

# The Shrinking Pipeline in Israeli High Schools

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## INTRODUCTION

Worldwide surveys indicate that the number of women studying undergraduate-level computer science (CS) has been constantly decreasing in the last 20 years (Camp, 1997, 2002; Camp, Miller, & Davies, 1999; National Center for Education Statistics, 2004). According to Galpin (2002), the low participation of women in the computing studies is recognized worldwide. As it turns out, the situation is similar among high-school students as well (Davies, Klawe, Nyhus, Sullivan, & Ng, 2000). However, while many studies are carried out at the university level and programs are implemented in order to change the situation, high-school students do not attract such attention. In Israel too, as far as we know, no research has ever been performed that focused on female high-school students studying CS. This article presents such a study. Specifically, it focuses on high-school female students studying advanced-level CS.

Based on data collected in Israel, significant differences were found in the percentages of female high-school students studying advanced-level CS among different sectors. More specifically, while the percentage of female high-school students studying advanced-level CS is about 50% for the Arab minority sector, the percentage of female students studying CS at the same level among the Jewish majority sector is only about 25%. Different studies around the world identified various factors that discourage women from studying CS and from persisting in the field. By focusing on the Israeli high-school female students studying CS at the highest level and coming from two sectors, we suggest that the research presented in this article may partially explain the above-mentioned phenomenon. Further findings are presented in Eidelman and Hazzan (2005).

## BACKGROUND

Margolis and Fisher (2002) suggest that the underrepresentation of women in the computing fields is important on two levels: on the personal level and on the societal-cultural level. Therefore, Margolis and Fisher suggest that the significant differences between the representation of women and men in the CS fields in general, and in high-school CS classes in particular, should not be ignored. This underrepresentation has a special significance in Israel, a small country in which the efficient utilization of its human resources is of great importance.

### **Underrepresentation of Women in the Computing Fields: A Worldwide Perspective**

As mentioned in the introduction, the underrepresentation of women in the computing fields is recognized worldwide (Galpin, 2002). However, recent in-depth analysis of this phenomenon reveals that the problem is not universal, but rather is restricted to specific countries and cultures (Adams, Bauer, & Baichoo, 2003; Galpin; Lopez & Schulte, 2002; Schinzel, 2002). More specifically, in certain countries and cultures, such as Greece, Turkey, Spain, Portugal, Mauritius, Romanic countries (e.g., France and Italy), North African countries, Arabic countries, and South American countries, the representation of women in CS is high and constant in contrast to the United States, Israel, Anglo-Saxon countries, Scandinavian countries, and German- and Dutch-speaking countries, in which the representation of women in CS is relatively low and decreasing. Accordingly, it is reasonable to assume that cultural factors play an important role in encouraging or discouraging women from studying CS.

## Underrepresentation of Women in the Computing Fields: An Israeli Perspective

As mentioned previously, a significant difference exists in the percentages of female high-school students studying advanced-level CS between the Arab and Jewish sectors in Israel. As it turns out, high school is a critical point in the CS pipeline, at which many female students, mainly in the Jewish sector, are lost. This situation encouraged us to initiate the research described in this article, which examines factors that influence the enrollment and persistence of Israeli female high-school students (of two populations, Arab and Jewish) in advanced-level CS studies.

The Israeli education system has a unique characteristic that may be useful for research works of this kind; that is, the Arab and the Jewish pupils learn in separate educational systems according to the same curriculum. One solution that has been suggested for countries in which women are underrepresented in CS (and that would like to change this situation) is to visit countries in which this problem does not exist, and to identify the cultural differences, as well as actions taken to encourage women to study CS, that may explain why women in such countries find CS an attractive field (e.g., Adams et al., 2003). From this point of view, Israel is a perfect place for such research. Specifically, in order to understand the low participation of Jewish female high-school students in CS, there is no need to visit another country. It is sufficient to investigate the differences that exist between the two populations, which live in the same country and, as has been mentioned before, study CS according to the same curriculum, one of which (the majority) suffers from this underrepresentation, while the other population (the minority) does not.

## MAIN THRUST OF THE ARTICLE

This section describes the research setting and its results.

The research population consisted of 12th-grade CS students from nine typical high schools from both sectors (five schools from the Jewish sector, four schools from the Arab sector). Table 1 describes the

Table 1. Distribution of research population

	Total	Male	Female
Number of students from the Jewish sector	90	65 (72%)	25 (28%)
Number of students from the Arab sector	56	22 (39%)	34 (61%)
Total	146		

distribution of the students according to gender and sector. CS teachers were included in the research population as well.

Three comparisons were conducted in the research: Jewish female students vs. Jewish male students, Arab female students vs. Arab male students, and Jewish female students vs. Arab female students. This article focuses on the differences between Jewish and Arab female students.

The research applied both quantitative and qualitative approaches. Data were gathered using the following research tools: comprehensive questionnaires that included closed and open questions completed by all students; ethnographic, semistructured interviews with 18 Jewish and Arab female students; and classroom observations during CS lessons (both lab lessons and traditional classroom lessons). In addition, interviews were conducted with CS teachers.

In what follows, we present the analysis of data, gathered by questionnaires and interviews, with respect to three topics: support and encouragement, future and success orientation, and the perception of CS.

## Support and Encouragement

Several questions in the questionnaire addressed the support and encouragement to study CS that students receive from different sources. One of the questions was “Who encouraged you to choose CS studies?” for which the pupils could choose from a given list of figures more than one figure. Table 2 presents the distribution of answers to this question.

Table 2 reflects an unequivocal conclusion: Arab female high-school students receive much more encouragement to learn CS than do their Jewish counterparts.

In another question, the students were asked to rate their agreement with the following statement: “Our school encourages its students to study advanced-level CS.” The difference between the two

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