



Parental Attribution of Mathematics Achievement in Lebanon: Gendered Patterns of Effort and Talent

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Abstract: This study investigated parental perceptions of children's mathematics achievement in Lebanon, focusing on gendered patterns in how success is explained. Survey data from 299 parents examined ratings of children's mathematics performance, explanations for success or failure, and perceived academic strengths. Although parents rated girls and boys similarly in achievement, explanations for success differed by gender: boys' success was attributed mainly to innate mathematical ability, whereas girls' was attributed to motivation, effort, or support from others. Further analyses showed that parent characteristics, including age, gender, and survey language, influenced attribution styles. In terms of perceived academic strengths, parents more often associated boys with mathematics and logic, and girls with communication-based skills. The findings raise concerns about a possible unintentional communication of gendered expectations at home and call for future research into their development and long-term effects on children's academic self-concept.

Keywords: Parental Beliefs, Mathematics, Perceptions, Gender Stereotypes, Achievement Attribution, Lebanon

1. Introduction

Gender bias continues to influence educational outcomes in many parts of the world (Card & Payne, 2020; Lavy & Sand, 2015). Parents play a central role in shaping how children think about their abilities. Studies have shown that parents' expectations are shaped by social beliefs about gender and achievement, which are then passed on to their children (Giménez-Nadal et al., 2019; Tiedemann, 2000).

In mathematics, cultural ideas about talent tend to favour boys. The belief that intelligence in this field is related to brilliance or natural ability is known as the gender-brilliance stereotype (Gálvez et al., 2019; Zhao et al., 2022). This belief is widespread in academic and public settings, as the perception of innate talent is often linked to males (Leslie et al., 2015). These attributions affect how children see themselves and how others explain their performance (Robinson-Cimpian et al., 2014).

The following review summarises how mathematics-specific abilities have been associated with innate talent and masculinity, and how these beliefs shape parents' interpretations of children's mathematics achievement.

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1.1 Mathematics-Gendered Perceptions and the Idea of Success in that Academic Field

Mathematics is positioned as a foundational school subject, surrounded by perceptions that it requires innate abilities. Because beliefs about innate talent are often associated with boys, mathematics is often perceived as a subject more suited to males. The general public in Australia, Canada, and the UK (Forgasz & Leder, 2017) have expressed these perceptions as they considered mathematics more important for boys than girls. This view was found specifically among younger research participants. Such perception is further uncovered in domains/careers where success is stereotypically linked to innate intelligence, a trait more likely to be associated with men than women (Bian et al., 2018). These ingrained beliefs also affect women's interest and sense of belonging in academic and professional positions that are seen to involve 'brilliance' (Bian et al., 2018).

The perception of brilliance as a requirement for success is most visible in academic fields that are highly selective or associated with elite performance. Leslie et al. (2015) found that women and African Americans were underrepresented in disciplines where success was believed to depend on innate talent. Similarly, in an analysis of teacher evaluations, Storage et al. (2016) found that individuals from these groups were less likely to be described using terms like "brilliant" or "genius". The same study noted that gendered and racial stereotypes appeared early in the academic pipeline. It seems that treating brilliance as essential can lead to a narrower view of who is capable, which can affect participation and perception in these fields.

Research in psychology has exposed how stereotypical perceptions influence attitudes and behaviours. For instance, Meyer and colleagues (2015) observed that individuals in STEM tend to have beliefs about the field's prerequisites that closely match its real gender composition, where more men are present. Although Meyer et al. (2015) did not establish causation, the findings suggested that the perceptions of required skills were influenced by how innate ability was linked to success in these fields. On the other hand, Van der Lee and Ellemers (2015) provided real-world evidence of the consequences of such biases. Male applicants in the Netherlands were more likely to receive higher evaluations and secure funding, even in fields with equal gender distribution among applicants. Decisions about who is selected or supported habitually rely on perceived ability rather than actual performance, thereby reinforcing existing inequalities between groups. Over time, these messages may affect children's self-concept and subject choices, contributing to later gender gaps in participation in advanced mathematics (Kim et al., 2024).

1.2 Parents Perceiving Mathematics as a Masculine

Previous research has rarely focused on parents' beliefs about mathematics; nevertheless, parents' perceptions of their children's abilities are shaped by broader societal norms. In a 9-year longitudinal study by Rätty and Kasanen (2013), gender was found to have a significant effect on parents' perceptions of their children's mathematics competence. The difference in perceptions favouring males' abilities suggested that parents based their evaluations on the cultural beliefs that boys had a natural advantage in mathematics performance. Other studies (e.g., Tomasetto et al., 2015) have revealed that parents held a more negative view of girls' mathematical abilities than of boys, indicating a gender bias in parental perceptions.

More recent research has suggested that gendered parental beliefs persist even when boys and girls perform similarly. For example, McCoy et al. (2022) found evidence of gender stereotyping in mothers' and

teachers' perceptions of mathematics performance. Experimental work has further shown that reducing parents' gender stereotypes and expectations can improve children's motivation in mathematics (Lee et al., 2022).

Although somewhat limited in quantity and largely conducted in the US and Europe, the existing literature rigorously scrutinises gendered perceptions surrounding mathematics. The studies have used longitudinal approaches to investigate this complex matter and provide a strong causal foundation (Caruana et al., 2015; Tomasetto et al., 2015). Although chiefly quantitative and often involving students and the general public, these studies have touched on societal beliefs ingrained in people's perceptions of mathematics. Related research on teachers has found that linking mathematics to innate talent can lower expectations for girls' performance (Heyder et al., 2020; Leslie et al., 2015; Meyer et al., 2015).

A noticeable trend in the literature is that research on parents' views of mathematics and mathematical ability was more common in earlier decades than in recent years (e.g., Yee & Eccles, 1988). It is unclear why recent studies have paid less attention to parents' perspectives on mathematics and beliefs about ability. However, there appears to be a shift in educational research trends to seek emerging areas such as the integration of technology in education (Baydas et al., 2015; Martín-Gutiérrez et al., 2017), online learning methodologies (Valverde-Berrocoso et al., 2020), and human resource development (Saat et al., 2020; Smale-Jacobse et al., 2019). Despite these developments, the role of parents in shaping children's experiences with mathematics remains significant (Huston, 2015; Lazarides et al., 2017). However, few recent studies have examined how parents interpret their children's mathematics performance with regard to gender. Evidence from Middle Eastern contexts regarding parents' attributions for mathematics success and failure also remains limited. This study responds to that gap by examining parental interpretations of mathematics achievement in a context where gender beliefs are shaped by local schooling structures, language politics, and social norms.

1.3 Educational System in Lebanon

Lebanon's education system mirrors the country's wider political and sectarian divisions. In addition to formal distinctions between public and private schools, deep-rooted sectarian affiliations shape school governance, curriculum choices, and institutional priorities. Religious and private schools have considerable autonomy in selecting or omitting parts of the national curriculum, and in some cases, promote practices that are associated with specific ideological or sectarian positions (Baytiyeh, 2017; Mackey, 2006). Meanwhile, the public education sector faces chronic underfunding, political interference, and structural neglect. It has undergone a few meaningful reforms in recent decades, but remains under-researched in terms of equity and gender responsiveness, in particular (BouJaoude & Ghaith, 2006; Shuayb, 2018). In this fragmented landscape, there are limited, consistent efforts to address gender bias in education and in subjects such as mathematics, which are culturally associated with intelligence and ability (Walkerdine, 1998; Muradoglu et al., 2023; Zhao et al., 2022). Beliefs about who is "naturally good" at mathematics may go unchallenged and continue to reflect existing gender hierarchies if there are no unified policies or targeted reform. These conditions, therefore, make it important to examine the factors that shape children's academic success and ability.

1.3.1 Perceptions of Mathematics Achievement in Lebanon

Research on gender and education in Lebanon remains limited, especially around parents' gendered perceptions of their children's achievement. Most existing studies focus on teachers or students. For example, Sarouphim and Chartouny (2017) found that some middle school teachers in private schools believed boys performed better in mathematics, and that girls lacked strong mathematical thinking. However, this research did not examine the role of parents. In another study, El Takach and Yacoubian (2020) found that Lebanese public school students habitually imagined scientists as white and male. These stereotypes were more common among older students and reflected the views presented by teachers and textbooks. Studies like these are important in interpreting gender beliefs reinforced in schools, but they do not consider how parents might contribute to these patterns.

A study by Hariz and Moukarzel (2019) analysed the perceptions of nine school principals and seventeen teachers regarding students' mathematics performance and gender-related factors in single-sex and coeducation schools. They examined how gender affected learning environments, students' achievement, and the effectiveness of different teaching methods. Their mixed-methods approach included interviews, questionnaires, and classroom observations. Although the study found no gender differences in mathematics performance, the analysis was largely descriptive and did not apply a systematic qualitative framework.

A key distinction in Hariz and Moukarzel's (2019) study was how concentration levels were attributed by gender. Teachers perceived boys as more focused than girls, and although lesson plans were largely consistent, female teachers were described as more tolerant of disruptive behaviour than their male colleagues. These findings revolved around gendered assumptions, yet the researchers did not identify them as stereotypes. The interpretations were either presented as neutral observations or treated as behavioural differences rather than socially shaped expectations, leaving their implications unaddressed. This calls for research to move beyond treating gendered patterns as neutral and to critically engage with gender as a social construct (Lorber, 2010).

A substantial body of research on teachers' perceptions of student achievement in Lebanon focuses on giftedness and its attributes (e.g., Antoun et al., 2020; Sarouphim, 2010, 2009, 2015). This body of work raises important questions about how educational priorities are defined and if current practices reinforce certain expectations, including gendered ones, markedly in mathematics. El Khoury (2014) noted that teachers often identified giftedness based on report card grades, and there were no official policies guiding this process. Other researchers drew attention to the lack of national frameworks or support systems for gifted education (Antoun et al., 2023; Sinabian, 2021). Some examined how school type or socio-economic background influenced teachers' perceptions of giftedness (Antoun, 2022; Antoun & Plunkett, 2023). Although gender was not always a central concern, some studies noted that boys were more frequently identified as gifted (El Khoury, 2014).

The emphasis placed on giftedness in Lebanese education raises questions about the assumptions behind it. The idea that students possess fixed, innate talent remains contested (Dai, 2018), yet many of these studies appear to treat giftedness as something inherent rather than developed. This perspective overlooks the broader research showing that ability can be cultivated over time through support and opportunity (Dweck, 2006; Sternberg et al., 2005; Subotnik et al., 2011). When success is framed primarily as the

result of natural ability, students who are not initially labelled as gifted may be excluded from support or underestimated in terms of potential. This view of learning also reinforces a wider belief system in which ability is seen as biologically determined, echoing gendered narratives about who is ‘naturally’ good at subjects like mathematics.

Given these concerns, research priorities in Lebanon could benefit from a priority reassessment. Why is giftedness assumed to be a paramount issue? Is there a substantial population of “intelligent” individuals who are marginalised? The narrow focus on high-performing students has left other areas underexamined, such as learning difficulties and the educational barriers faced by marginalised and refugee students. These issues arguably require greater attention in both research and policy. The continued focus on giftedness suggests that definitions of achievement and ability may be influenced by deeper social values that privilege certain learners over others (Bourdieu & Biggart, 2002). This study turned to mathematics as it is mostly associated with intelligence and fixed ability (Walkerdine, 1998) and examined if gendered expectations influenced parents’ interpretation of their achievement and abilities.

2. Theoretical Framework

This study drew on two key theoretical perspectives: attribution theory and feminist theory. These were used to grasp how parents made sense of their children’s mathematical performance and if their interpretations reflected gendered expectations.

Attribution theory, developed by Weiner (1985, 2000, 2010) helped explain the meanings individuals make of success and failure. It proposed three dimensions of explanation: locus of causality (the cause is internal or external), stability (the cause is seen as consistent or changeable), and controllability (the individual can or cannot influence the outcome). These attributions shape people’s views of ability, effort, and potential in education. For example, when parents attribute a child’s success in mathematics to natural talents, they are drawing on internal, stable causes that are linked to beliefs about fixed ability. On the contrary, if success was attributed to motivation or external help, then that reflects different expectations about how success is perceived.

This framework guided the analysis of exploring parents’ attributions of their children’s achievement when gender is compared. Most research using attribution theory has focused on teachers and how they interpret performance (Georgiou et al., 2002; Woodcock & Vialle, 2016) or respond to differences in perceived abilities (Frenzel & Stephens, 2013; Woodcock & Jiang, 2013; Woolfson & Brady, 2009). Fewer studies have examined how parents make sense of their children’s achievement, though parental perceptions can shape children’s confidence and self-belief (Heyder et al., 2019). Prior research has shown that parents tend to underestimate their daughters’ mathematical abilities and hold lower expectations for success compared to sons (Cimpian et al., 2016; McCoy et al., 2022).

This study also drew on feminist perspectives in mathematics education, in the work of Walkerdine (1988, 1998), who challenges the assumption that mathematical ability is purely academic. Walkerdine argued that dominant discourses in schooling construct mathematics as a domain requiring logic, independence, and abstract thinking, and that these traits have long been associated with masculinity. Girls within this framing have been described as emotional, less confident, or not suited to the subject, regardless of their achievement. These assumptions may lead parents to explain identical achievement through different

lenses, thus subtly reinforcing gendered narratives about mathematics that carry over into how ability is interpreted and explained. In combination with attribution theory (Weiner, 1985), Walkerdine's framework informed the study's focus on whether parents' interpretations of academic performance might vary by the child's gender.

3. Research Aim

This study examined how parents in Lebanon perceived their children's achievement in mathematics. It focused on whether the explanations they gave (attributions) exposed gendered expectations and if certain parent characteristics were linked to those beliefs. The aim was not to compare boys' and girls' actual achievement, but to understand how parents explained, evaluated, and assigned meaning to their children's academic outcomes in this subject. Five hypotheses guided this research:

- **H1:** Parents' perceptions of mathematics achievement differ according to the child's gender.
- **H2:** The explanations parents give for their children's success in mathematics differ by gender, with girls' success more likely to be attributed to effort or motivation rather than ability.
- **H3:** Parents are more likely to associate boys with mathematical or logical strengths and girls with linguistic or communication-based strengths.
- **H4:** Parent and school (such as age, educational background, gender, and type of school) demographics moderate the relation between the child's gender and the type of attribution made for their mathematics success (e.g., boys' success due to ability; girls' due to motivation), in line with cultural expectations.
- **H5:** The same parent and school characteristics also moderate the relation between child gender and whether the child is perceived to excel in mathematics (for example, mathematics versus literacy), in line with cultural expectations.

4. Methodology

4.1 Participants

Initially, 387 participants volunteered for this study; 88 were excluded. Participants were included if they completed the full survey and provided key demographic information (e.g., gender, education, region). Responses were excluded if demographic data were missing or if the survey was exited before completion. These cases likely reflect participants exiting the survey before completion; therefore, their data could not be included in the analysis. The study's outcomes were interpreted based on the final sample ($N = 299$). More than half the participants chose to take the survey in Arabic (52.5%), indicating that translation was crucial to ensure accessibility and facilitate more accurate data collection. Many participants who chose the English version of the survey had bachelor's degrees (48.2%) or Master's degrees (24.4%). This is likely because English is widely used in higher education in Lebanon, which may have made participants more comfortable completing the survey in English.

Most participants (87.6%; $n = 262$) identified as female. This imbalance is unlikely to reflect platform bias and is more likely to echo voluntary participation patterns, with mothers more inclined than fathers to engage in research on children's schooling. Prior work suggests that men's underrepresentation in family-

and education-related surveys may be linked to norms that position caregiving and reproduction as women's domains (Slauson-Blevins & Johnson, 2016). In this study, mothers may also have been more likely to participate because they often take primary responsibility for monitoring children's learning.

Given that the study examined parental perceptions rather than direct comparisons between mothers and fathers, the sample was considered appropriate for addressing the research questions. Nevertheless, the predominance of mothers limits the generalisability of the findings to fathers' perspectives and is acknowledged as a limitation.

The nationality distribution in this study revealed a predominantly Lebanese participant group of 91.3% ($n = 272$). Approximately 4.7% ($n = 14$) of individuals had Lebanese nationality and also held dual or other citizenship. A small percentage of participants identified as Palestinian or Syrian, accounting for 1.7% ($n = 5$). Additionally, there was even less representation of individuals with Lebanese Armenian backgrounds, with only 0.7% ($n = 2$) of the sample.

Although the majority identified as Muslims, accounting for 76.6% ($n = 229$), there was also representation from other religious beliefs, including Christianity (17.4%, $n = 52$) and Durūz (4.3%, $n = 13$). Only 1.3% ($n = 4$) of participants identified as agnostic, and only one stated being an atheist.

The highest percentage of participants, 48.2% ($n = 144$), held an undergraduate degree, approximately 16.4% ($n = 49$) had completed high school, and 7.7% ($n = 23$) had vocational training. In contrast, a small percentage of participants (1.7%, $n = 5$) reported having no formal education. The presence of participants with higher academic attainment, such as a Master's degree (24.4%; $n = 73$), indicates that the study attracted many educated participants.

The sample appeared to be geographically diverse. Participants reported growing up in different areas within Lebanon. The highest representation was from South Lebanon, at 37.1% ($n = 111$), indicating that the survey may have been effectively circulated or targeted to residents from that area. Beirut (20.4%; $n = 61$), Mount Lebanon (17.1%; $n = 51$), and North Lebanon (10.4%; $n = 31$) were also well-represented compared to lower percentages of the Akkar (2.7%; $n = 8$) and Baalbeck-Hermel (2.3%; $n = 7$) regions (see Table 1 for age information about the participants). Due to the lack of an updated census (since 1932) of population size or distribution by region in Lebanon, this sample may not necessarily represent the entire population. The lack of a census stems from concerns about the potential re-division of power and the loss of authority and wealth associated with such distribution among the sectarian majority (Hoffman, 2020). The generalisation of findings to population demographics (e.g., religion, place of origin) could be considered a limitation due to a lack of precise population data.

Table 1: Age Groups of Participants

Participants	Overall		Female		Male	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
18-25	9	3.0	8	3.1	1	2.7
26-30	31	10.4	29	11.1	2	5.4
31-40	147	49.2	130	49.6	17	45.9
41-50	100	33.4	86	32.8	14	37.8
51 or more	12	4.0	9	3.4	3	8.1

Note. $N = 299$, $n_{female} = 262$, $n_{male} = 37$

In addition to gathering data from parents, participants were also asked to provide details about their child's gender, grade level, and school type. This additional information enabled analysis of parents' perceptions of their children's mathematical achievement, with particular attention to children's gender and grade level. The sample of children was evenly split between males (Table 2), 50.2% ($n = 150$), and females, 49.8% ($n = 149$), allowing for a gender-based analysis concerning parental perceptions of mathematics achievement. Additionally, most of the sample was in primary school, which allowed the focus on younger learners in interpreting the findings.

Table 2: Demographic Characteristics of the Children

Sample Characteristic	<i>n</i>	%
Gender		
Female	149	49.8
Male	150	50.2
Grade Level		
Primary/Grade 1	126	42.1
Primary/Grade 2	85	28.4
Primary/Grade 3	31	17.1
Intermediate/Grade 4	37	12.4

4.2 Procedure

The participants were recruited via a paid advertisement on Facebook for purposive sampling (Patton, 1990) by controlling for a specific demographic (parents in Lebanon) within its settings. A dedicated research page was first created on Facebook in early June 2022. Then, an advertisement, formatted as a JPEG and designed in an online graphic design platform, was displayed on that page and managed via Facebook's Meta Business Suite. The page functioned as the primary platform for addressing participants' queries. Using a research-dedicated page rather than a personal account ensured more professional communication and maintained the project's credibility. The page remains active and serves as a space for sharing academic research within the Lebanese community.

The advertisement directed Facebook users to take the Qualtrics survey. An information sheet and consent statement were provided at the beginning of the survey, and participation was stated as entirely voluntary. The information sheet noted that participants could exit the survey at any time without submitting their responses. No identifying information was collected, and all responses remained anonymous and confidential. Ethical approval for the study was granted by the Human Participants Committee at the researcher's affiliated institution.

To ensure sample representation, the advertisement opted to equally target the audience located/living in all five Governorates of Lebanon: North, Beqaa Valley, Mount Lebanon, Beirut, and South. The age was specified as 18-65+, with itemised interest in school, parenting, education, employers who were parents, and parents with *teenagers*. The advertisement was posted for ten days, starting June 13, 2022, and was boosted to reach an estimated 567-1.6K people per day. The advertisement was suspended after reaching 29,303 Facebook users from the target audience.

4.3 Materials

The survey consisted of four main sections. The first section included four items asking parents to select one school-aged child (Grades 1–12) and report the child's gender, grade level, and school type. The second section focused on mathematics achievement and attributions, comprising one achievement rating item, one item on attributions for success, one item on attributions for failure, and two items assessing perceived academic strengths and anticipated fields of study. The third section included approximately 20 Likert-scale items assessing parents' gender-role attitudes. Analyses of the third section are outside the scope of the present paper, as it constitutes a separate line of inquiry examined in a subsequent study. The final section contained 10 demographic items covering parents' age, gender, education level, nationality, region, religion, and involvement in home teaching.

All survey items were originally written in English and first translated into Arabic by the first author, then independently back-translated by a sworn translator and checked for variances. Both versions were pilot-tested with a small group of bilingual parents ($N=8$) who provided feedback on clarity, wording, and cultural relevance. For example, participants were asked whether any items or terms felt awkward, overly academic, or unfamiliar, and whether the Arabic version conveyed the same meaning as the English version. No major issues were identified, and both versions were judged to be clear and appropriate. This process was used to ensure semantic equivalence across language versions rather than for psychometric

validation, as the survey consisted primarily of categorical attribution and perception items rather than multi-item scales (Brislin, 1970; DeVellis & Thorpe, 2021).

As the instrument consisted mainly of categorical or single-response items (e.g., attribution, perceived excellence domain), internal consistency reliability was not calculated. However, procedures were followed to ensure consistency in administration across both language versions. For example, all branching logic, item order, and response options were matched precisely to prevent differential experiences based on survey language.

4.3.1 Rating and Attributing of Mathematics Performance

Parents were first asked to choose one child (if they had multiple) and to specify that child's gender, grade level, and type of school (e.g., public or private). Parents were then asked to record their opinions about their children's current mathematics performance; they were allowed one entry using a 7-point scale: 1) very poor; 2) moderately poor; 3) below average; 4) average; 5) above average; 6) moderately excellent; 7) excellent.

Teachers' attributions and beliefs were previously structured in an Attribution Interview (Fennema et al., 1990). Parents in this study were to choose one reason why they thought that their child was working at the level they perceived in the earlier question: whether it was due to their child's *a) ability/lack of ability; b) effort/lack of effort; c) intrinsic motivation/lack of intrinsic motivation; d) good luck/bad luck, easiness/difficulty of the task; e) received help from the teacher; or f) others* (e.g., parents or peers). The *ability, effort, task, and luck* constructs were adopted from Weiner (1974) by Fennema and colleagues (1990). The last two attributions (teacher or others) were hypothesised by Fennema and Peterson (1985), who suggested that girls depended more on others' help when confronting complex mathematical tasks. Attributional gender bias is common in many empirical studies (Espinoza et al., 2014; Wang et al., 2015; Weiner, 2005).

The attribution question was formatted using Qualtrics' Question Behaviour display logic. The question was displayed according to the parents' choice of their child's achievement level; for example, if an average or higher level was chosen, the following question asked, "To what do you attribute your child's success?" The question and the answer choices were negated if below-average choices were made.

4.3.2 Perceived Task of Excellence

Parents were asked whether they thought their child excelled more in tasks that required mathematical or logical reasoning (mathematics) or in communication and organisational skills, such as storytelling/summary (literacy). This was a two-level categorical question taken from Carlana and Corno's (2021) study of parents' recommendations of field choice and the choices of male and female students when encouraged by their same-gender parents.

5. Data Analysis and Results

The survey data with a 100% completion rate were initially exported from Qualtrics in CSV format, then imported into SPSS, where variables were recoded and prepared for analysis. All statistical analyses were

carried out using SPSS version 29 (IBM Corp, 2022). Table 3 provides an overview of the study hypotheses, statistical tests used, and key results.

Table 3: Summary of Hypotheses, Statistical Tests, and Key Results

Hypothesis	Prediction	Statistical Test	Key Result	Decision
H1	Parents' ratings of mathematics achievement differ by child gender	Mann–Whitney U	No significant difference ($U = 11,597$, $p = .56$)	Not supported
H2a	Parents' attributions for success in mathematics differ by child gender	Chi-square test of independence	Significant association, $\chi^2(3, N = 274) = 10.23$, $p = .017$, $V = .19$	Supported
H2b	Parents' attributions for failure in mathematics differ by child gender	Chi-square test	Test not conducted due to assumption violations (skewed responses)	Not tested
H3	Perceived domain of excellence differs by child gender	Chi-square test of independence	Significant association, $\chi^2(1, N = 299) = 11.85$, $p < .001$, $\phi = .21$	Supported
H4	Parent and school characteristics moderate gendered success attributions	Multinomial logistic regression	Several moderators were significant (e.g., parent age, gender, survey language)	Partially supported
H5	Parent characteristics moderate gender differences in perceived academic excellence	Binary logistic regression	No stable interaction effects detected	Not supported

5.1 Comparing Perceptions of Achievement Level Between Genders

The first hypothesis examined whether there was a statistically significant difference in how parents rated girls' and boys' mathematics achievement. A total of 299 valid responses were analysed, with parents rating their child's performance on a 7-point scale from 1 (very poor) to 7 (excellent). Descriptive statistics were computed for each group before conducting inferential analyses.

Of the children, 8.4% ($n = 25$; 11 girls and 14 boys) were perceived by parents as underachieving in mathematics (rated below average). The distribution of responses across genders was nearly even, with 138 girls (50.4%) and 136 boys (49.6%) represented in the final analysis. On average, girls were rated at $M = 5.54$ ($SD = 1.45$) and boys at $M = 5.58$ ($SD = 1.52$), which indicated that parents perceived girls and boys to be at similar achievement levels overall.

Given the ordinal nature of the scale and the non-normal distribution of the data, the Mann–Whitney U test was used as a non-parametric alternative to the independent t -test. The result indicated no statistically significant difference in parental perceptions of achievement by gender, $U = 11,597$, $p = .56$.

These findings did not support H1. On average, boys and girls were perceived as performing similarly in mathematics, and gender did not appear to influence parents' achievement-level ratings.

5.2 Gender Differences in Attribution of Success and Failure

A chi-square test of independence was conducted to examine whether parents' explanations for their children's success or failure in mathematics differed by gender (H2).

The four success attribution categories used were: ability, effort, intrinsic motivation, and external factors/support (e.g., teacher or parent help, luck, or ease of task). These categories were collapsed to address low expected cell counts. This decision was made to meet the chi-square assumption of having no more than 20% of expected counts below five, as recommended by Pallant (2016). The *teachers' tasks are easy*, *having good luck on the test*, *receiving help from teachers*, and *receiving support from others* were merged into a single category called *external factors and support*. The chi-square test was administered again, and 100% of the cells had expected frequencies of 5 or more for the attributions of success, and 87.5% for the attributions of failure, which indicated that the assumption of difference was now reasonably met.

The chi-square test revealed a statistically significant value of $\chi^2(3, n = 274) = 10.23, p = .017$ for the success attribution, suggesting that the attributions of success for females differed statistically significantly from the attributions for males. The strength of the association, measured using Cramér's V (Gravetter et al., 2020), was $V = .19$, indicating a small to moderate effect.

The test revealed some gender differences in parents' attributions for success and suggested a potential gender bias in perceptions of reasons for success. Males' mathematical success was more associated with excellent abilities, finding teachers' tasks easy, and receiving help from the teacher. On the other hand, females' success was more likely due to intrinsic motivation, good luck during the test, and help from others (see Table 4). The post hoc analysis (count vs expected counts) showed that girls' success, compared to boys', was frequently linked to external causes, which could be perceived as undermining their abilities.

Table 4: Chi-Square Crosstabulation for Success Attributions with Child’s Gender

			My child has excellent mathematical abilities	My child exerts a lot of effort	My child has intrinsic motivation	External factors and support	Total
Child’s gender	Male	Count	77	17	14	28	136
		Expected Count	65.0	17.4	20.8	32.8	136.0
		% within Child’s gender	56.6%	12.5%	10.3%	20.6%	100.0%
		Adjusted Residual	2.9	-.1	-2.3	-1.3	
	Female	Count	54	18	28	38	138
		Expected Count	66.0	17.6	21.2	33.2	138.0
		% within Child’s gender	39.1%	13.0%	20.3%	27.5%	100.0%
		Adjusted Residual	-2.9	.1	2.3	1.3	
Total		Count	131	35	42	66	274
		Expected Count	131.0	35.0	42.0	66.0	274.0
		% within Child’s gender	47.8%	12.8%	15.3%	24.1%	100.0%

The same procedure was carried out for the failure attributions, and amendments were carried out for the categories. The responses were collapsed into four categories to address small cell sizes: *lack of mathematical ability*, *lack of effort*, *lack of intrinsic motivation*, and *lack of external factors and support*. However, the distribution of responses was highly skewed: most parents ($n = 23$, 92%) attributed failure to a lack of external support or situational factors, and no parents selected a lack of mathematical ability. Given this imbalance and the violation of chi-square test assumptions (i.e., low expected cell counts), no statistical comparison was conducted.

Instead, the pattern suggested a strong tendency to avoid attributing mathematics failure to internal or stable traits, such as low ability, which may reflect a reluctance to assign blame or a belief in external influences over inherent deficits. This absence of internal attribution was observed for both genders and may merit further investigation in future research.

5.3 Comparing Girls' and Boys' Perceived Task of Excellence

Another chi-square test for independence was used to test the association between the child's gender and parents' perceived domain of excellence, either mathematics and logic skills or communication and organisational skills. A 100% cell count with expected frequencies of 5 or more indicated that the assumption was reasonably met. The chi-square test revealed a strong statistically significant value of $\chi^2(1, n = 299) = 11.85, p = <.001$ for the perceived excellence task. Since this is a 2 x 2 table, the phi coefficient was considered instead of Cramer's V. The effect size was medium $\phi = .206$, suggesting that females' excellence relating to the type of task differed statistically significantly from that for males and that there appeared to be an association between gender and the task the parents perceived their children excelled in the most.

A contingency table analysis was used to identify specific differences in responses between girls and boys and where these differences occurred most (see Table 5). The test revealed that the counts for mathematics and logic skills were statistically significantly larger than expected for males, and the counts for communication and organisational skills were statistically significantly larger for girls, which supported hypothesis H3 of a potential association.

Table 5: Chi-Square Crosstabulation for Perceived Task of Excellence with Child's Gender

			Male	Female	Total
In which of the following tasks do you think your child can excel?	A task that requires math and logic skills	Count	119	90	209
		Expected Count	104.8	104.2	209.0
		% within	56.9%	43.1%	100.0%
		Adjusted Residual	3.6	-3.6	
	A task that requires communication and organisational skills (summarising/storytelling)	Count	31	59	90
		Expected Count	45.2	44.8	90.0
		% within	34.4%	65.6%	100.0%
		Adjusted Residual	-3.6	3.6	
Total	Count	150	149	299	
	Expected Count	150.0	149.0	299.0	
	% within	50.2%	49.8%	100.0%	

5.4 Moderation of Gendered Attribution by Parent and School Characteristics

A series of multinomial logistic regressions was conducted to examine if parents' characteristics moderated the relation between their child's gender and the way they attributed success in mathematics. The outcome variable, the combined attribution of success, captured parents' dominant explanation for their child's success, and as mentioned earlier, included four categories: ability, effort, motivation, and external factors. Each model used external attribution as the reference category. Child gender (coded as 1 = male, 2 = female) was included as a predictor in every model, alongside a single moderator (e.g., parent education, region), and an interaction term (Child Gender \times Moderator) to assess moderation effects.

Multinomial logistic regression was chosen as the analysis method because the dependent variable was categorical with more than two unordered levels. Models were run separately for each moderator to avoid overfitting, simplify interpretation, and address multicollinearity. Where moderators contained many categories or sparse subgroups, variables were recoded to ensure statistical stability. For example, education was grouped into Low (no qualification, high school, vocational), Medium (bachelor's degree), and High (master's degree or above). Similarly, the region was grouped into Central (Beirut, Mount Lebanon), North/East (North Lebanon, Akkar, Beqaa, Baalbek-Hermel), and South (South Lebanon, Nabatieh), and nationality was grouped into Lebanese vs. non-Lebanese.

Several moderators significantly affected the gendered pattern of attribution (see Table 6). When school level (grade) was included as a moderator, the overall model was significant, $\chi^2(12, N = 274) = 28.10, p = .001$, with a pseudo R^2 of .045. The most notable interaction occurred at Grade 3, where boys were

significantly less likely than girls to have success attributed to ability ($B = -2.57, p = .047$). Additionally, independent of gender, parents were more likely to attribute success to ability for children in Grades 3 and 4 ($B = 2.91$ and $B = 2.53$, respectively; both $p = .005$). Parent age group was also a significant moderator, $\chi^2(12, N = 274) = 25.73, p = .0063$, pseudo $R^2 = .043$). Younger and older parents differed in how they interpreted boys' and girls' success, with younger parents more likely to attribute girls' success to motivation.

Survey language significantly moderated the gender-attribution relation, $\chi^2(9, N = 274) = 25.44, p = .0025$, pseudo $R^2 = .037$. Arabic-speaking parents were more likely than English-speaking parents to attribute girls' success to effort and external support. Parent gender also significantly moderated the relation, $\chi^2(3, N = 274) = 8.15, p = .0421$, pseudo $R^2 = .019$, indicating that mothers and fathers showed different attribution patterns for boys and girls.

School type was another significant moderator, recoded into Private versus Non-Private (Public, UNRWA, NGO). The model yielded $\chi^2(3, N = 274) = 5.18, p = .0158$, with a pseudo R^2 of .015. However, the interaction term between child gender and school type was not significant, indicating that while attribution patterns differed by school type, these differences were not uniquely moderated by the child's gender. Similarly, nationality, recoded as Lebanese versus non-Lebanese, showed a significant overall model, $\chi^2(3, N = 274) = 5.18, p = .0158$, but the interaction term with gender was not significant. This suggested that gendered attribution patterns were consistent across Lebanese and non-Lebanese groups.

Region of origin, recoded into Central, North/East, and South, also resulted in a significant model, $\chi^2(3, N = 274) = 5.18, p = .0158$, pseudo $R^2 = .015$. Although this factor contributed to the overall model fit, no significant interaction was found, indicating that gender biases in attribution were relatively stable across geographic locations in Lebanon.

Religion was not statistically significant; its model yielded $\chi^2(9, N = 274) = 15.47, p = .1275$.

The findings indicated that although gendered attributions were common among parents, their strength and expression varied depending on key demographic and contextual factors. Notably, the survey language, parent age, school type, and parent gender emerged as meaningful moderators of this bias. The results supported theoretical claims from attribution theory and feminist critiques of mathematics as a gendered domain, showing that parental beliefs might be socially shaped and not neutral.

Table 6: Summary of Significant Interaction in the Moderation of Gendered Attribution by Parent and School Characteristics

Moderator	Significant Interaction Term	<i>B</i>	<i>SE</i>	<i>p</i>
School Level	Child_Gender × Grade 3 (Ability)	– 2.57	1.29	.0470*
Parent Age Group	Child_Gender × Age 41–50 (Motivation)	– 1.11	0.52	.0316*
	Child_Gender × Age 31–40 (Motivation)	– 0.84	0.40	.0371*
Survey Language	Child_Gender × Arabic (Motivation)	– 1.27	0.48	.0078**
Parent Gender	Child_Gender × Female Parent (Ability)	– 0.93	0.46	.0427*
Region (Grouped)	Child_Gender × South Lebanon (Motivation)	– 1.45	0.72	.0438*

Note. $p < .05$ marked with *; $p < .01$ marked with **. “Significant Interaction Term(s)” reflect the specific child gender × moderator combinations with $p < .05$. All models used “external factors” as the reference attribution category.

5.5 Moderation of Gendered Differences in Perceived Academic Strength by Parent and School Characteristics

Binary logistic regression models were conducted to examine whether parent characteristics moderated the relationship between child gender and perceived academic excellence (H5). The outcome variable (Task) was coded as 1 = mathematics/logical reasoning and 0 = literacy/communication. Each model included child gender, a parent characteristic (e.g., gender, age, education), and their interaction.

Several models showed statistically significant overall fit (e.g., parent age, gender, education, and nationality). However, many individual interaction terms failed to converge due to sparse data in some categories. To address this, categories were collapsed (e.g., education grouped into Low vs High; religion into Muslim, Christian, and Other), but even with these adjustments, the interaction terms could not be reliably estimated.

As a result, no statistically stable evidence was found that parent characteristics moderated the relation between child gender and the perceived academic domain of excellence. The findings suggested that if gendered beliefs were present, they were likely consistent across demographic subgroups or required a larger sample to reliably detect differences.

5.6 Parents’ Characteristics Predicted Their Perceived Type of Excellence

Given the instability of interaction terms in the previous regression model for H5, the analysis was extended to a binary logistic regression that directly examined which parent characteristics predicted the types of excellence they perceived in their children. Child gender was included here as a covariate rather than a moderator to simplify the model and focus on the independent contribution of each parent-related factor without compounding interaction effects.

Academic excellence, mathematics/logical reasoning, was coded as 1, versus literacy/communication, coded as 0. Predictors included child gender, parent age (collapsed into ≤ 40 vs > 40), education level, religious affiliation, region of origin, nationality, and school type. All variables were entered simultaneously into the model to isolate each factor's unique contribution. This analytic approach was appropriate given the binary nature of the outcome and the aim of testing the influence of multiple demographic characteristics on parental perceptions.

The model was statistically significant, $\chi^2(9, N = 299) = 30.62, p = .0003$, indicating that the set of predictors reliably distinguished between the two types of perceived excellence. The model explained approximately 8.4% of the variance in the outcome (pseudo $R^2 = .084$).

Child gender remained a statistically significant factor. Parents were significantly more likely to perceive boys as excelling in mathematics or logical reasoning tasks compared to girls, $B = 0.99, SE = 0.29, Wald = 11.86, p = .001, OR = 2.70, 95\% CI [1.53, 4.77]$.

Parent age also remained a significant predictor. Compared to the youngest age group (≤ 40 years), parents over 40 were significantly less likely to view their children as excelling in mathematical rather than literacy-based domains ($B = -0.98, SE = 0.37, p = .008, OR = 0.38$), suggesting that older parents more frequently associated their children with communication or linguistic strengths. Although the model with collapsed age groups was more stable, an earlier model using detailed age categories revealed a progressive decline in perceptions of mathematical excellence with increasing parent age. Compared to the youngest age group, parents aged 31–40 ($B = -2.66, p = .015$) and 41–50 ($B = -3.24, p = .004$) were significantly less likely to perceive their children as excelling in mathematics over literacy-related tasks.

Other predictors, including parent education level, religious affiliation, region, school type, and nationality, were not statistically significant in this model ($ps > .05$). Although parents with a Master's degree continued to show a trend toward perceiving their children as excelling in math ($B = 1.80, p = .078$), this did not reach significance.

A second binary logistic regression was conducted to examine if parent gender, survey language, or child's school level predicted parents' perceptions of their children's area of excellence (mathematics/logical versus literacy/communication). The decision to separate the models was to avoid exceeding reasonable model complexity for the study's sample size ($N = 299$). The overall model was not statistically significant, $\chi^2(5) = 1.28, p = .937$, indicating that the predictors did not reliably distinguish between the two categories of perceived excellence. None of the individual predictors reached statistical significance, including parent gender ($B = -0.24, p = .516$), survey language ($B = -0.12, p = .647$), or child's school level (Grade 2: $B = 0.20, p = .523$; Grade 3: $B = 0.16, p = .655$; Grade 4: $B = 0.26, p = .528$). The Nagelkerke R^2 was .003, suggesting a very small effect size.

The results suggested that both child gender and parent age potentially influenced the kinds of excellence parents associated with their children. Parents were more likely to view boys as excelling in mathematics and logic, whereas older parents tended to perceive their children as having less mathematical aptitude than younger parents.

6. Discussion

This study examined parents' views of their children's mathematical achievement in Lebanon, the ways they explained their success or failure, and if these accounts varied by gender. The results showed that girls' and boys' overall performance was rated similarly. However, parents' explanations of their achievement differed significantly. Girls were attributed with motivation or external support, whereas boys were more frequently perceived as naturally gifted. These attribution patterns were consistent across the sample but were moderated by certain parent characteristics, including age, survey language preference, and gender.

It is important to note that the parent sample was predominantly composed of mothers, which may have shaped the patterns observed in attribution styles. Given evidence that mothers and fathers can differ in how they interpret children's academic success, the findings primarily reflect maternal perspectives. As such, the results should be interpreted with caution when considering fathers' attribution patterns.

6.1 Gendered Attribution Despite Similar Achievement Ratings

There was no difference in how parents rated the overall achievement of girls and boys in mathematics. This result defied the first hypothesis (H1), which predicted that girls would be evaluated lower. At face value, this might seem like progress towards gender equality. However, the similarity in ratings concealed a potentially deeper bias in how success was explained. Parents were more likely to attribute boys' success to innate mathematical ability and girls' success to their effort and motivation. To Weiner (1985), stable, internal causes such as talent were perceived as more predictive of future success. On the contrary, attributing performance to motivation or external help implies something more fragile or contingent than what the person's success may endure. The findings suggested potentially different expectations or explanations for success for girls and boys. When success is attributed to innate talent, as with boys, it implies a stable, internal cause, that is, it will likely endure over time. In contrast, attributing success to motivation or support implies a more unstable and external explanation, dependent on conditions that may not last (Weiner, 1985).

Research over several decades has shown that people often associate mathematical talent with boys and hard work with girls (Bian et al., 2018; Tiedemann, 2000; Tomasetto et al., 2015). The underlying explanations differ, even when actual performance is equivalent. A recent study by Zhao et al. (2022) found that gendered beliefs about brilliance persisted in education systems that considered mathematics a field requiring innate intelligence. These beliefs are not harmless; they can affect children's self-concept, motivation, and choices about what they are capable of achieving (Skaalvik et al., 2015; Wang et al., 2015).

6.2 The Role of Parent Characteristics

The study found that some parental characteristics increased the likelihood of gendered patterns. Mothers were more likely than fathers to attribute their daughters' success to motivation rather than ability. In many societies, mothers primarily supervise or manage children's daily education (Gracia & Ghysels, 2017; Yamamoto & Holloway, 2010). It is possible that the difference may not be due to stronger bias, but rather to greater involvement that leads mothers to focus on their children's behaviour and observe them closely,

thus viewing perseverance and effort as meaningful ingredients of their daughter's success. At the same time, this might also be due to mothers adopting common social ideas about gender, like the belief that boys are naturally good at mathematics or that girls do well because they try hard. Here, there is also a risk that they may unintentionally reproduce these gendered expectations. Nevertheless, there is a limited opportunity to draw a sharp distinction between mothers and fathers in this study, as mothers were significantly overrepresented in the sample.

Parents who completed the survey in Arabic were also most likely to attribute girls' success to effort, whereas English-speaking parents were somewhat more likely to use ability-based attribution. The variation might relate to differences in parents' educational experiences, as language usually signals the type of curriculum or learning environment to which they were exposed (Tollefson & Tsui, 2003). Educational values tied to language communities in Lebanon might differ from national versus international curricula (Mackey, 2006). Parents who studied in English-speaking or international schools may have been exposed to educational cultures that viewed success in mathematics as the result of innate brilliance. Ernest (1995) argued that dominant philosophies of mathematics shape how the subject is taught and valued, with some systems framing it as fixed or exclusionary. Arabic-medium education may place greater emphasis on discipline and persistence (Akar, 2012; Faour, 2012), possibly leading to different interpretations of success.

Age was also rendered as a contributor to the gendered pattern. Older parents were more likely to associate their children's success with literacy, whereas younger parents showed a stronger link between gender and perceived mathematical strength. This finding contrasts with expectations that younger generations would hold more egalitarian beliefs. Similar generational conservatism has been observed in other contexts (Dotti et al., 2017; Kostenko et al., 2016; Ponarin & Kostenko, 2013), and that implies that stereotypical views are not necessarily erased through contemporary schooling and education. It is plausible that the Lebanese schooling systems reproduce existing gender norms instead of challenging them, as education is often fragmented along sectarian and political lines (Baytiyeh, 2017; Mackey, 2006).

6.3 Stereotypes in Perceived Excellence

Parents more often chose mathematics for boys and literacy for girls when asked to choose their child's area of excellence. This outcome implied a stereotype of male brilliance and female diligence documented across different cultures (Bian et al., 2018; Carlana & Corno, 2021). The results were not shaped by factors such as school type or religious affiliation, but by the child's gender and the parents' age. This is consistent with the idea that gendered beliefs about intelligence are part of a wider social belief system that transcends individual institutions or schooling models (Walkerdine, 1998). Parents may carry these assumptions regardless of the values promoted in their children's schools.

The finding supports the concerns raised in feminist critiques of mathematics education (Walkerdine, 1998). The idea that mathematics requires logic, abstraction, and independence, which are qualities coded as masculine, can discourage girls from seeing themselves as competent in this field, even when they perform well. It is plausible that when such views are reinforced at home, gender differences may begin to take shape even before a child enters the classroom. Prior studies have shown that these messages are often absorbed early when reinforced through consistent signals at home and in school (Carlana & Corno, 2021; Galdi et al., 2014; Passolunghi et al., 2014; Tomasetto et al., 2015).

6.4 Limitations

Several limitations need to be acknowledged in this research. The sample did not represent the wider Lebanese population and included a disproportionately high number of mothers. As previous research has suggested (Slauson-Blevins & Johnson, 2016), it appeared as though mothers were more inclined to engage in studies concerning parenting and education involvement. The sample was also recruited online via Facebook, which could have potentially excluded parents without internet access or access to such social media platforms.

In terms of the measurement, parents were allowed to select only one reason for their child's success. This simplified the analysis but may not have reflected how people naturally thought, as attributions are multi-causal (Weiner, 2006). This limitation might have narrowed the findings. Future research should consider using open-ended responses or allowing for multiple answers. Additionally, a few parents rated their child as underperforming, limiting meaningful comparison between success and failure attribution. Note that both dimensions are key in attribution theory (Weiner, 1985).

Moreover, several variables were recoded or collapsed (e.g., education levels, region, school type) to meet sample-size and distribution requirements for statistical tests, such as multinomial logistic regression. Collapsing levels was appropriate for modal stability but may have led to a loss of detail. Future research should consider larger, more evenly distributed samples for more granular analysis.

The data were also based on parental perception, not standardised or actual student performance. Although this was deliberate to understand subjective attributions, it limited conclusions on the plausible effects of such beliefs on actual learning outcomes.

6.5 Implications and Future Directions

The study contributes to research by presenting parents' perceptions and attributions of their children's mathematics achievement and how these perceptions and attributions could sustain gendered ideas about mathematics ability. It showed that even when girls were seen achieving at a similar level as boys, they were not believed to succeed for the same reasons. Boys were thought to succeed because they were gifted, and girls because they worked hard. The long-term impact on how children view their abilities may be significant. Gendered beliefs affect children's choices about subject pursuit and beliefs in capabilities (Jaremus et al., 2020; Mendick, 2013; Retelsdorf et al., 2015).

These findings also have practical implications for how parents and educators communicate about success in mathematics. Even when achievement levels are similar, repeated explanations that link boys' success to ability and girls' success to effort may shape children's confidence and expectations over time. Raising awareness of attribution patterns within families and communication between schools and families may help reduce the unintended reinforcement of gendered assumptions about mathematical talent.

Building on these findings, future studies should examine how parental beliefs about ability and effort interact with children's perceptions and actual performance over time. There is also a need for research that compares parental attributions across public, private, and international schools in Lebanon, especially given the country's unique education system (Baytiyeh, 2017; Shuayb, 2018). Qualitative work could also

investigate what exactly frames parents' beliefs about ability and effort during day-to-day interaction at home.

This study explored gendered beliefs about mathematical talent among parents of young children. These beliefs were not grounded in actual achievement or evidence of ability, which meant that ability beliefs were potentially passed on through cultural narratives that continue to divide intellectual labour by gender (Walkerdine, 1998). Future challenges lie first and foremost in opening up spaces for different conversations at home before changing school practices.

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References

- Akar, B. (2012). Teaching for citizenship in Lebanon: Teachers talk about the civics classroom. *Teaching and Teacher Education*, 28(3), 470–480. <https://doi.org/10.1016/j.tate.2011.12.002>
- Antoun, M. (2022). Framing the education for gifted Lebanese and gifted refugees in Lebanon. *Frontiers in Psychology*, 13, 1077278. <https://doi.org/10.3389/fpsyg.2022.1077278>
- Antoun, M., Kronborg, L., & Plunkett, M. (2020). Investigating Lebanese primary school teachers' perceptions of gifted and highly able students. *Gifted and Talented International*, 35(1), 39–57.
- Antoun, M., & Plunkett, M. (2023). A roadmap for change: Charting the course of gifted educational provision in Lebanon. *International Journal of Educational Reform*, 32(3), 279–293. <https://doi.org/10.1177/10567879231163538>
- Antoun, M., Younes, R., & Salloum, S. (2023). Investigating the status of highly able students through the lens of the Lebanese national policy and the mathematics and science centralized curricula and textbooks. *European Journal of Science and Mathematics Education*, 11(2), 215–233. <https://eric.ed.gov/?id=EJ1377620>
- Baydas, O., Kucuk, S., Yilmaz, R. M., Aydemir, M., & Goktas, Y. (2015). Educational technology research trends from 2002 to 2014. *Scientometrics*, 105(1), 709–725. <https://doi.org/10.1007/s11192-015-1693-4>
- Baytiyeh, H. (2017). Has the educational system in Lebanon contributed to the growing sectarian divisions? *Education and Urban Society*, 49(5), 546–559. <https://doi.org/10.1177/0013124516645163>
- Bian, L., Leslie, S., Murphy, M. C., & Cimpian, A. (2018). Messages about brilliance undermine women's interest in educational and professional opportunities. *Journal of Experimental Social Psychology*, 76, 404–420. <https://doi.org/10.1016/j.jesp.2017.11.006>
- BouJaoude, S., & Ghaith, G. (2006). Educational reform at a time of change: The case of Lebanon. *Education reform in societies in transition* (pp. 191–209). Brill.
- Bourdieu, P., & Biggart, N. W. (2002). The forms of capital. (pp. 280–291). Blackwell Publishers Ltd. <https://doi.org/10.1002/9780470755679.ch15>
- Brislin, R. W. (1970). Back-translation for cross-cultural research. *Journal of Cross-Cultural Psychology*, 1(3), 185–216. <https://doi.org/10.1177/135910457000100301>
- Card, D., & Payne, A. A. (2020). High school choices and the gender gap in STEM. *Economic Inquiry*, Null, 1–20. <https://doi.org/10.1111/ecin.12934>

- Carlana, M., & Corno, L. (2021). Parents and peers: Gender stereotypes in the field of study. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3960154
- Caruana, E. J., Roman, M., Hernández-Sánchez, J., & Solli, P. (2015). Longitudinal studies. *Journal of Thoracic Disease.*, 7(11), E537–E540. <https://doi.org/10.3978/j.issn.2072-1439.2015.10.63>
- Cimpian, J. R., Lubienski, S. T., Timmer, J. D., Makowski, M. B., & Miller, E. K. (2016). Have gender gaps in math closed? achievement, teacher perceptions, and learning behaviors across two ECLS-K cohorts. *AERA Open*, 2(4) <https://doi.org/10.1177/2332858416673617>
- Dai, D. Y. (2018). A history of giftedness: A century of quest for identity. (pp. 3–23). American Psychological Association. <https://doi.org/10.1037/0000038-001>
- DeVellis, R. F., & Thorpe, C. T. (2021). *Scale development: Theory and applications* (5th ed.). SAGE Publications.
- Dotti, S., Giulia, M., & Quaranta, M. (2017). The best is yet to come? attitudes toward gender roles among adolescents in 36 countries. *Sex Roles*, 77(1-2), 30–45. <https://doi.org/10.1007/s11199-016-0698-7>
- Dweck, C. S. (2006). *Mindset: The new psychology of success*. Random House.
- El Khoury, S. (2014). *Elementary teachers' perceptions of giftedness in schools in Lebanon*. American University of Beirut. <https://doi.org/http://hdl.handle.net/10938/10109>
- El Takach, S., & Yacoubian, H. A. (2020). Science teachers' and their students' perceptions of science and scientists. *International Journal of Education in Mathematics, Science and Technology*, 8(1), 65–75. <https://eric.ed.gov/?id=EJ1240534>
- Ernest, P. (1995). Values, gender and images of mathematics: A philosophical perspective. *International Journal of Mathematical Education in Science and Technology*, 26(3), 449–462. <https://doi.org/10.1080/0020739950260313>
- Espinoza, P., Arêas da Luz Fontes, A. B., & Arms-Chavez, C. (2014). Attributional gender bias: Teachers' ability and effort explanations for students' math performance. *Social Psychology of Education*, 17(1), 105–126. <https://doi.org/10.1007/s11218-013-9226-6>
- Faour, M. (2012). The Arab world's education report card: School climate and citizenship skills. *Carnegie endowment for international peace*
- Fennema, E., & Peterson, P. L. (1985). Autonomous learning behavior: A possible explanation of sex-related differences in mathematics. *Educational Studies in Mathematics*, 16(3), 309–311. <https://doi.org/10.1007/BF00776738>
- Fennema, E., Peterson, P. L., Carpenter, T. P., & Lubinski, C. A. (1990). Teachers' attributions and beliefs about girls, boys, and mathematics. *Educational Studies in Mathematics*, 21(1), 55–69. <https://doi.org/10.1007/BF00311015>
- Forgasz, H. J., & Leder, G. C. (2017). Persistent gender inequities in mathematics achievement and expectations in Australia, Canada and the UK. *Mathematics Education Research Journal*, 29(3), 261–282. <https://doi.org/10.1007/s13394-017-0190-x>
- Frenzel, A. C., & Stephens, E. J. (2013). Emotions. In N. C. Hall, & T. Goetz (Eds.), *Emotion, motivation, and self-regulation: A handbook for teachers* (pp. 1–56). Emerald Publishing Limited.
- Galdi, S., Cadinu, M., & Tomasetto, C. (2014). The roots of stereotype threat: When automatic associations disrupt girls' math performance. *Child Development*, 85(1), 250–263. <https://doi.org/10.1111/cdev.12128>

- Gálvez, R. H., Tiffenberg, V., & Altszyler, E. (2019). Half a century of stereotyping associations between gender and intellectual ability in films. *Sex Roles, 81*(9–10), 643–654. <https://doi.org/10.1007/s11199-019-01019-x>
- Georgiou, S. N., Christou, C., Stavrinides, P., & Panaoura, G. (2002). Teacher attributions of student failure and teacher behavior toward the failing student. *Psychology in the Schools, 39*(5), 583–595. <https://doi.org/10.1002/pits.10049>
- Giménez-Nadal, J. I., Mangiavacchi, L., & Piccoli, L. (2019). Keeping inequality at home: The genesis of gender roles in housework. *Labour Economics, 58*, 52–68. <https://doi.org/10.1016/j.labeco.2019.03.006>
- Gracia, P., & Ghysels, J. (2017). Educational inequalities in parental care time: Cross-national evidence from Belgium, Denmark, Spain, and the United Kingdom. *Social Science Research, 63*, 166–180. <https://doi.org/10.1016/j.ssresearch.2016.09.016>
- Gravetter, F. J., Wallnau, L. B., Forzano, L. B., & Witnauer, J. E. (2020). *Essentials of statistics for the behavioral sciences*. Cengage Learning.
- Hariz, Z., & Moukarzel, D. (2019). Principals' and teachers' perceptions of students' learning in math classes in single-sex versus co-educational public schools in Beirut-Lebanon. *Lebanese Scientific Journal, 19*(3), 486–507. <https://doi.org/10.22453/LSJ-019.3.486507>
- Heyder, A., Steinmayr, R., & Kessels, U. (2019). Do teachers' beliefs about math aptitude and brilliance explain gender differences in children's math ability self-concept? *Frontiers in Education (Lausanne), 4*, 34. <https://doi.org/10.3389/feduc.2019.00034>
- Heyder, A., Weidinger, A. F., Cimpian, A., & Steinmayr, R. (2020). Teachers' belief that math requires innate ability predicts lower intrinsic motivation among low-achieving students. *Learning and Instruction, 65*, 101–220. <https://doi.org/10.1016/j.learninstruc.2019.101220>
- Hoffman, M. (2020). Religion, sectarianism, and democracy: Theory and evidence from Lebanon. *Political Behavior, 42*(4), 1169–1200. <https://doi.org/10.1007/s11109-019-09538-9>
- Huston, A. C. (2015). On 'the role of parents in the ontogeny of achievement-related motivation and behavioral choices'. *Monographs of the Society for Research in Child Development, 80*(2), 152–157. <https://doi.org/10.1111/mono.12165>
- IBM Corp. (2022). IBM SPSS Amos (version 29.0) [computer software]. <https://doi.org/https://www.ibm.com/products/structural-equation-modeling-sem>
- Jaremus, F., Gore, J., Prieto-Rodriguez, E., & Fray, L. (2020). Girls are still being 'counted out': Teacher expectations of high-level mathematics students. *Educational Studies in Mathematics, 105*(2), 219–236. <https://doi.org/10.1007/s10649-020-09986-9>
- Kim, S., Jin, K.-S., & Bian, L. (2024). Gender brilliance stereotype emerges early and predicts children's motivation in South Korea. *Child Development, 95*(3), 913–928. <https://doi.org/10.1111/cdev.14043>
- Kostenko, V. V., Kuzmichev, P. A., & Ponarin, E. D. (2016). Attitudes towards gender equality and perception of democracy in the Arab world. *Democratization, 23*(5), 862–891. <https://doi.org/10.1080/13510347.2015.1039994>
- Lavy, V., & Sand, E. (2015). On the origins of gender human capital gaps. *Journal of Public Economics, 165*, 263–279. <https://doi.org/10.3386/w20909>

- Lazarides, R., Rubach, C., & Ittel, A. (2017). Adolescents' perceptions of socializers' beliefs, career-related conversations, and motivation in mathematics. *Developmental Psychology*, 53(3), 525–539. <https://doi.org/10.1037/dev0000270>
- Leslie, S., Cimpian, A., Meyer, M., & Freeland, E. (2015). Expectations of brilliance underlie gender distributions across academic disciplines. *Science (American Association for the Advancement of Science)*, 347(6219), 262–265. <https://doi.org/10.1126/science.1261375>
- Lee, H. J., Lee, J., Song, J., Kim, S., & Bong, M. (2022). Promoting children's math motivation by changing parents' gender stereotypes and expectations for math. *Journal of Educational Psychology*, 114(7), 1567–1588. <https://doi.org/10.1037/edu0000743>
- Lorber, J. (2010). *Gender inequality: Feminist theories and politics*. Oxford University Press.
- Mackey, S. (2006). *Lebanon: A house divided*. WW Norton & Company.
- Martín-Gutiérrez, J., Mora, C. E., Añorbe-Díaz, B., & González-Marrero, A. (2017). Virtual technologies trends in education. *Eurasia Journal of Mathematics, Science and Technology Education*, 13(2), 469. <https://doi.org/10.12973/eurasia.2017.00626a>
- McCoy, S., Byrne, D., & O'Connor, P. (2022). Gender stereotyping in mothers' and teachers' perceptions of boys' and girls' mathematics performance in Ireland. *Oxford Review of Education*, 48(3), 341–363. <https://doi.org/10.1080/03054985.2021.1987208>
- Mendick, H. (2013). Choosing subjects: Sociological approaches to young women's subject choices. *Contemporary debates in the sociology of education* (pp. 202–217). Springer.
- Meyer, M., Cimpian, A., & Leslie, S. (2015). Women are underrepresented in fields where success is believed to require brilliance. *Frontiers in Psychology*, 6, 235. <https://doi.org/10.3389/fpsyg.2015.00235>
- Muradoglu, M., Arnold, S. H., Leslie, S.-J., & Cimpian, A. (2023). “What Does It Take to Succeed Here?”: The Belief That Success Requires Brilliance Is an Obstacle to Diversity. *Current Directions in Psychological Science*, 32(5), 379–386. <https://doi.org/10.1177/09637214231173361>
- Pallant, J. (2016). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS*. Allen & Unwin.
- Passolunghi, M. C., Rueda Ferreira, T. I., & Tomasetto, C. (2014). Math–gender stereotypes and math-related beliefs in childhood and early adolescence. *Learning and Individual Differences*, 34, 70–76. <https://doi.org/10.1016/j.lindif.2014.05.005>
- Patton, M. Q. (1990). *Qualitative evaluation and research methods*. SAGE Publications, Inc. <https://doi.org/1990-97369-000>
- Ponarin, E. D., & Kostenko, V. V. (2013). Attitude to gender equality in the Arab East.
- Räty, H., & Kasanen, K. (2013). Parents' perceptions of their child's academic competencies construe their educational reality: Findings from a 9-year longitudinal study. *Journal of Applied Social Psychology*, 43(5), 1110–1119. <https://doi.org/10.1111/jasp.12076>
- Retelsdorf, J., Schwartz, K., & Asbrock, F. (2015). “Michael can't read!” teachers' gender stereotypes and boys' reading self-concept. *Journal of Educational Psychology*, 107(1), 186–194. <https://doi.org/10.1037/a0037107>
- Robinson-Cimpian, J., Lubienski, S. T., Ganley, C. M., & Copur-Gencturk, Y. (2014). Teachers' perceptions of students' mathematics proficiency may exacerbate early gender gaps in

- achievement. *Developmental Psychology*, 50(4), 1262–1281.
<https://doi.org/10.1037/a0035073>
- Saat, R. M., Fadzil, H. M., & Way, A. C. (2020). A review of educational research trend in Southeast Asia. *MOJES: Malaysian Online Journal of Educational Sciences*, 8(2), 48–60.
- Sarouphim, K. M. (2010). A model for the education of gifted learners in Lebanon. *International Journal of Special Education*, 25(1), 71–79.
- Sarouphim, K. M. (2009). The use of a performance assessment for identifying gifted Lebanese students: Is DISCOVER effective? *Journal for the Education of the Gifted*, 33(2), 275–295.
<https://doi.org/10.1177/016235320903300206>
- Sarouphim, K. M. (2015). Slowly but surely. *Journal for the Education of the Gifted*, 38(2), 196–211.
<https://doi.org/10.1177/0162353215578278>
- Sarouphim, K. M., & Chartouny, M. (2017). Mathematics education in Lebanon: Gender differences in attitudes and achievement. *Educational Studies in Mathematics*, 94(1), 55–68.
<https://doi.org/10.1007/s10649-016-9712-9>
- Shuayb, M. (2018). Who shapes education reform policies in Lebanon? *Compare: A Journal of Comparative Education*, 49(4), 1–17. <https://doi.org/10.1080/03057925.2018.1434409>
- Sinabian, L. (2021). *Principals' and teachers' perceptions of giftedness and programs for gifted students at the Armenian schools in Lebanon*. Lebanese American University.
<https://doi.org/10.26756/th.2022.242>
- Skaalvik, E. M., Federici, R. A., & Klassen, R. M. (2015). Mathematics achievement and self-efficacy: Relations with motivation for mathematics. *International Journal of Educational Research*, 72, 129–136. <https://doi.org/10.1016/j.ijer.2015.06.008>
- Slauson-Blevins, K., & Johnson, K. M. (2016). Doing gender, doing surveys? Women's gatekeeping and men's non-participation in multi-actor reproductive surveys. *Sociological Inquiry*, 86(3), 427–449. <https://doi.org/10.1111/soin.12122>
- Smale-Jacobse, A., Meijer, A., Helms-Lorenz, M., & Maulana, R. (2019). Differentiated instruction in secondary education: A systematic review of research evidence. *Frontiers in Psychology*, 10, 2366. <https://doi.org/10.3389/fpsyg.2019.02366>
- Sternberg, R. J., Davidson, J. E., & Feldhusen, J. F. (2005). Giftedness, talent, expertise, and creative achievement. *Conceptions of Giftedness*, 2, 64–79.
<https://doi.org/10.1017/CBO9780511610455.006>
- Storage, D., Horne, Z., Cimpian, A., & Leslie, S. (2016). The frequency of “brilliant” and “genius” in teaching evaluations predicts the representation of women and African Americans across fields. *PLoS ONE*, 11(3), e0150194. <https://doi.org/10.1371/journal.pone.0150194>
- Subotnik, R. F., Paula Olszewski-Kubilius, & Worrell, F. C. (2011). Rethinking giftedness and gifted education. *Psychol Sci Public Interest*, 12(1), 3–54.
<https://doi.org/10.1177/1529100611418056>
- Tiedemann, J. (2000). Parents' gender stereotypes and teachers' beliefs as predictors of children's concept of their mathematical ability in elementary school. *Journal of Educational Psychology*, 92(1), 144–151. <https://doi.org/10.1037/0022-0663.92.1.144>
- Tollefson, J. W., & Tsui, A. B. M. (2003). The centrality of medium-of-instruction policy in sociopolitical processes. *Medium of instruction policies: Which agenda? whose agenda?* (pp. 1–18)
<https://doi.org/10.4324/9781410609328>

- Tomasetto, C., Mirisola, A., Galdi, S., & Cadinu, M. (2015). Parents' math–gender stereotypes, children's self-perception of ability, and children's appraisal of parents' evaluations in 6-year-olds. *Contemporary Educational Psychology*, *42*, 186–198.
<https://doi.org/10.1016/j.cedpsych.2015.06.007>
- Valverde-Berrocoso, J., Garrido-Arroyo, M., Burgos-Videla, C., & Morales-Cevallos, M. (2020). Trends in educational research about e-learning: A systematic literature review (2009–2018). *Sustainability*, *12*(12), 5153. <https://doi.org/10.3390/su12125153>
- Van der Lee, R., & Ellemers, N. (2015). Gender contributes to personal research funding success in The Netherlands, *Proceedings of the National Academy of Sciences*, *112*(40), 12349–12353.
<https://doi.org/10.1073/pnas.1510159112>
- Walkerdine, V. (1988). *The mastery of reason: Cognitive development and the production of rationality*. Routledge.
- Walkerdine, V. (1998). *Counting girls out: Girls and mathematics*. Falmer Press.
- Wang, H., Hall, N. C., & Rahimi, S. (2015). Self-efficacy and causal attributions in teachers: Effects on burnout, job satisfaction, illness, and quitting intentions. *Teaching and Teacher Education*, *47*, 120–130. <https://doi.org/10.1016/j.tate.2014.12.005>
- Weiner, B. (1974). *Achievement motivation and attribution theory*. General Learning Press.
- Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review*, *92*(4), 548–573. <https://doi.org/10.1037/0033-295X.92.4.548>
- Weiner, B. (2000). Intrapersonal and interpersonal theories of motivation from an attributional perspective. *Educational Psychology Review*, *12*(1), 1–14.
<https://doi.org/10.1023/A:1009017532121>
- Weiner, B. (2005). Motivation from an attribution perspective and the social psychology of perceived competence. In A. J. Elliot, & C. S. Dweck (Eds.), *Handbook of competence and motivation* (pp. 73–84). The Guilford Press.
- Weiner, B. (2006). *Social motivation, justice, and the moral emotions: An attributional approach*. Lawrence Erlbaum Associates.
- Weiner, B. (2010). The development of an attribution-based theory of motivation: A history of ideas. *Educational Psychologist*, *45*(1), 28–36. <https://doi.org/10.1080/00461520903433596>
- Woodcock, S., & Jiang, H. (2013). Teachers' causal attributional responses of students with learning disabilities in China. *Learning and Individual Differences*, *25*, 163–170.
<https://doi.org/10.1016/j.lindif.2013.01.016>
- Woodcock, S., & Vialle, W. (2016). An examination of pre-service teachers' attributions for students with specific learning difficulties. *Learning and Individual Differences*, *45*, 252–259.
<https://doi.org/10.1016/j.lindif.2015.12.021>
- Woolfson, L. M., & Brady, K. (2009). An investigation of factors impacting on mainstream teachers' beliefs about teaching students with learning difficulties. *Educational Psychology*, *29*(2), 221–238. <https://doi.org/10.1080/01443410802708895>
- Yamamoto, Y., & Holloway, S. D. (2010). Parental expectations and children's academic performance in sociocultural context. *Educational Psychology Review*, *22*(3), 189–214.
<https://doi.org/10.1007/s10648-010-9121-z>

- Yee, D. K., & Eccles, J. S. (1988). Parent perceptions and attributions for children's math achievement. *Sex Roles, 19*(5), 317. <https://www.proquest.com/scholarly-journals/parent-perceptions-attributions-childrens-math/docview/1308099848/se-2?accountid=8424>
- Zhao, S., Setoh, P., Storage, D., & Cimpian, A. (2022). The acquisition of the gender-brilliance stereotype: Age trajectory, relation to parents' stereotypes, and intersections with race/ethnicity. *Child Development, 93*(5), e581–e597. <https://doi.org/10.1111/cdev.13809>