP (Cognitive Academic Literacy Proficiency) we assume that science classes afford skills of certain registers. Whereas the BICS are acquired relatively quickly, CALP needs specific instruction, especially for second language learners, *i.e.*, migrants, since the language of instruction is not their first language (Cummins, 1969). The PROMISE team developed physics lessons with the aim to improve CALP skills for grade 6-8 by following the method of Scaffolding (Gibbons, 2002). The established teamwork helped to increase the awareness of the teachers on the role of language in science lessons.

3.3 Science education in Turkey and Germany

As the majority of migrants living in Germany are of Turkish origin, we were interested in commons and differences of science education in these two countries. We compared physics schoolbooks, curricula for secondary school and for vocational teacher trainings (Fer, 2008), and the consideration of the human right to education and of diversity in science classes. Munire Erden stated the existence of “many serious problems in applying these principles, such as insufficient duration of compulsory education, low school enrolment rates, school abandonment and the education of girls. A rapidly increasing rate of population, immigration, differences between regions, and the cultural and Islamic values of rural people are the basic reasons of these problems” (Erden, 2008). As the majority of Turkish migrants in Germany are of similar rural provenance with therefore a similar social background, similar challenges and demands on teachers and on the education systems in both countries emerge.

4. SUMMARY

The project PROMISE was an interdisciplinary (social sciences, science education, human rights) and international (Germany, Austria, Bosnia-Herzegovina, Turkey) project to establish activities against the specific barriers for migrants in science education. The explorative research efforts focussed on 3 topics: (i) The influence of female role models in science in the distinct countries, where we identified differences in role models and in female students' aspirations to study physics. (ii) The varieties of language in science classes and the difficulties migrants meet to acquire Cognitive Academic Language Proficiency. Specific science lessons have been developed and tested. Herein we found that the teachers' awareness of language varieties in science significantly increased. (iii) The consideration of diversity and human rights in science education in the partner countries, where we found that Turkish and German teachers meet similar challenges when teaching diversity classrooms.

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