Factors Affecting the Future Career Pathway Decisions of Lower-income Computing Students

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1. Introduction

Within research on broadening participation in computing, the experience and perspectives of undergraduate students have been important elements of exploration. As undergraduate students are experts of their own experience, conducting research that focuses on understanding their perspective can help those who organize programmatic efforts to respond to student needs and concerns. This paper emerges from the context of a specific National Science Foundation (NSF)-funded Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) program. As with all S-STEM programs, Florida Information Technology Graduation Attainment Pathways (Flit-GAP) focuses on lower-income students, and thus this research surveying the program participants can help draw conclusions and pragmatic considerations about how to broaden participation for students historically marginalized by their socioeconomic status. Unique among S-STEM programs, Flit-GAP focuses on the transition between the later years of undergraduate education and the student's next steps, whether that is conducting research in graduate school, exploring internships for industry, or utilizing entrepreneurship to go into business for oneself. Existing scholarship highlights that students who participate in undergraduate research are more likely to pursue graduate school, co-curricular work experiences positively influence students' likelihood of finding a job upon graduation, and entrepreneurship education increases the awareness to become self-employed and form new ventures [1] – [4]. However, the factors influencing lower-income students' career decisions specifically are underexplored.

For this paper, we surveyed all Flit-GAP students to understand their perceptions of their future career paths with a particular focus on how they select the career path for them. We utilize surveys conducted at the end of the first year of the first cohort of participation to exploratorily examine various demographic and psychological factors that would support a student's selection of one career pathway over another. While all the career pathways may be valuable, lower-income students may be disinclined from exploring some pathways that institutions like Flit-GAP, the NSF, and universities may have a vested interest in promoting. This study explores the significance of any relationships among personal priorities, demographics, and career pathway choices. By exploring the factors that impact how students prioritize their career pathway decisions, we can help student support programs find creative ways to address the student concerns regarding their future careers.

2. Literature Review on Computing Career Pathways and Broadening Participation

As broadening participation in computing has become an important research focus, we have developed a considerable amount of recent research on increasing participation for women,

historically excluded racial groups, and other identities. Much of this research focuses on broadening participation by increasing a sense of belonging, persistence, and retention within computing for marginalized communities in undergraduate education [5] – [10]. Although these studies provide important insight into making undergraduate education more inclusive, the transition from undergraduate studies to career pathways is also critical. By better understanding how students think about their career pathways during undergraduate education, we can help support transitions that broaden participation. Undergraduate student career pathways could be divided up into a few key pathways for their post-college careers. Perhaps most commonly, many students are focused on internships to pursue a professional computing industry career pathway [11]. Factors hindering computing students from pursuing internships are student interest in internships include, lower self-efficacy, the challenging application process for internships, and other priorities such as family, focusing on their GPA, etc. [12]. Less frequently, students may consider going into business for themselves as an entrepreneurship pathway. Job market conditions and socioeconomic status are primary factors influencing the students' decision to pursue entrepreneurship [4], [13]. Finally, though perhaps not exhaustively, students can consider attending graduate school and conducting research through a master's or Ph.D. degree. Students' interest and actual enrollment in graduate school are primarily influenced by faculty mentorship, interests, and self-efficacy within computing [2], [3]. These three pathways are also how Flit-GAP has organized its programmatic efforts. Although these pathways are not mutually exclusive, they are distinct, at least from the undergraduate student's perspective. Professionals may view graduate school as a short stepping stone to a professional pathway, but from an undergraduate's perspective, a few years' delays may be significant.

Although we have important insight into the factors contributing to undergraduate computing students' perception of and eventual participation in these career pathways, we have significantly less information about lower-income students' perceptions. The initial evidence is that lower income students have significantly different perceptions regarding the risks and opportunities of their career pathways [14], [15]. Kapoor & Gardener-McCune [11] found that computing students with lower socioeconomic backgrounds found it difficult to pursue industry internship due to family and other circumstances. Krenz et al. [16] indicated that lower-income computing students had difficulty pursuing graduate school full-time due to familial and economic responsibilities. To better support lower-income students in computing to broaden their participation in computing careers, it is critical to understand these students' viewpoints on job factors associated with different career pathways for their post-graduation plans.

3. **Research Purpose and Questions**

We have conducted an exploratory analysis of the intended career pathways of lower-income students in computing and the factors that contribute to them. The factors explored include demographics, parental background, and other preferences for their careers. The following are our two research questions:

RQ1 How do undergraduate computing students' demographics and family backgrounds impact their selection of future career pathway?

RQ2 What preferential factors impact computing students' future career pathways?

4. Methods

4.1. Program and Institutional Context

This research was conducted as part of Flit-GAP, which is an NSF S-STEM program. The S-STEM programs are intended to support lower-income STEM students by providing them with financial assistance and academic and career support through curricular and co-curricular activities [17]. Flit-GAP was launched in 2021 as a collaboration between three public universities, namely Florida International University (FIU), University of Central Florida (UCF), and University of South Florida (USF). The program offers financial aid and career pathway support for students pursuing a degree in computer science, information technology, cybersecurity, or computer engineering.

The scholarship portion of Flit-GAP provides students with between five hundred and ten thousand dollars per year based on their unmet financial need, which is calculated by subtracting the student's expected family contribution and their private, state, and institutional scholarships from the cost of attendance at their university [17]. Students can receive up to three years of financial support to complete their bachelor's degree and one additional year of support if they decide to pursue a graduate degree in a computing field at one of the three participating universities. The career pathway support portion of Flit-GAP allows participants to participate in one or more of the following career pathway experiences based on their interests: an internship (professional pathway), a mentored research experience (graduate pathway), or a zero-credit-hour course about entrepreneurship with the opportunity to present their idea to potential funders at the end of the course (entrepreneurship pathway).

Additionally, throughout the academic year, Flit-GAP offers a variety of hybrid co-curricular events that aim to inform students about different post-graduation pathway options and foster community among participants across the three institutions. For the 2021-2022 school year, Flit-GAP events included an orientation for students to learn more about the program; a LinkedIn event where students learned tips and tricks for networking on the site; a graduate school showcase that spotlighted the computing graduate programs offered by the three universities; an alumni panel where participants from a prior computing-focused S-STEM program at the three universities answered Flit-GAP students' questions about industry and graduate school pathways, and an end-of-the-year symposium for students to showcase their work.

The 2021-2022 cohort included a total of 41 students from FIU, UCF, and USF. The Flit-GAP team proposed recruiting student groups traditionally underrepresented in IT-related disciplines. Overall, 29% of Flit-GAP Cohort 1 were female students, including five female students from

FIU, five female students from UCF, and two female students from USF. Across the universities, nearly half (49%) of Flit-GAP Cohort 1 were Hispanic/Latinx or Black/African American students (34% and 15%, respectively). FIU and UCF, federally designated Hispanic Serving Institutions, enrolled more than one-third Hispanic/Latinx students within each of their cohorts. More than a quarter of USF's Cohort 1 included Hispanic/Latinx students. A quarter of FIU's Flit-GAP scholars included Black/African American students.

4.2. Data Collection and Analysis

Participants for this study were recruited based on their participation in Flit-GAP. The program's external evaluation team sent all students who were active in the program as of Spring 2022 an email that included a link to the Qualtrics survey. Students were informed that their participation was voluntary, and those who completed the survey received a $10 Amazon gift card. The response rates from FIU, UCF, and USF were 88%, 93% and 73%, respectively, with an average response rate of 87%. Some additional surveys were incomplete. For each test, if a participant left relevant items blank, their response was not included in the analysis.

The survey instrument included items about participants' pathway selection, knowledge of and exposure to the three pathways, career desires, sense of belonging within computing, and experiences in the program. Kumar, Bond-Trittipo and Secules developed the items focused on pathway selection and knowledge of and exposure to three pathways based on an interview study they conducted with Flit-GAP students from FIU in early Fall 2021. This study focused on participants' career desires and perceptions of graduate, research, and entrepreneurial career pathways [15]. Items focused on career desires were developed by modifying the Career Plan Development items included on the Persistence Research in Science and Engineering (PRiSE) survey instrument [18]. Sense of belonging items were taken from a survey used to evaluate a computing-focused S-STEM program at the three universities [19], and the external evaluation team developed items about students' experiences in the program.

Survey responses were exported from Qualtrics as an Excel spreadsheet. Because of the low number of responses and the exploratory nature of the survey, the research team elected to primarily use descriptive statistics to analyze the data. In the following section, we provide information about participants' pathway selection by gender, race/ethnicity, parent/guardian education level, and amount of financial support provided by parents/guardians. Additionally, we compare the average job factor scores (on a five-point Likert scale) by gender and financial support provided by parents/guardians. To examine whether a correlation exists between job factors and future pathway selection, we calculated Pearson correlations. All inferential statistical tests (Pearson correlations, Chi-squared tests, etc.,) were performed on the data using R version 4.1.3 in RStudio. We attempted to perform inferential statistical analyses to determine whether gender, parents' education level, financial assistance level, and pathway choices were related. However, due to the small sample size and missing values, we were not able to perform

Chi-squared tests. These factors might be related, but we don't have the data to demonstrate it at this time due to the smaller sample size and the missing values. The relationship between these demographic factors and pathway choices can be explored further in future work with a larger sample size.

5. Results

5.1. Relationship of Demographic Identities, Family Background, and Pathway Choice

RQ1 sought to understand how undergraduate computing students' demographics, and family backgrounds impact their selection of future career pathways. The next sections present our preliminary analysis of RQ1

5.1.1 Gender and Pathway Choice

Fig 1 shows the overall pathway choice. As seen below, 21 participants chose internships and four chose research from the total sample (n=36). 11 were undecided or did not answer. No one chose entrepreneurship as a future career pathway. As the scholarship program aimed to help increase understanding and interest in career pathways, the lack of interest in entrepreneurship and research and high number of undecided responses at the end of the first cohort year are worthy of further investigation.

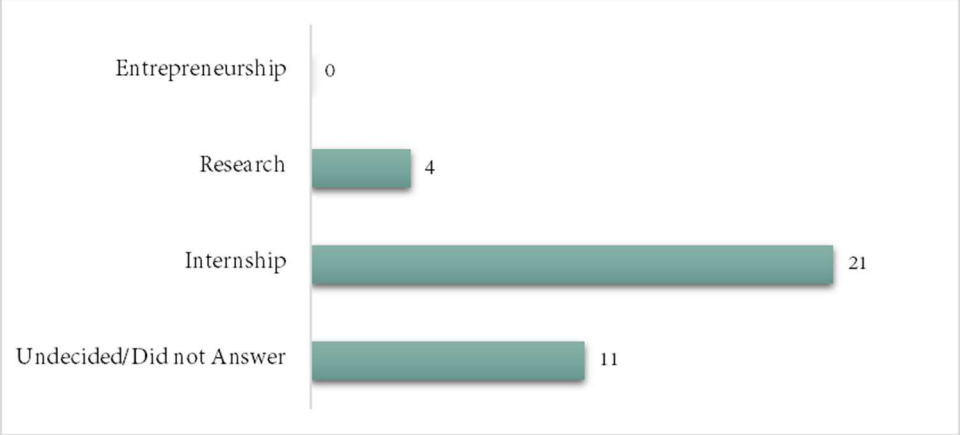

Figure 1 *Overall Pathway Choices*

Fig 2 shows pathway choice by gender. Out of the 23 participants who chose internship, 14 identified as male, 6 identified as female, and 3 participants did not report their gender. We recognize that male and female are understood as terms for biological sex and not gender identity, but this graph is in accordance with the current phrasing of the survey instrument. We are working to update the survey in future iterations. There was a non-binary and a text write-in option, but these were not utilized. Out of four people who chose research as their pathway, one was male, two were female-identifying participants, and one did not report their gender. Students

who selected undecided were seven men, three women, and three did not report their gender identity.

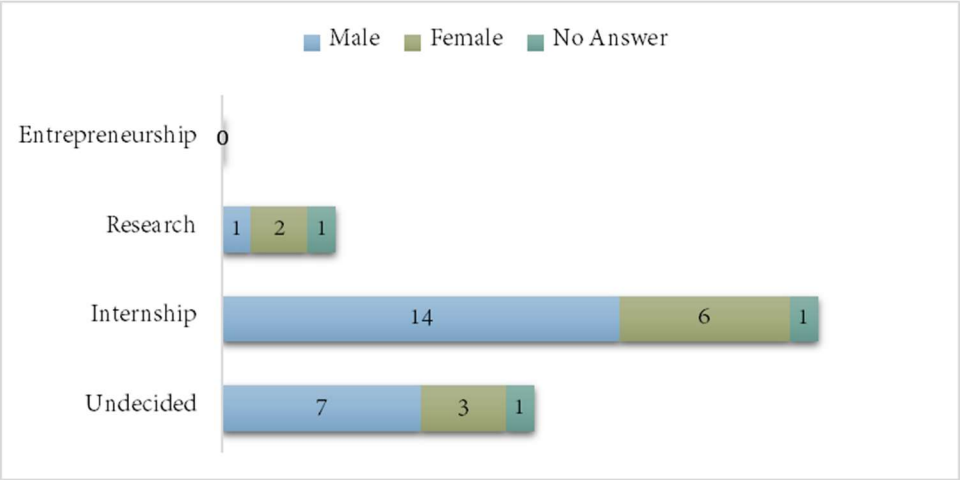

Figure 2 *Pathway Choices by Gender*

We observe from the figure that men may prefer internships slightly more, and women may prefer research slightly more. In future, we will perform inferential tests to see whether these relationships hold.

5.1.2. Race/Ethnicity and Pathway Choice.

Fig 3 shows pathway choices by ethnicity. Out of 36 participants, 14 identified as Hispanic (non-White), 19n identified as non-Hispanic and three chose not to identify their ethnicity. Out of the 14 Hispanic participants, eight of them selected internship, two selected research, and four were undecided in their pathway choices. Of the 19 participants who identified as non-Hispanic, 12 selected internship, one selected research and six were undecided of their pathway choice.

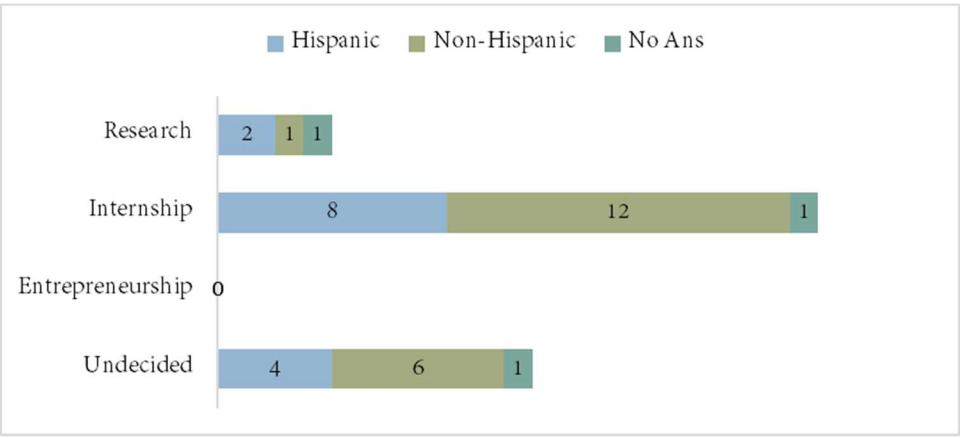

Figure 3 *Pathway Choices by Ethnicity*

Fig 4 shows pathway choices categorized by racial identities. The participants were asked to identify their race in a checklist having Asian, Black, Alaskan Native/American Indian (AIAN),

Native Hawaiian/Pacific Islander (NHPI), White, and Other with an option to write-in. Since it was a checklist, we grouped people who identified with two or more races into one category. Nine participants identified as Asian, four people identified as Black, 10 identified as White, three participants identified with two or more races, and three chose not to identify themselves.

Out of nine participants who identified as Asian, five chose internship and four were undecided of their pathway choices. Of the four Black-identifying participants, three were undecided and one chose to be in the internship pathway. Of the ten participants who identify as White, eight selected internship pathway, one selected research and one was undecided of their pathway choices. One participant who identified as NHPI chose internship as their pathway. Of two people who identified with two or more races, one of them selected internship and one was undecided of their pathway.

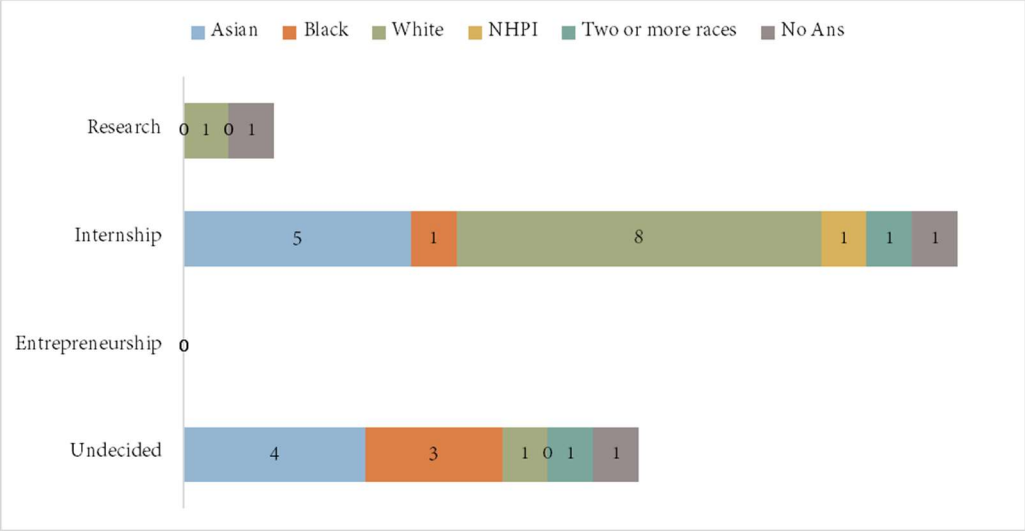

Figure 4 *Pathway Choices by Race*

From the Figs. 3 & 4, we observe that White students were much less undecided than other races, and they tended to prefer internship pathways. Hispanic students preferred internship pathways. More Black and Asian students were undecided than preferred internship pathways. This could be a pattern worth exploring with a statistical test on a larger sample size.

5.1.3. Parents' Education Level and Pathway Choice

Fig 5 presents the pathway choices of the participants grouped by their parents' education level. We divided the educational levels as did not complete high school, high school (HS)/General Educational Development Test (GED), bachelor's/associates/some college, and master's & above.

It can be observed from Fig. 5 that the students with parents having Bachelor's/Associate's/Some college (n=8) chose internship as their pathway. We also found that the students whose parents

had no high school education or high school/GED and some colleges (n=9) were undecided on their pathways.

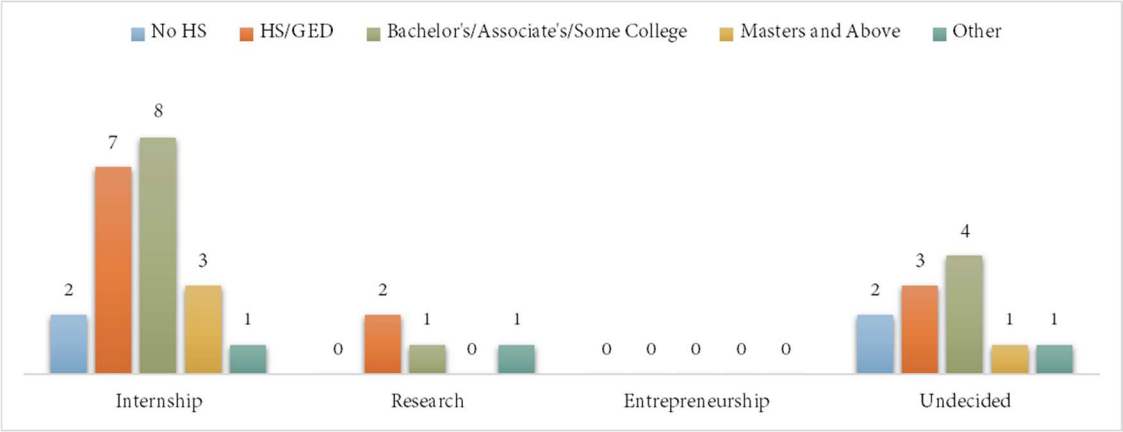

Figure 5 *Pathway Choices by Parents' Education Level*

5.1.4. Pathway Choice by Financial Assistance Parents/Guardians Provide

Fig 6 below represents the number of students who selected each pathway by the level of financial assistance they receive from their parents or guardians. Out of the total sample (n=36), 31 responded to the parent/guardian financial assistance item. Of those 31 participants, 19 selected internships, three selected research, and nine indicated that they had not decided upon a pathway. Of the six participants who indicated that they support their parents/guardians financially, three indicated that they were undecided, two chose the research pathway, and one chose an internship. Of the 11 participants who do not receive financial support from their parents/guardians, nine selected internships and two of them were undecided. Out of the six participants who receive some financial assistance from their parents/guardians, three selected internships, two selected undecided, and one selected research. Lastly, of the eight participants who indicated that their parents/guardians fully cover their tuition and living expenses, 6 chose internship, and two indicated that they were undecided.

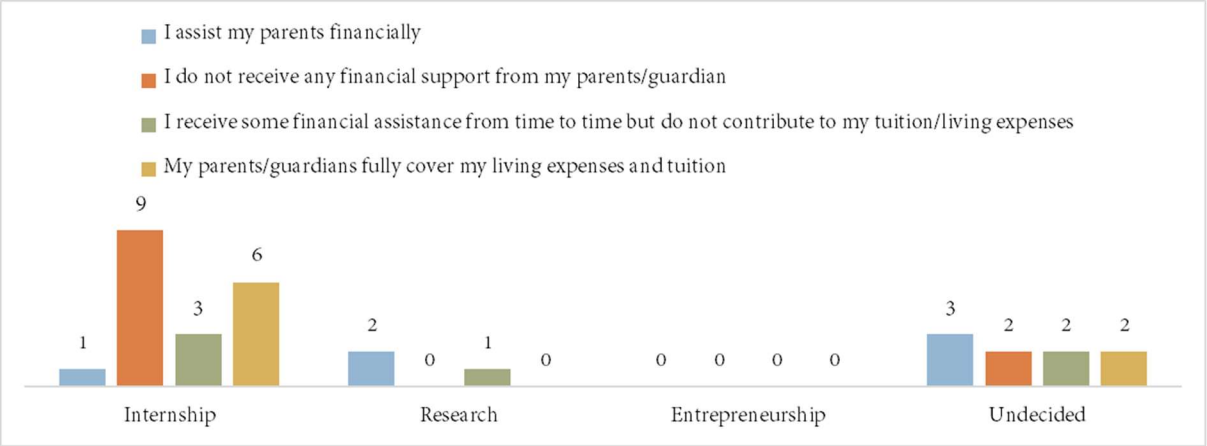

Figure 6 Pathway Choices by Parent/Guardian Financial Assistance Level

As we can see, an internship was the most frequently selected pathway for all groups besides those who financially assist their parents/guardians. For this group, the internship was the least selected pathway (one of six participants), and undecided was the most frequently selected (three of six participants). For participants who do not receive financial assistance from their parents/guardians, receive some financial assistance from their parents/guardians, or whose parents/guardians fully cover their tuition and living expenses, research was the least selected pathway (zero of 11 participants, one of six participants, and zero of eight participants, respectively).

5.2 Job Factors and Career Pathways

RQ2 sought to understand factors impacting computing students' future career pathways. To do that, we first present important job factors chosen by students. Next, we present the correlation between job factors and students' potential career pathway choices by gender and financial assistance level from parents/guardians. We were curious to understand if students receiving different financial assistance sought after different factors while looking for a job, for example, salary and job benefits or if they were looking for creative freedom and contributing to society. Hence, we chose to understand the students' perspective of factors influencing their future jobs.

5.2.1. Importance of Various Job Selection Factors for Participants

We asked the participants to rank the importance of different factors that they would look for in their future career. The factors were 1) salary, 2) benefits, 3) job security, 4) job location, 5) flexibility to work from home, 6) opportunities for career advancement, 7) intellectual change, 8) level of responsibility, 9) degree of independence in their job, 10) contribution to society, 11) creating new knowledge, 12) promoting diversity, equity and inclusion (DEI) within their jobs, 13) having a creative freedom in their job, and 14) pursuing their passion through their jobs. Table 1 shows the descriptive statistics, including means, and standard deviations of the important job factors for all students as well as by gender and financial assistance level from parents/guardians.

As we can observe from Table 1, the participants chose career advancement, job security and salary as their top three most important factors they would look for in their jobs with respective means of 4.72, 4.64 and 4.56. The three factors that are less likely to factor into a job selection are creating new knowledge, contribution to society and flexibility to work from home with respective means 4.16, 4.04 and 3.96.

Table 1 *Means and Standard Deviations for important factors to look for in a job (higher mean are bolded)*

Job Factors	***All (n=33)***		***Man (n=22)***		***Woman (n=11)***		***I assist my parents / guardians financially (n=5)***		***I do not receive any financial support from my parents / guardians(n=8)***		***I receive some financial assistance from my parents / guardians(n=5)***		***My parents / guardians fully cover my living expenses and tuition (n=5)***	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Salary	**4.56**	0.58	**4.57**	0.51	4.50	0.71	**4.8**	0.45	4.5	0.76	4.6	0.55	4.4	0.55
Benefits	4.52	0.51	4.36	0.50	**4.70**	0.48	**4.8**	0.45	4.6	0.52	4.2	0.45	4.4	0.55
Job security	**4.64**	0.49	**4.50**	0.52	**4.80**	0.42	4.6	0.55	**4.8**	0.46	**4.8**	0.45	4.4	0.55
Job location	4.46	0.78	4.23	0.93	**4.70**	0.48	**4.8**	0.45	4.1	0.90	**4.8**	0.45	4.2	1.10
Flexibility to work from home	3.96	1.02	3.93	1.07	3.90	0.99	4.0	1.22	3.6	0.74	**4.6**	0.55	3.6	1.52
Opportunities for advancement	**4.72**	0.46	**4.57**	0.51	**4.90**	0.32	**4.8**	0.45	**4.8**	0.46	**4.8**	0.45	4.6	0.55
Intellectual challenge	4.32	0.69	4.07	0.73	**4.70**	0.48	4.4	0.89	**4.5**	0.76	4.0	0.71	4.4	0.55
Level of responsibility	4.24	0.52	4.21	0.58	4.30	0.48	4.2	0.84	**4.4**	0.52	4.0	0.00	**4.4**	0.55
Degree of independence	4.24	0.88	3.93	1.00	**4.70**	0.48	**4.4**	0.89	**4.4**	0.52	4.2	0.45	4.0	1.73
Contribution to society	4.04	0.73	3.93	0.62	4.10	0.88	3.6	0.89	4.0	0.53	3.8	0.84	**4.6**	0.55
Creating new knowledge	4.16	0.75	3.93	0.73	4.40	0.70	4.0	1.00	4.0	0.93	4.2	0.45	**4.4**	0.55
Promoting DEI	4.48	0.71	4.21	0.80	**4.90**	0.32	4.4	0.55	4.4	1.06	4.6	0.55	**4.8**	0.45
Having creative freedom	4.20	0.87	4.00	0.96	4.40	0.70	3.8	1.10	3.9	0.99	**4.6**	0.55	**4.6**	0.55
Pursuing your passion	4.44	0.77	4.21	0.89	**4.80**	0.42	4.2	0.84	4.4	1.06	**4.8**	0.45	4.6	0.55

For male participants, the top three most important factors were career advancement (M=4.57, SD= 0.51), and salary (M=4.57, SD=0.51) and job security (M= 4.50, SD=0.52), respectively. The three factors that are less likely to factor into a job selection for male participants are degree of independence (M= 3.93, SD= 1.00), contribution to society (M = 3.93, SD = 0.62), creating new knowledge (M= 3.93, SD=0.73) and flexibility to work from home (M = 3.93, SD = 1.07).

Female participants had average scores for the important job factors that varied from 4.9 to 3.9, with standard deviations that ranged from 0.32 to 0.99. The top five important factors selected by female participants were opportunities for advancement (M= 4.90, SD= 0.32), promoting diversity, equity, and inclusion (M=4.90, SD= 0.32), job security (M=4.80, SD=0.42), pursuing your passion (M= 4.80, SD= 0.42) and benefits (M= 4.70, SD= 0.48). The three factors that are less likely to factor into a job selection for female participants are level of responsibility (M=

4.30, SD= 0.48), contribution to society (M = 4.10, SD = 0.88), and flexibility to work from home (M = 3.90, SD = 0.99).

5.2.2. Importance of Job Factors by Parent/Guardian Financial Assistance Level

For participants who assist their parents/guardians financially, salary, benefits, job location, and opportunities for advancement were the most important factors (M=4.8, SD=0.45 for all four job factors), and contribution to society (M=3.6, SD=0.89), having creative freedom (M=3.8, SD=1.10), flexibility to work from home (M=4.0, SD=1.22), and creating new knowledge (M=4.0, SD-1.00) were the job factors with the lowest average scores. These four job factors also had the lowest average scores for participants who receive no financial assistance from their parents/guardians, with the flexibility to work from home (M=3.6, SD=0.74), having creative freedom (M=3.9, SD=0.99), creating new knowledge (M=4.0, SD=0.93), and contribution to society (M=4.0, SD=0.53). Job security (M=4.8, SD=0.46), opportunities for advancement (M=4.8, SD=0.46), and benefits (M=4.6, SD=0.52) were the job factors with the highest average scores for participants who receive no financial assistance from their parents.

The most important job factors for participants who receive some financial assistance from their parents/guardians were job security, job location, opportunities for advancement, and pursuing their passion (M=4.8, SD=0.45 for all four job factors), and the least important were contribution to society (M=3.8, SD=0.84), level of responsibility (M=4.0, SD=0.00), and intellectual challenge (M=4.0, SD=0.71). Like the other three groups, opportunities for advancement (M=4.6, SD=0.55) was one of the most important factors for participants whose parents/guardians fully cover their living expenses and tuition. The other most important job factors for this group were promoting DEI (M=4.8, SD=0.45), contribution to society (M=4.6, SD=0.55), having creative freedom (M=4.6, SD=0.55), and pursuing their passion (M=4.6, SD=0.55). Flexibility to work from home (M=3.6, SD=1.52), degree of independence (M=4.0, SD=1.73), and job location (M=4.2, SD=1.10) were the three job factors with the lowest average scores for participants whose parents/guardians fully cover their living expenses and tuition.

The average score for contribution to society was much higher for participants whose parents/guardians fully cover their living expenses and tuition (M=4.6) compared to the other three groups, whose means fell between M=3.6 and M=4.0. Furthermore, the average score for having creative freedom was M=4.6 for participants whose parents/guardians fully cover their living expenses and parents who receive some financial assistance from their parents/guardians, which is considerably higher than the averages for participants who receive no financial assistance from their parents/guardians and participants who assist their parents/guardians financially (M=3.9, M=3.8, respectively). The average scores for creating new knowledge and promoting DEI also trended downward as parent/guardian financial assistance level decreases. Lastly, we observed that the average score for degree of independence increases as parent/guardian financial assistance level decreases.

5.2.3. Correlations of Job Factors and Pathway Selections

Next, we demonstrate the correlations between these job factors and pathway selections for our participant sample in Table 2. Positive correlations have been highlighted in bold green text, while negative correlations have been highlighted in red italicized text. Correlations that were weaker than 0.1 were not highlighted.

Table 2 *Correlations between job factors and pathway choices*

Pathway Selection	**Job Factors**													
	Salary	**Benefits**	**Security**	**Location**	**WFH**	**Advancement**	**Intellectual Challenge**	**Responsibility**	**Independence**	**Society**	**Knowledge**	**Promoting DEI**	**Freedom**	**Passion**
Internship	**0.141**	**0.205**	**0.503**	*-0.174*	**0.122**	**0.178**	**0.199**	**0.197**	**0.321**	**0.25**	0.067	0.017	-0.064	**0.23**
Research	-0.04	*-0.183*	-0.047	0.09	**0.246**	0	*-0.133*	*-0.137*	0	0.031	-0.097	0.093	**0.217**	-0.04
Entrepreneurship	**0.207**	0	*-0.14*	*-0.156*	**0.187**	-0.045	-0.019	**0.11**	-0.022	**0.268**	0.023	*-0.222*	0.083	*-0.196*

Although further significance tests on these correlations are part of our future work, our preliminary analysis shows some patterns. Selecting an internship pathway is most positively correlated with a desire for job security and independence and is negatively correlated with placing importance on location. Selecting a research pathway is positively correlated with a desire to work from home and is most negatively correlated with placing an importance on benefits. Selecting an entrepreneurship pathway is most highly correlated with a desire to help society and importance of salary and is most negatively correlated with promoting DEI.

6. Discussion

6.1 Understanding Gaps in Career Pathway Interests

We conducted this survey during the first year of a five-year programmatic initiative that is supporting lower-income computing students as they finish their undergraduate education and move towards their first steps in their career pathway. Although any of the three pathways could be a fulfilling life path, we were curious to understand the ways that our students understood and expressed interest in these pathways. While programmatic intentions treat these three pathways

as potentially equal options, it is clear that the student participants do not view them equally. No students expressed interest in entrepreneurship. We are continuing to explore why this is, and our survey includes measures that can indicate mitigating factors, such as whether students understood what entrepreneurship entails, whether they have any peers or role models in entrepreneurship, and job factors (discussed in 4.2). Similarly, few students selected a research pathway. This will impact programmatic efforts as well, as the program has allocated funds to support the attendance of graduate school if students wish to attend one of the participating universities. We found no significant demographic patterns, but we initially noticed that White students, men, and students whose parents had bachelor's degrees each slightly preferred internship over other pathways.

We note that this survey is a pilot survey that came at the end of a year of programming. Thus, the lack of interest in entrepreneurship and research is not only expressing initial interest but also reflecting the impact of programmatic efforts for the first cohort year. We recognize that the students in the program, in some ways, reflect the views typical engineering and/or computing students, as many programs emphasize internship pathways as crucial. In other ways, the students in the program have higher demonstrated financial needs than other students, which may increase their economic anxiety and desire for a secure well-paying job.

We are conducting qualitative interviews and observations on the program as well, discussed in another paper [15]. As we continue to provide feedback to improve the responsiveness and messaging of the programming, we will continue to monitor the overall patterns of interest in the pathways and, eventually, the pathways that students take upon graduating. Perhaps by improving the messaging around entrepreneurship and research we will improve student understanding and interest and see a shift in pathway selection. We will also have opportunities to improve sample size and statistical power by combining cohorts and improving response rates in future years.

6.2 Understanding job factors influencing career pathway selections.

We investigated students' ratings of job factors as a way of better understanding their career pathway selections. Students tended to prioritize job security, salary, and opportunities for advancement. As men dominated the sample, their trends mirror the overall trend, while women tended to value a wider set of job factors: opportunities for advancement, promoting diversity, equity and inclusion, job security, pursuing your passion, and benefits. This list indicates both gender differences and begins to suggest the ways that our students' values influence their career pathways. While we do not know exactly how students define job security or opportunities for advancement, it seems reasonable to say that internship / professional pathway is well-aligned with them. Graduate school and entrepreneurship are much less "secure" and the opportunities for advancement may be seen as riskier or more delayed. We also have a hint at the way women are looking at a wider variety of factors and may be more influenced to look at a wider variety of

career pathways than men (as we initially saw in the demographic findings). This is worthy of further exploration and perhaps programmatic intentional support.

There was also an indication that the level of financial assistance students receive from their parents/guardians might influence how they think about job factors. Although all of our students qualified for the Flit-GAP program and had unmet financial need, not all were in exactly the same financial position. Students who said they support their parents/guardians financially (the lowest financial status) were more likely to focus on job benefits and they did not prioritize contribution to society or having creative freedom. These relatively conservative inclinations are understandable, with the need to support their parents financial weighing on them presently, the immediate problem they need to solve is to receive a stable job. Perhaps the meaning of "independence" was even interpreted as economic independence, rather than independence of one's work-related activities. In contrast, participants who said their parents/guardians fully cover their living expenses and tuition (the highest financial status) prioritized contributions to society, having creative freedom, promoting DEI, and creating new knowledge more than the lower financial status groups. We can presume then, that programmatic messages that implore students to go after their dreams in these more ambitious ways (e.g., impact on society) may be appealing to the more financially stable participants. In contrast, if the programs want to support the students with the lowest socioeconomic backgrounds within their cohorts, they may need to address financial aspects, mitigating risks, and long-term advantages of a career path in light of those perceived risks and disadvantages.

The correlations between job factors and career pathway selections help us demonstrate some of those trends. As might make sense logically, job security is most positively associated with selecting an internship pathway and negatively associated with entrepreneurship and graduate school. If the program would like to encourage a different pathway as well, there may need to be a longer conversation and messaging about what job security could mean for a graduate student or entrepreneur, as these pathways are not initially perceived that way, and this is a major deciding factor. Students who select a research pathway tend to have interests in freedom and working from home, whereas freedom is negatively correlated with an interest in an internship pathway. This suggests that for some students, emphasizing freedom and ability to work from home will be an attraction to graduate school pathways, although so far this group is still smaller than the internship-group. Finally, entrepreneurship is most highly correlated with a desire to help society (and with salary). We see a similar correlation of desire to help society and selecting an internship pathway, however desire to help society is not correlated with selecting a research pathway. This could be another point of discussion—as many researchers and professors probably see ways that their research or others' research can help society, this could be a place for improved messaging that could have an impact on student impressions.

7. Limitations and Future work

Our current survey was only a pilot survey and was significantly limited by small sample size and lack of responses. As we write, for the current year we are sending the survey again as a pre-survey for a new cohort and as a post-survey across all cohorts. This will allow sample sizes to be larger. We have also had success in that recent data collection to achieve much higher response rates by utilizing paper surveys during official programming events, rather than email surveys. We will follow up on the analysis we have conducted with this more robust dataset in future publications. We particularly intend to use Chi-squared, ANOVA, and matched pairs t-test (pre-post) statistical testing to test for the significance of the patterns we initially saw here.

8. Conclusion

We emphasize the importance of the student perspective in understanding how to create effective student programming. For lower-income students, as for many others, financial concerns will be of utmost importance. The financial assistance provided by Flit-GAP is one crucial aspect in alleviating financial concerns, yet student concerns about finances will expand beyond their present day, and knowledge or lack thereof could cloud their decision-making about their future. While programs like Flit-GAP can provide information about future career pathways, if they do not understand the specific fears, ambitions, and thought processes of their student population they will not know how to create a program that truly broadens their participation in the computing field. We hope that this work helps provide insight into the student perspectives that will be crucial to ongoing broadening participation efforts.

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