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Implications of Gender Consciousness for Students in Information Technology

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Introduction

Gender consciousness is the recognition that one's physical sex shapes one's relationship to the political world. Similar to other forms of group consciousness, it entails identification with others like oneself, a positive affect toward them, and a sense of connectedness with the group and its well-being (Tolleson Rinehart 14). Gender consciousness is a necessary precondition for feminism (Hogeland 19) and feminist activism, although individuals can reject the label of feminist while still being quite gender conscious (Prindeville and Bretting 18).

In previous research, women have been found to exhibit low levels of gender awareness when reflecting on their career experiences (Bierema, "A Model of Executive Women's Learning and Development" 118; Caffarella, Clark, and Ingram 90-93). Greater gender awareness could help advance women's careers, these researchers concluded. Others have observed, however, that many women avoid or deny gender consciousness, particularly if it seems to lead to political consequences and risk of reprisals (such as being labeled a 'feminazi'; Hogeland 18-21). Fear of such consequences, in combination with societal gender role expectations (Watt 39), may contribute to the tendency for women to avoid competition with men and choose less ambitious career paths (Bierema, "The Role of Gender Consciousness" 5).

One professional arena in which this paradox plays out is information technology (IT). Women are seriously underrepresented in IT educational programs and careers, especially at higher levels—in doctoral as compared to undergraduate programs in universities, and in corporate officer as compared to programming jobs in the IT workforce (Bentson, Camp 104-108, NCWIT). Lack of confidence in working with computers and a purported lack of interest in the masculine world of computing are among the many reasons that have been proposed to explain the paucity of women in IT (Kramer and Lehman 160-164, Turkle 41-59). As yet, however, little consideration has been accorded to gender consciousness among IT students, or its relationship to the gender gap in computing. Does awareness of the minority status of their gender in the IT world (dis)advantage female IT students?

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To begin to address this question, in this study we explore the effects of gender consciousness on students enrolled in information technology-related programs at five large public research universities in the United States. Based on 136 in-depth face-to-face interviews, we identify characteristics of students with different degrees of gender consciousness and assess the overall level of gender consciousness among the IT students. We then consider what relationship, if any, exists between level of gender consciousness and students' self-efficacy, considered in terms of their self-confidence and ambition, as regards their educational outcomes and future IT careers. Our interview data suggest that gender consciousness is related to students' lived experience, including their experience in their particular IT discipline; tends to correspond to high levels of self-efficacy; and has positive implications, via the mediating variable of self-efficacy, for the educational and professional success of women in IT.

Literature Review

Gender consciousness and feminism

The terms 'gender consciousness' and 'feminism' are often discussed together, and much research into the former adopts a feminist perspective. According to Hogeland (19), however,

> [g]ender consciousness is a necessary precondition for feminist consciousness, but they are not the same. The difference lies in the link between gender and politics. Feminism politicizes gender consciousness, inserts it into a systematic analysis of histories and structures of domination and privilege.

Similarly, Gurin (cited in Reid and Purcell 760) defines feminism as *politicized gender consciousness*. This is characterized by (a) a sense of interdependence and shared fate with other women, (b) recognition of women's relatively low status and power compared to men, (c) attribution of power differentials to illegitimate sources, such as institutionalized sexism, and (d) an orientation toward collective action to improve women's position in society. Reid and Purcell (760) note further that in order to identify as feminist, women must also hold positive (or at least not negative) opinions of the social group "feminists"—one reason many women who agree with the ideals of feminism may hesitate to take on the label of feminist.

Gender consciousness can be seen as a step along the developmental path leading to feminism. According to Carroll, gender consciousness-raising typically takes place in three phases. First, the individual begins to identify with women, acknowledging common interests. Second, s/he notices disparities in how women are treated and feels this is unjust. Third, s/he recognizes that "the problems women face demand collective, political solutions and cannot be solved through individual efforts" (328; see also Gurin). Similarly, Rickart (214) proposed a feminist identification scale (FIS) with five stages: passive acceptance, revelation, embeddedness, synthesis, and active commitment; gender consciousness can be said to be present by the second stage and feminism by the last stage.

Both Carroll's and Rickart's developmental stages incorporate the two components necessary to group identification in general, as articulated by social psychologist Henri Tajfel (2): *cognitive*, "in the sense of awareness of membership", and *evaluative*, "in the sense that this awareness is related to some value connotations." Accordingly, varying stages in feminist identification are associated with shifts in cognitive-conceptual integration and moral and ethical development in the individual, as well as with the centrality of gender to the concept of the self, which varies from individual to individual (Rickart 214).

A number of advantages have been claimed for heightened gender awareness. Gender consciousness can play a supporting role in leading women to take political action, as noted by Tolleson Rinehart:

> If women require special resources to overcome the lack of welcome they may find as they try to become political, gender consciousness can provide them. Gender identification and gender role ideology furnish these means by providing an intrinsic belief system: I can and should participate; and a sense of extrinsic support: I do this with and for others like me. (139)

Gender consciousness can also play a facilitating role in educational contexts, which are especially relevant to the present study. In Brody et al.'s study of three Catholic high schools about to transition from single-sex to co-educational, "participants' consciousness of gender issues was heightened: faculty and administration were formally and informally discussing gender concepts and students were talking about male and female issues." The researchers found that "the combination of leadership, staff and curricular awareness, and an understanding of gender fair and gender affirmative practices can serve to improve institutional effectiveness and lead to higher levels of student achievement."

Notwithstanding the pervasiveness of gendered systems of power in society and the benefits of gender consciousness, many people are not gender aware. Bierema ("The Role of Gender Consciousness" 5) calls such people the "gender unconscious." Moreover, some women who are gender unconscious "may also be aware of gendered power relations but choose to deny, minimize, or ignore them because the cost is too high" (5).

There are various reasons why individuals might become aware of gendered power relations, yet resist the conclusion that these relations are undesirable and should be changed. From her experience teaching college students about feminism and feminist principles, Titus identified four categories of resistance: Deny, Discount, Distance, and Dismay (26-33). The individual in the first three categories actively resists feminist thought, by *denying* that structural gender inequality exists; by *discounting* gender issues as unimportant or contextually irrelevant; or by acknowledging that a problem exists, but *distancing* him- or herself by shifting blame onto factors outside the realm of personal intervention. In the last category, *dismay*,

the individual's eyes become opened to institutionalized oppression, but the scale of the problem seems so great that he or she despairs of being able to do anything to bring about a more just society.

Finally, Henderson-King and Stewart argue that for women specifically, there are unique obstacles to the formation of a group consciousness. In particular, women spend considerable time interacting with and focusing on men in their daily lives, and this "is done at the expense of [women's] relationships with women and, therefore, at the expense of developing group identification and group consciousness" (507). This risk seems especially great in professional contexts such as computing, which are overwhelmingly male dominant.

The Gender Computing Gap

Perhaps nowhere are levels of student engagement and achievement of greater contemporary concern in the U.S. than in the arena of information technology, where girls and women have been left behind with seemingly few prospects for catching up. Women drop out at rates faster than men at all levels of educational and professional advancement, resulting in a gender gap that is especially pronounced at the highest levels of the computing workforce, and that has not narrowed appreciably in over 20 years (Camp 104-108, ITAA, Vegso). Despite efforts to move more women into the pipeline at lower levels (e.g., Margolis and Fisher); girls and women still express less interest than boys and men in studying computer science and in pursuing IT careers (Bentson, Vegso).

In research on gender and computing education, this persistent state of affairs has been attributed to both structural and individual factors. Based on a survey of research on women and computing from the 1990s, Dryburgh (181-202) identified eight groups of factors affecting girls' and women's computing experiences: interest/motivation; attitudes; experience; role models/mentors; culture (class, lab, and general computer culture); stereotypes/sex role beliefs/(knowledge of the field); historical/structural factors; and sex discrimination. At the elementary school level, research has tended to focus on structural factors such as lack of gender-equity policies, lack of diversity in curriculum, and lack of female role models in computing. At the post-secondary level, there has been an increasing focus on social psychological factors such as attitudes, experience, the effects of role models and encouragement (cf. Shashaani 433-451). What motivates and interests women in computing is also studied more often at higher educational levels (Dryburgh 181-202).

Confidence is an individual factor often related to women's computer avoidance. Women are socialized to underestimate their abilities in traditionally male domains such as mathematics and computing, resulting in "learned helplessness" behaviors (Kramer and Lehman 169). Ring (210-215) found that girls had lower self-confidence than boys in using educational software. Fisher et al. (3) found an experience-related gender gap in confidence among first year college students; men were more confident in their ability to master the course material and were more likely to claim an expert level of knowledge of a

programming language. A recent large-scale Web survey of 1,768 IT majors at U.S. universities found that female students still report lower levels of computer efficacy than do male students (Ogan, Robinson, Ahuja, and Herring,). However, Fisher et al. (3) found that persistence in the program and extra feedback along the way can mitigate the negative effects for female students of having lower self-efficacy and less computer experience.

Individual agency can also play an important, positive role. Bussey and Bandura propose that gender conceptions are constructed from life experiences together with motivational and self-regulatory mechanisms. Rather than being passively shaped by these influences, however, "people contribute to their self-development and bring about social changes that define and structure gender relationships through their agentic actions within the interrelated systems of influence" (676). Recent sociological theories invoke similar notions of agency in explaining how gender conceptions arise. "In these approaches, agents are understood to *actively* construct gender within the limits of existing social discourses or historically specific social institutions" (Carr 528). This view recognizes the possibility not just for gender-conscious individuals to overcome the obstacles they face as women in IT, but for their actions to bring about societal change.

Predictors of career success

Past research has repeatedly demonstrated a correlation between high self-efficacy, academic persistence, and career success (Aycan 472, Multon, Brown, and Lent 34, Zeldin and Pajares 240),[1] including in IT fields. As Bénabou and Tirole note, "[c]onfidence in one's abilities generally enhances motivation" (871). Career motivation, in turn, can positively affect performance effectiveness (Day and Allen 83-4).

It has been claimed that women are less ambitious than men in pursuing prestigious, high-paying careers. In a study of career aspirations and planning among non-managerial women, Hite and McDonald (223) found that career goals were often adapted to meet other life circumstances, such as family responsibilities. Bentson claims that women in IT are motivated more strongly to do meaningful work than to earn large salaries. Even in comparable positions, however, women tend to trail men in pay, promotion, benefits, and other economic rewards (Bierema, "The Role of Gender Consciousness in Challenging Patriarchy" 3).

Bierema ("A Model of Executive Women's Learning and Development" 118) argues that a sense of interconnectedness with other women can improve women's career experiences. Women often exhibit low levels of gender awareness when reflecting on their careers, even when reporting experiences of gender-based hardship, discrimination and harassment (Caffarella, et al. 90-93). According to Bierema ("The Role of Gender Consciousness in Challenging Patriarchy" 4), "[w]omen's uncritical career development not only causes them to adapt to a masculine model, but also prevents them from addressing power differentials or claiming a career on their own terms as women." She proposes, along with Caffarella and Olson (145), that "raising the consciousness of women about the 'glass ceiling' for women in organizations [could] affect their life

dreams and what they believe they can achieve." We suggest that the same is true for women in information technology fields.

Research Questions

In this study, we investigate the implications of gender consciousness for students majoring in information technology fields. Specifically, we ask:

- **RQ1:** How gender conscious are IT students overall?
- **RQ2:** What are the characteristics of students at different levels of gender consciousness?
- **RQ3:** What relationships, if any, exist between gender consciousness and IT students' self-confidence and ambition, identified in previous research as predictors of educational and career success?

Methodology

Answers to these questions emerged somewhat fortuitously out of a series of in-depth, face-to-face interviews we conducted as part of a larger study of women's experience in18 IT programs at five U.S. universities (Ogan et al., Herring, Ogan, Ahuja, and Robinson). The purpose of the larger study was to compare lesser-studied applied IT disciplines with computer science, which has been the focus of most scholarship on women and IT education to date (e.g., Fisher, Margolis and Miller; Margolis and Fisher). The five universities selected for the study are major public research institutions with a computer science program and at least two out of four applied IT programs: informatics, instructional technology, library and information studies,[2] and management information systems. The interviews were one of two methods used to collect information about female and male students' experiences in their academic programs (the other was a Web-based survey, described in Ogan et al.). The interview results are analyzed here for the first time.

One hundred and thirty-six students (87 women and 49 men) were interviewed on their home campuses during the 2004-2005 academic year. We aimed to overrepresent women at a ratio of two women to every man, since our primary interest was the attitudes and experiences of female students. The largest portion of the interviewees came from computer science (N=56), reflecting the fact that all five of the participating universities have a CS program. The next largest group was information systems majors (N=26), followed by information studies majors (N=23). Sixteen students were interviewed from informatics and 15 from instructional technology programs, the lower numbers reflecting the fact that there were fewer of these programs in the universities that participated in the study. The interviewees were roughly evenly spread across academic level, with 47 undergraduates, 47 Master's, and 42 Ph.D. students.[3] The characteristics of the interviewee sample by discipline, academic level, and gender are summarized in Table 1.

Discipline	Undergraduate			Master's			Ph.D.			Total		
	F	M	Total	F	M	Total	F	M	Total	F	M	Total
CS	21	11	32	6	4	10	10	4	14	37	19	56
Informatics	3	4	7	5	1	6	2	1	3	10	6	16
IST	*Graduate only*			5	3	8	5	2	7	10	5	15
LIS	*Graduate only*			8	3	11	8	4	12	16	7	23
MIS	4	4	8	7	5	12	3	3	6	14	12	26
Total	28	19	47	31	16	47	28	14	42	87	49	136

Table 1. Students interviewed, by discipline, academic level, and gender

Because of the sampling method used, the ratio of women to men interviewed was roughly the same for each discipline and for each academic level (2:1), except where that was not possible to achieve because of small numbers of female students in some programs. Thus the numbers in Table 1 do not represent the actual proportions of women and men in the IT programs; rather, our previous research (Ogan et al., Herring et al.) suggests that women are a minority in all but IST and LIS.[4] Of the students who agreed to be interviewed, most were white, with 18% being East or South Asian, and 2% African American; they ranged in age from late adolescence to late middle age.[5]

Students were recruited for the interviews in one of three ways: They took part in the Web survey that we conducted earlier about IT students' experiences and attitudes; they were recommended by faculty, staff members in their programs, or by friends who had already agreed to participate in the study; or they responded to a general invitation to participate in the study sent by a faculty/staff member to a departmental mailing list. The invitation to participants did not foreground gender as an issue; it indicated only that the researchers were interested in studying "the experiences of women and men in IT programs at major U.S. universities," with the goal of making recommendations to improve such programs.

The semi-structured interview consisted of approximately 50 questions asking about students' reasons for choosing their major program of study, their experiences in their IT programs, their early computer experiences, and a series of questions about gender and computing, including questions related to self-efficacy and ambition. The interviewer, who is also the second author of this paper, was a 39-year-old male doctoral student in Instructional Technology of mixed Asian-white ethnicity who was employed as a research associate for the project. The interviews took place face-to-face in rooms that each university made available for this purpose, lasted for approximately 45-60 minutes each, and were digitally recorded.

Data analysis methods

The interviews were first manually transcribed, then the students' answers to each interview question were content analyzed by the authors and a project research assistant, who, after discussion of potentially unclear cases, agreed with each others' interpretations in over 95% of the cases. For the purposes of this study, we analyzed the interview

responses for evidence of three qualities: gender consciousness, self-confidence, and ambition.

From the students' responses, it was evident that two aspects of gender consciousness needed to be differentiated. These are combined in the second phase of Carroll's (328) stages of gender consciousness-raising: The individual *notices disparities in how women are treated and feels this is unjust*. However, we observed in reviewing the answers given by our interviewees that the first part of the formulation (the cognitive or awareness aspect) was often evident without the second part (the evaluation aspect, in Tajfel's terms). Thus we decided to distinguish between students who both notice gender disparities in IT programs and are bothered by them, and students who notice gender disparities and are not bothered by them. This distinction allows a third type to emerge: students who do not notice (or who deny or dismiss, in Titus's terminology) gender disparities, and are (therefore) not bothered by them. As a shorthand, we refer to these levels as high, median, and low gender consciousness.

In addition, we characterized each interviewee overall for ambition and (separately) for self-confidence. Based on previous research (see Multon et al. for an overview), these two attributes are considered to be good predictors of academic and career success. After extensive discussion of individual cases, we agreed among ourselves on characteristics of high, medium, and low self-confidence and high, medium, and low ambition interviewees; these characteristics are described in detail and illustrated below.

Descriptive statistics were generated to analyze the three gender consciousness categories with respect to student demographics (gender, discipline, and academic level) and different levels of ambition and self-confidence. Because of the small numbers in some of the categories, it was not possible to conduct tests of statistical significance. Tables summarizing the descriptive statistics can be found in the Appendix, except for those summarizing the results central to the analysis, which are presented and discussed in the following sections.

Findings

Overall gender consciousness

Our first question asked, *how gender conscious are the IT students overall?* In order to answer this, we first had to decide which of our three categories of gender consciousness the interviewees belonged to. Those decisions were based on multiple considerations. Individuals in the 'low consciousness' category could acknowledge, when it was brought to their attention by the interviewer, that there were gender differences in their programs or fields. However, they did not mention them spontaneously during the interview, and when asked to elaborate upon or explain the effects of these differences, they could not do so. Moreover, they expressed no concern about gender disparities in IT when these were pointed out to them by the interviewer's questions. A small number of (male) students in this category responded defensively, denying that gender disparity existed.

For example, when asked about gender disparities in his program and field, and whether his demographic profile had affected him, Andy,[6] a Master's student in computer science, avoided commenting on gender specifically:

> "Well, I don't know. So I guess it's – I mean I'm a WASP[7] basically, a stereotypical WASP. It's sort of the – I'm not really in a position to notice it I guess. In generally – in general I assume that if there's been anything that's probably helped. But I don't know that I – I'm not really in a position to notice it whether it would or not."

The students we placed in the 'median consciousness' category, in contrast, were able to provide examples, when asked, of how the experiences of males and females in their programs or fields were different, and could speculate as to reasons for the differences. However, they did not indicate that they were particularly bothered by them. An example of someone in this category is Lisa, a female undergraduate in computer science, who said, "Gender, the gender gap is incredibly noticeable, there were only five women in my class to start and now there's only three. How that's affected me, it's gotten me some unwanted attention. [Laughs.] But that's it."

The students in the 'high consciousness' category, finally, expressed frustration with the gender-unequal status quo, could offer interpretations of it informed by an awareness of power disparity, and in some cases had taken concrete action (e.g., participating in women-oriented events or programs) to effect change. These students were most likely to mention gender as a factor in their experience before it was raised by the interviewer. For example, Jane, a Master's student in Informatics, shared the following in response to a question about what she would most like to change about her program,

> "One of the drawbacks I found with [my program] is they didn't have a good support group for women. So I did join [the women in computing group] over in Computer Science, and I was the only Informatics girl in the organization. So this year that's changed, and I helped broaden [the women in computing group] so it included Informatics, but initially there was no initiative for women at [my program]. That was kind of disappointing."

Jane repeatedly referred to instances of being "disappointed" by gender related issues that came up in her academic life, but she was also active in trying to make a difference.

In all, 29 individuals (21%) were initially classified into the high gender consciousness category, 80 (59%) in the median category, and the remaining 27 (20%) in the low gender consciousness category. That is, the majority of students expressed an awareness of gender asymmetries in IT, but did not seem to feel that they were unjust.

These initial numbers included five male students classified as 'high gender conscious' because they met the criterion of being bothered by the gender gaps they saw in their programs, albeit for reasons different from the others: They perceived women as

receiving (undeserved) special treatment, or they were unhappy because the scarcity of women made it harder for them to find women to date. We assessed these concerns to be qualitatively different from those of others who associated the gender gap with academic or professional unfairness toward women, and a decision was made to exclude them from further analysis, so as not to compromise the interpretability of the 'high gender conscious' category. (See Appendix, Table A for the characteristics of the five males who were excluded.) After this adjustment, the distribution of gender consciousness was: high (18%), median (61%), and low (21%).

This overall median level of gender consciousness may seem high for a science domain populated, according to stereotype, by socially-unaware "geeks" and "nerds" (Kendall, Turkle 41-61). However, the gender computing gap has received a certain amount of attention in the mainstream media in recent years (e.g., ITAA, Vegso) and has started to enter the cultural consciousness. Most of the IT students we interviewed had heard about the gender gap and could suggest explanations for why it exists.

Gender consciousness and student demographics

Our second question asked, *what are the characteristics of students with different levels of gender consciousness?* Not surprisingly, gender consciousness is related to student gender. Five times as many women expressed a high level of gender consciousness as men, while three times as many men as women expressed a low level of gender consciousness. Women and men fell into the median gender consciousness category proportionately equally (see Figure 1 and Table 2).

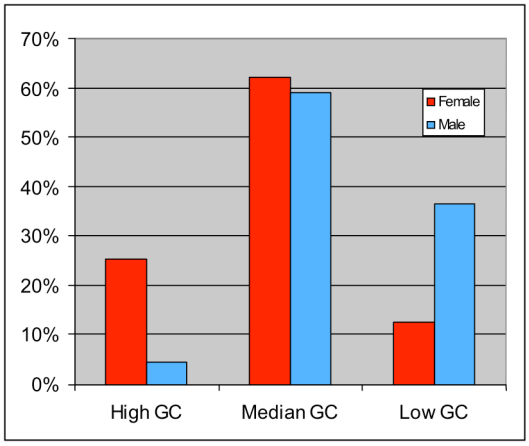

Figure 1. Distribution of gender consciousness (GC) by gender

Gender	High GC		Median GC		Low GC		Total	
Female	22	(25%)	54	(62%)	11	(13%)	87	(100%)
Male	2	(5%)	26	(59%)	16	(36%)	44	(100%)
Total	24	(18%)	80	(61%)	27	(21%)	131	(100%)

Table 2. Distribution of gender consciousness by gender

Computer science was the discipline with the highest level of gender consciousness, with 41% of the CS women interviewed falling in this category. CS is the discipline in our study with the lowest female enrollments (between 10-20% of students in 2006, according to national statistics; NCWIT), giving female students plenty of opportunity to experience and reflect on gender disparities first-hand. In contrast, students in instructional technology and library and information studies, programs with higher female enrollments, were less likely to indicate that they noticed or were bothered by gender disparities. CS men, but few CS women, were found in the low gender consciousness category, while the distributions of informatics and management information systems students were proportional across the three categories of gender consciousness. (See Appendix, Table B.)

Academic level of the students in our study also appeared to be associated to some extent with gender consciousness, although the trends are more suggestive than conclusive. Ph.D. students were most common in the high consciousness category, while Master's students predominated in the median consciousness category. Undergraduates are slightly overrepresented in both the high and the low categories. (See Appendix, Table C.)

These findings suggest that gender consciousness in IT programs is related to students' lived experiences. Women, especially in male-dominated fields, have greater gender consciousness than men because as the minority they are more affected by gender disparities. In contrast, the women in programs with high female enrollments were less likely to report being bothered by gender disparities, perhaps because the high numbers of women in the program make it less likely that they will experience gender-based discrimination, and provide a stronger support network if they do. Likewise, doctoral students, who have had more experience in academia than students at lower levels, have had more opportunities to observe or experience gender discrimination first-hand.

Gender consciousness and self-confidence

Our third question asked, *what relationships, if any, exist between gender consciousness and IT students' self-confidence and ambition?*

'Self-confidence' was assessed based on measures generated for the purpose of this study of two kinds of behavior: the students' behavior during the interviews, and their reflections about their own abilities and likelihood of academic and career success. With regard to the first measure, during the interviews, some students made more direct eye contact with the interviewer and had a more relaxed manner and bearing, communicating higher self-confidence. From the recordings, it was also apparent that some students spoke fluently and confidently, while others made more pauses and false starts in answering questions, and used more qualifiers, hedges, and "I don't know" fillers, conveying an overall impression of lower confidence. Our self-confidence assessments also took into account interview content; for example, if students minimized or were

apologetic about their academic performance, this was taken to indicate low self-confidence.

The interviewees generally presented themselves confidently, with 61 students (47%) coming across as highly self-confident, 62 (47%) demonstrating median self-confidence, and only eight (6%) appearing low in self-confidence. The high confidence level projected by the interviewees may reflect the fact that they were volunteers, and highly confident individuals are more likely to volunteer to participate in face-to-face interview studies. Even so, it is encouraging that no overall differences were observed in self-confidence based on gender. On a scale from 1 to 3, where 3 is 'highly self-confident', both women and men averaged 2.4.

Andy, the CS Master's student quoted above, is an example of someone we assessed to be low in self-confidence. When asked whether he felt he was a successful student, Andy initially responded "certainly," but then amended his answer with considerable hesitation and restarting:

> "A successful student I would certainly – I think I'm certainly a successful student whether that's a – I'm not so sure that I'm successful like finding things past being a student like finding a job. (…) So I'm not sure if it's – I think a success as a student is just making good grades, and I think somewhat recognition adds to the success but I'm not sure about sort of the in the overall framework of things, whether it might be too early to tell."

Andy made almost no eye contact with the interviewer, which contributed to our impression that he lacked self-confidence.

In contrast, Bella, a Master's student in the same program as Andy, seemed highly self-confident. She asserted, "I embrace my nerd. (…) I like this stuff and I'm okay with the way that I am and I don't need others to tell me that to act a certain way." Carol, a Ph.D. student in information studies at another university, also seemed very confident. "I don't know if that's a personal trait or if it's gender related or whatever, but just generally if I find something that's gonna stop me from doing something, then I'll make sure to do it and – and generally try to become the boss of whatever stopped me," she declared. While most of the men we interviewed were not like Andy, these two women were not atypical of the female interviewees.

We observed a pattern in our interviewees that suggests a relationship between self-confidence and gender consciousness. In general, the higher a student's gender consciousness, the higher their self-confidence seemed to be, especially for women. In contrast, the male students seemed most confident when they knew about—but were not concerned about—the gender gap in computing. These findings are represented graphically in Figure 2 and summarized in Table 3. High self-confidence decreases for both genders, and median self-confidence increases, as one moves from high to median to low gender consciousness. (The numbers for low self-confidence are too small to allow for any generalizations.) The students with low gender consciousness seemed the least

self-confident, especially the men. Note that since there are only two men in the high gender consciousness category, their percentages are not meaningful.

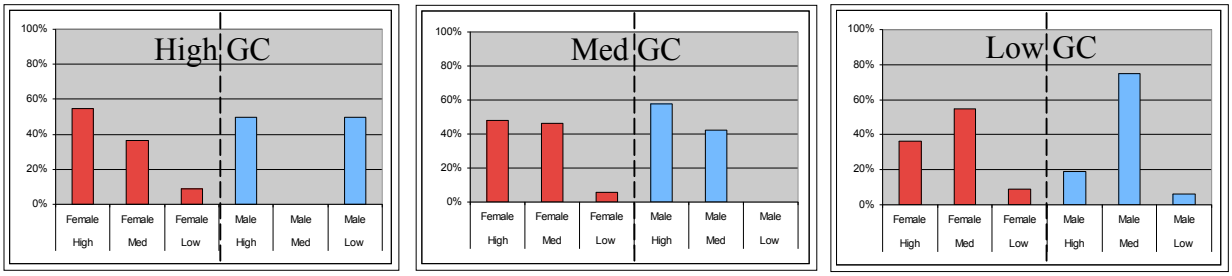

Figure 2. Self-confidence of high, median, and low gender conscious students (percentages of students of each gender in each consciousness category)

Red=female, Blue=male

Self-Confidence		High GC		Median GC		Low GC	
High	Female	12	(55%)	26	(48%)	4	(36%)
	Male	1	(50%)	15	(58%)	3	(19%)
Med	Female	8	(36%)	25	(46%)	6	(55%)
	Male	0	(0%)	11	(42%)	12	(75%)
Low	Female	2	(9%)	3	(6%)	1	(9%)
	Male	1	(50%)	0	(0%)	1	(6%)
	Total	24		80		27	

Table 3. Self-confidence of high, median, and low gender conscious students (percentages of students of each gender in each consciousness category)

Gender consciousness and ambition

'Ambition' was assessed on the basis of students' responses to questions we asked about their future goals and their personal measures of success. In addition, some students made comments about responsibilities they had taken on voluntarily (especially, although not always, regarding gender disparities that they observed), which suggested that they were ambitious, initiative-taking individuals.

Ambition in our interviewees was distributed along a bell-shaped curve, with 34 students (26%) expressing high ambition, 87 (66%) expressing median ambition, and 10 (8%) expressing a low level of ambition. Consistent with previous research, the women we interviewed were not as ambitious as the men, although the difference was slight. On a scale from 1 to 3, where 3 is 'highly ambitious', men averaged 2.3 and women averaged 2.1.

Danielle, a female computer science Ph.D. student, is an example of someone who expressed a high level of ambition. "I'm going to do the, get the highest grade on the test and highest grade on the quiz and I'm going to do best on the first assignment," Danielle declared competitively. "And see you all later! You can come talk to me," she added, laughing.

In contrast, Mika, an undergraduate Asian women in computer science, expressed a low level of ambition. For example, when asked about her plans for the future, she replied, "I actually have no idea. I think, I don't know I... If I can't... I'm actually thinking about... I'm taking a lot of hardware courses, so I'm thinking about getting a dual in C.E." Instead of responding about her career plans, Mika replied that she was thinking about extending her coursework, thereby delaying her career.

The pattern for ambition in relation to gender consciousness is similar to that for self-confidence. Higher levels of ambition corresponded to higher levels of gender consciousness, overall; however, this manifested somewhat differently for women and men. Highly ambitious women were overrepresented in the high gender consciousness category: The high consciousness category only accounts for 18% of the analyzed population, but nearly half (42%) of the highly ambitious women are there. Highly ambitious men, in contrast, tend to fall in the median consciousness category, and the men in this category are notably more ambitious than the women. Low gender consciousness is associated with lower levels of ambition, especially for men.

These findings are represented graphically in Figure 3 and summarized in Table 4. Similar to the results for self-confidence, a tendency can be seen for median (and low) ambition to increase at the expense of high ambition for both women and men as gender consciousness decreases. (Again, because there are only two men in the high gender consciousness category, the percentage for men in this category is not meaningful.)

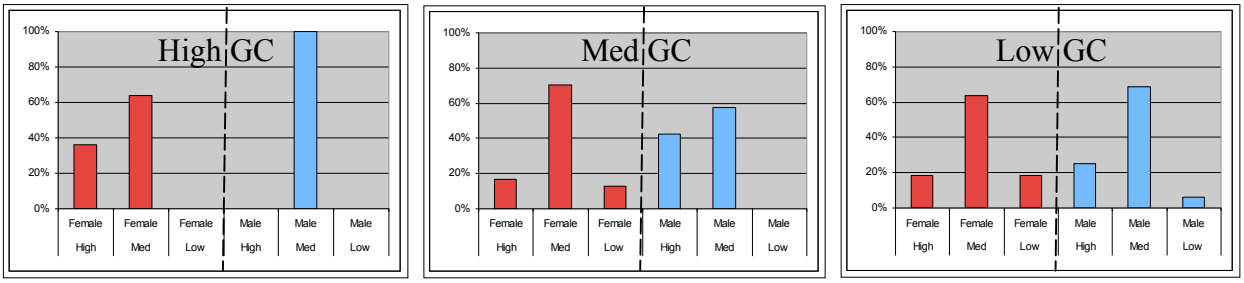

Figure 3. Ambition of high, median, and low gender conscious students (percentages of students of each gender in each consciousness category)

Red=female, Blue=male

Ambition		High GC		Median GC		Low GC	
High	Female	8	(36%)	9	(17%)	2	(18%)
	Male	0	(0%)	11	(42%)	4	(25%)
Med	Female	14	(64%)	38	(70%)	7	(64%)
	Male	2	(100%)	15	(58%)	11	(69%)
Low	Female	0	(0%)	7	(13%)	2	(18%)
	Male	0	(0%)	0	(0%)	1	(6%)
	Total	24		80		27	

Table 4. Ambition of high, median, and low gender conscious students (percentages of students of each gender in each consciousness category)

Unfortunately, no causal relationship can be established on the basis of these findings between gender consciousness and self-confidence and ambition. We do not know, for example, if women such as Bella and Danielle chose to study IT because they already possessed the self-confidence and ambition necessary to persist and succeed in a masculine domain, or if they became more self-confident and ambitious as a result of their (potentially radicalizing) experiences as minorities within their chosen IT domain. What is clear, however, is that there is no incompatibility between a high level of gender consciousness and a high level of self-efficacy, as far as these female IT students are concerned.

Discussion

The findings from the interviews with the IT students provide answers to our three research questions and also have broader implications for understanding gender consciousness and its relationship to the gender gap in computing.

We first asked: How gender conscious are IT students overall? In order to address this and the other questions, we introduced a distinction not previously articulated in the literature on gender consciousness, separating cognitive *awareness* of gender disparity from affective *response* to that awareness. This distinction revealed the overall level of gender consciousness of the IT students to be median, rather than low, as it might otherwise have appeared had we applied Carroll's stages of gender consciousness-raising without modification. This is a somewhat encouraging finding, since even if most students are not actively concerned about it, awareness of the gender gap is a step in the direction of taking action to close the gap.

It is possible that the students became aware of the gender computing gap through their direct experience of seeing fewer women than men in their IT programs and disciplines. However, since median gender consciousness was also common for students in gender-balanced disciplines such as LIS and IST, it seems likely that other forces contributed to making these IT students aware of gender issues. Popularization of the gender computing gap in the media in recent years (e.g., ITAA, Vegso) may have raised awareness of the issue to some extent.

Our second research question asked: What are the characteristics of students at different levels of gender consciousness? Demographics and student experience were associated with level of gender consciousness to some extent in our sample. The high gender conscious students were disproportionately female and disproportionately majoring in a male-dominant IT field (especially computer science). They were mostly doctoral students and undergraduates. Median consciousness students were most likely to be pursuing a Master's degree, but they were otherwise diverse. The low gender consciousness students were disproportionately male, and more likely to be majoring in computer science (if male) or an IT field with balanced gender representation (instructional technology or library and information studies, whether male or female).

Our three-way categorization separated female from male IT students at the extremes of high and low gender consciousness, while revealing median consciousness to be characteristic of females and males in equal proportion. This seems plausible, given that both genders must participate to maintain the status quo, and that median consciousness does not question the status quo. Moreover, female students are more likely to be adversely affected by the status quo and thus to notice and be bothered by it (and potentially, to agitate for change). The existence of a low-consciousness group made up of students who are least affected by gender disparity—males in computer science, who enjoy a clear majority, and both males and females in relatively gender-equitable disciplines such as instructional technology and library and information studies—also makes sense in motivational terms.

The third research question asked: What relationships, if any, exist between gender consciousness and IT students' self-confidence and ambition? Applying our three-point scale of gender consciousness to the interview data, we observed that both self-confidence and ambition appeared to decrease with a decrease in gender consciousness among our interviewees. At the same time, women and men are served differently by having different levels of gender consciousness: The women appeared most ambitious and self-confident when they were highly gender aware, while the men appeared most ambitious and self-confident when they were moderately gender aware. Neither gender appeared to be particularly self-confident or ambitious in the low gender consciousness category.

Such differences, if validated by further research, have implications for students' future success in their degree programs and beyond. Considerable past research has demonstrated a correlation between high academic self-efficacy, academic persistence, and career success (Aycan 472, Multon, Brown, and Lent 34, Zeldin and Pajares 240). Our finding that overall levels of self-confidence and ambition were roughly the same for women as for men in this study, in contrast with previous research suggesting that women in IT are less confident and ambitious, is thus rather encouraging.

It is also encouraging that being aware of—and concerned about—gender disparities in IT does not appear to have led these women to a disempowered state of dismay, in contrast to Titus's students who acknowledged structural gender inequality, or undermined their self-confidence or aspirations; on the contrary, it is associated with higher levels of both. This suggests that high gender consciousness, to the extent that it is associated with high self-efficacy, will increase the likelihood of positive individual outcomes, including completing one's program of IT study and entering and advancing in an IT career.

Finally, highly gender conscious individuals are more likely to go on to reach the third phase in Carroll's sequence of gender consciousness raising, in which they recognize that the problems women face demand collective, political solutions and cannot be solved through individual efforts (328). This, in turn, may lead them to engage in activism to change the male-dominated status quo. As such, gender consciousness raising may be beneficial not only at the individual level, but at the societal level. Practically

speaking, given that IT jobs in the U.S. are currently going unfilled (or being filled by foreign nationals) for lack of qualified applicants (ITAA, NCWIT), closing the IT gender gap would benefit the national economy by bringing qualified women into the IT workforce. In terms of social justice, it would establish a more equitable status quo in the increasingly pervasive IT domain.

Limitations and Directions for Future Research

The findings of this study are suggestive rather than definitive. While 136 subjects is a substantial population for an interview study, after we had classified the students according to demographic variables and gender consciousness and self-efficacy levels, the numbers in the resultant categories were too small to permit statistical testing of the patterns that emerged. Moreover, this study did not directly assess outcomes, but rather inferred benefits of high gender consciousness from the association between gender consciousness and two measures of self-efficacy (self-confidence and ambition). A large-scale, systematic study measuring gender consciousness and correlating it with characteristics of self-efficacy and student performance and career outcomes is necessary to validate the tendencies that emerged through our interviews of IT students.

In a theoretical vein, hints given in the interviews suggest that it would be analytically useful to distinguish further sub-types of gender consciousness related to individual motivation. Individuals might manifest low gender consciousness, for example, because they have internalized existing power differentials and never questioned them, or because they are actively complicit in protecting and defending those power differentials. The latter may have been the case for some of the males in our sample who attributed disparities between males and females in IT to something other than gender. Distinctions such as this are not well captured by extant characterizations of gender consciousness and call for more focused exploration.

Finally, the interviews in the present study were not originally conducted with the intention of studying gender consciousness; rather, it emerged as a theme through our analysis. A promising area for future research would be to interrogate feminist self-identification and activism among IT students more explicitly in order to assess higher levels of gender consciousness. Such research could identify potential change agents and shed light on practices that help materially to create a more positive climate for women in IT.

Recommendations

In addition to individual and grassroots efforts, we believe that concerted educational policy efforts are necessary to close the persistent gender gap in information technology (ITAA, Vegso). If gender consciousness is positively related to student self-confidence and ambition, especially for women, institutions of higher learning should consider incorporating gender consciousness raising into IT curricula. Just as exposure though coursework to feminism has been found to lead students to a greater appreciation of feminist perspectives (Reid and Purcell 759), exposure to reflections on the gender gap in

computing could raise IT students' gender consciousness from simple awareness to concern. As Brody et al. found, conversation between students and administrators and among students about gender fair and gender affirmative practices can also result in better institutional outcomes. Such conversations are especially important to introduce into IT education, where awareness of gender disparity is high, yet the means to change it remain localized.

Of course, proposals to raise gender consciousness in IT may encounter resistance, both from administrators and from students themselves (Titus 23). However, the risks of gender awareness are reduced in a supportive institutional environment. Educational policy makers should be prepared to defend the benefits of having successful female IT students and graduates, on programmatic grounds as well as on grounds of social justice.

Notes

[1] More generally, "perceived personal efficacy influences the choices people make, their aspirations, how much effort they mobilize in a given endeavor, how long they persevere in the face of difficulties and setbacks, whether their thought patterns are self-hindering or self-aiding, the amount of anxiety and stress they experience in coping with taxing and threatening environments, their vulnerability to depression, and their resilience to adversity" (Bussey and Bandura 690).

[2] We use this composite term to refer to schools of Library and Information Science, Information Schools, and Schools of Information.

[3] In each unit, we aimed to interview two women and one man in the master's program, two women and one man in the Ph.D. program, and four women and two men in the undergraduate program, if one was offered by the unit. Undergraduates were oversampled, because undergraduate programs tended to have higher enrollments than graduate programs, and because there were fewer undergraduate than graduate programs in the IT units included in the study. This sampling method resulting in a roughly equal distribution of interviewees across the three academic levels.

[4] While we do not have enrollment figures by gender for the units from which our interviewees were drawn, the gender breakdown of respondents to a Web-based survey of all students in the same 18 units provides some indication (Ogan et al., Herring et al.). Women made up about 19% of CS, 33% of MIS, 35% of Informatics, 50% of IST, and 60% of LIS survey respondents.

[5] The ethnicity and age distribution of the interviewees is similar to that of the Web survey respondents.

[6] In American culture, a WASP is a White, Anglo-Saxon Protestant.

[7] Interviewee names used in this article are pseudonyms. Potentially personally identifying information in quotations by interviewees has been omitted or anonymized.

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Appendix: Data analysis tables

Level	Undergraduate=2 Master's=2 Ph.D.=1
Discipline	Computer Science=3 Information Systems=2
Self-Confidence	High=3 Median=2
Ambition	High=2 Median=3
	N=5

Table A. Characteristics of "high gender conscious" males excluded from the analysis

Level	Gender	High GC	Median GC	Low GC	Total
Undergrad	Female	9 (32%)	15 (54%)	4 (14%)	28 (100%)
	Male	0 (0%)	10 (59%)	7 (41%)	17 (100%)
	Total	9 (20%)	25 (56%)	11 (24%)	45 (100%)
Master's	Female	3 (10%)	25 (81%)	3 (10%)	31 (100%)
	Male	0 (0%)	8 (57%)	6 (43%)	14 (100%)
	Total	3 (7%)	33 (73%)	9 (20%)	45 (100%)
Ph.D.	Female	10 (36%)	14 (50%)	4 (14%)	28 (100%)
	Male	2 (15%)	8 (62%)	3 (23%)	13 (100%)
	Total	12 (29%)	22 (54%)	7 (17%)	41 (100%)

Table B. Distribution of gender consciousness by academic level and gender

Discipline	Gender	High GC	Median GC	Low GC	Total
Computer Science	Female	15 (41%)	20 (54%)	2 (5%)	37 (100%)
	Male	0 (0%)	10 (63%)	6 (38%)	16 (100%)
	Total	15 (28%)	30 (57%)	8 (15%)	53 (100%)
Informatics	Female	2 (22%)	6 (67%)	1 (11%)	9 (100%)
	Male	0 (0%)	4 (67%)	2 (33%)	6 (100%)
	Total	2 (13%)	10 (67%)	3 (20%)	15 (100%)
Instructional (Systems) Technology	Female	1 (10%)	5 (50%)	4 (40%)	10 (100%)
	Male	0 (0%)	3 (60%)	2 (40%)	5 (100%)
	Total	1 (7%)	8 (53%)	6 (40%)	15 (100%)
Library and Information Studies	Female	0 (0%)	15 (88%)	2 (12%)	17 (100%)
	Male	2 (29%)	3 (43%)	2 (29%)	7 (100%)
	Total	2 (8%)	18 (75%)	4 (17%)	24 (100%)
Management Information Systems	Female	4 (29%)	8 (57%)	2 (14%)	14 (100%)
	Male	0 (0%)	6 (60%)	4 (40%)	10 (100%)
	Total	4 (17%)	14 (58%)	6 (25%)	24 (100%)

Table C. Distribution of gender consciousness by IT discipline and gender