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Is It Really a Paradox? A Mixed-Methods, Within-Country Analysis of the Gender Gap in STEM Education

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Abstract: It is well established that women's representation in scientific and technical fields decreases with societal affluence, but the mechanisms underlying this so-called paradox remain contested. This study leverages distinctive features of the Israeli educational system to identify social psychological and organizational mechanisms driving contextual variability in the gendering of physics and computing subjects. Using in-depth interviews and original surveys, we compare gender gaps in ninth graders' attitudes and aspirations across two highly segregated yet centrally administered state school sectors: one serving the socioeconomically marginalized Arab Palestinian minority, and one serving the Jewish secular majority. Results reveal curricular affinities, discourses, and course-taking patterns that are differentially gendered across school sectors. While boys and girls in Arab Palestinian schools report more instrumentalist motivations and more positive attitudes toward mathematically intensive fields, students in Jewish schools engage in highly gendered, self-reflexive discourses that support gendered course-taking. Findings support arguments positing gender-specific effects of postmaterialist, individualistic value systems, and suggest that the cultural and organizational processes that generate larger gender gaps in more affluent countries may also play out within countries.

Keywords: gender; STEM; technology; gender equality paradox; secondary education; Israel



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1. Introduction

In 2010, American anthropologist Joseph Henrich and colleagues coined the acronym WEIRD, Western, Educated, Industrialized, Rich, and Democratic, to describe the limited scope of existing psychological research and the need for more diversity in populations studied (Henrich et al. 2010). Research on gender segregation, and especially on gender inequality in science, technology, engineering, and mathematics (STEM) fields, has also long suffered from a lack of diversity in the populations and contexts considered. With the growing availability of standardized cross-national databases, this is changing.

As they have begun to explore gender segregation in a broader comparative context, researchers have identified patterns that are at odds with conventional understandings of more and less “modern” countries. Contrary to the idea that social institutions become more equal (and less gendered) as socioeconomic development advances (Treiman 1970; Jackson 1998; Inglehart and Norris 2003), a series of cross-national comparative studies have shown that gender gaps in STEM educational and labor market outcomes are larger in societies classified as WEIRD than in poorer, reputedly gender-traditional countries

(Charles and Bradley 2009; Charles 2017; Stoet and Geary 2018; Chow and Charles 2020; Yalcinkaya and Adams 2020; Chow and Charles 2020).

Efforts to understand the social psychological and organizational mechanisms driving variability in the STEM gender gap have been complicated by difficulties in comparing countries that vary simultaneously on several intercorrelated dimensions and in discerning individual motivations from aggregated cross-national statistics and secondary survey data. More fine-grained within-country comparisons are one way to address this challenge (Kim et al. 2023; Ortega et al. 2025). The present study applies a mixed-method research design to leverage distinctive features of the Israeli educational system. Specifically, we use in-depth interviews and original surveys to compare gender gaps in ninth graders' attitudes, aspirations, and experiences across two highly segregated yet centrally administered state school sectors: one serving the socioeconomically marginalized Arab Palestinian minority, and one serving the dominant Jewish secular majority.

Results reveal curricular affinities, discourses, and course-taking patterns that are differentially gendered. While boys and girls in Arab Palestinian schools report more instrumentalist motivations and more positive attitudes toward mathematically intensive fields, students in Jewish schools engage in highly gendered self-reflexive discourses that support gendered course-taking. Findings support arguments suggesting gender-specific effects of postmaterialist individualistic value systems, and suggest that the cultural and organizational processes that generate larger gender gaps in more affluent countries may also play out within countries.

In the following two sections, we review recent evidence on contextual variability in the STEM gender gap and describe our research setting.

2. Cross-National Differences in the STEM Gender Gap

In advanced industrial societies, such as the United States, United Kingdom, Sweden, and Germany, women's strong underrepresentation in mathematically intensive scientific and technical fields persists despite widespread public awareness and decades of research and policy attention. While extremely skewed gender ratios are often assumed to reflect fixed biological or psychological differences between men and women, research dating back to the 1980s shows substantial cross-national variability in patterns of gender segregation, with poorer and reputedly gender-traditional societies more gender-integrated on some measures (Roos 1985; Charles 1992; Charles and Grusky 2005).

Comparative researchers have recently turned their attention to gender gaps in STEM domains, especially in the growing and highly lucrative "tech" fields of engineering and computing (Charles and Bradley 2009; Charles 2017; Stoet and Geary 2018; Chow and Charles 2020; Yalcinkaya and Adams 2020). While the negative correlation between societal affluence and women's representation in many scientific and technical fields has been clearly established, the causes of this correlation remain contested. This is partly because societal affluence coincides with many other country characteristics, including gender-liberalism, self-expressive value systems, gender-essentialist math stereotypes, and high average mathematics achievement. Analysts from a range of disciplines have focused on one or more of these correlates to make diverse causal claims about observed macro-level patterns.

Sociologists and social psychologists have identified the individualism and self-expressive cultures characterizing affluent welfare states as possible segregating forces, arguing that cultural stereotypes about gender difference ("gender essentialism") more strongly influence individual outcomes and aspirations in societies where school and work are framed as vehicles for personal self-expression (Charles and Bradley 2009; Charles 2017; Yalcinkaya and Adams 2020; Blank et al. 2022; Budge et al. 2023). These accounts build

on evidence that widely shared stereotypes about the natural aptitudes and affinities of men and women are produced and reproduced in families, schools, and labor markets of affluent societies through self-fulfilling interactional and organizational feedback loops (Correll 2001; Cheryan et al. 2009; Thébaud and Taylor 2021). These play out, among other things, in gender-specific effects of school sorting practices and mathematics achievement environments (Mann et al. 2015; Pinson et al. 2020; Marsh et al. 2021).

Evolutionary psychologists tend to treat gendered preferences as more fixed than socially constructed. Stoet and Geary (2018, 2022) attribute uneven STEM gender gaps to the greater freedom that women enjoy in liberal-egalitarian societies to pursue the (less lucrative) “people-oriented” career paths that they prefer or to choose the fields that reflect their relative academic strengths. Their use of the term “Gender Equality Paradox” to describe patterns of cross-national variability has been criticized for reflecting an oversimplified view of the gender structure (Richardson et al. 2020; Marsh et al. 2021). Framing the strong gender segregation found in advanced industrial societies as “paradoxical” evokes an evolutionary process by which gendered constraints weaken across-the-board as socioeconomic modernization advances. Such a unidimensional view is at odds with evidence that the liberal gender-egalitarian principles that arise with broad-based societal affluence coexist with persistent gender-essentialist stereotypes (Nosek et al. 2009; Cotter et al. 2011; Grunow et al. 2018); recent economic studies suggest that gender-essentialist beliefs (including those about differences between men and women in mathematical ability and affinity) may even strengthen with societal affluence and growing individualism (Breda et al. 2020; Napp and Breda 2022; Napp 2023).

Because most research on variation in STEM gender gaps has been based on comparisons of countries that differ on numerous intercorrelated dimensions, it has been difficult to distinguish spurious from causal associations. Previous studies have relied on aggregated cross-national statistics and secondary surveys, which are not well suited for discerning individual motivations and organizational processes. Our mixed-method within-country research design helps mitigate these limitations.

3. The Israeli State School System: Centralized Yet Segregated

Due to its administratively centralized yet socioeconomically bifurcated structure, the Israeli state school system can provide an illuminating case for exploring mechanisms underlying variability in STEM outcomes. Distinguished by starkly different socioeconomic and cultural positionalities, Jewish and Arab Palestinian citizens in Israel are served by separate, unequally resourced state schools that follow a single national curriculum and are administered centrally by the national Ministry of Education. About 95 percent of Arab Palestinian students in Israel attend Arabic-language state high schools, which are more poorly funded and have higher rates of family poverty and lower levels of parental education and academic achievement than the coeducational Hebrew-language state high schools attended by most Jewish students (Blass 2017). The few single-sex Hebrew-language state religious schools, which are not considered here, have STEM enrollment patterns for Jewish boys and girls that are similar to those of their coeducational counterparts (Blank et al. 2022).

Comprising about 21 percent of Israel’s citizens, Arab Palestinians are predominantly Muslim (approximately 85%, with the rest mostly Christian and Druze). Compared to the liberal individualism reflected in the dominant secular Jewish culture, Arab Palestinians tend to espouse more collectivist values (Yuchtman-Ya’ar 2002; Sharabi 2018), as is often the case for populations experiencing socioeconomic precarity and low social mobility (Hofstede 2001; Inglehart 2018). Our student sample includes Israeli citizens who attend Israeli state schools (Arab Palestinians residing in the territories of the West Bank and Gaza

are not Israeli citizens, and they attend schools that mainly teach curricula designed by the Palestinian Authority's Ministry of Education).

The curriculum of state schools is strictly regulated by the Israeli Ministry of Education (MoE). Regardless of instruction language (Hebrew or Arabic), students at all state schools follow similar STEM curricula and take the same national matriculation exams. Students in high school grades 10–12 (aged 15–18) complete matriculation requirements consisting of compulsory and elective subjects. The advanced electives include vocational or academic subjects from the humanities, social sciences, technology, and natural sciences. STEM fields, especially physics and computer science, are the most selective and potentially lucrative since they are considered a route to high-tech professions, which have very high rates of economic return in Israel (Bar-Haim and Feniger 2021). Previous achievement is a main criterion for advanced subject enrollment. Only high academic achievers (especially in mathematics) can enroll in advanced physics and computer science classes, although not all high achievers choose these fields.

Ninth grade is the final year of middle-school, when students (aged 14–15) choose advanced subjects to study in high school. In many schools, including all that participated in our study, ninth graders attend “exposure” events with their parents, which provide information about different advanced elective subjects, their prerequisites, and the associated career trajectories. Students report their choices during the second half of the school year, and they are usually notified of their placements by the end of the academic year.

Based on a combination of original classroom surveys and semi-structured interviews with ninth-grade students, we use quantitative and qualitative methods to explore the social psychological and organizational mechanisms by which gendered educational dispositions and gendered sorting processes are translated into curricular outcomes in nine coeducational middle-schools in Israel: five serving the Arab Palestinian population and four serving the Jewish population. We are particularly interested in gender differences in ninth-grade students' attitudes towards STEM subjects and narratives about curricular choice and future aspirations. We focus our surveys on attitudes toward physics and computing, which are gateways to some of the most prestigious, lucrative, and male-dominated “tech” occupations in Israel and other affluent societies. While the “S” in STEM refers to science, gender differences are much stronger in mathematically intensive subjects in Western industrial societies, while subjects such as biology, chemistry, and medicine have become much more gender-integrated in recent decades (England and Li 2006).

4. Research Design and Research Questions

Reminiscent of differences between more and less affluent *countries*, previous research within Israel shows that engineering and computing courses are more gender-integrated in less affluent *schools*—specifically in schools serving the socioeconomically precarious Arab Palestinian population (Ayalon 2002; Blank et al. 2022; Friedman-Sokuler and Justman 2020). Possible explanations for this variable gender gap include differences between the two school sectors in boys' and girls' relative dispositions toward STEM fields and/or in the placement criteria used to sort students into advanced subjects (achievement vs. student choice) (Pinson et al. 2020; Budge et al. 2023).

To explore these social psychological and organizational mechanisms further, we use a mixed method research design. We collect and analyze original survey data on ninth grade students in five Arabic- and four Hebrew-language middle schools to address two research questions related to curricular attitudes:

RQ1—Does the gender gap in educational dispositions (measured as affinity towards schooling in general, and affinity toward mathematics in particular) vary between the Hebrew- and Arabic-language school sectors?

RQ2—Does the gender gap in attitudes toward technical subjects (measured as aversion toward physics and computer science) vary between the Hebrew- and Arabic-language school sectors [and does any sectoral difference in this gender gap persist after taking account of gendered educational dispositions]?

To gain a deeper sense of student motivations and organizational processes, we conducted semi-structured interviews in the same schools with high-achieving ninth-grade students that address two further questions:

RQ3—How do boy and girl students differ in their perceptions of technical subjects (physics and computer science) within each school sector [and how do these perceptions relate to attitudes towards these fields]?

RQ4—How do boy and girl students differ in their future orientation within each school sector [and how is future orientation related to attitudes towards physics and computer science]?

5. Data and Methods

Survey and interview data for this study were collected in five Arabic- and four Hebrew-language middle schools in Israel. All data collection was completed before 7 October 2023, so findings do not reflect any changes in Jewish–Palestinian relations resulting from the current conflict. Schools were approached after receiving ethical approval from the Israeli Ministry of Education (MoE) Chief Scientist’s office. Participating schools are comprehensive state schools that neither require payment of tuition nor apply selection policies for enrollment (i.e., they rely on catchment areas). Based on the MoE’s school socioeconomic index, we selected schools catering to students from a range of social backgrounds within each of the two populations served. By focusing on the ninth grade, we were able to collect data from students before enrollment in different high-school streams (grades 10–12), but at a time when they were actively considering future choices and trajectories.

During the second half of the 2021–22 school year, an original survey was administered to all ninth-grade students (except for special education and remedial students) at the nine schools. The survey includes items used in several cycles of the international PISA and TIMSS surveys, as well as items developed especially for the present study. It was administered in each school’s language of instruction (Hebrew or Arabic) and completed by students during class time using a personal computer or a smartphone. Students were given an opportunity to opt out. The average classroom response rate was around 80%, with 1232 students included in the analysis.

To assess the first two research questions, we used principal components analysis to construct three composite attitudinal measures, which serve as dependent variables in ordinary least squares (OLS) regression models. We measure educational dispositions as affinity toward schooling (henceforth “School Affinity”) and affinity towards mathematics (henceforth “Math Affinity”). The items used for these measures were adapted from TIMSS and PISA. Since we are specifically interested in understanding negative attitudes toward lucrative tech-related STEM fields (henceforth “Tech Aversion”), our survey questions were written to measure disinterest in physics and computer science, the common curricular pathways to lucrative high-tech careers. Appendices A–C provide details on the construction of these composite variables.

Our multilevel regression models include school fixed effects (dummy indicators representing eight of the nine schools), and indicators of student gender, school sector (Arabic- vs. Hebrew-language), and sector-by-gender interaction. The latter is of primary interest, as it allows us to assess whether attitudinal gender gaps differ significantly between

the Arabic- and Hebrew-language school sectors. Our models also control for self-reported achievement in mathematics and English (0–100 scales); both subjects are compulsory, with similar curricula in Arabic and Hebrew. Also included are controls for parental education (=1 if at least one parent completed postsecondary education), parental occupation (=1 if at least one parent worked in a STEM-related occupation), number of siblings, and number of books at home (a proxy for parental cultural capital). The inclusion of school fixed effects accounts for the nested structure of our data by controlling for unmeasured school characteristics that may contribute to within-sector differences in the attitudinal gender gap.

In addition to surveys, we conducted semi-structured interviews with three boys and three girls in each of the nine schools (N = 54 students) between 2021 and 2023. The interviews were restricted to high-achieving boys and girls whose grades qualify them for advanced high school physics and/or computer science coursework, based on information provided by school personnel. Students were informed about the interview's general topic, and formal consent was obtained from them and their parents. The interview protocol focused on the students' perceptions of STEM fields of study and their considerations and deliberations regarding their choice of advanced high school subjects. Students were also asked to describe their plans and explain how their plans align with their educational choices. Interviews were conducted in the native tongue of the student (Hebrew or Arabic) by trained Jewish or Arab Palestinian research assistants, either face-to-face in schools or via Zoom. Interviews were recorded and transcribed. We use pseudonyms to identify participants.

Thematic analysis of the interviews was carried out jointly by native Hebrew- and Arabic-speaking researchers. During the first analytic stage, Authors 1 and 4 read the interviews, transcribed them holistically, and identified the main themes and coding categories that were subsequently discussed by the full research team. The interviews were read and analyzed against these main codes.

6. Findings

We first present the results from our quantitative survey analysis, which reveals significant differences across school sectors in girls' and boys' relative affinities for tech-related subjects. Semi-structured interviews with the subset of ninth-grade students who were academically qualified for the most selective STEM subjects (physics and computing) allow us to explore in greater depth the motivations, identities, and perceptions underlying the observed sectoral differences. These qualitative analyses reveal intersectional differences in how students perceive scientific and technical fields and how they understand their enrollment choices and possible futures.

6.1. Survey Results

Table 1 shows descriptive survey statistics, broken down by sector. Mean scores confirm significant gender gaps in math affinity and tech aversion in Hebrew- but not Arabic-language schools, with boys in Hebrew-language schools expressing more positive attitudes than their girl schoolmates. With respect to school affinity, we find that girls score significantly higher than boys in both sectors. Interestingly, Table 1 also shows that students (boys and girls) in Arabic-language schools have generally more positive attitudes toward mathematics and tech-related subjects than their counterparts in Hebrew-language schools. We explore these sectoral differences through a series of multivariate regression models. All models include fixed school effects, controls for academic achievement and students' socioeconomic background, and an interaction terms that allows for attitudinal gender gaps to vary by school sector (Arab Palestinian vs. Jewish).

Table 1. Descriptive statistics by school sector and gender.

Variable	Hebrew-Language Schools		Arabic-Language Schools	
	Girls	Boys	Girls	Boys
Tech Aversion	0.78 (0.95) **	0.05 (0.97)	−0.29 (0.85)	−0.36 (0.84)
Math Affinity	−0.45 (1.04) **	−0.20 (0.98)	0.33 (0.89)	0.25 (0.90)
School Affinity	−0.06 (0.90) **	−0.41 (1.12)	0.33 (0.82) **	0.08 (0.90)
Postsecondary Educ Parent (=1)	0.79 (−)	0.71 (−)	0.54 (−)	0.61 (−)
Parent STEM (=1)	0.25 (−)	0.25 (−)	0.10 (−)	0.09 (−)
Number of Siblings	2.33 (1.12)	2.17 (0.81)	4.04 (2.29)	3.70 (2.23)
Number of Books at Home	92.09 (85.61)	87.21 (79.37)	84.37 (80.36)	92.23 (84.71)
Math Achievement (1–100)	74.47 (21.19)	72.37 (21.93)	75.50 (21.70)	76.30 (21.44)
English Achievement (1–100)	84.38 (12.65)	83.63 (13.60)	74.70 (21.70)	75.79 (20.68)
N	278	262	406	304

Note: ** $p < 0.01$ for t -test of within-sector gender differences. Values are means (standard deviations). All information is self-reported. See Appendices A–C on construction of affinity and aversion variables.

Table 2 shows selected coefficients for OLS models predicting dispositions toward school and toward mathematics. Values for our focal gender-by-sector interaction are displayed in the first row. Consistent with the mean scores described above, these models show a girl-advantaging gender gap in school affinity that holds for both school sectors, but a boy-advantaging gender gap in math affinity in the Hebrew-language school sector only. The latter is evident in the large positive Girl $\times$ Arab Palestinian coefficient in the second column.

Table 2. Selected coefficients from linear regression analyses predicting ninth graders' educational dispositions in nine Israeli schools.

Variable	School Affinity	Math Affinity
Girl $\times$ Arab Palestinian Sector	−0.045 (0.101)	0.352 (0.094) **
Girl (=1)	0.316 (0.075) **	−0.335 (0.071) **
Arab Palestinian Sector (=1)	0.191 (0.103)	0.157 (0.096) **
Math Achievement (0–100)	0.011 (0.001) **	0.021 (0.001) **
English Achievement (0–100)	0.007 (0.002) **	−0.006 (0.002) **
School Affinity		0.210 (0.027) **
School Fixed Effects Included	YES	YES
Adjusted R ²	0.213	0.364
N students (schools)	1232 (9)	1232 (9)

Notes: ** $p < 0.01$. Values are coefficients (standard errors) from OLS regression models with school-fixed effects. All models include controls for parental education, parental STEM occupation, number of siblings and number of books at home. See Appendices A and B on construction of affinity variables.

Table 3 shows models predicting tech aversion (i.e., disinterest in physics and computer science). The gender-by-sector interaction term in model 1 indicates a smaller gender gap in schools serving Arab Palestinian students, even controlling for academic achievement and socioeconomic background. In model 2, the addition of school affinity and math affinity measures improves model fit (adjusted r-square = 0.310, compared to 0.247 in model 1) and modestly attenuates the gender-by-sector interaction, suggesting that these more general dispositions are important predictors of tech aversion and partially mediate the interactive relationship between gender, school sector, and tech aversion. The Girl $\times$ Arab Palestinian interaction remains strong and statistically significant in model 2, meaning that the sectoral differences in the tech aversion gender gap cannot be explained fully by differences in math affinity, school affinity, socioeconomic background, or school achievement.

Table 3. Selected coefficients from linear regression analyses predicting ninth graders' tech aversion in nine Israeli schools.

Variable	Model 1	Model 2
Girl × Arab Palestinian Sector	−0.703 (0.102) **	−0.611 (0.099) **
Girl (=1)	0.765 (0.076) **	0.708 (0.074) **
Arab Palestinian Sector (=1)	−0.644 (0.124) **	−0.630 (0.119) *
Math Achievement (0–100)	−0.007 (0.001) **	0.000 (0.001)
English Achievement (0–100)	−0.001 (0.002)	−0.002 (0.002)
School Affinity		−0.089 (0.029) **
Math Affinity		−0.281 (0.030) **
School Fixed Effects Included	YES	YES
Adjusted R ²	0.247	0.310
N	1232	1232

Notes: * $p < 0.05$, ** $p < 0.01$. Values are coefficients (standard errors) from OLS regression models with school-fixed effects. All models include controls for parental postsecondary education, parental STEM occupation, number of siblings, and number of books at home. See Appendices A–C on the construction of affinity and aversion variables.

In sensitivity tests, we find that our conclusions are unchanged under different model specifications—i.e., we find similar gender-by-sector interaction effects in models with and without controls for parental education, parental STEM occupation, number of siblings, and number of books at home, and with and without school fixed-effects.

As elsewhere in the affluent West, our survey results indicate that Jewish girls in Israel express relatively strong aversion to tech-related fields and mathematics, while girls in the socioeconomically marginalized Arab Palestinian school sector express greater interest.

6.2. Interview Results

To explore the social-psychological and organizational mechanisms underlying sectoral differences in the tech gender gap, we conducted semi-structured interviews with girls and boys who met the enrollment criteria for advanced coursework in physics and computing. Information on three main topics emerged from the interviews: attitudes toward STEM, in general, and physics and computer science in particular, motivation to study these subjects, and future aspirations and their relevance to the choice of STEM fields of study.

With respect to boys' attitudes, we found more similarities than differences between Jewish and Arab Palestinian students, with most expressing positive sentiments toward STEM, although boys in Arabic-language schools more often emphasized the practical value or the prestige associated with STEM subjects. For example, Samer, a boy in an Arabic-language school mostly serving students from low socioeconomic status (SES) backgrounds, explained: "I like physics, it's similar to math in that it challenges you to think and make you concentrate. I believe it will help me improve my skills". Another boy from the same school, Ahed, emphasized that physics is "the best" and most prestigious subject in their school and that is why he likes it: "The teachers in the school push us to choose the best advanced courses, I mean physics, physics is the best [most prestigious] subject".

Ayman, a boy attending a school located in a town with a higher concentration of middle-class Arab Palestinian families, explained that his choice of computer science was influenced by the positive experiences of his uncles, who are employed in the high-tech sector, and his own experience with computers. He also chose physics because "it's very useful and will help me in the future. . . It will help me with [raising] the average of my matriculation results and to get easily admitted to university" (Advanced STEM coursework is rewarded with a bonus in the final average in the Israeli matriculation certificate).

Basem, a student in a different Arabic-language school, was more explicit about the benefits of studying physics and computing: "Among us, the Arabs, physics and computer science are considered the best advanced subjects, that's why they're the most prestigious

and wanted. The most important thing for me is getting good grades that will help me get accepted to university". In contrast to Ayman, Basem did not mention a career in high-tech, but rather said he prefers to become a lawyer. His decision to take advanced physics and computing is instrumental in securing a high average in the matriculation certificate so he can get accepted to law school. Similarly, Mohamad, Basem's peer from the same school, who wants to pursue a career in information technology, talked about how he must invest in studying mathematics "in order to achieve my [future] goals".

Jewish boys also emphasized the importance of advanced physics and computer science to their career goals. Guy, who was attending a school serving mainly middle-class Jewish families and aiming for a future career in high-tech, observed: "Today, everything is basically technology, and what you know about computers can only help you in the future". Amir, in a school serving mostly lower-middle-class Jewish students, further explained: "In the future, robots will replace many jobs. I want to be the brain behind these robots, in a job that cannot be replaced".

However, in contrast to students in Arabic-language schools, who described utilitarian considerations almost exclusively, students in Hebrew-language schools also referenced interest, disinterest, and feelings when explaining their choices. One of the main discursive differences between the Arab Palestinian and Jewish boys was in the Jewish boys' use of the phrase "love" to describe their choices. For example, in explaining his choice of advanced physics and computer science courses, Shai reported: "I love mostly math, physics, computers. . . I really, really love all STEM, these subjects really develop your thinking". Aviram, a boy from a school serving a middle-class Jewish population, used the verb "love" no fewer than 20 times to explain his future aspirations. When referring to computer science he added, "equations and calculating, just to use it in computer [language] I just love this way of thinking, [the way it makes] the brain work. . .". Yanay, a boy attending a school in an affluent suburb, told us: "I really love all the sciences, biology, chemistry, physics. If I could, I would probably take physics, but it didn't work out [in terms of meeting the prerequisites], so I'm taking biology and chemistry because this is what interests me".

Yanay's peer from the same school explained that he is not interested in advanced subjects such as social sciences, biology, or theater: "Humanistic subjects, at least in this school, are not that good". He reported that his choice of physics and computing resulted from a mix of disinterest in (and even disdain for) a long list of subjects (including the less selective and prestigious STEM field of biology), and practical considerations regarding what would help him to get accepted in elite technological units in the army and in a higher-education engineering program. He explained, "I hesitated between Arabic and physics because these two subjects help in the Army [i.e., serving in prestigious intelligence units], and they are also interesting. But in the end, I took physics, because you must have a STEM subject for [studying] software engineering [in university]". The military service and its elite technological units were also mentioned by other Jewish boys, mainly from privileged backgrounds, as an important instrumental reason to choose physics and computer science.

Like both groups of boys, most Arab Palestinian girls reported high levels of interest in STEM fields. Yet rather than aspiring to engineering and high-tech careers, many expressed interest in medical careers. For instance, Rawan from a school at the center of Israel, reported: "In ten years' time, maybe I'll still be a student at the university, but let's say I'll already graduate. . . so I see myself as one of the best doctors in the country. . . I still haven't decided where to study but maybe Tel-Aviv University or the Technion". These girls reported very clear instrumental choices, choosing advanced subjects in high school that they thought would advance their career aspirations. Lina explained: "I chose a subject that will help me

in the future. I didn't choose just what I like but also asked what will help me fulfill my dream. . . I mean the job I want to have. . . That's why I took physics and computer science". Similar to the rationale of Basem, who chose advanced STEM subjects to enhance his chance of law-school acceptance, Lina describes the choice of advanced high-school courses as an investment in her future. This understanding was also reflected in Nihad's account, who told us, "I chose chemistry and biology. . . I think it will help me in the future because I know what I'll study [in higher education]. . . medicine is my childhood dream". In contrast to Nihad, who said that she likes biology, Badra explained that she "has a brain [that] is more [suitable for] physics than biology". When asked about her plans, she had a very specific vision: she wanted to be an engineer in a medical laboratory at the Technion, a highly prestigious Israeli academic institution that focuses on STEM fields of study.

More than any other group we interviewed, high-achieving Arab Palestinian girls reported clear, and often very specific, academic and career aspirations. Suhila, who lives in a community characterized by high levels of poverty and conservative gender norms, was adamant about the importance of education: "My grades are very high, the highest in our class. It is very important for me. Education is the most important thing in my life. . . to be intelligent is a weapon. Sure, when I grow up, I want to go to university and have a great job that will earn me a good salary". When asked about her career plans, Suhila replied that she wants to be a doctor or engineer and to live by herself in a big house. She added: "It will give me self-confidence to feel that I don't waste my life. . . I want to prove that even if you were born female, it doesn't mean you have to stay home, get married and have children". While other girls from Suhila's school did not reflect such a feminist perspective, they all emphasized the importance of educational success and expressed high educational and occupational aspirations. Rania, for example, told us that in the future she sees herself as "one of the greatest doctors in the country". She added that she has not yet decided whether to study medicine at Technion or Tel Aviv University, two highly prestigious and selective institutions. Some Arab Palestinian girls we interviewed were not interested in medicine, but in careers in fields such as psychology, art therapy, or education. Yet, like those who wanted to become doctors, these girls imagined a relatively clear future path and saw their advanced high-school coursework as a means of achieving those aspirations.

Among the four groups interviewed for this study, Jewish girls stood out for their strong disinterest in tech-related STEM fields. Although they were high-achieving students who excelled in all subjects, most rejected physics and computer science in favor of STEM fields such as chemistry, biology, or non-STEM subjects. Yarden, a girl in a school serving upper-middle-class Jewish families, explained her choice of biology in that it is "connected to me, to my body, to my environment". She understood physics and computing to be less suitable for her and for girls in general, because they do not deal with emotions, "just like robots". She observed: "Girls are more sensitive. . . like, they really need this femininity aspect". In explaining her preference for biology over physics and computing, Yarden constructs the fields in highly gendered terms, invoking common stereotypes of mathematically intensive fields, including the distinction between people and things (Rommes et al. 2007). Using strikingly individualistic language, she described her chosen field of biology as "connected to me, my body".

In contrast to Arab Palestinian students and Jewish boys, who often described difficulty and "challenges" as part of their chosen fields' appeal, some Jewish girls reported avoiding fields that they perceived to be difficult. For example, Neta, Yarden's peer at a high-SES Hebrew-language school, told us that she had considered courses in mathematically oriented fields, but decided against them because they are considered difficult, and she does not feel she is talented enough to study them at the advanced level. "Subjects like Arabic and biology are easier for me", she added. Hadar, a girl from the same school, expressed a

similar sentiment, telling us: “At the beginning [of the choice process], I thought I’d take chemistry and biology. . .but then I thought it would be too much work. My sister asked me if I want to work hard or have fun in my last [school] years. If you want to have fun, [my sister said] take advanced art”. Hadar also mentioned that her sister convinced her that she could study science in the future if she wanted to. Although difficulty was also a perceived drawback for Jewish girls from less affluent communities, this consideration appeared less decisive. Tali, for example, explained that she decided to take computer science because it would help her “in the military service, at the university, and as a general knowledge”.

Many Jewish girls from affluent communities expressed aversion to subjects to which they did not feel an emotional connection. Yael, a girl attending a school catering to a relatively affluent Jewish population, explained that she likes the natural sciences, especially physics and biology. She even added that she had “fallen in love” with physics after experiencing success. She decided against pursuing computer science, however, because she did not feel the same emotional connection. Like Yarden, Yael describes a sense of emotional connection to fields of study as a major factor in her enrollment decisions. Putting the reflexive self at the center of the process means that choices needed to “feel” right, rather than reflecting instrumental, calculated decisions. These self-expressive priorities largely reflect positions of socioeconomic privilege. But hybridized versions of self-expressive logic were also found among Jewish girls from less affluent communities. Anat explained that she chose computer science because “computers are where the whole world is going”. When asked about her choice of physics, she hesitated and said that her teacher helped her “fall in love” with this subject. Anat thus explains a utilitarian choice with reference to an emotional connection, through self-expressive discourses of “connection” and “love”.

Compared to Arab Palestinian girls and boys from both school sectors, Jewish girls expressed much less confidence about their plans, expressing the view that it is “too early” for them to decide about their careers. When asked about her plans, Neta giggled and said, “I don’t know yet exactly what I want [to do]. . .social work. . .psychology, medicine like my parents, but I’m not sure”. Lia, who, like Neta, comes from a privileged background, told us, “I just want to keep my options open. . .I don’t know what I want to do in [the future]. . .if you need to, you can take other matriculation exams in the future”. Yael said, “I’ll do something that I’m interested in. . .Ten years from now, I’ll be a manager of a project or something”. Yael emphasizes “interest” as a major criterion for her future career choice. While she conveys high self-confidence, she reports less specific future plans than most Jewish boys and most Arab Palestinian girls.

Among the thirteen Jewish girls interviewed, only two described clear occupational plans; both attended a school serving middle- and upper middle-class families. Noa told us that she wants to study medicine and, therefore, chose biology and high school medical studies. Other girls mentioned medicine as a relevant career path, but emphasized that they had not yet decided. Psychology was another frequently mentioned possible career path for Jewish girls.

7. Conclusions: Doing Gender, Doing Culture

Over the past two decades, cross-national comparative research has helped us go beyond essentialist and WEIRD-centric portrayals of girls as universally averse to mathematically intensive fields (Charles 2017; Charles and Bradley 2009; Stoet and Geary 2018; Yalcinkaya and Adams 2020). It has been clearly established that the STEM gender gap is variable and contextually contingent, but reasons for this variability are not well understood. This study leverages unique features of the Israeli educational system and a mixed-method design to explore some underlying social, psychological, and organizational mechanisms.

Using in-depth interviews and original surveys, we compare gender gaps in ninth graders' STEM-related attitudes and aspirations across two highly segregated yet centrally administered state school sectors: one serving the dominant Jewish secular majority, and one serving the socioeconomically marginalized Arab Palestinian minority. Quantitative and qualitative results reveal curricular affinities, discourses, and course-taking patterns that are differentially gendered. While boys and girls in Arab Palestinian schools report more instrumentalist motivations and more positive attitudes toward mathematically intensive fields, students in Jewish schools engage in highly gendered, self-reflexive discourses that support gendered course-taking. Results are consistent with the argument that material security and individualistic value systems support a "postmaterialist" framing of curricular choice as the expression of an authentic inner self. Since gender is a highly salient dimension of these "inner selves", self-expressive choice may manifest as "expression of gendered selves" (Charles and Bradley 2009; Cech 2021).

We find that high-achieving students use discursive frames to explain their selection of advanced subjects that vary by gender and school sector. In schools serving the more economically precarious Arab Palestinian population, both boys and girls expressed strongly utilitarian, instrumentalist motivations for curricular choice, describing clear career goals and course-taking strategies closely aligned with those goals. These students rarely used the self-expressive language of "love", or even of personal connection or interest. Jewish boys used instrumentalist frames as well, but these were supplemented with reference to their deep interest in, and sometimes love for, their chosen fields.

Jewish girls stood out for the relative scarcity of their utilitarian discourse, the non-specificity and ambivalence with which they described their future aspirations, and the self-reflexiveness of their narratives about course selection. When asked about their plans, most Jewish girls emphasized the importance of fitting in, being happy, and loving their work, and they explained their aversion to computing and physics by invoking stereotypical, masculinized images of these fields. The small minority who did pursue coursework in mathematically intensive fields often explained their choices in feminine-gendered and self-reflexive terms, describing, for example, how they "fell in love" with STEM. Here, we see how emotional expressions can reveal social gender norms (Hellum and Oláh 2018).

The different framings of curricular choice and career aspirations can be understood as socially structured and partly performative—as different ways of negotiating cultural beliefs about masculinity, femininity, and science (Archer et al. 2012, 2013; Ensmenger 2015). While these boys and girls are all "doing gender" through their choices and narratives (West and Zimmerman 1987; Butler 1990; Faulkner 2007), they are simultaneously "doing culture", in the sense that these gendered choices and discourses are constructed within and moderated by distinct Jewish and Arab Palestinian cultures that shape the way that they are understood and enacted. The self-expressive and utilitarian-instrumental discourses found in Israeli schools represent distinctive cultural repertoires through which Jewish and Arab Palestinian students enact their respective communities' normative expectations for high-achieving students. Previous intersectional analyses of tech fields in the United States have demonstrated how gender patterns and processes vary across other sociocultural groups (Alfrey and Twine 2017; Ma and Liu 2017; Alegria 2019; Chow 2024). A similar culturally inflected gendering is evident in comparing boys' and girls' narratives of curricular choice between schools serving Jewish and Arab Palestinian citizens of Israel.

Under conditions of broad-based societal affluence, one way of doing culture is by articulating and following highly individualized curricular interests, or "passions". This self-expressive strategy contrasts with the more instrumental approach to curricular and career choice that tends to prevail in more socioeconomically precarious cultural contexts (Inglehart 2018). Although "doing what we love" may help reduce drudgery and improve

general well-being, research suggests that understanding one's own aptitudes and affinities can be influenced by cultural stereotypes, biased self-assessments, and prevailing power dynamics (Correll 2001; Charles and Bradley 2009; Cech 2021; Tokumitsu 2015). Under these circumstances, the pursuit of passions may reinforce stereotypes and gender segregation and foster increased inequality.

In this study, we compared gender processes across a social group boundary that is highly salient in Israel and deeply inscribed into national institutions, including schools. Our results suggest that the cultural and organizational processes that generate variability across countries in the nature and extent of gender inequality can also play out across social groups within countries. The intersectional and contextually contingent nature of the STEM gender gap remains relatively unexplored. There is still much for future researchers to learn about how specific forms of marginalization and privilege map onto variability in women's and men's relative representation in scientific and technical fields within and across societies.

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Informed Consent Statement: Informed consent was obtained from all subjects and their parents involved in the study. The interviews were conducted in the primary language used by the interviewees, which was either Hebrew or Arabic. All students were offered a chance to opt out before completing the survey questionnaire.

Data Availability Statement: The quantitative data used in this study are available on request from the authors, pending permission from the Israeli Ministry of Education.

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Appendix A. Construction of the School Affinity Score

This variable was constructed using a principal component analysis (mean = 0, SD = 1, higher values denote more favorable attitudes) of the following items (1—Strongly disagree, 4—Strongly agree):

It is important for me to succeed in my studies.

Success in my studies will help me in the future.

In most of my classes I make the greatest effort possible to understand the subject matter in the best way possible.

It is important to me that I get a good grade so that I may be accepted to the subjects of my choice in high school.

I understand the material thoroughly in most of my classes.

Eigenvalue: 2.566, Cronbach's alpha: 0.803.

Appendix B. Construction of Math Affinity Score

This variable was constructed using a principal component analysis (mean = 0, SD = 1, higher values denote more favorable attitudes) of the following items (1—Strongly disagree, 4—Strongly agree):

We learn interesting things in math.

Math is more difficult for me than most subjects (reversed).

It is important for me to succeed in math since it will help me in the future.

I would be happier not to have to learn math (reversed).

In high school I want to learn math at the highest level possible.

Math is boring (reversed).

I understand quickly what is taught in math.

Eigenvalue: 3.369, Cronbach's alpha: 0.821.

Appendix C. Construction of the Tech Aversion Score

This variable was constructed using a principal component analysis (mean = 0, SD = 1, higher values denote more agreement, i.e., less interest in STEM) of the following items (1—Strongly agree, 4—Strongly disagree):

Physics doesn't interest me.

Computer science doesn't interest me.

Eigenvalue: 1.547, Cronbach's alpha: 0.707.

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