International Review of Public Administration, 2015
Vol. 20, No. 1, 70–83, http://dx.doi.org/10.1080/12294659.2014.967372

A meta-analysis of gender gap in student achievement in African countries

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We conducted a meta-analysis to examine gender differences in educational assessments in African countries. We analyzed the primary database of the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) assessments. This study included a review of the relevant literature on meta-analysis techniques, and an overview of SACMEQ and gender issues in kindergarten (K)–12 in developing countries. The process of meta-analysis employed in this methodological study included searching, coding, calculation of effect sizes and their variances, weighting, confidence interval plots, Q test, funnel plots, and a discussion of results, implications, and future research. We found a small significant gender difference in mathematics in favor of boys and an insignificant gender difference in reading. Moreover, fertility rate was found to be an important predictor of gender gap in reading and math. Finally, we suggest a few implications for theoretical perspectives by connecting the key findings.

Keywords: SACMEQ; gender gap; Africa

Introduction

There has been increased scholarly interest in the developing economy of places such as African countries and Southern and Eastern Asian countries. Economic theory suggests that a better educated workforce is likely to spur a country's growth (Apple, 1988; 'Closing the gap,' 1995) since education improves a country's wealth. Most developing countries put an emphasis on education to get their citizens out of poor living conditions, and try to improve adult literacy and school enrollment. With all the emphasis and efforts, however, there still exists a 'gender gap' between males and females in developing countries (Gillborn & Youdell, 2000; Lauder, Brown, & Wels, 1997; Weiner, Arnot, & David, 1997). According to the *Economist* ('Closing the gap,' 1995), 'among the 900 million illiterate people in poor countries, women outnumber men by two to one; 60% of the 130 million children with no access to primary school are girls.' Thus, examining differences between males and females in terms of math and reading achievements is a necessary step towards understanding the magnitude of educational inequality.

The developed world has already achieved gender parity when it comes to student achievement. It is the third-world countries, of which African countries are a part, that still struggle with gender disparity in student achievement and education access. The statistical technique of meta-analysis is chosen for this present study because it provides

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an overall picture of the extent of the gender gap. Instead of focusing on just one country, several countries are included, and several studies that have investigated this topic are synthesized in our study. Therefore, the purpose of this methodological study is to investigate whether or not significant differences by gender exist among African countries' kindergarten (K)–12 students in terms of reading and math achievement. This study has three research questions: (1) Is there a gender difference in reading/math achievement levels in African countries? (2) Which country has the largest level of gender gap, and what is the magnitude of the gender gap? (3) What is the relationship between fertility rate and gender gap across countries?

Literature review

Gender gap moderators

According to *USA Today* ('World population,' 2008, p. 15), gender gap means 'the difference between women's health, economic, educational, and political status relative to men.' Gender gap is closely linked to the stereotype about female inferiority in mathematics (Else-Quest, Hyde, & Linn, 2010). Secada (1992) identified that Black and Hispanic students, as well as students from working-class families, were the most vulnerable groups in mathematics learning. Thus, he called for a more in-depth examination of the intersection of gender, race/ethnicity, and class (Lim, 2008, p. 618).

Research on gender differences in mathematics achievement is based on the premise that boys, on average, outperform girls. Several hypotheses for this have been put forward. The most common one is the social structural theory cited by Else-Quest et al. (2010, p. 106):

> Social structural theory (sometimes referred to as social role theory; Eagly, 1987; Eagly & Wood, 1999) is another relevant psychological theory in that it maintains that psychological gender differences are rooted in sociocultural factors, such as gendered division of labor. A society's gendered division of labor fosters the development of gender differences in behavior by affording different restrictions and opportunities to males and females on the basis of their social roles. Accordingly, if girls are expected to care for younger siblings rather than learn algebra, their access to formal schooling may be limited.

There is no universal measure to support the social structural theory of gender effect on mathematics achievement. However, five major indices have been formulated for the theory. They are the Gender Empowerment Measure (GEM), Gender Equality Index (GEQ), Standardized Index of Gender Equality (SIGE), and Gender Gap Index (GGI). Using the Programme for International Student Assessment (PISA) 2003 data, Guiso, Monte, Sapienza and Zingales (2008) found that GGI was a significant predictor of the magnitude of the gender gap in math performance. Else-Quest et al. (2010), on the other hand, found that gender equity indices did not significantly predict gender achievement in the Trends in International Mathematics and Science Study (TIMSS) (Mullis, Martin, Gonzalez, & Chrostowski, 2004). With PISA, in contrast, each of the five indices had a significant negative relationship to achievement.

Basically, the indices of gender gap were constructed to reflect economic, educational, and political status. However, since it is hard to differentiate one from another among five indices of gender gap, the decision of which indictor represents the gender gap across nations does not permit an easy answer. Although many composite indicators of societal gender gap exist (e.g., standardized index of gender equality), the indices have restricted meanings for the current study for the following reasons:

(1) The composites themselves are somehow confounded with each other. For example, the GGI included health/survival info as well as data on economic opportunity, educational attainment and political empowerment.
(2) In the case of the SIGE, not all Southern Africa Consortium for Monitoring Educational Quality (SACMEQ) countries use the index, so comparisons across all the target nations are impossible.

For this review, we could not use any of the indicators described above as moderators because data on the indices for more than half of the countries included in this review were missing. Hence, we settled on fertility rate for the year 2008 because the data on it was readily available for all the countries. Also, fertility rate is a component of the SIGE index.

Women in rich countries have a tendency to deliver fewer babies while those in poor countries have the opposite situation; therefore, as one of the considerable moderators to gauge socioeconomic status reflecting gender effect per country, the study adopts the fertility rate, which, according to Else-Quest et al. (2010, p. 108), represents 'relative female-to-male access to education, life expectancy, economic activity rate; women's share in higher labor market occupations; women's share in parliamentary seats' and 'weights economic domain heavily'. The justifications for using fertility rate as a moderator are elaborated as follows:

(1) Greater female participation in the labor force has often been suggested as a means of or factor in reducing fertility. This suggestion is based on the assumption that employment outside the home provides satisfaction for women, even acting as an alternative to the rearing of children.
(2) Education may indirectly lead to wider use of contraception and a reduction in fertility by providing opportunities for personal advancement, raising aspirations for a higher standard of living, ensuring a better understanding of the reproductive process, and improving access to modern and effective means of contraception as well as freeing women from traditionalism and enabling them to pursue modernism.

Why meta-analysis?

Gene V. Glass (1976, p. 3) defined meta-analysis as 'the statistical analysis of a large collection of analysis results from individual studies for purpose of integrating the findings.' Two articles (Cooper & Hedges, 1994) that appeared in the *Review of Educational Research* in the early 1980s brought the meta-analytic and synthesis-as-research perspective together. Following this, Hunter, Schmidt, and Jackson (1982) introduced meta-analytic procedures that focused on (a) comparing the observed variation in study outcomes to that expected by chance and (b) correcting observed correlations and their variance for known sources of bias (e.g., sampling errors, range restrictions, unreliability of measurements). Rosenthal (1991) presented a compendium of meta-analytic methods covering, among other topics, the combining of significance levels, effect size estimation, and the analysis of variation in effect sizes. Rosenthal's procedures for testing moderators of effect size estimates were not based on traditional inferential statistics, but on a new set of techniques involving assumptions tailored specifically to the analysis of study outcomes.

Meanwhile, according to Bickman and Rog (2008), another generation of more sophisticated methodological and statistical work has expanded and strengthened the foundation of meta-analysis. The pinnacle of these efforts was the publication of the *Handbook of research synthesis* (Cooper & Hedges, 1994). Through the 1990s, the use of meta-analysis spread from psychology and education (Hunt, 1997) to many other disciplines, especially social policy analysis and the medical sciences. Meta-analysis procedures impose a useful discipline on the process of summarizing research findings. Meta-analysis also represents key study findings in a manner that is more differentiated and sophisticated than conventional review procedures that rely on qualitative summaries or 'vote-counting' of statistical significance. Finally, effect sizes are relatively independent of sample size, and have the advantage of being comparable across all of the studies.

We hypothesize that if we pool all the studies/countries together, then we should be able to see the overall effects of gender on mathematics and reading achievement. We used the standardized mean difference *d*. A positive *d* means that males performed better than females, and negative *d* means that females did better than males. According to Cohen's (1969) guidelines, the magnitudes of effect sizes are 0.20 for small, 0.50 for medium, and 0.80 for large.

Meta-analyses on gender differences in mathematics and reading

A meta-analysis done by Hyde, Fennema, and Lamon (1990) on gender differences in mathematics in the USA covered studies conducted between 1967 and 1987, including several state-wide tests. They found a small (d = 0.20) significant gender difference in mathematics in favor of the males, and the best moderator was age. Using the TIMSS and PISA data for 2003, the range of gender difference effect sizes for PISA-math for the 40 countries that participated was d = –0.17(Iceland) to d = 0.29 (Liechtentsein). The overall effect size for PISA-math was d = 0.11, and it was significantly different from 0 in favor of the males. For the 46 countries that participated in TIMSS-math, the weighted mean average effect size was d = –0.01 and it was not significant. The range for the TIMSS-math was d = –0.42 (Bahrain) to d = 0.40 (Tunisia). Two of the African countries, South Africa and Botswana, which participated in TIMSS 2003, also participated in SACMEQ II. The gender difference in math for Botswana was d = –0.04, and for South Africa d = –0.02 (Else-Quest et al., 2010).

Randhawa and Gupta (2000) examined possible gender differences as well as cultural differences in mathematics achievement between Canadian high school students and Indian high school students who speak English. A 2 × 2 multivariate analysis of variance (MANOVA), with locale and gender as the two fixed factors with two levels each, was performed. The multivariate *F*-ratios indicated that gender was significant. Felson and Trudeau (1991) examined gender differences in mathematics performance using data from children in grades 5 through 12 and found that boys scored significantly higher than girls. Preckel, Goetz, Pekrun, and Kleine (2008) investigated gender differences in gifted and average-ability German sixth graders in achievement in mathematics. There were significant test score differences in favor of the boys in both gifted and average-ability students (d = 0.66). Using the 1996 Kansas Mathematics Assessment, Pomplun and Capps (1999) explored gender differences in answers to constructed-response mathematics items. They found that the effect sizes of seventh and 10th grade for 1996 Kansas Mathematics Assessment ranged from –0.08 to 0.19.

Saito (2004a) found gender differences in reading and mathematics achievement in Seychelles, Botswana, Mauritius, and South Africa. In these countries, girls significantly outperformed boys at least in reading, if not both. Boys significantly outperformed girls in Tanzania, Kenya, and Mozambique at least in mathematics. Meanwhile, Bassey, Joshua, and Asim (2008) verified the existence of gender inequality in the mathematics achievement of rural male and female students in Nigeria. Significant test score differences were seen between the mathematics achievement of the rural male and female students, with males performing better than females. Saito (1998a) found no differences between boys and girls in reading literacy; however, the differences among pupils from different socioeconomic groups were quite large.

Research design

Instruments

We conducted a meta-analysis based on gender effects in 15 countries on achievement using the SACMEQ dataset. Despite the previous work on gender gap in reading and mathematics achievement, it is odd that many gender studies based on the SACMEQ assessment have quite different results regarding gender differences in reading and mathematics (Chimombo, 2005; Onsomu, Kosmbei, & Ngware, 2006; Saito, 1998a; Zhang, 2006). In addition, no review using meta-analysis techniques has been done to establish gender differences in achievement in K–12 in African countries. Therefore, it is necessary to conduct a meta-analysis, thereby leading greater validity than any other single study (Ringquist, 2013). Furthermore, the use of SACMEQ contributes more precise data collection, because some primary studies for meta-analysis often omit initial information or statistical measures to compute effect sizes.

We had access to the SACMEQ primary database, so even though some articles only provided a few summary statistics necessary to compute effect sizes, we were able to obtain other information from the database. SACMEQ was launched in 1995 and consists of 15 countries in Southern and Eastern Africa: Botswana, Kenya, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Uganda, Zambia, Zanzibar, and Zimbabwe. As Hungi and Thuku (2010, p. 67) state, 'The methodology used in SAQMEQ projects for test construction, questionnaire construction, sampling and scaling are basically the same as the Progress in International Reading Literacy Study (PIRLS), Trends in International Mathematics and Science Study (TIMSS) and the Program for International Student Assessment (PISA),' although these three use different tests. We will treat these 15 African countries as 15 primary studies because each of them is based on a particular country which is in line with our interests. There have been three SACMEQ assessments. The first one, called SACMEQ I, involved seven African countries and focused on reading achievement. The second one, known as SACMEQ II, involved 14 African countries and focused on reading and mathematics, and the third one, called SAQMEQ III, involved 15 countries and focused also on reading and mathematics. We only used SACMEQ I and SACMEQ II for this study because SACMEQ III was not available when we first analyzed the data in 2010. The SACMEQ reading and mathematics assessment is given to randomly sampled grade 6 students in the participating countries. Both SACMEQ reading and math contain 60 multiple-choice items and are scaled to a mean of 500 and standard deviation of 100.

The Nigerian study is the only non-SACMEQ study included in this analysis. The study involved a random sample of 2000 students (1000 girls and 1000 boys) in 11th grade in Cross River State in Nigeria. The study reported test statistics, degrees of freedom, and sample sizes which we were able to use to calculate the effect size. The exam was a 45-minute, 30-item multiple-choice mathematics achievement test constructed by the researchers based on the prescribed senior secondary two (SS II) curricula in Nigeria. It covered basic areas of numeration, algebraic processes, geometry, trigonometry, and statistics/probability. The study reported the overall gender difference as well as gender differences stratified by school type (private or public) and socioeconomic background (low or high). No gender difference was found for either the high socioeconomic category or private schools. Conversely, the authors found significant gender differences in favor of the boys in public schools and low socioeconomic strata. It is noteworthy that no gender difference was found for either the high socioeconomic category or private schools.

Meanwhile, when it comes to previous studies in students' achievement scores in developed countries, first of all, in the U.S., gender differences in mathematics are declining (L.V. Hedges & A. Norwell, 1995, quoted in Else-Quest et al., 2010, p. 104; Hyde et al., 1990) or have been eliminated (Hyde, Lindberg, Linn, Ellis, & Williams, 2008), which is consistent with the 'gender similarities hypothesis' maintaining that boys and girls are similar on most psychological variables (Hyde, 2005). In addition, according to Stanley and Stanley's (2011) Florida Comprehensive Assessment Test (FCAT) study, gender was not significantly correlated with FCAT score.

Moderator measure

We used the countries' fertility rates for 2008 as the moderator, because it is the only gender equity indicator that was available for all the countries we examined.

Procedure: searching and coding

The authors searched Educational Resource Information Center (ERIC) using the keyword 'SACMEQ' and obtained 31 hits which included 12 journals, nine peer-reviewed journals, seven reports and two dissertations. Since the total number of hits was not too large, we decided to look at all of them. We narrowed down the studies to 12 because these were the ones that had the numbers we could use to compute the effect size. We coded the publication year of the study, sample size, name of the author(s), country the study is based on, funding source, and SACMEQ data archive used. When some studies did not have information for their effect sizes, we looked over the original database to calculate them. We got seven reading effect sizes (for seven countries) from SACMEQ I, and 28 effect sizes from SACMEQ II (14 countries; 14 effect sizes for reading and 14 effect sizes for math). Including the Nigerian study, we had a total of 36 effect sizes covering 15 different African countries.

Inter-rater reliability

Using the information provided in the studies as well as utilizing the SACMEQ databases, each rater computed effect size for all the countries in the review. We then compared the effect sizes and found a discrepancy relating to the sign (+/–) in two of them. We resolved this by examining these two studies again and computing the effect sizes together.

Effect size calculations

We calculated the effect sizes, corrected all the effect sizes for bias, and calculated the variances, the weights, and the confidence intervals. For effect size, we used the formula:

$$d = \frac{\bar{X}_M - \bar{X}_F}{\sqrt{\frac{(n_M-1)S_M^2+(n_F-1)S_F^2}{n_M+n_F-2}}} \tag{1}$$

A positive effect size means that boys did better than girls in the countries examined. On the other hand, a negative d implies that females performed better than males in the countries examined. We used the fixed effects model and computed the variance of each effect size as:

$$V(d) = \frac{n_M + n_F}{n_M * n_F} + \frac{d^2}{2(n_M + n_F)} \tag{2}$$

where n_M is the number of male students, n_F the number of females, and d the effect size. The weighting was then done using

$$\mathrm{w} = 1/V(d) \tag{3}$$

where d is the effect size.

Results

The primary studies include 35 observations, and their assessment years are from 2003 to 2009. The country that has the largest effect size was Seychelles, which was –0.54 in reading subject. This means the Seychelles male students had much lower scores in reading than females. Table 1 shows the list of the countries covered, effect sizes, sample sizes, and types of assessment, which is descriptive statistics.

We divided the studies into two subgroups depending on the subject. Group one was math and group 2 was reading. The distribution of effect sizes for reading and math combined is shown in Figure 1. It looks fairly normal except for one country (Seychelles) that seems like an outlier.

When stratified by subject, the same country, Seychelles, still stands apart from the rest, as shown in Figure 2. For reading, the range effect size for was d = –0.54 (Seychelles) to d = 0.18 (Malawi). For math, the range was d = –0.36 (Seychelles) to d = 0.35 (Tanzania).

Fixed effects for the overall model combined show that the combined effect size across reading and mathematics was not significantly different from zero (d = 0.004, p = .47). We used a fixed effect model to conduct a one-way analysis of variance (ANOVA) and found a significant $Q_{between}$ and Q_{within} (Q_w = 121.09, Q_b = 627.19, Q_T = 748.28, p < .01 for both). The Q_{within} was shared between the groups, as shown in column 2 in Table 2.

The Q_{within} in both groups was significant, indicating that the mean effect size for reading and math was significantly different from zero. We also employed two variations of mixed effect models, as shown in Table 2. The first mixed model was a one-way ANOVA using the method of moments and fixed effect weights, and the second mixed model was a fixed effect model with modified weights, *wmix*. To obtain modified weights, we ran a random effect model separately for math and reading and

Table 1. List of countries, sample size, effect size, subject, and assessment type.

Year	Country	# of boys	# of girls	d	Subject	Assessment
2003	Namibia	2231	2225	0.02	Reading	SACMEQ I
2005	Kenya	1695	1604	–0.01	Reading	SACMEQ II
2005	Lesotho	1378	1777	–0.15	Reading	SACMEQ II
2005	Malawi	1220	1113	0.15	Reading	SACMEQ II
2005	Mauritius	1528	1417	–0.23	Reading	SACMEQ II
2005	Seychelles	742	742	–0.54	Reading	SACMEQ II
2005	Swaziland	1524	1615	–0.16	Reading	SACMEQ II
2005	Namibia	2462	2586	–0.06	Reading	SACMEQ II
2005	Zambia	1352	1255	–0.02	Reading	SACMEQ II
2005	Zanzibar	1237	1277	0.06	Reading	SACMEQ II
2005	Uganda	1483	1159	–0.03	Reading	SACMEQ II
2006	Zimbabwe	1329	1368	–0.11	Reading	SACMEQ I
2007	Nigeria	1000	1000	0.24	Math	SACMEQ II
2007	Mozambique	1963	1214	0.06	Reading	SACMEQ II
2007	Mozambique	1945	1191	0.31	Math	SACMEQ II
2008	Kenya	1692	1604	0.22	Math	SACMEQ II
2008	Lesotho	1374	1770	–0.03	Math	SACMEQ II
2008	Malawi	1215	1108	0.20	Math	SACMEQ II
2008	Mauritius	1487	1383	–0.08	Math	SACMEQ II
2008	Seychelles	741	741	–0.36	Math	SACMEQ II
2008	Swaziland	1524	1614	0.05	Math	SACMEQ II
2008	Namibia	2429	2561	0.07	Math	SACMEQ II
2008	Zambia	1341	1245	0.10	Math	SACMEQ II
2008	Zanzibar	1207	1252	0.21	Math	SACMEQ II
2008	Uganda	1471	1148	0.11	Math	SACMEQ II
2008	Kenya	1698	1535	0.05	Reading	SACMEQ I
2008	Malawi	1066	912	0.18	Reading	SACMEQ I
2008	Mauritius	1490	1427	–0.12	Reading	SACMEQ I
2008	Zambia	1389	1153	0.07	Reading	SACMEQ I
2008	Zanzibar	1126	1146	0.03	Reading	SACMEQ I
2008	Botswana	1630	1692	–0.31	Reading	SACMEQ II
2008	Botswana	1629	1692	–0.11	Math	SACMEQ II
2008	Tanzania	1378	1476	0.17	Reading	SACMEQ II
2008	Tanzania	1376	1473	0.35	Math	SACMEQ II
2009	South Africa	1545	1618	–0.22	Reading	SACMEQ II
2009	South Africa	1523	1612	–0.08	Math	SACMEQII

Note: *d*, standardized mean difference. A positive *d* value indicates males scored higher than females.

added the variance components to get the new weights as ($1/[v_i+var_j]$). For the fixed model, the overall effect sizes for reading and math were both significantly different from zero, as shown by the confidence in Table 2. These differences, however, are negligible because they are lower than Cohen's (1969) guidelines for small effect. We concluded that there was no significant gender difference under the mixed model using two different weighting schemes. The confidence intervals for the individual countries varied significantly, as depicted in Figure 3.

The countries with small to moderate gender differences are shown in Table 3.

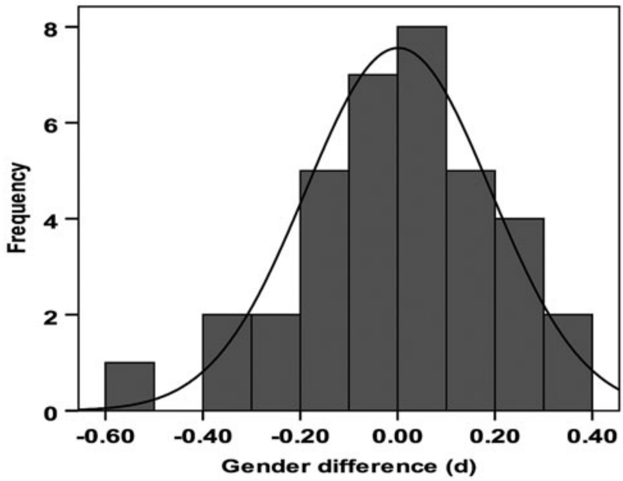

Figure 1. Distribution of effect sizes of math and reading combined.

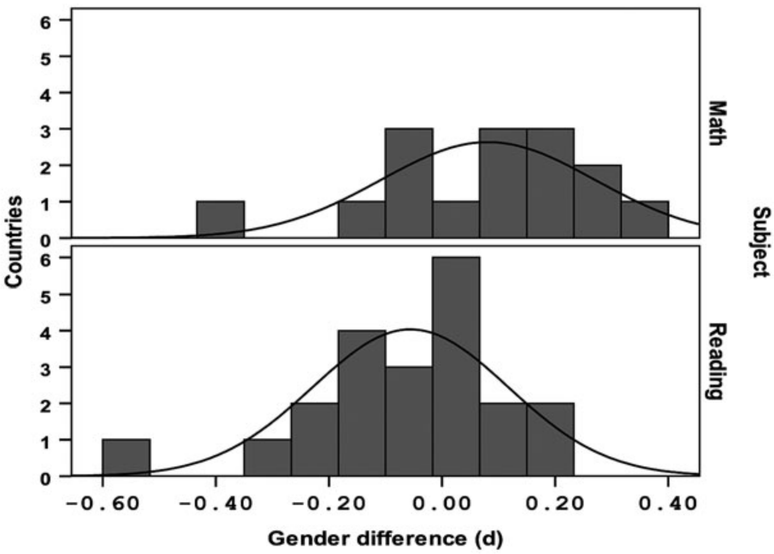

Figure 2. Distribution of effect sizes of math and reading separated.

Moderator: fertility rate

Next we included a moderator, fertility rate, to help explain the variation in gender differences. We settled on the country's fertility rate for the year 2008 for the moderator because the data on it was readily available for all the countries. There was a positive moderate to strong relationship between fertility rate and effect size, as shown Figure 4.

Irrespective of the subject (reading or mathematics), in countries with fertility rates of less than 4, girls tend to outperform boys, whereas in countries with fertility rates

Table 2. Fixed and mixed effects models.

	Fixed effect Weight = w	Mixed effect Weight = w	Mixed effect Weight = w mix
Math			
d	0.09	0.08	0.08
95%CI	[.07, .11]	[.001, .16]	[–.004, .17]
Q_W	289.37	19.15	16.92
k	15	15	15
Reading			
d	–.05	–.06	–.06
95%CI	[–.07, –.04]	[–.12, .01]	[–.12, .01]
Q_W	337.82	22.84	25.10
k	21	21	21

Note: *k* = number of effect sizes, *Qw* = The Q test statistics for the within variance, *d* = effect size, *CI* = Confidence interval.

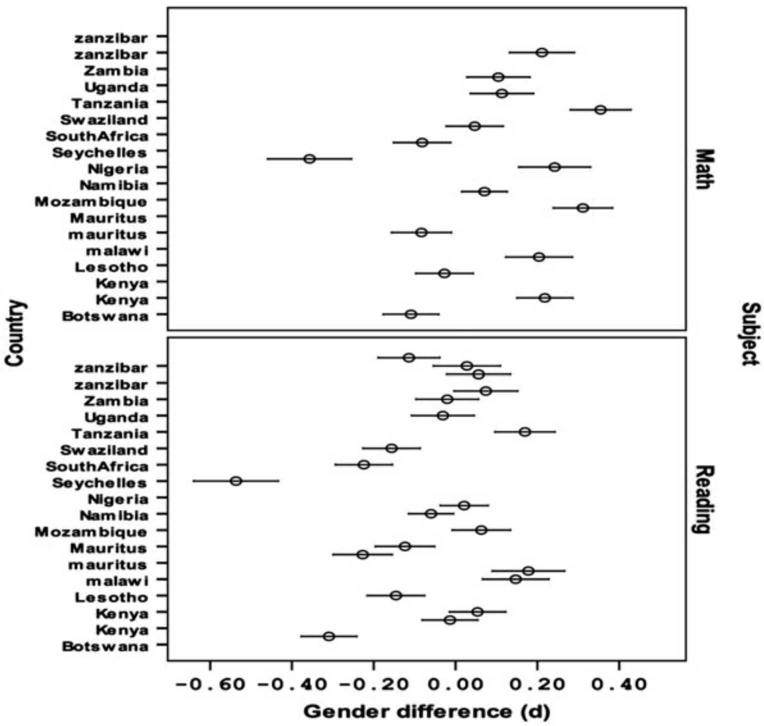

Figure 3. Ninety-five percent confidence interval for the weighted effect sizes by country.

higher than 4, boys do better than girls. We used a weighted (the same weights we used for the fixed effect one-way ANOVA model) regression model to find the predictive power of fertility rate on gender differences in mathematics and gender differences in reading. The fertility rate positively predicted the gender difference in both mathematics (b = .09, Qw = 188.63, $p < .001$) and reading (b = .08, Qw = 191.05, $p < .001$). For mathematics, for every one-unit increase in fertility rate, the

Table 3. Countries where gender difference is significantly different from zero.

Country	Math	Reading
Tanzania	[.28, .43]	
Mozambique	[.24, .38]	
Nigeria	[.15, .33]	
Kenya	[.15, .29]	
Zanzibar	[.13, .29]	
Malawi	[.12, .29]	
Seychelles		[–.64, –.43]
Seychelles	[–.46, –.25]	
Botswana		[–.38, –.24]
Mauritius		[–.30, –.15]
South Africa		[–.29, –.15]

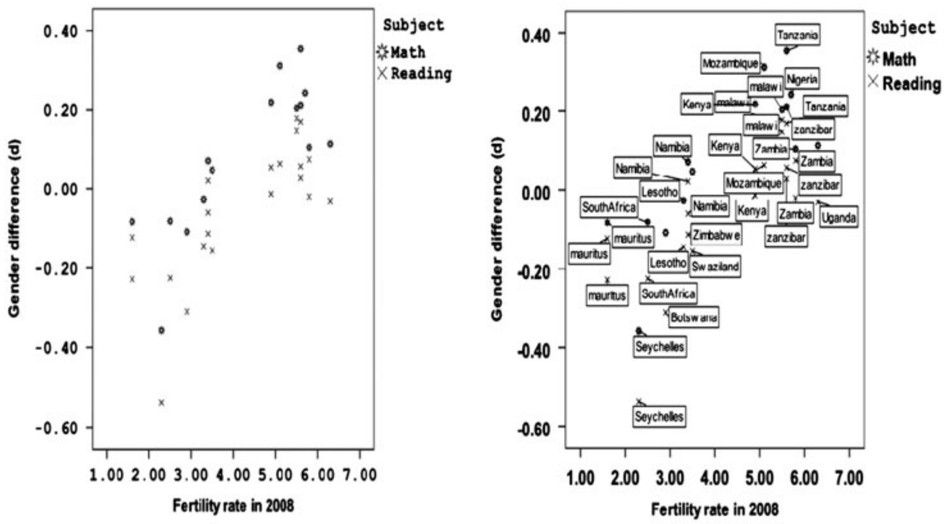

Figure 4. Scatter diagram of the fertility rate versus gender difference in math and reading.

gender gap increased .09 units, whereas for reading, for every one-unit increase in fertility rate, the gender gap increased .08 units.

Publication bias

The range of possible articles to include in a meta-analysis is quite broad. The meta-analysis of this study includes published journal articles, books, dissertations, technical reports, unpublished manuscripts, conference presentations, and the like. Since unpublished studies are hardly accessible, using only formally published material due to the ease of locating it can lead to publication bias. In order to resolve this potential problem, a funnel plot using all the effect sizes in both SACMEQ I and II is examined. As shown in Figure 5, the funnel plot is quite convincing in showing that we do not have publication bias in this review.

Given the purpose of the meta-analysis to summarize the empirical evidence on the effect of gender on the achievement level and potential upward bias of published

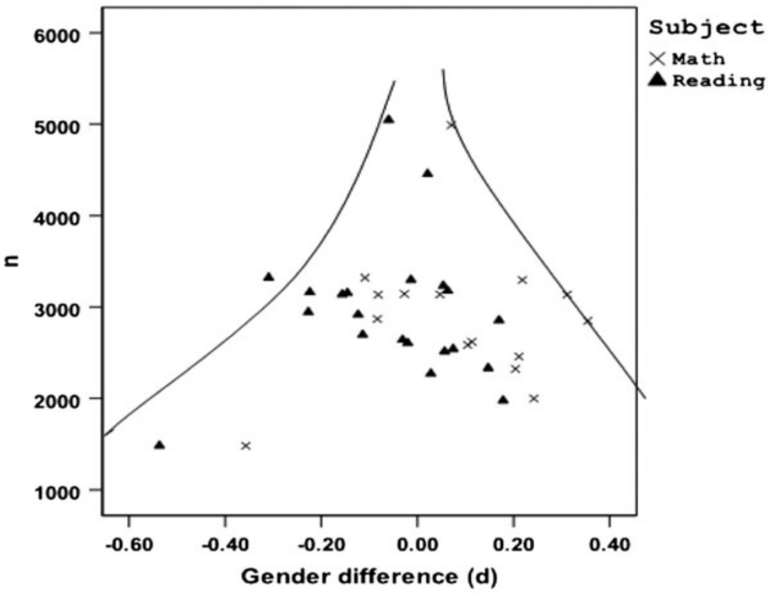

Figure 5. Funnel plot of the relationship between sample size and effect size (d).

studies, all the effect sizes in SACMEQ II are deemed eligible, regardless of whether or not they have been published.

Conclusions and discussion

This article examined gender differences in mathematics and reading in African countries using meta-analysis. Overall, the results of this study were mildly promising. In other words, gender differences in math and reading achievement were found in this study. In particular, in Tanzania, Mozambique, Nigeria, Kenya, Zanzibar, Malawi, Uganda, and Zambia, there was a large performance gap between male and female students in mathematics, with males having higher scores than females. In South Africa, Mauritius, Botswana, and Seychelles, females performed better in reading than males. Seychelles had the largest gender gap in reading, with females scoring higher than males, while Tanzania had the highest gap in math, with the males scoring higher than females. For future study, the reasons for the high gender gap in Tanzania and Seychelles could be explored.

Even though we could not use any of the four commonly used gender equity indices because of missing data for half the countries we examined, we were able to use fertility rate, which is a composite of the Gender Empowerment Index (GEI). We found a positive relationship between fertility rate and gender gap. The gender gap was wider in countries with fertility rates higher than 4. It is assumed that fertility rates are highly correlated with socioeconomic backgrounds. Therefore, to bring the fertility rate down, governments must institute measures that aim to uplift the socioeconomic status of their people.

With the same analogy, Saito (1998b) argues that males and females who have equivalent socioeconomic backgrounds and are within identical school location groups show similar performances in reading achievement scores. Accordingly, for future research, we suggest that urbanicity can be included as a moderator. This will inform the ministries of education in the SACMEQ countries where to put more focus in their quest to minimize gender gap.

In spite of many strong points, this study has some limitations. The study focused only on sub-Saharan African countries that participate in SACMEQ; therefore, generalizing the results to other countries that do not participate in SACMEQ must be done cautiously. Nevertheless, future research could include various moderators that can provide valuable information that could be used to advise the ministries of education in the SACMEQ countries to discover the causes of the inequities.

In conclusion, the meta-analysis technique requires much patience to ascertain what makes sense to put into a model, in addition to the model specifications. In the field of social structural theory reflecting gender gap, the meta-analysis technique is just beginning to gain traction. In this light, we suspect that meta-analysis will continue to be a useful method in the future.

Notes on contributors

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