



Research Article

An Attempt to Explain the Gender Gap Reversal in Academic Achievement in Arab Countries

محاولة لشرح انعكاس الفجوة بين الجنسين في التحصيل الأكاديمي في البلدان العربية

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Abstract

Girls outperforming boys in academic achievement is attracting a lot of attention from educational researchers, and there is a growing literature on the factors explaining this reverse gender gap. This study aims to contribute to the literature by explaining the gender gap reversal in academic achievement of students in four Arab countries participating in the Program for International Student Assessment (PISA) 2012. Using Amartya Sen's capability approach, we define the *desire to learn* as an emotional capability. The latter is a hypothetical construct and a latent (unobservable) variable that we assume predicts achievement positively. We employ the Multiple Indicators Multiple Causes (MIMIC) technique to assess the *desire to learn*. The MIMIC estimation model is used to calculate the *desire to learn* scores for males and females. Our findings demonstrate that girls have a far higher score of *desire to learn* than boys which explains their outperformance.

المخلص

تفوق الفتيات على الذكور في التحصيل الدراسي يجذب الكثير من الاهتمام من الباحثين التربويين، وهناك بحوث متزايدة حول العوامل التي تفسر هذه الفجوة العكسية بين الجنسين. تهدف هذه الدراسة إلى المساهمة في البحوث العلمية من خلال شرح انعكاس الفجوة بين الجنسين في التحصيل الأكاديمي للطلاب في أربع دول عربية شاركت في تقييمات PISA 2012. باستخدام نهج قدرة أمارتيا سين (Sen Amartya)، نحدد الرغبة في التعلم كقدرة عاطفية. هذه الأخيرة هي بناء افتراضي ومتغير كامن (غير قابل للرصد) نفترض أنه يؤثر بشكل إيجابي على التحصيل الدراسي. استخدمنا في هذه الورقة تقنية المؤشرات المتعددة الأسباب المتعددة العوامل (MIMIC) لتقييم الرغبة في التعلم. يستخدم نموذج تقدير MIMIC لحساب درجات الرغبة في التعلم للذكور والإناث، وتوضح النتائج التي توصلنا إليها أن الفتيات لديهن درجة أعلى بكثير من الرغبة في التعلم من الذكور مما يفسر تفوقهن في الأداء.

Keywords: Academic achievement, Capability approach, Desire to learn, Gender gap reversal, Multiple Indicators Multiple Causes (MIMIC)

الكلمات المفتاحية: نهج قدرة _ انعكاس الفجوة بين الجنسين _ التحصيل الأكاديمي للطلاب _ الرغبة في التعلم _ تقنية المؤشرات المتعددة الأسباب المتعددة العوامل (MIMIC)

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1. Introduction

Gender issues have been at the forefront of the development debates. These debates focused on promoting girls' education, health, employment, and greater political rights. Because of the implications for social and economic development, one central issue has been female participation in schooling, measured by the portion of student enrollment which was female. Governments in the Middle East and North Africa region (MENA) have done much to reduce the gender gaps to economic and social development. However, this progress, while substantial, was always seen as females "catching up" with males in terms of human capital indicators such as access to schooling and educational attainment. Nevertheless, in the MENA region, and in the Gulf States in particular, females have surpassed males in one critical indicator: academic achievement (Ridge, 2014). Today, females outperform males in mathematics, science, and reading achievement. And although the tendency for females to outperform males is not limited to the MENA region, the area of the world where this "reverse gender gap" is greatest is in the Gulf States of the MENA region (Ridge, 2014).

This article will explore the reasons why. More precisely, we address the following question: What explains today's girls' outperformance in the MENA region? To answer this question, we will employ the concepts advanced by Amartya Sen's theory of "capability." We will define and analyze an emotional capability that we call the *desire to learn* and conduct our empirical analysis using Multiple Indicators Multiple Causes (MIMIC) method in an attempt to detect its effect on overall achievement and to measure it for boys and girls separately. Hence, our hypothesis is the following: Girls have more *desire to learn* than boys which positively predicts their higher achievement.

In this article, we make four contributions. First, we intend to provide a measure for the hypothetical capability construct – the *desire to learn* – using PISA 2012 Data by employing the MIMIC model. Second, the paper extends previous research on the explanation of factors responsible for the students' achievement gap. We will compare the *desire to learn* scores of boys and girls. Third, this study adds to the modest body of empirical quantitative research that attempts to apply the capabilities framework. Fourth, the concept of desire was applied to different specific domains including eating, sex, aggression, substance use, shopping, and social media (Hofmann & Nordgren, 2015). We contribute to this literature by applying this concept to education and more precisely to educational achievement.

2. Overview of the gender gaps in education

Gender-based inequalities are a universal and pervasive characteristic of all societies, today and in history. One of the most crucial dimensions in which gender differences manifest themselves is in human capital accumulation and its acquisition through education. The gender equality is of high importance, leading the United Nations Educational, Scientific and Cultural Organization (UNESCO) to declare gender equality as one of the most important goals for education (UNESCO, 2015a), and ultimately to incorporate this aim within the framework of sustainable development goals (United Nations, 2018). In the literature, we can distinguish between the gender gap in access to schooling and the gender gap in educational performance. In this section, we highlight the gender gap in participation in primary, secondary, and tertiary education, as well the gender gap in educational performance across MENA countries.

2.1. Gender gap in participation

Historically, females in the MENA region have had less access to education than their male counterparts. MENA countries have made tremendous progress in closing gender gaps in enrollment at all levels of education.

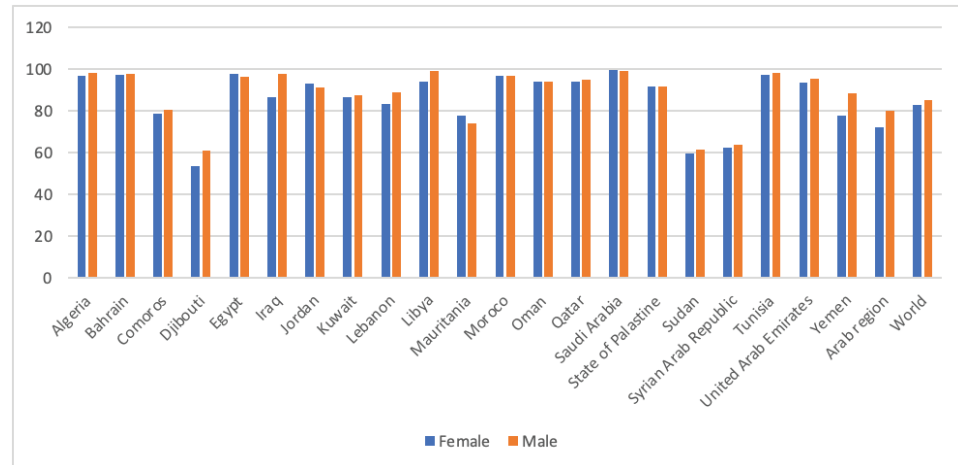
2.1.1. Primary school

In 2017, the school Net Enrolment Rate (NER¹) for girls increased significantly to 83%, while the boys had a modest increase to 85% (United Nations, 2019). Most Arab countries were within the reach of or have achieved universal primary education for both sexes. It is worth noting that the latest available data in Djibouti, Mauritania, the Sudan, and the Syrian Arab Republic showed an NER for both sexes of <80% (Figure 1). Those countries face the challenge of increasing the number of children in school.

Access to education has improved in the Arab States (Figure 2), and there has been a clear trend in reducing gender disparities in primary net enrolment ratios for the majority of Arab countries. In all Arab countries, the gender gap declined by 6 percentage points between 2000 and 2017 (United Nations, 2019).

Figure 1

Net enrolment rate in primary education, latest available data (percentage)

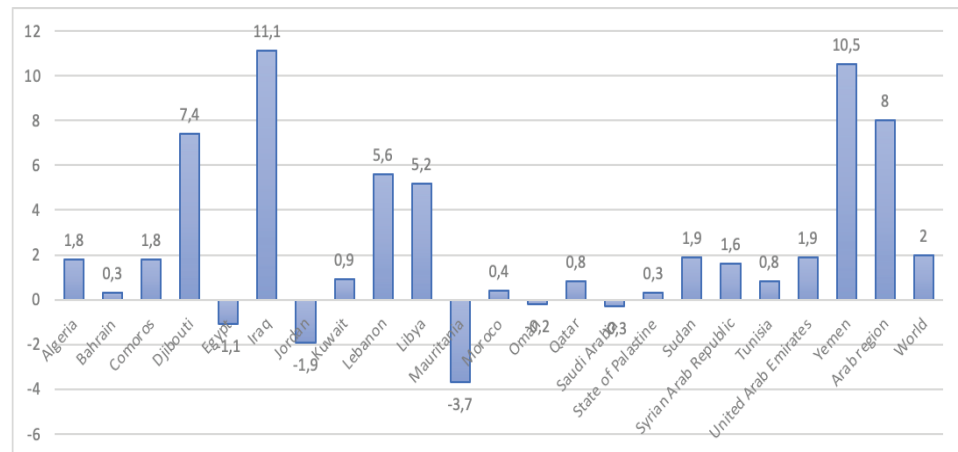


Note: See Table A1 for the latest available data

Source: UNESCO, Institute for Statistics (2019)

Figure 2

Gender Gap² in primary education, latest available data (percentage)



Note: See Table A-1 for the latest available data

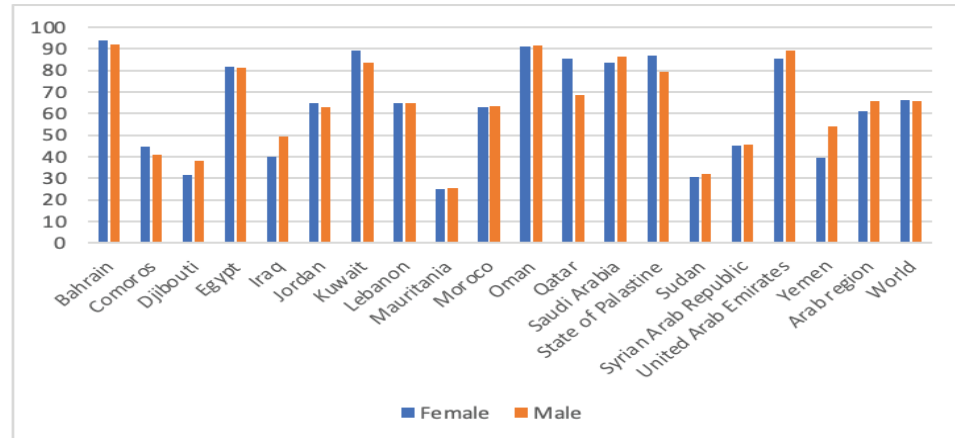
Source: UNESCO, Institute for Statistics (2019).

2.1.2. Secondary school

The level of girls’ secondary school enrollment is a good indicator of women’s empowerment because it can show whether equality has been achieved at a high or low level of enrollment. Figure 3 shows that the net enrolment ratio in secondary is extremely low for both sexes in Mauritania (girls 25% and boys 26%) and in Sudan (girls 31% and boys 32%). According to the UN statistics (2019), the gender gap was largest in

Figure 3

Net enrolment rate in secondary education, latest available data (percentage)



Note: See Table A-2 for the latest available data.

Source: UNESCO, Institute for Statistics (2019).

Yemen (14 percentage points) followed by Iraq (10 percentage points), indicating a severe disadvantage for girls. However, there was a reverse gender gap – meaning a higher rate for girls than for boys – in other countries such as Bahrain, Comoros, Egypt, Jordan, Kuwait, Lebanon, the State of Palestine, and Qatar (United Nations, 2019).

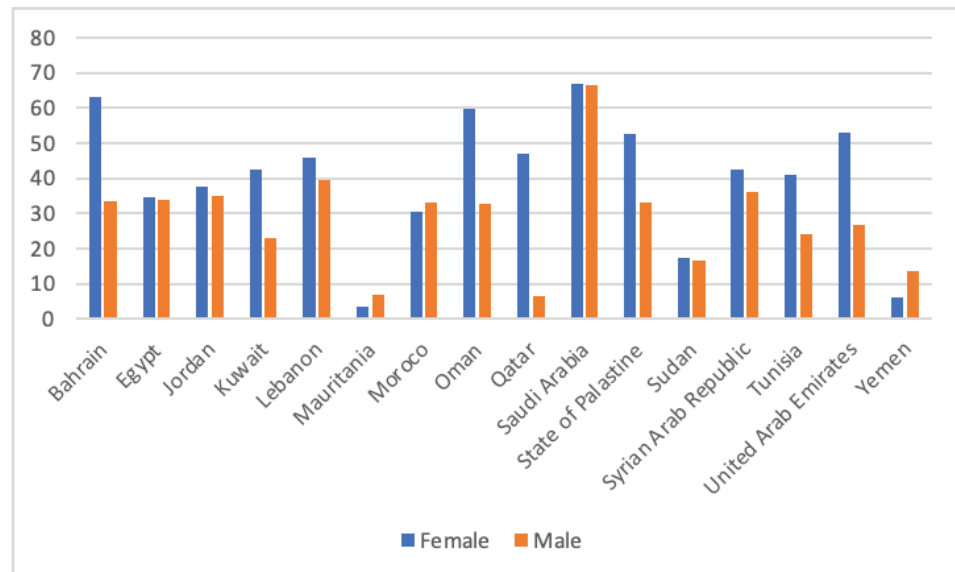
2.1.3. Higher education

The percentage of young people (aged 19–23 years) who are enrolled in tertiary education varies significantly between countries (Figure 3). Lowest gross enrolment ratios (GER³) were in Mauritania and Yemen for both sexes (United Nations, 2019). In Mauritania, few young people were enrolled in university (females 4% and males 7%). While in Yemen, the gross enrolment ratios were 6% for females and 14% for males. Enrolment in tertiary education among Arab States was highest in Saudi Arabia for both females and males (67%). In the majority of Arab countries, where data were available, the gender gap favors women. The gap was greatest in Qatar, where the percentage of women enrolled in higher education is 47% at standard tertiary age, compared to just over 6% of men.

The magnitude of the gender gap in primary school completion is smaller than for secondary school completion and tertiary enrollment (Bossavie & Kannine, 2018). Gender inequalities in primary school enrollment have declined in recent decades, leading some observers to assume that disparities in educational enrollment are now limited to secondary and higher education (Psaki et al, 2018). Furthermore, while gender

Figure 4

Gross enrolment ratio in tertiary education, latest available data (percentage)



Note: See Table A-3 for the latest available data.

Source: UNESCO, Institute for Statistics (2019).

gaps in education vary by country, they are generally wider when literacy rates are lower (Figure 4). In 2016, 750 million adults (15+ years) worldwide lacked basic literacy skills. Globally, there were 92 literate women for every 100 literate men, with as few as 77 literate women for every 100 literate men in low-income countries (United Nations, 2019). However, progress in improving adult female literacy rates in Arab countries from 2000 to 2016 was more than double that of males. For females, it was 13 percentage points against 6 percentage points for males (United Nations, 2019).

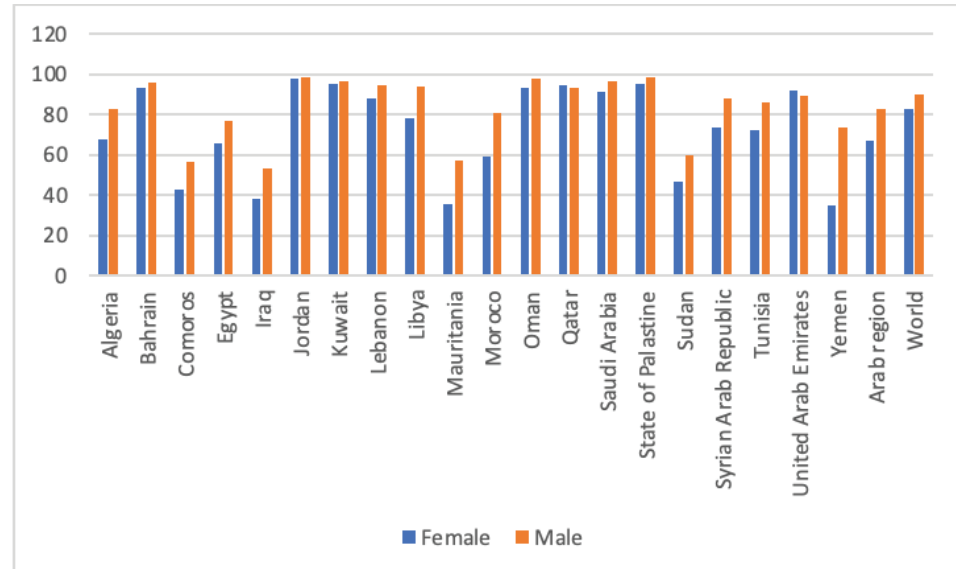
2.2. Gender gap in performance

Differences in achievement between female and male students have always been of interest, not only in educational research but also from a political and economic context (Hausmann et al., 2009; UNESCO, 2015b). These differences are frequently seen as a matter of inequality (Klasen, 2002). Recent international evaluations of academic achievement suggest that today females are beginning to systematically outperform males in multiple dimensions (mathematics, science, and reading) and from early schooling through to college.

Figure 5 shows that, generally, women outperform men in mathematics. The gender parity index was highest in Oman (1.3), slightly less in the State of Palestine, Jordan,

Figure 5

Gender gap in Adult literacy rates, latest available data (percentage)



Note: See Table A-4 for the latest available data.

Source: UNESCO, Institute for Statistics (2019).

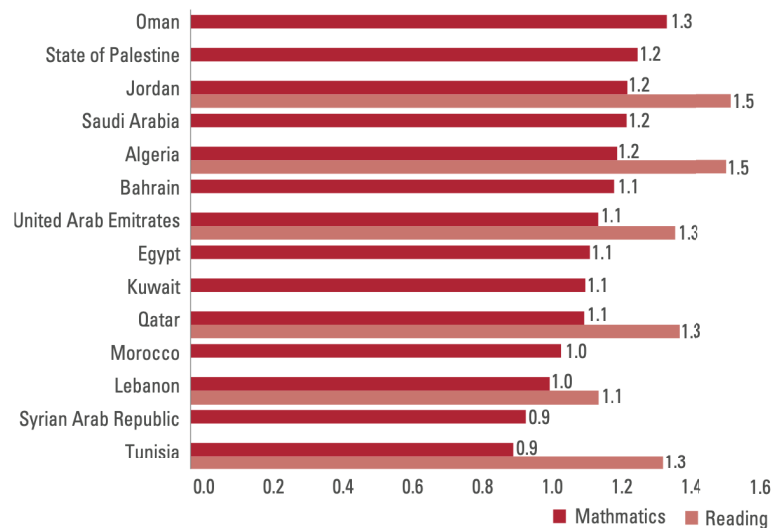
Saudi Arabia, and Algeria (1.2) followed by Bahrain, the United Arab Emirates (UAE), Egypt, Kuwait, and Qatar (1.1). Girls and boys performed equally well in Morocco and Lebanon. In the Syrian Arab Republic and Tunisia, boys outperform girls in mathematics. With regard to reading in lower secondary education in all the countries, girls outperform boys. Jordan and Algeria recorded the highest gender parity index in reading skills at 1.5, followed by Tunisia, Qatar, and the UAE at 1.3, and then Lebanon at 1.1.

3. Gender gap reversal in academic achievement: Literature review

According to the literature on gender disparities in achievement, the gender gap varies with social, cultural, and educational contexts (Lavy & Sand, 2015; Nollenberger et al., 2016; Pope & Sydnor, 2010). Additionally, achievement gaps vary with students' race and ethnicity (Husain & Millimet, 2009; Penner & Paret, 2008) and their families' and peers' socioeconomic status (Entwisle et al., 2007; Legewie and DiPrete, 2012). The gender gap varies with school subjects too and some research has demonstrated that girls do better in reading and boys do better in mathematics (Cobb-Clark & Moschion, 2017; Lavy & Sand, 2015). Dercon and Singh (2013) find that there exhibits a pro-boy advantage in the Ethiopian and Indian in Grade 6 mathematics achievement, while Vietnam displays

Figure 6

Gender Parity Index for achievements in mathematics and reading in lower secondary education, latest available data (percentage)



Source: UNESCO, Institute for Statistics (2019).

a distinctly pro-girl advantage in the same subject. Likewise, Zuze (2015) presents evidence of variation in the magnitude of gender achievement gaps across the East African region, with Kenya and Tanzania showing large pro-boy gaps in SACMEQ⁴ Grade 6 mathematics achievement. A study conducted in the UAE over the period 1991–2000 shows a decline of gender difference in high school final mathematics achievement; more precisely, females outperform males in mathematics achievement (Alkhateeb, 2001). Likely, research in Gulf States has shown that girls' achievement in education is rapidly outpacing that of boys (Ridge, 2014). International educational assessments have also highlighted the gender gap. Several low- and middle-income countries exhibit pro-girl gaps in recent rounds of large-scale educational assessments such as the Progress in International Reading Literacy Study (PIRLS; Mullis et al., 2017), the Trends in International Mathematics and Science Study (TIMSS; Mullis et al., 2016), and the Program for International Student Assessment for Development (PISA-D; Ward, 2020). The mixed results emerging from the different studies suggest that gender issues are unique to countries, and the local context largely determines the factors that contribute to gender achievement gaps (Zuze, 2015). The literature distinguishes between different categories of explanations for gender gaps in educational achievement:

(i) biological, where girls' superior academic achievement is linked to evidence that girls develop the cognitive skills that underpin learning earlier than boys (Andreoni et al., 2019);

(ii) parents' gender-specific expectations and investments in their children (Mencarini et al., 2019);

(iii) social and cultural influences (Nollenberger et al., 2016); and

(iv) schooling, where it is argued that educational practices favor girls (Entwisle et al., 2007).

Why are girls outperforming boys today? What explains this significant shift? To explain this tendency, we will introduce the concept of the *desire to learn*. We argue that one of the characteristics that differentiates boys and girls in terms of achievement is their *desire to learn*. Desires are known to be pervasive and essential in everyday life, motivating people to attend to fundamental wants and needs (Hofmann & Nordgren, 2015). The concept of desire was applied to different specific domains including eating, sex, aggression, substance use, shopping, and social media (Hofmann & Nordgren, 2015). We contribute to this literature by applying this concept to education and more precisely to educational achievement. We will assume that the more one experiences a *desire to learn*, the more one is able to better achieve. To put theory to the *desire to learn* in our context, we refer to Sen's capability approach.

4. Amartya Sen's capability approach

In Sen's capability approach, the focus is on two core concepts: functionings and capabilities. A functioning is an achievement of a person: what he/she manages to do, given his/her personal characteristics and external circumstances (Sen, 1985). The functionings include longevity, nourishment, basic health, avoiding epidemics, and being literate. A capability is based on freedom and it is the ability to do or be. In other words, capabilities refer to what a person can choose to do or to achieve, that is, the ability to achieve alternative combinations of functionings – being able to be sheltered or educated (Sen, 1987). Hence, functionings represent the actual manifestations of capabilities (Clark, 2005). The capability approach, pioneered by Sen, was further developed by Nussbaum (2000). In the capability literature the questions of which capabilities should be selected as relevant were discussed (Claassen, 2020). Nussbaum (2000) supports a well-defined set of capabilities, which she believes should be enshrined in the constitutions of all countries (Nussbaum, 2000, 2003). Her well-known list of 10 "central human capabilities" include life; bodily health; bodily integrity; senses, imagination, and thought; emotions; practical reason; affiliation; other species; play; and control over one's environment (Anand et al., 2005; Nussbaum, 2006, pp. 76–78).

Although Nussbaum (2000) lists the basic human capabilities, Sen (2008) is disinclined to establish a fixed list of capabilities to go with his capability approach arguing that the wide range of dimensions of capabilities can be used for different purposes (for instance, poverty evaluation, assessment of human rights, assessments of human development, etc.) allowing public authorities to diagnose what is going well or badly in people's lives. So, one strength of Sen's framework is that it is a flexible, multi-purpose framework and can be applied in different ways (Clark, 2005; Robeyns, 2005).

The relation between capabilities and functionings is simple and is described formally in Sen (1985) as follows:

Any individual i possesses certain commodities denoted as Φ_i and referred to as a vector of commodities. These commodities are endowed with certain characteristics $c(\Phi_i)$ and are of two types: tangible and non-tangible (Krishnakumar & Ballon, 2008). The tangible commodities are often the material or physical ones. However, the non-tangible commodities may include the intellectual or the social inputs which are in no way to be neglected. The vector of states of being (functionings) is denoted as \mathbf{b}_i where:

$$b_i = f_i(c(\Phi_i | z_i, z_{ext}))$$

f_i is a conversion function particular to each individual i . It maps the characteristics of commodities into the space of functionings given his personal characteristics (\mathbf{z}_i) and external circumstances (\mathbf{z}_{ext}).

The capability approach has provided a theoretical background to a growing body of empirical studies (Di Tommaso, 2007; Krishnakumar & Ballon, 2008; Martinetti, 2000) beginning with the construction of the Human Development Index (UNDP, 1990).

This study aims to use the capability approach to explain differences in student achievement in the PISA 2012 evaluation between boys and girls using the concept of *desire to learn*. The latter can be considered, according to Nussbaum's (2000) list of capabilities, as an emotion that is being able to have attachments to things which is in this case attachment to better educational achievement. The *desire to learn* seems to be a capability that people might generally have reason to value, but its requirements vary significantly according to cultural norms from society to society and for different groups within each society.

5. Latent variable model

One of the key elements of our operationalization approach is the specification of capability as latent (unobservable) variable. We propose to use a methodology that suits the *desire to learn* framework and can be practically implemented. Structural equation model (SEM) has been used as a framework for the estimation of capabilities (Di Tommaso, 2007; Krishnakumar & Ballon, 2008). The MIMIC model which belongs to the broader class of SEM adds exogenous causes for the latent factors thus providing an explanation of our capability. The *desire to learn* is assumed to be linked to exogeneous variables like, for instance, gender or family, school factors, etc. So, by specifying the *desire to learn* as a latent (unobservable) variable, we build upon the early work of Jöreskog and Goldberger (1975) where latent variables are hypothetical constructs (not observed) but have implications among observable variables.

The MIMIC approach comprises two parts: a structural equation for students' *desire to learn* which relates the latent variable *desire to learn* to the causes including traditional measures of socioeconomic status and self-reported measures covering students' engagement with and at school, students' drive, disciplinary climate, and teacher–student relations. A measurement equation that links the latent variable to its different indicators (functionings) which correspond to students' achievements in three different domains: mathematics, science, and reading (Diagram 1). Diagram 1 formalizes our framework where boxes contain variables that are observed in the data and the circle contains the unobserved or latent variable. The arrows in the diagram connect the boxes and the circle. When an arrow points from one variable to another, it means that the first variable affects the second.

The specification of the model is as follows:

The latent variable **D** is linearly determined, subject to a disturbance ϵ , by a set of observable causes $X_1 X_2 \dots X_k$.

$$D = \alpha_{1X_1} + \alpha_{2X_2} + \dots + \alpha_{kX_k} + \epsilon$$

$$D = \Omega X + \epsilon,$$

where $\Omega = (\alpha_{1\dots k})$ and $X = (X_1 \dots X_k)$.

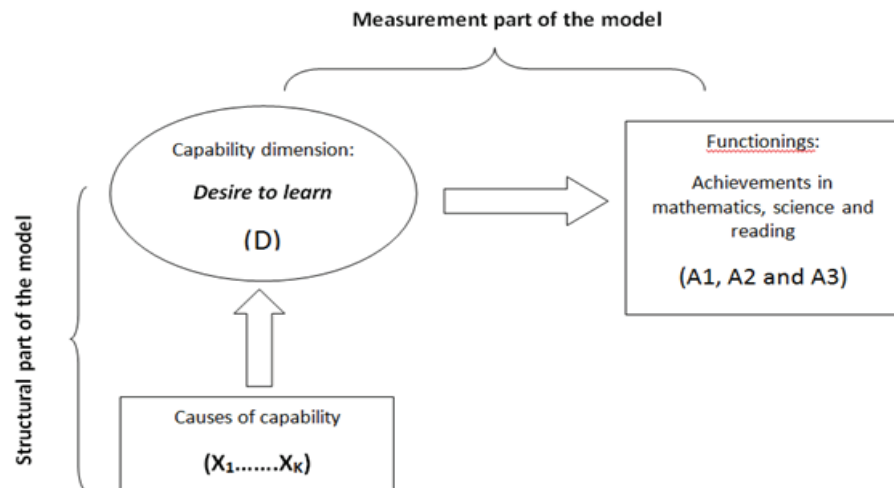
The latent variable **D** affects educational achievements in mathematics, science, and reading.

$$A_i = \beta_i D + \mu_i,$$

where $i = 1, 2,$ and 3 denoting the three subjects and β_i is the coefficient to be estimated.

Figure 7

Structure of the theoretical framework



Hence, our model is composed of two parts: the structural equation (1) and the measurement equation (3). Combining (1) and (3) yields to the following reduced form:

$$A_i = \beta_i \Omega X + \varepsilon + \mu_i$$

$$A_i = \Phi X + \xi,$$

where the reduced form coefficient matrix is $\Phi = \beta_i \Omega$ and the reduced form disturbance vector is $\xi = \beta_i \varepsilon + \mu_i$.

6. Empirical study

We examine the relation between achievement and the *desire to learn*. Our hypothesis is that there is a positive link between achievement and the *desire to learn*. A student who is eager to learn will achieve higher levels of achievement in school. Since the main actors in the educational process are the students, their families, and the school; and in order to have an adequate measure of the *desire to learn*, we combine traditional socioeconomic measures with self-perceived variables about school and teachers, which are supposed to feed this emotion and thus have an impact on student's achievement.

Socioeconomic status of the student, widely debated in the literature for more than three decades, is found to have a powerful impact on students' achievement⁵ (Baker et al., 2002; Bouhlila, 2014, 2015; Heyneman, 2015; Llie & Lietz, 2010). Apart from the background, the student's achievement is influenced by the school environment

Table 1*Number of participating students*

	Number of participating students	Females	Males
Jordan	7038	3615	3423
Qatar	10966	5305	5661
Tunisia	4407	2390	2017
UAE	11500	5792	5708
Total	33911	17102	16809

Source: PISA 2012.

including the disciplinary climate and the teacher–student relations. The school climate is another factor that influences student’s outcomes. Individual school perceptions of school climate are used to calculate the latter. The school climate is a leading factor in explaining student’s learning and achievement (Maxwell et al., 2017). Federici and Shaalvik (2014) find that students’ perceptions of teachers are positively related to their academic achievement. Overall, studies show that students who have good relationships with their teachers do better in school (Crosnoe et al., 2004; Roeser et al., 1996; Skaalvik et al., 2015).

6.1. Data

PISA 2012 data is used. The PISA design process begins with the selection of a sample of schools, followed by a sample of all students in each school. PISA surveys are conducted with 15-year-old students as the target population. The PISA survey is notable in that it examines not only what students know in various domains of mathematics, science, and reading, but also how they can apply what they have learned in various contexts.

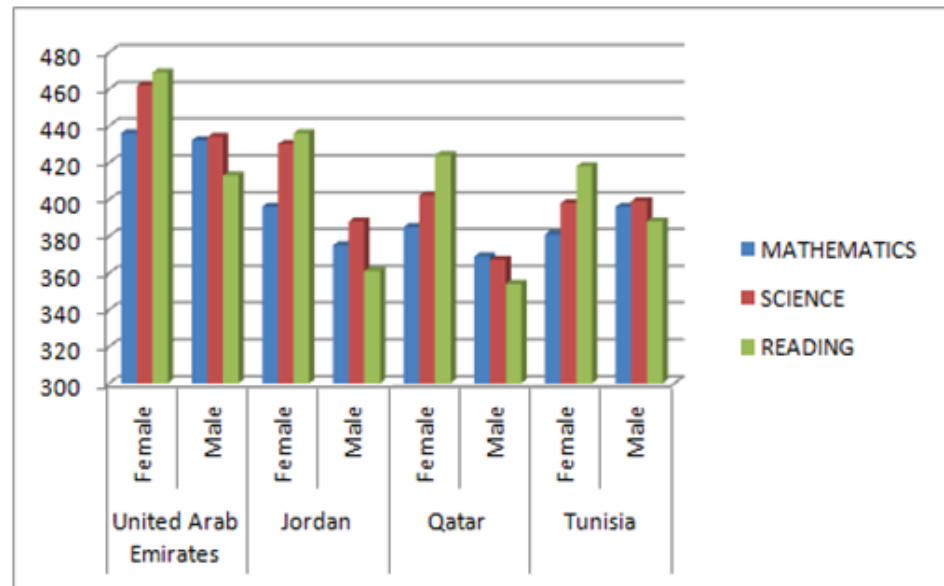
PISA 2012 included four countries from the Middle East and North Africa (MENA): Jordan, Qatar, Tunisia, and the UAE. In terms of GDP per capita, our sample is very heterogeneous, as Qatar and the UAE are high-income countries, while Jordan and Tunisia are middle-income countries. The 2012 survey covers 33,911 students (Table 1) and contains a plethora of data about students’ backgrounds and school environments.

Additionally, PISA 2012 revealed that females outperform males in the three evaluations across the countries of our study (Figure 8).

The variables used for the purpose of this study are the highest level of parents’ education, home educational resources, and student immigration status which are indicators of socioeconomic status. Individual characteristics such as age and gender are also used. For the school environment, we retained self-perceived indicators about the

Figure 8

MENA scores by gender (PISA 2012)



Source: PISA 2012 data.

disciplinary climate and the teacher–student relations. Furthermore, in the psychological literature, other aspects explain educational achievements. They include perseverance and having long-term goals (Duckworth et al., 2007). As predictors of the *desire to learn* and thus achievement, we include perseverance and attitudes toward learning outcomes. PISA 2012 indices (OECD, 2013) are used to measure some of these control variables (see Table A-5). It's worth noting that PISA 2012 provides five plausible values for each domain for the outcome variables. We calculated the average of these values separately for each domain. The summary statistics of the different variables used in this study are provided in Table 2.

In all of the countries studied, the sample of students is evenly divided between boys and girls, and all of the students tested are around the age of 15. Furthermore, in Jordan and Tunisia, respectively, 85% and 99% of students are natives. In Qatar, however, these percentages drop to 46% and 45%, respectively. This is unsurprising given that the Gulf States are known for attracting emigrants from all over the world.

In terms of parents' highest educational level, the average ranges from 12 years in Tunisia to 14 years in Qatar and the UAE, demonstrating the Arab countries' educational progress over the decades. Moreover, for all countries, the index of home educational resources is negative, ranging from -0.11 in Qatar to -0.77 in Tunisia. Positive values of this index indicate that students have adequate educational resources (See Table A-5). Furthermore, Jordan and Qatar have negative attitudes toward learning outcomes, or

what they have learned at school. Students in Tunisia and the UAE, on the other hand, feature a positive attitude. Positive values of this index indicate that students have a more favorable attitude toward learning outcomes (see Table A-5).

The mean values of the index of perseverance are low denoting a lack of perseverance among the students in the countries under study. The index of perseverance has a mean value, ranging from 0.11 in Qatar to 0.41 in the UAE, with a maximum of around 3.52 (see Table A-5).

Similarly, the perceived disciplinary climate in all of the participating countries is unfavorable. Except for the UAE, all of the countries' mean values are negative. This index's positive values indicate that the student had a good disciplinary climate in the lessons of the language of instruction (see Table A-5). Finally, low and negative teacher–student relations index mean values indicate that students in the countries under study have a strained relationship with their teachers as higher values on this index indicate positive teacher–student relations (see Table A-5).

6.2. Results

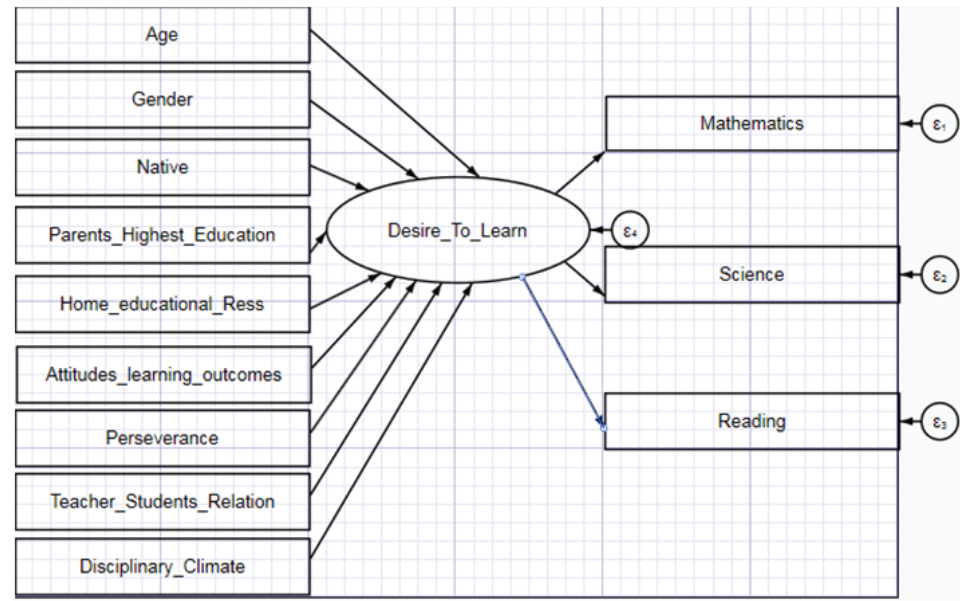
In this subsection, we present the results of the estimation of the structural part of the model and the measurement part of the model according to the path Diagram 2. The *desire to learn* scores are then computed separately for females and males in each participating country. The model is estimated according to the procedure discussed above. Survey adjustment is made in order to obtain reliable coefficient estimates and robust standard errors. The results of the structural model are presented in Table 3. Those of the measurement model are presented in Table 4.

Gender is one of the major influences on a person's *desire to learn*. At 1%, all of the coefficients for this variable are high and significant (except for Tunisia where the coefficient is negative and not significant). This finding supports our hypothesis that girls have a stronger *desire to learn* than boys. It's also worth noting that age has no significant impact on the *desire to learn* in Jordan, Qatar, and the UAE. However, in Tunisia, age positively predicts the *desire to learn* ($\alpha = 13.25$; $p < 0.05$). Being native has a positive impact on the *desire to learn* in Tunisia ($\alpha = 47.84$; $p < 0.01$). Nevertheless, the picture is totally different in Qatar and the UAE, where the *desire to learn* decreases dramatically when students are native. **Being native of the Gulf States, the *desire to learn* by 62.84 points and 49.09 points in Qatar and UAE, respectively, a result which is significant at 1% level.

Table 2
Summary statistics

Variable	Jordan		Qatar		Tunisia		UAE		UAE		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Max
Mathematics	382.73 (71.86)	169.89	670.82	388.55 (93.59)	135.07	737.74	393.47 (71.47)	216.78	672.93	439.48 (83.66)	780.50
Reading	414.40 (71.39)	165.02	605.10	401.95 (102.79)	95.333	755.313	410.09 (77.86)	165.82	650.86	448.54 (87.66)	757.06
Science	421.36 (70.46)	199.86	644.01	397.50 (98.63)	151.47	722.59	406.16 (68.11)	174.97	609.51	457.78 (86.13)	756.37
Age	15.86 (0.27)	15.42	16.33	15.76 (0.29)	15.25	16.25	15.86 (0.28)	15.42	16.33	15.84 (0.28)	16.33
Gender	0.54 (0.49)	0	1	0.52 (0.49)	0	1	0.52 (0.49)	0	1	0.52 (0.49)	1
Native	0.85 (0.34)	0	1	0.46 (0.49)	0	1	0.99 (0.07)	0	1	0.45 (0.49)	1
Parents' highest educational level	13.49 (2.73)	3	16	14.26 (2.99)	3	16	12.08 (4.20)	3	17	14.13 (2.97)	16
Home educational resources	-0.58 (1.22)	-3.93	1.12	-0.11 (1.16)	-3.93	1.12	-0.77 (1.19)	-3.93	1.12	-0.16 (1.11)	1.12
Attitudes toward learning outcomes	-0.18 (0.77)	-2.31	2.35	-0.32 (0.95)	-2.99	2.35	0.24 (1.12)	-2.99	2.35	0.08 (1.06)	2.35
Perseverance	0.35 (1.03)	-4.05	3.52	0.24 (0.98)	-4.05	3.52	0.11 (1.15)	-4.05	3.52	0.41 (0.96)	3.52
Disciplinary climate	-0.17 (1.02)	-2.48	1.85	-0.27 (1.11)	-2.48	1.85	-0.41 (0.90)	-2.48	1.85	0.04 (1.03)	1.85
Teacher-student relations	-0.31 (1.08)	-2.66	2.82	-0.43 (1.11)	-2.66	2.82	-0.26 (1.13)	-2.66	2.82	-0.07 (1.04)	2.82

Note: Standard deviation between brackets. Gender is a dummy variable which takes 1 for females and zero for males. Native is a dummy variable which takes 1 for native and zero otherwise.

Figure 9*The path diagram*

Furthermore, parents' education favors slightly this emotional capability in all countries and so do moderately home educational resources. Turning to the attitudes toward learning outcomes, they have a positive and significant influence in all countries. Perseverance accounts to feed this emotional capability where all the estimated coefficients are positive and significant at 1%. In addition, the perceived teacher–student relation has the expected positive and significant effect in all countries except for Tunisia where the estimated coefficient is positive but not significant. Finally, a good disciplinary climate has a positive and significant influence on the *desire to learn* in Jordan ($\alpha = 6.75$; $p < 0.01$), Qatar ($\alpha = 10.65$; $p < 0.01$), and UAE ($\alpha = 7.91$; $p < 0.01$).

Table 4 reports the estimation results for the measurement model. All the coefficients are significant and show a positive sign, meaning that the *desire to learn* has a positive influence on the three domains: mathematics, reading, and science. For instance, a unit change in the *desire to learn* of children in Jordan results in an increase of 1.05 units in reading achievement and 1.12 units increase in science achievement.

Tables 5 and 6 provide an idea about the quality of fit. In order to study the model fit, a series of indices regarded as the most informative are available to researchers (Hooper et al., 2008). Absolute fit indices determine how well a model fits the sample (McDonald & Ho, 2002). Included in this category is the standardized root mean squared residual (SRMR). The SRMR is the square root of the difference between the residuals of the sample covariance matrix and the hypothesized covariance model. The values of the

Table 3*Structural model results*

	Jordan	Qatar	Tunisia	UAE
Age	7.732 (4.837)	-3.762 (4.525)	13.25** (6.079)	6.018 (4.688)
Gender	24.34*** (2.850)	19.91*** (2.725)	-0.681 (3.752)	19.02*** (2.766)
Native	-8.042** (3.997)	-62.84*** (2.731)	47.84*** (14.68)	-49.09*** (2.834)
Parents' highest educational level	8.667*** (0.974)	8.762*** (0.804)	4.431*** (1.068)	8.733*** (0.946)
Home educational resources	9.370*** (1.211)	12.81*** (1.186)	14.62*** (1.693)	11.53*** (1.271)
Attitudes toward learning outcomes	3.567* (1.954)	11.48*** (1.590)	3.803** (1.737)	6.352*** (1.357)
Perseverance	12.92*** (1.373)	11.56*** (1.504)	8.204*** (1.610)	13.43*** (1.612)
Teacher students relations	6.817*** (1.454)	9.506*** (1.286)	1.071 (1.666)	4.450*** (1.387)
Disciplinary climate	6.750*** (1.395)	10.65*** (1.258)	2.881 (2.039)	7.916*** (1.379)
Observations	2,011	2,878	1,265	3,360

Notes: Robust standard errors in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 4*Measurement model results*

	Jordan	Qatar	Tunisia	UAE
Mathematics <- Desire (Constrained)	1	1	1	1
Reading <- Desire	1.05 (0.02)***	1.05 (0.01)***	1.05 (0.02)***	1.05 (0.01)***
Science <- Desire	1.12 (0.01)***	1.06 (0.007)***	0.99 (0.02)***	1.07 (0.01)***

Notes: Significance levels: ***1%; **5%; *10%. Standard errors between brackets.

SRMR range from zero to 1. Well-fitting models have values less than 0.05 (Byrne, 1998; Diamantopoulos & Siguaw, 2000). Acceptable values are as high as 0.08 (Hu & Bentler, 1999). A perfect fit corresponding to SRMR equals zero. In this case, the model fits well for all the countries since SRMR lies between 0.022 in Qatar and 0.032 in Tunisia. In addition, the R^2 values are very high for the three indicators (>80%) meaning that the *desire to learn* is a principal ingredient of better achievement. Finally, R^2 values for the structural model are reasonable. The predictors selected for the *desire to learn* explain more than 25% of this latent variable for Jordan, Qatar, and the UAE. In Tunisia, they capture one-sixth of the *desire to learn*

Table 5*Fit index*

	Jordan	Qatar	Tunisia	UAE
SRMR	0.031	0.022	0.032	0.024

Note: SRMR: standardized root mean squared residual.

Table 6*Equation-level goodness of fit (R^2)*

	Jordan	Qatar	Tunisia	UAE
Mathematics	0.82	0.92	0.80	0.87
Reading	0.80	0.85	0.74	0.88
Science	0.94	0.94	0.86	0.93
Overall R^2	0.29	0.41	0.17	0.36

After estimating the impact of students' desire to learn on their achievement, we can now calculate its predicted value. Based on these scores, the goal is to compare the desire to learn between girls and boys. We found the expected results (Table 7). Females' desire to learn scores are higher and positive than males' scores. Female students in Jordan have the highest desire to learn, followed by the UAE, Qatar, and Tunisia. Male students in Tunisia, on the other hand, have the highest scores compared to their peers in the other three countries. As a result, our hypothesis is that girls have a greater desire to learn than boys, which predicts their higher academic achievement is confirmed.

7. Discussion and Conclusion

This article tries to explain the gender gap reversal in students' academic performance in PISA 2012 (mathematics, science, and reading) in four MENA countries (Jordan, Qatar, Tunisia, and the UAE). Using Sen's capability approach as a theoretical framework,

Table 7*Standardized desire to learn scores*

	Jordan	Qatar	Tunisia	UAE
Females	0.37 (0.02)	0.14 (0.02)	0.02 (0.037)	0.27 (0.02)
Males	-0.47 (0.03)	-0.16 (0.02)	-0.02 (0.04)	-0.29 (0.02)

Note: Standard errors between brackets.

we propose a hypothetical construct consistent with a capability approach that we call *desire to learn*. The latter is regarded as an emotional capability that we believe predicts achievement. We use the MIMIC model, a subset of SEM, that is modeled using a latent variable framework, for its empirical implementation. The MIMIC model enables us to explicitly test whether the *desire to learn* construct explains performance differences between boys and girls. To measure the *desire to learn*, we use nationally representative PISA 2012 data and a set of variables capturing the home environment which were widely discussed in the literature as directly affecting students' achievements, as well as variables capturing the school environment and variables inherited from the psychological literature deemed to impact students' performance. The MIMIC approach helps to understand how these factors transit to enable better academic achievement.

Our findings suggest that the student's socioeconomic background, as well as factors related to the school environment, play a role in feeding this emotion. There is also evidence that perseverance and attitudes toward learning outcomes predict the *desire to learn* positively. The current study also highlights the fact that immigration status influences one's *desire to learn*. Being a native student of the Gulf States has a negative impact on one's *desire to learn*. Furthermore, our findings show that students' achievement is positively and significantly related to their *desire to learn*. The *desire to learn* scores most likely indicates that girls want to learn more than boys, which explains their superior performance and supports our hypothesis.

But what explains the girls' high scores of the *desire to learn*? We believe that females outperform males for a variety of reasons, the majority of which are social in nature. Girls in the MENA region face several social constraints which seem to be more pronounced in the Gulf States than in the other countries. Social norms control women's choices over domestic roles, early marriage and childbearing. The cultural framework behind such norms emphasizes the perception of men as the main economic providers – the bread earner – and women as mothers and caregivers, thus reinforcing the traditional image of women in the society. As a consequence, girls may consider school as the only path out of their confined social status. As for boys, the encouragement of local employment particularly in Gulf States may have created a lack of encouragement for males in education.

Our findings point to another critical issue. Being a native of the Gulf States has a negative impact on one's *desire to learn*, which means that education isn't as appealing as it should be. A plausible explanation could be the economic benefits that Gulf State natives may enjoy, which may have a negative impact on their *desire to learn*. As formal education allows a person to enter more prestigious occupations and gives greater

opportunity for job mobility and advancement, natives in Qatar and the UAE already enjoy this privilege. Furthermore, there are no discernible qualification barriers to the employment of nationals in the public sector of both states (Randeree, 2012). The policy of *Emiratization* and *Qatarization* has led natives in both countries to be attracted to, and employed in, the public sector because it offers superior employment conditions, higher remuneration, better job security, shorter working hours, generous vacations, and other attractive options. Another fact which calls for our attention is females' participation in the labor force. Girls are, by far, outperforming boys in learning outcomes—with the highest gender gap among all countries. Yet the MENA region has the lowest female labor force participation rates in the world (World Bank, 2019). Female employment rates in the Gulf area continue to lag behind those of males (Labour Statistics, 2020), maybe more for cultural reasons. For instance, many rural UAE national women refuse to work in a mixed-gender environment and prefer instead to work in female-dominated sectors, such as teaching, or opt to remain unemployed (Randeree, 2012).

This paper argues that by considering the *desire to learn* as a capability, it is this emotion that should be considered in determining how much boys and girls differ in school. It can either help or hinder students from pursuing potential functionings. The first broad implication is the need to consider whether policymakers should be concerned with capabilities or functionings. Sen (2008) has generally argued that public policy should focus on capabilities rather than functionings. Given that policies can only influence behavior through the interventions that they enable or support, an effective strategy for increasing students' *desire to learn* must be developed, involving teachers and school staff, psychologists and sociologists, as well as parents.

Our findings point to several future research avenues. First, more research is required using comprehensive and integrative models capable of testing hypotheses on complex and indirect relationships of determinants of gender gap reversal. SEM is a powerful tool for testing such models, and research of this type may help us understand the determinants of the gender gap and how they work. Second, more multidisciplinary research on gender gap reversal is required by combining theories and concepts from various domains (economics, sociology, psychology, etc.).

Academic achievement among students is influenced by both structural and personal factors. As a result, other insights from different disciplines could help us better understand the gender gap reversal in student achievement. More research using qualitative data is also needed to better understand students' low and high *desire to learn* and to devise an effective strategy to improve it.

Finally, a significant limitation of this study should be mentioned. The capability approach is difficult to constrain on an informational and methodological level because it is difficult to constrain the various factors responsible for emotional capability (*desire to learn*).

To summarize, there is no doubt that this paper should be regarded as a very preliminary step toward a more complete and satisfying application of Sen's theory, and many information and methodological issues require additional research to be fully clarified and resolved. It also attempts to explain the gender gap reversal by introducing the concept of a *desire to learn*. Despite these limitations, the findings enable us to draw a number of conclusions about the gender gap reversal. First, multidisciplinary approaches can help us better understand the gender gap reversal. Second, the variables used to explain the gender gap directly may not be direct, but may be mediated by personal–psychological and societal factors.

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Notes

¹the total number of students in the theoretical age group for a given level of education enrolled in that level, expressed as a percentage of the total population in that age group.

²Gender Gap = NER for Male – NER for Female.

³the number of students enrolled in a given level of education, regardless of age, expressed as a percentage of the official school-age population corresponding to the same level of education. For the tertiary level, the population used is the five-year age group starting from the official secondary school graduation age.

⁴the Southern and Eastern African Consortium for Monitoring Educational Quality, a standardized assessment conducted in 15 countries in southern and eastern Africa

⁵there is a huge literature on the impact of socioeconomic status on students' achievement having as a background the Coleman et al. (1966) report

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Annexure

Table A-1

Country	Female	Male	Gender gap	Year
Algeria	96.6	98.4	1.8	2016
Bahrain	97.3	97.6	0.3	2017
Comoros	78.9	80.7	1.8	2017
Djibouti	53.5	60.9	7.4	2018
Egypt	97.6	96.5	-1.1	2017
Iraq	86.6	97.7	11.1	2007
Jordan	93.3	91.4	-1.9	2004
Kuwait	86.8	87.7	0.9	2017
Lebanon	83.5	89.1	5.6	2017
Libya	94.1	99.3	5.2	1981
Mauritania	77.6	73.9	-3.7	2017
Morocco	96.6	97	0.4	2017
Oman	94.2	94	-0.2	2017
Qatar	94	94.8	0.8	2017
Saudi Arabia	99.6	99.3	-0.3	2012
State of Palestine	91.6	91.9	0.3	2017
Sudan	59.5	61.4	1.9	2017
Syrian Arab Republic	62.4	64	1.6	2013
Tunisia	97.2	98	0.8	2009
United Arab Emirates	93.6	95.5	1.9	2016
Yemen	77.7	88.2	10.5	2016
Arab region	72	80	8	2000
World	83	85	2	2017

Source: UNESCO, Institute for Statistics (2019).

Table A-2*Net enrolment rate in secondary education*

Country	Female	Male	Year
Bahrain	93.8	92.1	2017
Comoros	44.8	41.2	2017
Djibouti	31.7	38.3	2015
Egypt	81.6	81.3	2017
Iraq	39.9	49.5	2007
Jordan	65.1	63.2	2017
Kuwait	89.1	83.7	2015
Lebanon	65	64.8	2012
Mauritania	24.9	25.5	2017
Morocco	63	63.6	2017
Oman	90.9	91.5	2017
Qatar	85.4	68.5	2017
Saudi Arabia	83.5	86.4	2013
State of Palestine	87.1	79.5	2017
Sudan	30.8	32.3	2011
Syrian Arab Republic	45.3	45.8	2013
United Arab Emirates	85.6	89.4	2016
Yemen	39.8	54.1	2016
Arab region	61.3	66	2018
World	66.3	66	2018

Source: UNESCO, Institute for Statistics (2019).

Table A-3*Gross enrolment ratio in tertiary education*

Country	Female	Male	Year
Bahrain	63	33.7	2016
Egypt	34.8	34	2016
Jordan	37.5	35	2016
Kuwait	42.7	23	2013
Lebanon	45.8	39.6	2016
Mauritania	3.5	6.9	2016
Morocco	30.7	33.2	2016
Oman	59.7	32.8	2016
Qatar	47.1	6.4	2016
Saudi Arabia	66.7	66.5	2016
State of Palestine	52.8	33.1	2016
Sudan	17.5	16.5	2014
Syrian Arab Republic	42.7	36	2016
Tunisia	41.2	24.1	2016
United Arab Emirates	53.2	26.7	2016
Yemen	6.1	13.7	2011

Source: UNESCO, Institute for Statistics (2019).

Table A-4*Gender gap in adult literacy rates*

Country	Female	Male	Year
Algeria	67.5	82.6	2008
Bahrain	93	95.9	2016
Comoros	42.6	56.5	2012
Egypt	65.5	76.5	2017
Iraq	38	53	2013
Jordan	97.4	98.4	2012
Kuwait	94.9	96.7	2018
Lebanon	88.1	94.3	2009
Libya	77.8	93.9	2004
Mauritania	35.3	57.4	2007
Morocco	59.1	80.4	2012
Oman	93.2	97.4	2017
Qatar	94.2	92.9	2016
Saudi Arabia	91.4	96.5	2013
State of Palestine	95.2	98.6	2016
Sudan	46.7	59.8	2008
Syrian Arab Republic	73.6	87.8	2004
Tunisia	72.2	86.1	2014
United Arab Emirates	91.5	89.5	2005
Yemen	35	73.2	2004
Arab region	67.2	82.6	2016
World	82.7	89.8	2016

Source: UNESCO, Institute for Statistics (2019).

Table A-5*PISA 2012 indices*

Home educational resources The *index of home educational resources* (HEDRES) is based on the items measuring the existence of educational resources at home including a desk and a quiet place to study, a computer that students can use for schoolwork, educational software, books to help with students' schoolwork, technical reference books and a dictionary.

Attitudes toward school (learning outcomes) The *index of attitudes toward school (learning outcomes)* (ATSCHL) was constructed using student responses over the extent they strongly agreed, agreed, disagreed, or strongly disagreed to the following statements when asked about what they have learned in school: School has done little to prepare me for adult life when I leave school; school has been a waste of time; school has helped give me confidence to make decisions; school has taught me things which could be useful in a job.

Perseverance The *index of perseverance* (PERSEV) was constructed using student responses over whether they report that the following statements describe them very much, mostly, somewhat, not much, not at all: When confronted with a problem, I give up easily; I put off difficult problems; I remain interested in the tasks that I start; I continue working on tasks until everything is perfect; when confronted with a problem, I do more than what is expected of me.

Disciplinary climate The *index of disciplinary climate* (DISCLIMA) was derived from students' reports on how often the following happened in their lessons of the language of instruction: i) students don't listen to what the teacher says; ii) there is noise and disorder; iii) the teacher has to wait a long time for the students to <quieten down>; iv) students cannot work well; and v) students don't start working for a long time after the lesson begins. In this index, higher values indicate a better disciplinary climate.

Teacher–student relations The *index of teacher–student relations* (STUDREL) was derived from students' level of agreement with the following statements. The question asked stated "Thinking about the teachers at your school: to what extent do you agree with the following statements": i) Students get along well with most of my teachers; ii) Most teachers are interested in students' well-being; iii) Most of my teachers really listen to what I have to say; iv) if I need extra help, I will receive it from my teachers; and v) Most of my teachers treat me fairly. Higher values on this index indicate positive teacher–student relations.

Source: OECD (2013). Ready to learn: students' engagement, drive and self-beliefs – Volume III.