

Exploring Gender Diversity in IT and CS Departments Within 3 Private Universities in Erbil City

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Abstract

The number of information technology (IT) jobs is increasing dramatically in Iraq. This has produced an increased need for IT graduates than before. On the other hand, most IT and computer science (CS) departments in private universities are seeing small numbers of females in their courses. This indicates that these private universities have failed in attracting a sufficient percentage of female students. In this article, we explore the gender gap in IT and CS departments at 3 private universities: Tishk, Cihan, and Bayan, using 3 data sets related to the 2017 to 2018 academic year. The research design is descriptive and primary data were collected using personal observations made by the authors over the past 2 years. By analyzing these data sets, we can discover important issues such as students' diversity in computing departments. For example, we find that a gender gap does not clearly exist in the IT department of Tishk University, while it's more obvious in CS departments of Bayan and Cihan Universities. This finding implies that there is a need for some initiatives to attract women to IT and CS departments and to more investigate the gender gap in computing within the higher education level. These findings may also be relevant to the computing programs at other large public universities.

Keywords

gender diversity, CS departments, private universities, computer skills, gender gap

Introduction

The information technology (IT) field in Iraq and specifically in the Kurdistan region is witnessing a huge investment that requires more and more IT graduates to fill the market need. It is obvious that IT jobs are increasing in Iraq as indicated by the best-known search engines such as bayt.com and ncciraq.jobs.com. In general, attention to teaching IT is lacking in schools and high schools, and advanced IT institutes are not meeting the need for the required number of IT graduates. During the past few years, there has been a growing demand for the enrollment in the major of IT; thus, several private universities established various new departments related to IT, such as computer engineering, computer science (CS), computer networks, and information systems to enhance employability of graduates and to meet the labor market needs. With regard to diversity, the Ministry of Higher Education in Kurdistan region in 2018 stated that the total number of the students at higher education institutes in Kurdistan region is 94 700 and the percentage of female students is 48%.¹ The percentage of females in private universities is 37%, which is far less than that in public college, that is,

51%.¹ Furthermore, only a very small percentage of those females enrolled in private universities are joining IT departments. Improving these numbers is important not only to increase the number of IT workers in the field but to allow both males and females to contribute to the creation of technology and to the adaptation of existing methodology.

The gender gap in university IT students has been studied intensively internationally, such as in the United States, Europe, Nigeria, Malaysia, and too many other countries.²⁻⁴ However, we were unable to find any published literature about gender diversity in Iraq at the university level, which motivated our current study. We believe this study is unique and concerns universities that are generating a considerable number of potential workers each year.

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In this article, we analyze students' data from 3 private universities: Bayan, Cihan, and Tishk. These data sets are harvested from both required of all majors in the undergraduate's programs. There is one data set for each of the 3 universities: This data set contains students' numbers, gender, and grades of a few courses. Using these data sets, we try to answer the following 3 questions:

What is the gender gap in the IT department at Tishk University?

What is the gender gap in the CS department at Cihan University?

What is the gender gap in the CS department at Bayan University?

The main objective of our research is to answer these 3 questions that can be used to prompt initiatives that support gender diversity in IT and CS departments at universities. In many countries, there are many initiatives that have been implemented successfully to increase diversity at the university level, but we are focusing exclusively on IT departments. On the other hand, in future research, we might extend our efforts to other areas within the universities we examined.

Related Work

We could find no literature concerning gender diversity in higher education institutes inside Iraq and the Kurdistan region. Therefore, the authors reviewed other international studies concentrating on this issue. Our work focused on analyzing data for 3 departments at 3 different universities across 1 year. There is a similar study conducted in one CS department at Rutgers University in the United States, which uses 3 data sets for thousands of students across more than 3 years.⁵ The study found that a big percentage (45%) of women who were taking CS introductory course is not willing to major in CS because this course is required by other majors as well and it's not improving in raising female enrollment in CS major. There are a number of IT departments at North American universities that have set their goal to increase the percentage of females in their classrooms by changing their computer skills-1 (CS1) class to include more real-life applications and offering learning opportunities to students who did not have prior experience. In addition, these universities worked on providing research projects for female students, building a solid community of women in computing, engaging faculty in recruitment and training them on how to design engaging classes, increasing the diversity of the faculty, and reaching out to middle and high schools. A number of studies⁶⁻⁸ focus on summarizing and studying official reports about the gender diversity gap in science, technology, engineering, and math (STEM) within the United States and Canada. All report that females are consistently underrepresented both in STEM jobs and STEM undergraduate degrees over the past decade.

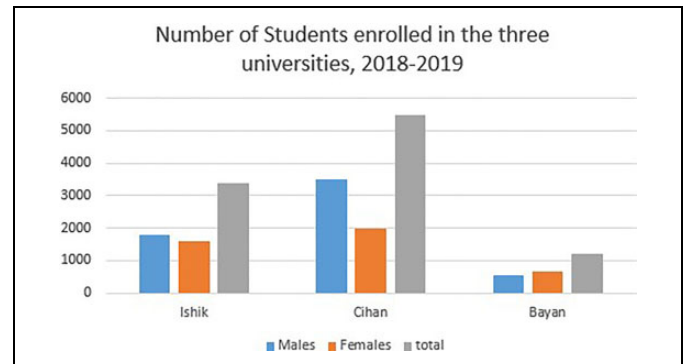


Figure 1. Numbers of enrolled students in the 3 universities.

There are a few other papers⁹⁻¹¹ that analyzed students' data in order to understand the phenomena of gender gaps in CS. One paper concentrated on gender diversity in an introductory programming course at the university level and found that male students find programming easier than females and have a higher potential for finding work after graduation. In addition, the study proposed some strategies to improve programming in female students. Another study⁸ indicates that to better understand gender gap or inadequate female representation, the social, psychological, and personality factors should be taken into consideration to see how they influence female career choices and STEM performance.

Method

This research work was done at 3 private universities: Tishk, Cihan and Bayan, all of them located within Erbil city in Iraq. Tishk has more than 4000 students, Cihan has more than 5000 students, and Bayan has around 1200 students. The estimated percentages of females for this year in these universities consecutively are about 45%, 40%, and 60%, respectively, as shown in Figure 1.

Our students come mainly from the Kurdistan region and other sates all over Iraq. A small percentage are from Syria. We selected these universities because we are working in them and hope to explore gender diversity in our IT departments so that we can open the door for future studies in the Kurdistan region and throughout Iraq to encourage increasing female workers in the IT sector.

It is important to explain about courses in IT departments of the 3 universities. There are 3 courses that prepare students for careers in IT after graduation: data communication, web design, and mobile applications, while all other courses are supporting these 3 courses. In addition, there are various IT activities for developing coding skills of students, for example, IT department of Tishk University conduct blind coding contest, National Innovative Competition on Engineering, programming contests, and #Code, which is a team programming competition supported by Google. However, the level of adopting e-learning in private universities is still low.¹²

The research design is descriptive and primary data were collected using personal observations made by the authors over

the past 2 years. Three data sets from 3 private universities have been considered to answer the questions of gender diversity. Each data set belongs to one of the 3 universities.

The first data set of Tishk University emphasizes students' numbers, their genders, and grades for the 2017 to 2018 academic year in the IT department. This data set helps us to compare the performance of females and males in 2 classes. These 2 classes are data structure and algorithms (IT2) and mobile applications (IT4). The data algorithm course is compulsory for second-year students and is one of the most difficult courses, while mobile applications is an elective course for fourth-year students and enrolls a high number of students because of its current importance. The importance of mobile applications course is related to the expanding number of mobile applications developers in Iraq. The second data set from Cihan University focuses on students' numbers, genders, and grades for 2017 to 2018 academic year in the CS department. This data set compares the relative performance of males and females in 2 classes: CS1 and CS2. These 2 courses are obligatory for first-year students and are based on the International Computer Driving License, a curriculum which makes them somewhat challenging because most students have no prior practical computing experience due to the lack of preuniversity education. International Computer Driving License includes many modules such as Microsoft Windows, Internet, Microsoft Excel, and Microsoft Word. The third data set of Bayan University tabulates students' numbers, genders, and grades for 2017 to 2018 academic year in the CS department. This data set helps us to compare the performance of females in 2 classes against males. These 2 classes are structured programming (CS1) and web design (CS2). A structured programming course is an introductory course for first-grade students and is one of the toughest courses because it exposes students to fundamental coding concepts for the first time to new CS students. However, the web design course (CS2) is offered for second graders and present basics of web technologies theory and practice parts. Hence, students' progress through these courses is predictive of their performance in the CS department because this course is one of the most interesting courses to students and it has a practical part of designing web pages and then publishing them to the world.

Number of enrollments in IT and CS departments of 2017 to 2018 academic year for the first grade is also provided in our data sets to display gender diversity in the first grade.

Figure 2 shows the enrollment of the first grades in IT and CS departments for the last academic year 2017 to 2018 and gender of registered students. The above data sets complement each other to give a broader picture of who our students are, what classes they take, and their performance in the selected courses. However, in this article, we present only data sets of students' numbers without their performance since the authors plan to publish them in a more intensive paper. Data sets were entered the statistical package for data analysis, then the average analyses are performed. After analyzing the results process,

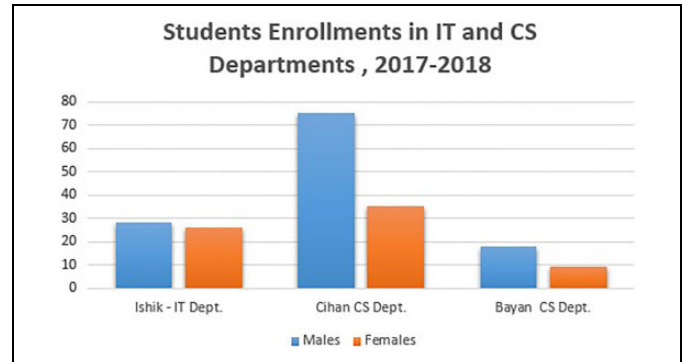


Figure 2. Enrollments in information technology and computer science departments in academic year 2017 to 2018.

the researchers make sure that the posed research questions are answered to draw conclusions. To guarantee useful findings that exactly reflect the perspectives of the respondents, the researchers concentrated on analyzing the results since it is considered as one of the most vital steps in our research.

Results

In this section, we analyze our data set to answer questions about the gender diversity gap in our 3 departments. The authors present gender diversity within the IT and CS departments at the 3 private universities by selecting 2 courses in each department and then stating the total students' numbers, including first graders within these departments. First, we start with Tishk International University.

- (1) For total number of IT students in 2017 to 2018: There were around 263 enrolled students (118 females and 145 males) who are distributed on different grades, mostly from the first- to fourth-grade level.
- (2) For the number of first-grade students in 2017 to 2018: Only 60 students enrolled, consisting of 26 females and 28 males.
- (3) For data structure and algorithms course: In Fall 2017 semester, 71 students registered in this, including 38 females and 33 males.
- (4) For mobile application course: In Spring 2018 semester, 48 students were registered, including 20 females and 28 males.

Table 1 gives the summary of students' numbers and gender gap, which are calculated based on the total number of students in the IT department. According to Psaki et al,¹³ it's better to define a gender gap if there is a difference bigger than 5 percentage points between the proportion of males and females entering or completing each level of schooling. The gender gap may show either a female disadvantage (positive difference) or a male disadvantage (negative difference).

Now we present gender diversity in the CS department at the Cihan University:

Table 1. Summary of Gender Diversity in Tishk's IT Department.

Description	Numbers	Female (%)
Students in IT department	263	45
First graders	60	35
Data structure students	71	53
Mobile app students	48	42
Gender gap	5	–

Abbreviation: IT, information technology.

Table 2. Summary of Gender Diversity in Cihan's CS Department.

Description	Numbers	Female (%)
Students in IT department	313	34
First graders	110	32
Compute skills	110	32
Gender gap	32	–

Abbreviations: CS, computer science; IT, information technology.

- (1) For total number of CS students in 2017 to 2018: There were around 313 enrolled students (108 females and 205 males) who are distributed on different grades, mostly from the first- to fourth-grade level.
- (2) For the number of first-grade students in 2017 to 2018: Only 110 students enrolled, consisting of 35 females and 75 males.
- (3) For CS1 and CS2: In Fall and Spring 2017 semester, 110 students registered in this obligatory course, including 35 females and 75 males.

Table 2 presents the summary of students' numbers and gender gap, which was calculated by subtracting female percentage (34%) in CS department from male percentage (66%), which equals 34%.

Finally, we present gender diversity in the CS department at Bayan University.

- (1) For total number of CS students in 2017 to 2018: There were around 100 enrolled students (41 females and 59 males). Those students are distributed on different grades and studies mostly from the first to fourth grade. In addition, there are morning and evening classes for each grade that are separated.
- (2) For the number of first-grade students in 2017 to 2018: Only 27 students enrolled, consisting of 9 females and 18 males.
- (3) For structured programming: They are the same students of first grades mentioned in previous point.
- (4) For web design course: Only 33 students were registered, including 11 females and 22 males.

Table 3 presents the summary of students' numbers and gender gap, which are calculated based on the total number of students in the IT department and it equals 18%.

Table 3. Summary of Gender Diversity in Bayan's CS Department.

Description	Numbers	Female (%)
Students in CS department	100	41
First graders	27	33
Structured programming students	27	33
Web design students	33	33
Gender gap	18	–

Abbreviation: CS, computer science.

Discussion

- (1) What is the gender gap in IT department at Tishk University?

Table 1 demonstrates that the IT department of Tishk International University has 5% difference as gender gap, which means female numbers are almost equal to males in general. However, females' rate is 35% in first-grade students, which makes it a significant difference, and there is a need to examine whether this rate is not constantly decreasing currently or in the future.

- (2) What is the gender gap in CS department at Cihan University?

Table 2 demonstrates that the CS department of Cihan University has 34% difference as gender gap, which means female numbers are far less than males in general. This gap is also clear in first-grade level, so it's important to observe gender diversity rate in this year and previous years to see if this gap is expanding or not.

- (3) What is the gender gap in the CS department at Bayan University?

Table 3 indicates that the CS department of Bayan University has 18% difference as gender gap, which means female numbers are much less than males in general. However, females' rate is 33% in first-grade students, which makes it substantial difference, and there is a necessity to observe whether this rate is not constantly decreasing or it might continue shrinking in future.

There are 2 possible reasons for the unequal representation of women in these programs, first is cultural preferences in Iraq, where females should become doctors, pharmacists, or teachers. The second reason is safety, where women try to find safe jobs that do not require physical efforts or long working hours.

Conclusions

In this research, we have used students' data from IT and CS departments at 3 private universities: Tishk, Cihan, and Bayan, to explore and examine the gender gap in IT undergraduate level. In addition, we focused on some courses to understand if any gender gap is there. We suggest that CS departments start to invest in increasing the diversity of their computing student population through building a solid community of women in

computing, engaging lecturers in recruitment and training them on how to design engaging classes, increasing the diversity of the faculty, and focusing on high schools. Furthermore, we hope that other researchers and departments use our work to increase diversity in their institutions and provide more female workers to IT industry. For example, we find that a gender gap does not noticeably exist in the IT department of Tishk University, although it's more obvious in the CS departments of Bayan and Cihan Universities. This finding infers that some initiatives are required to attract more women to computing departments. In addition, it is important to more investigate about the gender gap in computing within higher education level. Finally, these findings may also be relevant to the computing programs at other large public universities. The authors believe it's important to conduct more research to see whether the gender gap increasing over time or it's stable.

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References

- Higher Education in Kurdistan Region, Ministry of Higher Education and Scientific Research. [online] Available at: <https://www.mhe-krq.org/node/3332>. Accessed October 10, 2019.
- Shen H. Inequality quantified: mind the gender gap. *Nature*. 2013; 495(7439):22-24. doi:10.1038/495022a.
- Adeyemi K, Akpotu N. Gender analysis of student enrolment in Nigerian universities. *High Educ*. 2004;48(3):361-378. doi:10.1023/b:high.0000035547.19318.27.
- Yong Tienxhi J. The gender gap in Malaysian public universities: examining the 'lost boys'. *J Int Comparat Educ*. 2017;6(1):3-18. doi:10.14425/jice.2017.6.1.03.
- Babes-Vroman M, Juniewicz I, Lucarelli B, et al. Exploring gender diversity in CS at a large public R1 research university. In *SIGCSE '17 Proceedings of the 2017 ACM SIGCSE Technical Symposium on Computer Science Education*, Seattle, Washington, DC: ACM; 2017:51-56.
- Beede D, Julian T, Langdon D, et al. Women in STEM: a gender gap to innovation. *SSRN Electro J*. 2011. doi:10.2139/ssrn.1964782.
- Hango D. *Gender Differences in Science, Technology, Engineering, Mathematics and Computer Science (Stem) Programs at University*. Ottawa, Canada: Statistics Canada; 2013.
- Wang M, Degol J. Gender gap in science, technology, engineering, and mathematics (STEM): current knowledge, implications for practice, policy, and future directions. *Educ Psychol Rev*. 2016;29(1):119-140. doi:10.1007/s10648-015-9355-x.
- Rubio M, Romero-Zaliz R, Mañoso L, et al. Closing the gender gap in an introductory programming course. *Comput Educ*. 2015; 82:409-420. doi:10.1016/j.compedu.2014.12.003.
- Beyer S. Why are women underrepresented in computer science? Gender differences in stereotypes, self-efficacy, values, and interests and predictors of future CS course-taking and grades. *Comput Sci Educ*. 2014;24(2-3):153-192. doi:10.1080/08993408.2014.963363.
- Kanny M, Sax L, Riggers-Piehl T. Investigating forty years of STEM research: how explanations for the gender gap have evolved over time. *J Women Minor Sci Eng*. 2014;20(2):127-148. doi:10.1615/jwomenminorscieng.2014007246.
- Salim M. Educational technology implementation in private universities in Erbil city. *Int J Soc Sci Educ Stud*. 2019;5(3). doi:10.23918/ijsses.v5i3p303.
- Psaki S, McCarthy K, Mensch B. Measuring gender equality in education: lessons from trends in 43 countries. *Populat Develop Rev*. 2017;44(1):117-142. doi:10.1111/padr.12121.