HOW THE LEARNER AND LEARNING ENVIRONMENT CHARACTERISTICS AFFECT ACHIEVEMENT IN HIGH SCHOOL: THE CASE OF ADVANCED COMPUTER SCIENCE

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Abstract

This study aimed to model achievement in computer science in terms of learner's and learning environment characteristics. Data were collected from a random sample of 315 (28% girls) eleventh and twelfth grade students in computer science. A questionnaire was administered to all participants to collect quantitative data concerning the research variables and complementary qualitative data were obtained through interview with 15 of the participants. Results reveal that the improved structural model fits the data well and accounts for a substantial amount of variance (60.3%). The most influential variables on achievement in computer science are achievement in mathematics and self-efficacy while the effect of gender is negligible. The other variables have significant indirect effects on achievement in computer science

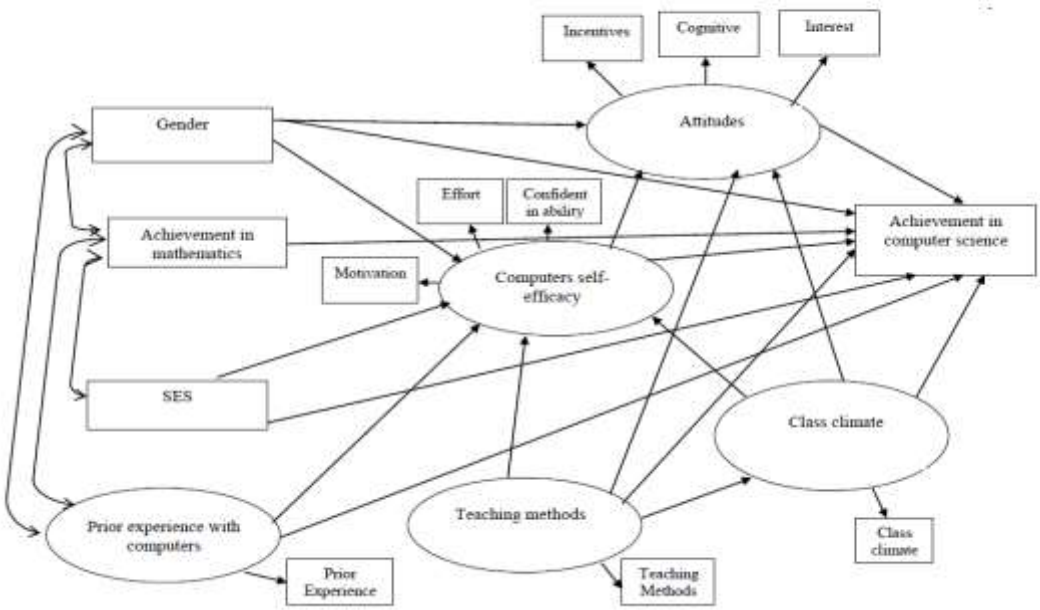
Keywords: Computer science, achievement, gender, self-efficacy, attitudes, classroom environment

MAIN TEXT

Many variables can affect academic achievement, in general, and achievement in computer science in particular. This study was focused on the effect of gender, SES, achievement in mathematics, prior experience with computers, attitudes towards computer science, computers self-efficacy, teaching methods and styles, and class climate, on achievement in advanced computer science.

Based on the literature reviewed, a structural model (Figure 1) of achievement in advanced computer science in terms of learner and learning environment characteristics was hypothesized and tested.

Figure 1: *Hypothesized Model of the Relationship between Learner and Learning Environment and Achievement in Advanced Computer Science*



METHOD

Participants. Data were obtained from a random sample of 315 (88 girls and 227 boys), eleventh and twelfth grade Israeli students in advanced computer science track.

*Instrument*s. Data were obtained using a two-part questionnaire. The first part examined student's background characteristics. The second part included questions regarding achievement in mathematics and computer science (scores 0-100), attitudes towards computer science (20 items, three dimensions), self-efficacy (12 items, three dimensions), previous experience (5 items grouped, one dimension), teaching methods (13 items, one dimension), and class climate (11 items, one dimension). Items measuring the last five variables are based on Edelman and Hazan's (2007) questionnaire and were fine-tuned to fit the participants in this study. Responses on these items were given on a 6-point likert scale where *1* reflects "completely disagree" and *5* "completely agree." In addition, in-depth interviews were conducted with 15 students in order to complement the quantitative data.

RESULTS AND DISCUSSION

The hypothesized model yielded fit indices indicating that its fit to the data is insufficient; hence, it was modified based on conceptual and statistical considerations. The modified model yielded indices of fit which were within the acceptable range [χ^2 = 90.05, *df* = 26, χ^2/df = 3.46; *GFI*=0.95; *CFI*=0.99; *SRMR*=0.05; RMSEA=0.08 (0.069, 0.106)]. The modified model explained 60.3% of the variation in the level of achievement in advanced computer science.

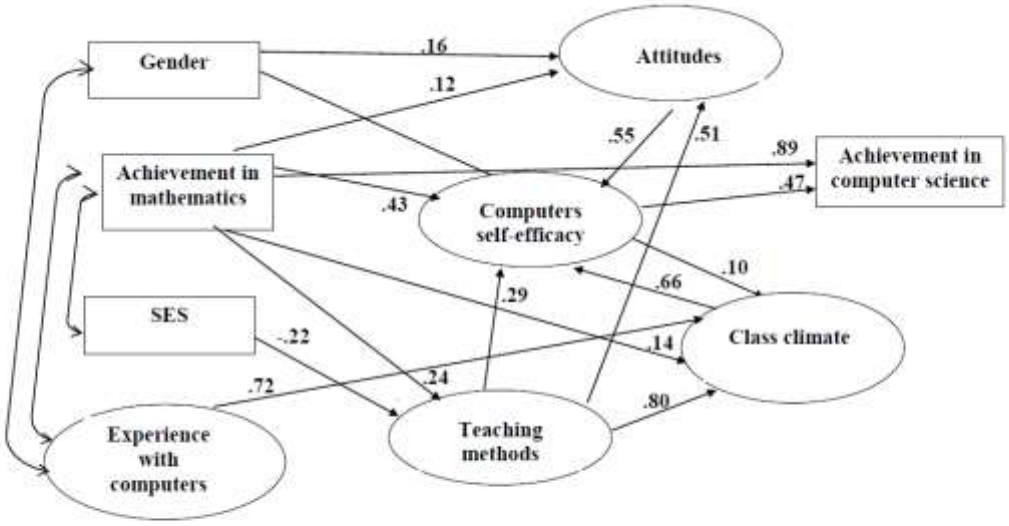


Figure 1: Improved Model of the Relationship between Learner and Learning Environment and Achievement in Advanced Computer Science

The most influential variables on the level of achievement in computer science are mathematics achievement and self-efficacy. The total effect of achievement in mathematics on achievement in computer science is 0.68 indicating that mathematical ability does positively affect the achievements in computer science. The total effect of self-efficacy is 0.47 revealing moderate positive effect on the achievement in computer science. Confirmation to this finding was obtained through the comprehensive interviews with students who believed that self-efficacy is a crucial and central factor that affects the student's success.

Self-efficacy is hypothesized as a mediator between attitudes towards computers, mathematics achievement, teaching methods, and classroom climate and achievement in computer science. Of these four variables, the effect (indirect) of classroom climate on achievement in computer science is the largest. Teaching methods has a significant effect on students' self-efficacy and on the classroom-learning climate, hence significant indirect effect on achievement in computer science. This finding was also confirmed in interviews with students who claimed that teaching methods affect their understanding of the material and its application successfully. The effect of attitudes towards computer science on self-efficacy was found to be positive with considerable magnitude (β=.55).

Three variables were found to influence attitudes: Gender, mathematics achievement, and prior experience in computer science. Previous experience in computer science does not affect achievement directly but it indirectly affects student attitudes; whereby students with previous experience express more positive attitudes, compared with inexperienced students. Interviews revealed that previous experience mostly affects the choice to enroll in computer studies, but since the choice has already been made, students' achievement is not dependent on previous knowledge, but on their self-efficacy and cognitive ability which shows mainly in their math achievement.

The effect of gender on achievement in computer science was found not significant. Female students who chose this track managed equally and sometimes even better than male students. However, the interviews showed that even today students are still trapped in the social perception claiming that computer science is a technological subject that is more appropriate for boys than for girls.

The findings from this study besides adding to a sparse body of knowledge can be used to guide institutional interventions aimed at increasing improving achievement in advanced computer science. We believe that understanding the variables affecting students' perceptions and success; can help improve the teaching an the achievement in computer science.