A Study of Gender Bias in Grading in the MCIS Program at CSU from 2013 through 2017

Jon D. Clark
jon.clark@colostate.edu

Shuchi Goyal
shuchi203@gmail.com

Department of Computer Information Systems
Colorado State University
Fort Collins, Colorado 80523, US

Abstract

The topic of male/female participation in both the undergraduate and graduate Computer Information Systems programs has persisted for several decades. Other Science, Technology, Engineering and Math (STEM) disciplines also have a disproportionate percentage of males, in spite of efforts to recruit women. The percentage of women in CIS programs is approximately 30%, much higher than Computer Science which has approximately 15% women. A student claim that there was a grading bias against women resulted in this study, who's purpose is to determine if there is a grading bias against women in the Master of Computer Information Systems (MCIS) program. All classes in the MCIS program were surveyed relative to the final course grades achieved by men and women over the period of 2013 through 2017.

Keywords: gender bias, grade bias, STEM disciplines, women in technology

1. INTRODUCTION

There have been a number of studies of the causes of low participation by women in STEM related fields, and in particular, the suggestion that that there is a gender bias, both in terms of grading while in school, as well as in performance assessment during one's career.

Hofer (2015) published a study of 780 physics teachers in Switzerland, Austria and Germany in 2015 and found that there was a measurable bias against girls during the beginning of their careers. It was further claimed that the results of this study could be generalized to a much broader group of STEM (Science Technology Engineering and Math) disciplines.

When teachers assess performance, gender-stereotypes appear to influence the process, particularly those that are cognitively demanding and ambiguous. It was also found that gender bias seems to disappear with greater years of teaching practice. German male teachers were found to be gender-neutral relative to the grading process.

The purpose of this study is to assess the degree of gender bias, if any, involved in the MCIS (Master of Computer Information Systems) program at Colorado State University (CSU), based solely on final course grades earned by male and female students. Obviously bias may be manifested in many ways, however, this study

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is intended as a preliminary assessment only. No generalization to STEM enrollments is intended.

2. LITERATURE REVIEW

A significant amount of the literature addressing the small proportion of women in IT (Information Technology) have focused on biases pushing women out of STEM (Williams, 2015). It has been suggested that it's a pipeline issue and we need only to encourage young girls to consider such fields. Another hypothesis is that women avoid STEM fields to achieve a better work-family balance. Finally, more research is being conducted that documents the role of gender bias as the driving force.

Williams (2015) goes on to identify five patterns of behavior that result in fewer women in STEM fields:

1. Prove-It-Again: approximately two-thirds of the women indicated having to prove themselves over and over again.
2. The Tightrope: masculine behavior is seen as necessary for competence.
3. The Maternal Wall: when women choose to have children their competence is again questioned.
4. Tug-of-War: often women who have experienced discrimination in their careers, distance themselves from other women.
5. Isolation: a significant proportion of black and Latina women find that socializing may negatively affect perceived performance.

Clearly this topic is complicated regardless of what model of influence one chooses to use. In addition, (Raymond, 2015), contends that men don't believe it's a serious problem. In the end, (Vedantam, 2015) found that girls often outperform boys in STEM disciplines at an early age but do not continue through the difficult courses in high school.

It has also been suggested (Clark, 2015) that teachers' unconscious beliefs regarding the aptitude of boys result in lower math scores being given to girls. Other studies, however, have found that girls may in fact be favored (Jackson, 2016), (Saleh, 2016) with a positive bias. To add another layer of complexity to the issue, gender bias has been studied by Protivinsky and Munich (2018) relative to it's impact on the selection of educational alternatives later in life, and that non-cognitive skills play a significant role regarding gender differences. Finally, the issue of the use of grade point average (GPA) as a predictor of aptitude has been found to be unpredictable by (Jackson, 2016; Seleh, 2016).

3. METHODOLOGY

The MCIS program at CSU consists of eleven three credit courses chosen from a set of fifteen. Though there is a core of mandatory courses used in each student's program of study, there is some flexibility based on the background and interests of individual students. The MCIS program has a high degree of technical content, and at least 50% of the courses involve some programming in Java, Linux, VB as well as some middleware languages. Approximately 50% of students have little to no prior programming experience or training.

The methodology used in this study involves the partitioning of final course grades into male and female student groups where the means and standard deviations of each will be used to determine if there is a difference. All courses surveyed are listed in the Appendix along with their titles and break down of male and female final course grades in terms of mean and standard deviation. There was no attempt to verify that the grades recorded were with or without bias. See Table 1, MCIS Course Statistics by Gender for details. While grater granularity would have been preferred in terms of individual course assignment grades, this wasn't practical as a retrospective analysis.

Additionally, it's important to note that all courses in the MCIS program, both at a distance as well as for residential students, use Instructional Coordinators (IC) for all grading and instructional support. While the faculty member of record for each course is responsible for developing the assignments and the rubric used for assessment, the IC performs the assessment. In addition, the IC acts as the first level of support, usually in terms of question and answers to student learning and other issues. The use of ICs may have some impact on gender bias in grading, but this impact, if any, was not assessed. It's important to acknowledge that a course grade while relevant, does not offer a great deal of precision relative to performance in a course.

The faculty member is responsible for the development of the rubrics used for each assignment, the grade distribution for each course and is available for student access throughout the semester. Jackson (2016)

suggested that rubrics may be used to inhibit bias in grading. Both male and female ICs are part of this support of the instruction. The gender of the instructor and the ICs were not considered in this study.

4. DISCUSSION AND FINDINGS

Keep in mind that the purpose of this research is to determine whether there is a grading bias against women in the MCIS program at CSU. The analysis will only involve the final course grades given in the fifteen participating courses. Given this modest objective, 120 course grades were the subject of analysis across all fifteen regular courses, both residential and at a distance.

A cursory scan of the graphs of Female/Male course grades for each class indicates a surprising uniformity of grade outcomes. To be sure, there is a pattern of females achieving a small but striking grade benefit in eleven of the fifteen classes. One might conjecture that if technical classes (i.e. those with significant amount of programming in Java, VB, Linux and SQL as examples) might this pattern be different? Using classes CIS605, CIS606, CIS611, CIS620, CIS655 and CIS665) females outperform males in three of five classes (the sixth was a tie and not counted).

A t-test was performed on each of the classes to determine whether there is a statistical basis for attributing a gender bias to the female/male grades. Referring to the table contained in the appendix with the p values for each class, there is no basis on which to attribute such a bias. The p values vary from a low of 0.12 for CIS575 to a high of 0.97 in CIS655. Using 0.05 as our threshold, there is no statistical basis for a claim of bias.

Finally, for the set of sixteen courses, there is a p value of 0.42, suggesting that there is no statistical basis for the claim of bias by the MCIS program.

5. CONCLUSIONS

There are a number of obvious conclusions to be drawn from the above findings:

1. The results seem consistent with research claiming that females excel at math and science early in their education, though not at a statistically significant level.
2. There appears to be no basis, certainly statistical in nature, supporting a gender bias in the MCIS program.

One might ask, however, whether there are other factors that might be considered. There are many such as: is there a moderating impact on grades through the use of Instructional Coordinators; might performance at an assignment level identify other factors of relevance. Finally, for future research we should increase the granularity of the assessments within each course to include all assignments, those of a technical nature as well as those involving teamwork. There may well be bias that is hidden within the scope of a course grade.

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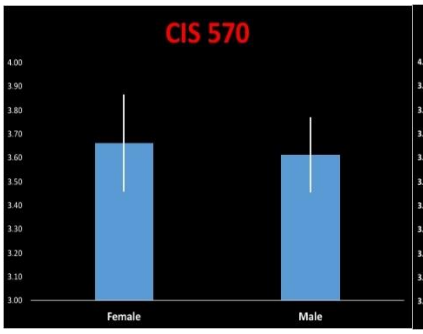
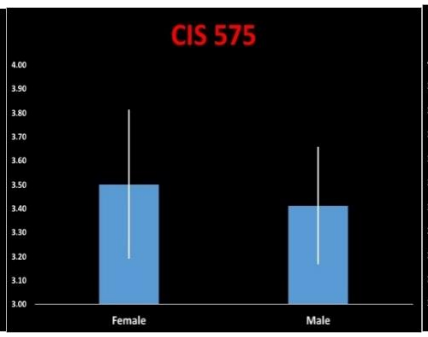
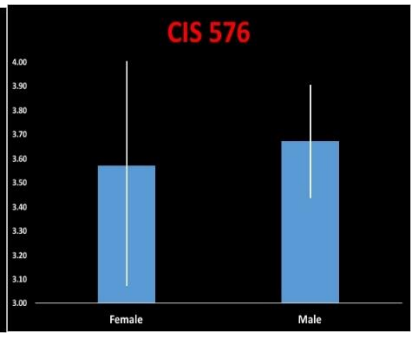
Appendices

MCIS Final Course Grades by Gender







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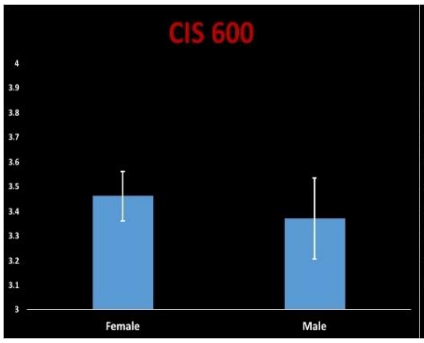

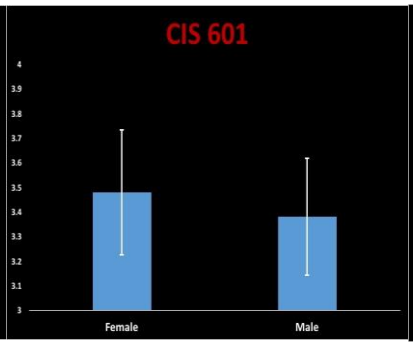

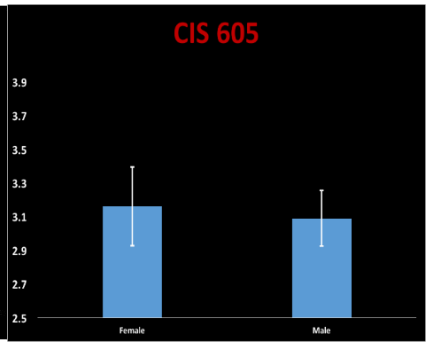

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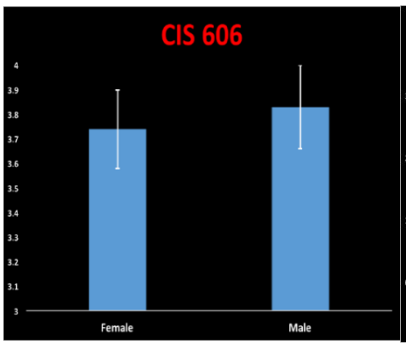

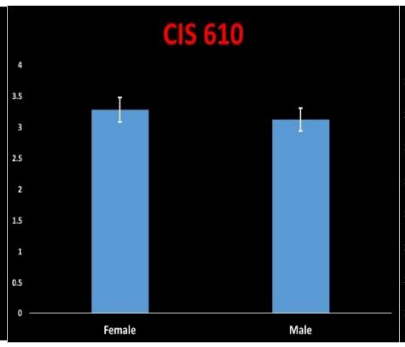

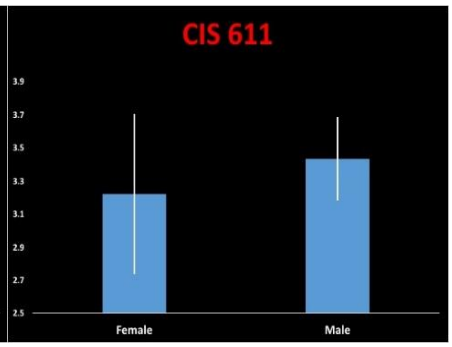

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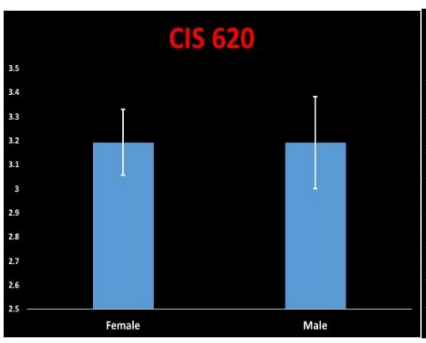

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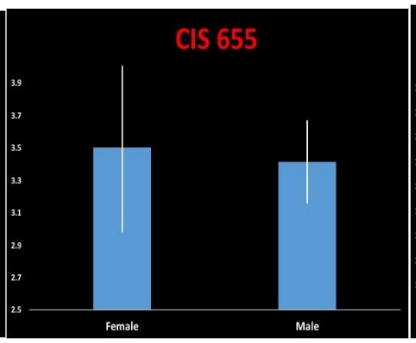

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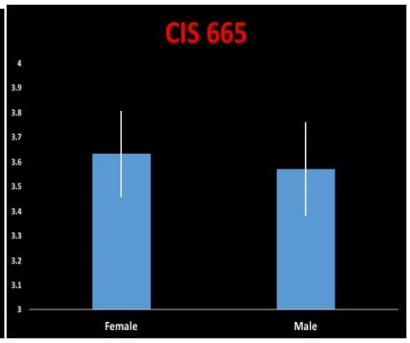

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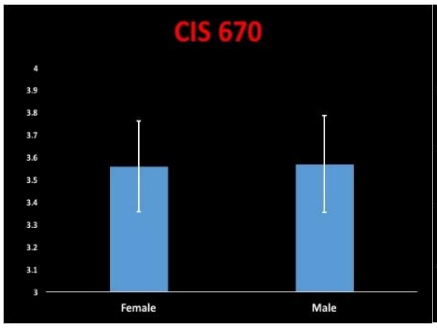

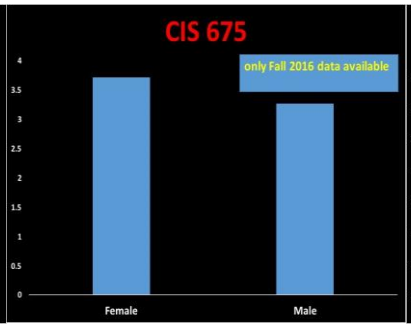

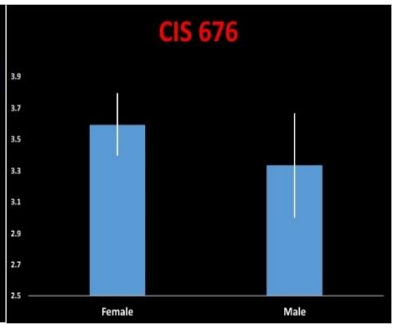

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MCIS Course Statistics by Gender

Course No.	No Of Students		Ave GPA		SD		p value
	F	M	F	M	F	M	
CIS570	170	391	3.66	3.61	0.20	0.16	0.62
CIS575	120	253	3.50	3.41	0.31	0.25	0.12
CIS576	7	18	3.57	3.67	0.50	0.24	0.85
CIS600	284	556	3.46	3.37	0.1	0.16	0.09
CIS601	149	351	3.48	3.38	0.25	0.24	0.74
CIS605	105	274	3.16	3.09	0.23	3.16	0.46
CIS606	172	423	3.74	3.83	0.16	0.17	0.18
CIS610	129	343	3.17	3.11	0.2	0.18	0.23
CIS611	105	300	3.22	3.43	0.48	0.25	0.27
CIS620	113	297	3.19	3.19	0.14	0.19	0.96
CIS655	67	196	3.5	3.41	0.53	0.26	0.97
CIS665	99	273	3.63	3.57	0.18	0.19	0.67
CIS670	124	268	3.56	3.57	0.20	0.21	0.90
CIS675	8	24	3.71	3.26	Fall 2016		NA
CIS676	9	7	3.59	3.33	0.20	0.33	0.59
Summary	1662	3976	3.50	3.41	0.19	0.20	0.42

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