GENDER DIFFERENCES IN ENGLISH LANGUAGE AND SCIENCE RELATED SUBJECTS IN THE CONTEXT OF HIGHER EDUCATION IN THAILAND

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ABSTRACT: *This study was conducted at a university in the surrounding areas of Bangkok to cross-compare academic performances between female (n = 406) and male (n = 496) students in both English language skills and GPA scores in science-based subjects. 902 second-year students were selected from four separate faculties to examine the interaction of the gender variable across a broader spectrum of academic backgrounds; faculty subgroups were clustered accordingly: business studies (n = 315), engineering (n = 317), computer science (n = 178) and veterinary medicine (n = 92). T-tests calculations indicated that female students' level of attainment was significantly higher in both academic spheres: English (females: 56.85, males: 47.87; [sig: p = <0.05]); GPA (females: 70.5, males; 63.75; [sig: p = <0.05]). Furthermore, according to faculty subgroup comparisons, females consistently outperformed their male counterparts in both English language and science related subjects, and also outnumbered their male peers in the top-100 achievers in both domains.*

KEY WORDS: English proficiency, science, performance, variability, gender

INTRODUCTION

Extensive research has shown that certain subjects are typically viewed as masculine or feminine. Science, mathematics and technology have been traditionally considered to be male-orientated (Eisenberg et al., 1996), and in which, it is a masculine imperative to succeed (Eccles, 1987; Hackett, 1985); leading to greater confidence levels in these domains (Pajares & Miller,1994; Wigfield, Eccles, & Pintrich, 1996). On the other hand, language arts are typically categorised as a feminine interest, and that a body of research has proposed that gender differences pertain to gender orientation, referring to the *stereotypic beliefs about gender* students maintain (Eisenberg et al., 1996; Hackett, 1985). Eccles's (1987) model of educational and occupational choice proposes that *cultural milieu factors* such as students' stereotyped gender roles are partially responsible for differences in choice behaviour in relation to academic and vocational trajectories. Differences in students' beliefs and choice behaviour begin to take shape towards adolescence, namely during transition to middle school (Eccles & Midgley, 1989).

With respect to intelligence and academic performance, Pekkarinen (2008) maintains that men are more prominently represented in both extremes of IQ test results, while Halpern (2012) posits that gender differences exist in certain cognitive domains. The latter remark was reflected in the 2011 National Assessment Educational Progress report (the Nation's report card - USA), in which girls at elementary and secondary levels recorded higher scores than boys in reading and writing (Orr et al., 2011), whereas boys demonstrated greater academic acumen in science. In accordance with Eccles & Midgely (1989), the findings from the NEAP also indicated that these differences became apparent as of K-12. Similar findings in Taiwan, published by the National Taipei University of Education, disclosed that in the eighth grade, boys outnumbered girls in the upper quartile for academic achievement in science. However,

demonstrating the effects of the *variability hypothesis*, the study also highlighted that boys were also more represented the bottom quartile, and as a consequence, the girls' overall performance was more constant and their respective mean was of a higher standard. Interestingly, the study also revealed that over time (1999 to 2003) girls' scores had improved, whereas the average score of male students had deteriorated; in the upper quartile, the achievement gap had halved by the end of this four-year period (from 14% to 7%).

Because of the perception that the very best performances in science allegedly pertain to boys, greater male variability has served to justify the prominence of men in top vocational roles in science and engineering positions. The then president of Harvard University (2005, Lawrence Summers) stoked controversy when adducing that "…in the special case of science and engineering, there are issues of intrinsic aptitude, and particularly of the variability of aptitude …". (*Quoted from the Higher Education Research Data, 2014 - Science in Australia Gender Equity*). The latter comment inspired the basis of the current study, which is to investigate the interplay of gender in academic performance variations in English language proficiency and science-related fields among a young adult university population in Bangkok.

LITERATURE REVIEW

The studies presented for discussion below investigated performance variations between male and female university students in three separate countries (India, Jordan and USA). For a balanced review of literature, the first two research papers focus on academic performance (GPA) in scientific fields, whereas the third paper analysed findings related to English language skills.

Academic performance variations among medical students, Kolkata, India
The first study examined a range of predictor variables and their correlation with subsequent academic performances in students' second year microbiology exams. The variables analysed encompassed previous academic performance, course attendance, place of residence, and more pertinently, gender. The study, published in the International Journal of Medicine and Public Health (Vol. 4, Issue 4, 2014), measured the correlation of the aforementioned variables with academic performance outcomes across a population sample consisting of 147 second year undergraduate medical students (male = 103, female = 44) at a well-known medical institution in Kolkata.

In order to measure the predictive reliability of past performance, students were separated into two groups: lower performers (those who required more than one attempt to pass all 1st year subjects), and higher performers (those who passed all 1st year subjects on their first attempt). Utilising this form of treatment, inevitably the higher-level performers scored considerably better in the microbiology examination than the lower level performers, and unsurprisingly, levels of attendance were also an influential factor in the microbiology test results, and as a result, it was concluded that attendance should be carefully registered and regulated through *corrective actions* to sustain higher levels of performance. Intriguingly, place of residence also has an effect on academic performance, to the extent that students living closer achieved significantly higher scores (local aid; n = 50. hostel aid; n = 97; 53.01 vs. 58.25 = p < 0.01).

More relevant to the current study, the mean exam results of the female group were significantly higher than those of the male students (M: females 60.97 vs. males 53.61; p <

0.01). Further subgroup analysis revealed that females performed higher than male students in both high attendance ($p < 0.05$) and low attendance groups ($p < 0.01$). The study concluded that variables that directly contribute to the standard of academic performance comprise prior performances, proximity of residence, attendance, and, gender

Academic performance variations among dentistry students, Jordan
A similar study in the Journal of Dental Education (2009) examined the extent to which gender influenced academic performance of undergraduate dental students. The study was carried out at the University of Jordan and data was collected from two groups of students (1) fourth-year dental students (n = 413; males = 178, females = 275) between 2005 and 2008, and (2) fifth-year students (n = 357; males = 128, females = 229) who graduated within the afore-specified period. The fundamental research question of the study was to analyse the degree to which gender-based differences influence the level of academic performance in dentistry at the University of Jordan.

The role of gender in performance variations among fourth-year students was analysed on the basis of assessment scores in six theoretical and six clinical courses, and for fifth year students, the variations in students' GPAs were examined. In relation to the fourth-year students, in both theoretical and clinical courses, multivariate analysis of variance (MANOVA) showed that mean differences in assessment scores between the two gender groups was significant. It came to light that female students performed significantly better in five theoretical courses, and with respect to clinical courses, female students outperformed male students in paediatric dentistry and prosthodontics, however male students outscored female students in conservative dentistry and orthodontics; nonetheless, no significant gender differences were observed in oral surgery or fixed prosthodontics. With reference to the cumulative GPAs of the fifth-year students, female graduates possessed significantly higher GPAs than their male counterparts. As a result, the study concluded that there was a significantly positive relationship between gender and academic performance among dental students, but the reasons accounting for these findings were not be determined

Gender related differences in neural processing
Although a number of claims posit that females exhibit greater potential in language based subjects (Pajares & Miller,1994; Wigfield, Eccles, & Pintrich, 1996; Orr et al., 2011), this particular scientific research study in question revealed the cognitive dispositions that account for females' greater potential in language tasks. The experiment was carried out at the Northwestern University (2008) and investigated gender differences in neural processing to study the ways in which boys and girls process language. 62 participants (girls = 31, boys = 31) were included in this study and were aged within the specified brackets of 9,11,13,15 years. All participants were native English speakers, right-handed, had no hearing or visual related impairments, had no history of neurological disorders or diseases, nor did they have reading or oral language deficits, nor medical requirements of any description.

The participants were subject to functional Magnetic Resonance Imaging scans, and the results illustrated that girls' brains showed heightened activity in regions used for language encoding, whereas the boys' brains demonstrated greater activity in the regions dedicated to visual and aural functions, which implies that boys learn most efficaciously through repeated listening and visual or sensory support to process input. Furthermore, participants also took the Wechsler Abbreviated Scale of Intelligence (WASI) tests to ascertain average IQs, and were

tested further for performance and verbal IQ. Additional forms of testing consisted of the Test of Word Reading Efficiency, Woodcock-Johnson Test of Cognitive Abilities as well as the comprehensive Test of Phonological Processing. The tests results clarified that girls performed to higher levels than boys across all forms of testing. Although girls marginally outperformed boys in relation to spelling (WRAT-III: $p = 0.077$) and reading (WJ-III: $p = 0.069$), however, girls showed significantly greater aptitude in phonetic decoding efficiency (TOWRE: $p = 0.032$), and rapid naming (CTOPP: $p = 0.028$).

The study also shed light on the biological reasons explicating girls' greater performances in language tasks (L1), as brain-behaviour correlations indicated that activity was more dynamic in the language areas of the brain (frontal and temporal regions) among female participants.

Research objective
The central aim of this study was to measure the impact of the gender variable across a sizeable sample population (N = 902) in English proficiency scores (L2) and respective GPA attainments from four separate scientific faculties. The first two studies reviewed previously examined the variability in academic performance according to gender across scientific subjects (medicine and dentistry), but evidently did not investigate students' corresponding English language potential. The third study provided an informative scientific account explicating cognitive differences that result in females' superior L1 language capabilities, however, trustworthy data pertaining comparisons in L2 proficiency variations in the context of EFL were not publicly available. The significance of the current paper is to empirically contribute to the debate surrounding the role of gender in academic achievement by examining the interplay of gender in English language skills and across science-related subjects across large and academically diverse population of university students.

Hypothesis

Based on the findings of the reviewed literature, female students are expected to outperform male students in both performance related measures by a significant margin; across (1) the entire population and (2) in each faculty.

METHODS

This study was conducted at a university of technology in the surrounding areas of Bangkok in the first semester of the academic year of 2018-19 following executive approval. The fundamental focus of the study was to examine the intervening role of the gender variable in performance outcomes in English language and science-related subjects.

Research Design

This was a quantitative research design given that all the data collated derived from formal examination results, and therefore this research investigation was not experiential in nature (thus removing the need for control groups). Initial calculations compared performance variations between genders in both English and scientific subject areas across the entire population (females = 406, males = 496). Subsequent statistical comparisons reviewed the extent of the gender variable in both academic spheres within each faculty to clarify whether the gender gap varied in male-orientated domains (computer science and engineering) and feminine-labelled subjects (business studies and veterinary medicine).

Participants

The sample comprised 902 second year students across four separate faculties and in general, demographics were reasonably well balanced (female = 406, male = 496). However, a closer look reveals demographic imbalances in each sub-group, which is presumably owed to the labelling of certain disciplines being strongly associated with one particular gender.

Table 1: Participant demographics

Faculty	N	Females	Males
Business studies	315	218	97
Engineering	317	86	231
Computer science	178	39	139
Veterinary med	92	63	29

Measuring Instruments

In order to ascertain students' English proficiency, throughout the 16-week term, students at the university are required to sit a number of assessments which contribute to their final grade. The first formal examination is the mid-term test (week 8; 20% of overall grade contribution), followed by a speaking test (week 12; 30%), and final exam (week 16; 50%). The two written forms of assessment are very similar as they both mostly consist of multiple choice questions related to grammar and vocabulary, as well as reading comprehension tasks. The students' current GPA attainments represented the average level of performance recorded across all degree-based modules taken in year one (two full terms) and year two (one full term).

Research Procedure

The students were selected based on the need to examine the influence of the gender variable in performance variations in both language and science-related subjects across a large population encompassing diverse academic interests, which would ultimately produce more informative findings. Second year students were preferred founded on the supposition that they were more academically mature than their debuting counterparts in year one, and less distracted by the pressures of thesis projects and work placements, which are introduced in the third year. The performance-related data was obtained by the university registrar following executive approval from the president of the university. All data were received in the form of a spreadsheet to facilitate statistical calculations.

Statistical Analysis

To statistically treat the data for the students' examination results across both subject areas, t-test calculations (0.05) examined the level of significance in performance variations between female and male students in both disciplines across (1) the entire sample population (N = 902; females = 406 and males = 496) and according to each individual faculty. In addition, standard deviation was also studied within these parameters to analyse the level of consistency in attainments among female and male students. Furthermore, to test the theory of variability, the representation of each gender in the top one

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hundred students and the lowest-performing one hundred students in English language proficiency and GPA attainments was closely examined for discussion.

RESULTS/FINDINGS

The primary question of this research paper was to ascertain the average level of English language performances and GPA attainments across the entire sample population (N = 902), and cross-compare respective performance variations according to gender.

Table 2: Academic performance variations between male and female students across N

Subject	Gender	N	M %	SD	P	Result
	F	406	56.85	19.24		
English					<.001	Sig
	M	496	47.87	17.96		
	F	406	70.5	13.85		
GPA					<.001	Sig
	M	496	63.75	15.4		

Note: means of N, English = 51.91%; GPA = 66.79%

Table 2 clarifies that across the entire sample population, female students significantly outperformed their male peers in both academic spheres; as denoted in the minimal p values. Furthermore, levels of standard deviation were comparable between male and female students across both subjects; insinuating similar levels of consistency among each gender in both domains.

Table 3: Academic performance variations between male and female business students

Subject	Gender	N	M %	SD	P	Result
	F	218	52.32	17.35		
English					<.001	Sig
	M	97	45.32	17.63		
	F	218	68	13.61		
Business					<.001	sig
	M	97	58.75	13.85		

Note: means for business, English = 50.2%; GPA = 65%

As seen in Table 3, the demographics of the business faculty were rather imbalanced, nonetheless the sample of male students was sufficiently large to provide a meaningful comparison. In accordance with the calculations of N, the results displayed above show that females performed at significantly higher levels in both business studies and English language proficiency (sig: $p < 0.05$).

Table 4: Academic performance variations between male and female engineering students

Subject	Gender	N	M %	SD	P	Result
	F	86	54.79	17.51		
English					<.001	Sig
	M	231	46.21	17.01		
	F	86	70	14.08		
Engineering					.008	sig
	M	231	65.5	15.68		

Note: means for engineering, English = 48.53%; GPA = 66.5%

Interestingly, the results presented on Table 4 highlight that aside from English proficiency, female students also outscored their male peers in an alleged masculine-orientated subject in significant terms ($p = .008$; sig $p < 0.05$). The two sub-group calculations also imply that the gender ratio does not influence the gender gap, as females performed to significantly higher levels when representing both the majority and minority demographics.

Table 5: Academic performance variations between male and female computer science students

Subject	Gender	N	M	SD	P	Result
	F	39	49.97	17.89		
English					.14	Not sig
	M	139	46.74	16.35		
	F	39	70	11.9		
Computer science					.002	Sig
	M	139	62.5	14.9		

Note: means for computer science, English = 47.44%; GPA = 64%

The results in Table 5 show that the difference in English proficiency skills between female and male students did not reach statistical significance ($p = 0.14$), despite females recording narrowly higher scores. Nonetheless, once again, in what could be perceived as another male-orientated subject, the minority female contingent achieved a significantly higher standard of academic attainment in computer science than their male counterparts ($p = .002$), (sig $p < 0.05$).

Table 6: Academic performance variations between male and female veterinary medicine students

Subject	Gender	N	M	SD	P	Result
	F	63	79.59	10.7		
English					0.031	Sig
	M	29	74.97	11.55		
	F	63	79.5	12.04		
Vet med					0.03	Sig
	M	29	74	13.8		

Note: means for veterinary medicine, English = 78.13%; GPA = 77.5%

Table 6 demonstrates that the veterinary medicine students were the most academically capable subgroup in both academic domains. This is due to the stringent entry examinations students are required to pass to be admitted onto the course, competing for a limited number of places; thus, contributing to enhanced performances. The fact that females outnumber males on the course is also a statement in its own right. Nonetheless, despite greater standards of academic acumen noted within this group, female students still manifested significantly higher levels of English proficiency ($p = .031$) and GPA attainments ($p = 0.03$).

Table 7: Testing the variability hypothesis in English language proficiency

English	F	M
Top 10	10	0
Top 100	68	32
Bottom 100	29	71
Bottom 10	3	7

Table 7 confirms that female students densely populated the top one hundred performers with respect to English language proficiency, and, in order to dismiss the concept of extreme variability, the group of top-ten performers was purely characterised by females. Conversely, the bottom one hundred students mostly consisted of male students, as did the bottom ten.

Table 8: Testing the variability hypothesis in English students' GPA attainments

GPA	F	M
Top 10	7	3
Top 100	55	45
Bottom 100	20	80
Bottom 10	2	8

Table 8 also disproves the theory of variability with respect to science related subjects, seeing that female students once again featured more prominently among the hundred most academically capable students, albeit with a smaller majority than observed in table 7. Nonetheless, despite the smaller majority, the top ten listings also consisted of more female students (7 versus 3), while at the other end of the spectrum, the lowest performances were overwhelmingly represented by male students.

DISCUSSION

The findings in this study, in line with the results discussed in the review of related literature validated the hypothesis that female students performed to significantly higher levels across both English proficiency and science-related subjects.

The element of surprise is that the faculties included in this study were all science-based, and yet females' academic performance in these scientific domains was unanimously superior. As with all self-driven academic studies, there were limitations. Firstly, this investigation comprised one private university in Thailand, thus it would be of interest to see whether an equally large gender gap would be observed in a public university setting, where entrance examinations are a pre-requisite for all academic courses, resulting in higher academic

standards. Although further research in neighbouring countries would be highly encouraged, it must be noted that the review of prior literature across India, Jordan and the USA also determined that females were academically more capable.

In addition, the size of the sample population studied in this paper (N = 902) was more extensive relative to those reviewed in prior literature, and took on the empirical task of concurrently examining both language and science related performance variables. The results brought to light identified female students as higher achievers in English language (L2) and scientific subjects. In addition to which, the very highest performers were mostly female students, and male students epitomised the lowest achievers, contradicting Pekkarinen's (2008) declaration that men are more prominently represented in both extremes of test results. Further investigative action is urgently needed to establish the reasons behind such an obvious gender gap in both academic domains, especially in the context of Thailand.

Implication to Research and Practice

The strength of this study was the size (N = 902) and the diversity of academic profiles (engineering, veterinary medicine, business studies and computer science). Across all subgroups, females' academic performance was superior to their male counterparts across both variables, which also implies that higher levels of English proficiency are seemingly associated with higher GPA attainments. Nonetheless, the prime limitation of this study was that all students attended the same private university. Diversifying the sample across the country and overseas would help to empirically test the inferential relationships discovered in this study in greater depth.

CONCLUSION

In concert with the findings discussed, the results presented in this study lend irrefutable support to the notion that females are higher performers in language and science-related subjects, especially in the context of higher education in Thailand. Wigfield & Eccles (2002) previously evinced that the most arduous challenge educators are faced with is that of altering students' perceptions of certain academic disciplines in such a manner that all subjects can be regarded as relevant and valuable to both genders. The results brought forth from this study would infer that female students do not only hold a higher esteem for language related subjects, but also for those that are typically associated with a culturally strong *masculine imperative* to succeed.

Future Research

While this study closely examined gender-related performance variations in English language proficiency and scientific disciplines, further research would be encouraged in order to investigate the interplay of the gender variable in the following settings:
(1) Academic performance at elementary and high school levels across a range of subjects to examine the potential development of the gender gap as a function of age.
(2) Academic attainments at schools and universities in both urban and rural areas, along with private and public institutions to ascertain the influence of socioeconomics within this parameter.
(3) Subsequent research interventions would also need to be carried out in countries throughout the region that are also active in EFL. This would help determine whether the results observed in this study represent an emerging phenomenon, or whether a gaping gender

related achievement gap is idiosyncratically unique to Thailand.

(4) Closer analysis of the correlative nature between English proficiency and (non-language related) GPA attainments also merits further inspection. This will also help to empirically test theories of intelligence and cognitive science; namely Spearman's 'g' factor theory (1904), which posits a strong correlation between unrelated cognitive tasks.

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