# Considering the Student Perspective:

**Factors that Undergraduates Perceive as Influential to their Academic Performance in Science**

Data Analysis and Conclusions from Master's Thesis by Ashley Welsh[*]

# 1 Introduction

If we hope to improve the success of all students in undergraduate STEM (science, technology, engineering and mathematics) programs, it is important to understand the factors that students perceive as influential to their academic performance. The sheer amount of course material to learn, developing appropriate study skills and habits, coping with a new learning environment, developing new relationships, and balancing school, work and family responsibilities are just a few of the factors that might influence whether a student chooses to remain in or leave the sciences (Moore et al., 2007; Seymour & Hewitt, 1997). D'Andrea & Gosling (2005) comment that:

> Student learning cannot be understood in isolation. Students are never simply 'learners', and 'learning' is not simply a psychological process… Gender, ethnicity, nationality, class, personal and value commitments, these have been given less attention in much of the recent literature on teaching and learning which has tended to focus on purely psychological processes, such as deep and surface approaches to learning and taxonomies of understanding… Student learning is a process that is also intimately influenced by the wider cultural environment and of the institution (D'Andrea & Gosling, 2005, p. 2)

The factors that students perceive as influential to their academic performance and retention can vary from one institution to the next. Consequently it is important to consider these factors in a specific university context, such as the University of British Columbia, which is the goal of the current study.

## 1.1 Research questions and an overview of the methodology

The Faculty of Science at the University of British Columbia attracts high-achieving students who, based on their high school grades are predicted to succeed in their first year of university (UBC Admissions Committee, 2007). Despite the fact that these students excel in high school, a noticeable number of undergraduates within the Faculty of Science fail or do poorly in some of their science courses. Administrators within the Faculty of Science, concerned with the performance of students pursuing degrees within the Faculty, prompted the development of this research. The following research questions guide this study:

1. What academic, social and personal factors do undergraduates within the Faculty of Science perceive as most influential to impeding or enhancing their academic performance?
2. How do male and female undergraduates differ in what they perceive as being most influential to their academic performance?

A mixed method design combining quantitative (survey) and qualitative (interviews and focus group discussion) data collection methods was used to answer the research questions. Overall, 492 students filled out a survey, 24 students completed one-on-one interviews and four students took part in a focus group discussion. Statistical analysis of the survey data assisted in pinpointing the factors students perceived as influencing their academic performance (Question 1) and in detecting whether differences existed among males' and females' perceptions (Question 2). One-on-one interviews and a focus group discussion were also incorporated to provide a more candid and personalized look into the educational

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experiences of the students to understand why males and females perceived particular factors as important.

### 1.2 Significance of this research

The information collected throughout this study was used to provide recommendations for how administrators, faculty and students could improve students' academic performance in undergraduate science. The recommendations might not only improve students' academics, but also positively influence their confidence in their academic abilities and improve their overall university experience. Hopefully, this study will serve as an impetus for researchers at institutions of higher education to examine and address the topic of student performance more explicitly. Different universities, Faculties and departments might identify more strongly with certain factors thus encouraging the need for more directed studies, such as this research. Pinpointing the factors that students perceive as most important might help educators to create programs or improve teaching and curriculum to enhance undergraduates' success.

# 2 Data Analysis

In this chapter I present my analysis of the data collected from the student survey, the 24 one-on-one interviews and the 4-person focus group discussion. First, I present the survey data to establish which factors students perceive as most influential to their academic performance. Then, I consider how males and females differ in their emphasis regarding the influence of particular factors. Finally, I will present the findings from my analysis of the one-on-one interviews and focus group discussion data to provide a more in-depth look at the experiences of students within the Faculty of Science. The quantitative and qualitative findings are examined together and discussed in more detail in Chapter 5 of my full thesis.

### 2.1 Student survey

The survey data was collected using the Vivoci EFM Continuum survey tool. This tool organized the data into bar and pie charts which allowed me to visualize the data before I began more rigorous statistical analysis. After having familiarized myself with the overall data, I exported it into SPSS (IBM, 2009) and Excel (Microsoft, 2004) files for analysis. SPSS was used for the majority of the statistical tests and Excel was used primarily for the construction of graphs and charts.

#### 2.1.1 Demographic information

When I first began analyzing the survey data I was immediately overwhelmed by the sheer amount of information that I had collected and the endless possibilities for analysis. To ease myself into the analysis process, I first decided to focus on students' demographic information. I was curious to understand who the students were and what their respective academic and social backgrounds were. 492 students pursuing degrees within the Faculty of Science completed the survey. Their demographics are summarized in Table 2.1.

**Table 2.1: A summary of the demographics for students who completed the survey**

| Demographic | Number of students (n) | Percentage of students (%) |
|---|---|---|
| What is your sex? | | |
| Male | 205 | 41.7 |
| Female | 287 | 58.3 |
| What is your citizenship? | | |
| Canadian | 421 | 86.1 |
| Permanent Resident | 35 | 7.2 |
| International Student | 33 | 6.7 |
| What is your race/ethnicity? | | |
| Aboriginal | 3 | 0.6 |
| Arab | 3 | 0.6 |
| Black | 1 | 0.2 |
| Chinese | 170 | 34.6 |
| Filipino | 10 | 2 |
| Japanese | 4 | 0.8 |
| Korean | 13 | 2.6 |
| Latin America | 8 | 1.6 |
| South Asian (i.e. East Indian, Pakistani, Sri Lankan) | 19 | 3.9 |
| Southeast Asian (i.e. Vietnamese, Cambodian, Malaysian, Laotian) | 15 | 3 |
| West Asian (i.e. Iranian, Afghan) | 9 | 1.8 |
| White | 189 | 38.4 |
| Multiracial | 24 | 4.9 |
| Other | 9 | 1.8 |
| I prefer not to respond | 15 | 3 |
| What is your current academic year of study? | | |
| 1st | 10 | 2 |
| 2nd | 142 | 28.9 |
| 3rd | 181 | 36.8 |
| 4th | 115 | 23.4 |
| 5th | 38 | 7.7 |
| greater than 5th | 5 | 1 |
| What is your average grade for courses taken at UBC? | | |
| 80-100% | 172 | 35 |
| 70-80% | 216 | 43.9 |
| 60-70% | 91 | 18.5 |
| below 60% | 9 | 1.8 |

| Demographic | Number of students (n) | Percentage of students (%) |
|---|---|---|
| What is your department? | | |
| Biochemistry | 5 | 1 |
| Biology | 163 | 33.4 |
| Chemistry | 35 | 7.2 |
| Computer Science | 36 | 7.4 |
| Earth and Ocean Sciences | 36 | 7.4 |
| General Science | 58 | 11.9 |
| Geographical biogeoscience | 3 | 0.6 |
| Integrated Science | 11 | 2.3 |
| Mathematics | 23 | 4.7 |
| Microbiology and Immunology | 27 | 5.5 |
| Physics and Astronomy | 43 | 8.8 |
| Physiology | 5 | 1 |
| Psychology | 3 | 0.6 |
| Statistics | 5 | 1 |
| Not yet decided | 9 | 1.8 |
| Other | 26 | 5.3 |
| Where do you live? | | |
| Home of parents/relatives/guardians | 220 | 44.8 |
| Off-campus rental house/apartment | 135 | 27.5 |
| On campus in university apartment or residence hall | 123 | 25.1 |
| Other | 13 | 2.6 |
| How long is your one-way commute from where you live to UBC? | | |
| less than 15 minutes | 137 | 28 |
| 15-30 minutes | 92 | 18.8 |
| 30-45 minutes | 58 | 11.9 |
| 45-60 minutes | 101 | 20.7 |
| greater than 60 minutes | 101 | 20.7 |
| How often is English spoken where you currently live? | | |
| Never | 10 | 2 |
| Infrequently | 27 | 5.5 |
| Sometimes | 34 | 6.9 |
| Half of the Time | 50 | 10.2 |
| Most of the Time | 103 | 20.9 |
| Always | 266 | 54.1 |

The demographic data indicate that students of White (n=189) and Chinese (n=170) descent are the ethnic majority and make up 38.4% and 34.6% of the survey respondents respectively. The remaining 27% (n=133) of students are Aboriginal, Arab, Black, Filipino, Japanese, Korean, Latin American, South Asian, Southeast Asian, West Asian, those who identified as other and those that were not inclined to identify their ethnicity. I consider these students collectively to be representing an "ethnic minority group" because none of these ethnicities comprise more than 5% of the survey respondents. Students of differing ethnicity might have different academic and cultural dispositions (Lee, 1994; Li, 2005), which might influence how they rank the importance of various factors on their academic performance. If this is the case, the results in this survey might be more heavily weighted towards the perceptions of White and Chinese students.

This study was intended for students in their second academic year of study or higher, and this is reflected in the demographic results with second (n=142), third (n=181) and fourth (n=115) year students comprising of 29%, 37% and 23% of the overall survey responses respectively. Only 2% of the responses came from first (n=12) year students and these responses can most likely be attributed to the fact that they came from students who were taking an upper year course in their first year. In relation to academic standing, students with an overall average between 80-100% (n=172), 70-80% (n=216) and 60-70% (n=91) make up 35%, 44%, and 19% of the survey respondents respectively. Students with averages below 60% comprise the smallest percentage and make up only 2% of the overall respondents.

Biology students make up the largest fraction of survey responses with the rest of the students pursuing degrees in a variety of departments within the Faculty of Science. About 33% of the survey respondents (n=163) are pursuing degrees in biology. Students in general science (n=58) represent the second highest percentage and consist of 12% of the respondents. The remainder of the responses (n=271, 55%) is comprised of students from 13 other disciplines and from those who have not yet decided their major.

The questions considering students' living arrangements, confirmed my assumption that the majority of students completing this survey would be living off-campus with the highest percentage living with their parents. Only 25% (n=123) of the students live on campus whereas 45% (n=220) live with their parents/guardians and 28% (n=135) live off-campus in rental apartments or housing. This observation demonstrates that UBC has a significant percentage of the student body living off-campus (72%) rather than on-campus. In addition to living off-campus, 41% (n=202) of the respondents travel more than two hours to and from school each day. With so many commuter students on campus, it is important to understand their perceptions (through the survey and interviews) as to how the commute influences their academic performance.

To understand a little more about students' language background, respondents were asked to indicate how often English is spoken in their home with 54% (n=266) and 21% (n=103) indicating that English was spoken always or most of the time respectively. About 25% of the students however claimed that English was spoken half of the time or less within their household. This demonstrates that just under half of the survey respondents are at least bilingual and that English might not be their primary language.

### 2.1.2 Comparison of the survey sample to the overall population

After analyzing the demographic information collected in the survey I compared it to the overall student population within the Faculty of Science. This helped me determine if my sample was representative of the larger population of students and thus whether or not the survey results could be generalized. The Dean's office in the Faculty of Science provided information representing the number of students enrolled in second year and higher within the Faculty of Science at UBC. This information was parsed out by both gender and discipline and is compared to the survey sample data in Table 2.2.

**Table 2.2: A summary of the number of students in second year or higher by gender and specialization in the Faculty of Science at UBC**

| Specialization | Faculty of Science Population | | Survey Respondents | |
|---|---|---|---|---|
| | Female | Male | Female | Male |
| Biochemistry | 165 | 212 | 1 | 4 |
| Biology | 577 | 326 | 119 | 44 |
| Chemistry | 144 | 147 | 17 | 18 |
| Computer Science | 126 | 452 | 9 | 27 |
| Environmental Science | 61 | 21 | - | - |
| Earth and Ocean Science | 50 | 73 | 24 | 12 |
| General Science | 824 | 554 | 43 | 15 |
| Geographical Biogeoscience | 13 | 14 | 3 | 0 |
| Integrated Science | 65 | 42 | 6 | 5 |
| Mathematics | 84 | 93 | 11 | 12 |
| Microbiology | 173 | 141 | 18 | 9 |
| Other | 3 | 8 | 21 | 14 |
| Pharmacology | 33 | 42 | 0 | 0 |
| Physics and Astronomy | 47 | 176 | 7 | 36 |
| Physiology | 28 | 29 | 3 | 2 |
| Psychology | 100 | 56 | 1 | 2 |
| Statistics | 40 | 32 | 2 | 3 |
| **Total** | **2533** | **2418** | **285** | **203** |

The gender split for the larger population is almost equal with female and males making up 51% and 49% of the students in second year or higher pursuing degrees in science, respectively. For the survey sample, 58% were females and 42% were males. When comparing the gender distribution of the survey sample to that of the entire population, the proportion of females in the survey sample (58%) is higher than that of the female population (51%). Thus, the survey findings are in favour of female students' responses and might not be representative of the general population within the Faculty of Science.

To simplify my comparison of the survey sample and the student population within the Faculty of Science at UBC, I clustered the majors to create three categories: Physical Sciences & Technology, Life Sciences and Other Sciences. The Physical Sciences and Technology category consists of chemistry, computer science, mathematics, physics and astronomy and statistics. I have combined biochemistry, biology, biotechnology, microbiology, pharmacology, and physiology into the Life Sciences category. The Other Sciences category included earth and ocean science, environmental science, geographical biogeoscience, general and integrated science, psychology, cognitive science or those who have yet to choose a degree. Table 2.3 provides a comparison of the survey sample and entire population by gender (within and between) and discipline.

**Table 2.3: A comparison of the survey respondents with the overall population by gender and discipline**

| Discipline | BETWEEN GENDER | | | | WITHIN GENDER | | | |
|---|---|---|---|---|---|---|---|---|
| | Population | | Sample | | Female | | Male | |
| | Females (%) | Males (%) | Females (%) | Males (%) | Population (%) | Sample (%) | Population (%) | Sample (%) |
| Physical Science & Technology | 32.9 | 67.1 | 31.6 | 68.4 | 17.4 | 16.8 | 37.2 | 51.0 |
| Life Sciences | 57.4 | 42.6 | 70.8 | 29.2 | 36.1 | 48.2 | 28.1 | 27.9 |
| Other Sciences | 58.4 | 41.6 | 69.9 | 30.1 | 46.5 | 35.0 | 34.7 | 21.1 |

When determining if the survey results findings can be generalized to the overall population I needed to take into consideration the differences existing between distributions of the survey sample and the entire population. Between gender differences were apparent amongst males and females with the females being more heavily populated in the Life Sciences and Other Sciences in comparison to the entire population of students in the Faculty of Science. When considering within gender differences, females and males pursuing degrees in the Life Sciences and Physical Sciences and Technology, respectively, were a greater part of the survey sample distribution relative to the entire population. Comparatively, females and males pursuing degrees in Other Sciences and the Life Sciences respectively, had a lower survey sample distribution than expected. Thus, the survey sample may not be fully representative of the entire population of the students pursuing degrees within the Faculty of Science because a greater proportion of females completed the survey. This difference is important to consider for the interpretation of the results and influenced my decision to explore how gender might affect what students' perceive as most influential to their academic performance.

### 2.1.3 Data analysis

The analysis of the survey data would help in answering the research questions. In the following section I present the results of my analysis of the survey data to determine the factors that undergraduates within the Faculty of Science perceive as most important to influencing their academic performance (Question 1). I will also consider differences in males' and females' survey responses using the Mann-Whitney *U* test (Question 2).

#### 2.1.3.1 Determining the most important factors

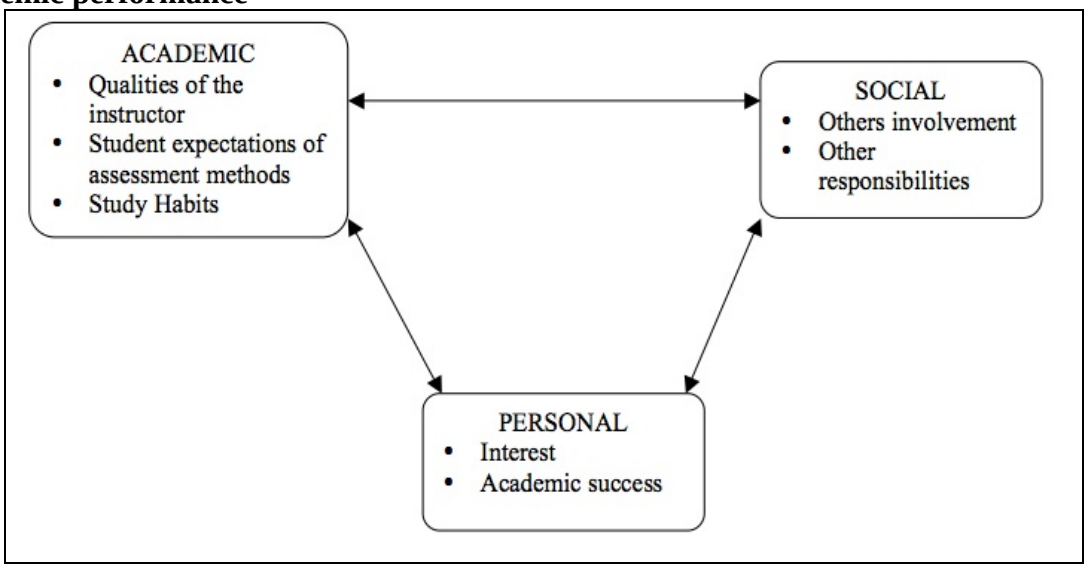
Two 5-point ordinal scales consisting of Unimportant to Very Important, and Strongly Disagree to Strongly Agree were used in the student survey. To begin the analysis, I computed the descriptive frequencies for each survey question for the overall student population, and for male and female students. To simplify the analysis of the frequencies, the survey responses were condensed into three categories: Unimportant, Somewhat Important and Important. The Slightly Important and Very Important responses were grouped with the responses in the Unimportant and Important categories respectively. The frequency charts for these groups of students are found in Appendix J. The frequency data was arranged in descending order to determine what factors students' perceived as most important to influencing their academic performance. There were nine survey questions that over 70% of students perceived as either important or very important and these are summarized in Table 2.4. This table also presents the percentage of males and females who perceived these questions as important and whether or not the survey questions were identified as an academic, social or personal factor.

**Table 2.4: A summary of the factors that undergraduates found most important to influencing their academic performance**

| Rank Value | Survey Question | Category | Percentage of students perceiving the question as important or very important (%) | | |
|---|---|---|---|---|---|
| | | | Overall | Males | Females |
| 1 | It is important for me to succeed academically | Personal | 98.2 | 96.1 | 99.7 |
| 2 | Ability for the instructor to make the course interesting | Academic | 89.4 | 84.2 | 93 |
| 3 | Developing and adapting study habits for university courses | Academic | 84.7 | 79.1 | 88.7 |
| 4 | The instructor's ability to speak English clearly | Academic | 83.7 | 81.4 | 85.3 |
| 5 | The lack of relevant practice problems to complete before an exam was a/an _____ factor influencing how well I performed on exams | Academic | 83.1 | 75.6 | 88.5 |
| 6 | My interest in a subject is a/an _____ factor in motivating me to complete the suggested homework/assignments | Personal | 77.5 | 76.6 | 78.2 |
| 7 | Receiving encouragement from my parents/family/guardians assists my academic performance | Social | 76.2 | 71.4 | 79.6 |
| 8 | My uncertainty in knowing what types and difficulties of problems will be asked on a midterm or final exam is a/an _____ factor limiting my academic performance | Academic | 72.2 | 68.8 | 74.6 |
| 9 | Volunteering or working during the school year limits the amount of time I spend studying | Social | 70 | 68.8 | 70.9 |

To ease the analysis of the survey questions that students perceive as most influential to their academic performance, I have grouped the questions into academic, social and personal categories. Their placement in these categories is represented in Figure 2.1.

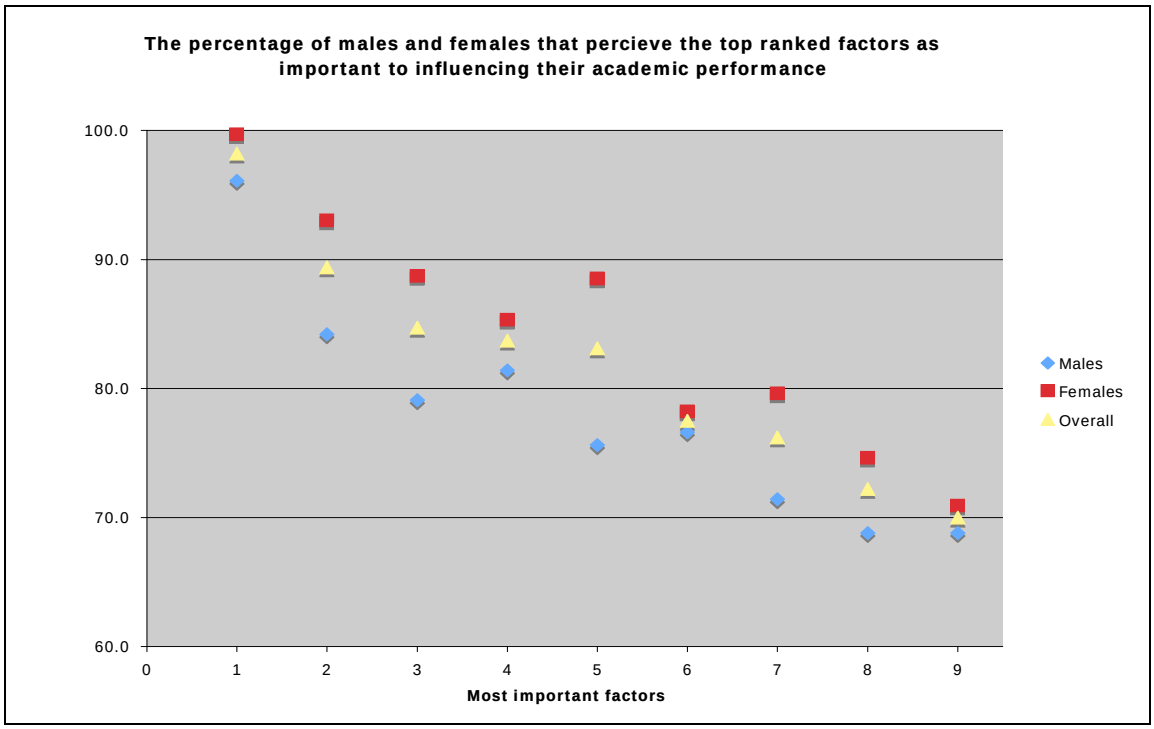
**Figure 2.1: The academic, social and personal factors that students perceive as most influential to their academic performance**




I have assigned the second, third, fourth, fifth, and eighth ranked questions to the academic category for they reflect the qualities of an instructor, student expectations of assessment methods, and study habits. I have distinguished the seventh and ninth ranked survey questions as social factors for they depict the importance that students place on the involvement of others and additional responsibilities in influencing their academics. Finally, I have placed the first and sixth ranked survey questions into the personal category because they reflect students' personal qualities such as interest and motivation.

The graph shown in Figure 2.2 compares how male and female students' responses varied in terms of the importance they placed on the nine survey questions (Figure 2.2).

**Figure 2.2: Top ranked survey questions by males and females**



In comparison to males, females perceived the majority of factors as more important to influencing their academic performance. The correlation between the female and male data for this graph was 0.91. Although more females perceived these factors as important, the data for males and females follows a similar trend. These observations served as an impetus to investigate in more detail the differences in students' responses based on gender.

#### 2.1.3.2 Determining gender differences

The Mann-Whitney *U* test was used to compute any significant differences between the survey responses for males and females. If the tests returned a *p*-value less than the fixed 0.05 level of significance, significant differences existed between the two groups. Using the Mann-Whitney *U* test in SPSS, I detected significant differences for 10 of the survey questions. The questions are presented in Table 2.5 in order of highest to lowest level of significance.

**Table 2.5: Factors that display significant differences between the response levels of male and female students**

| **Survey Question** | **Mann-Whitney *U* Value** | ***p*-value** |
|---|---|---|
| The lack of relevant practice problems to complete before an exam was a/an _____ factor influencing how well I performed on exams | 22544 | 0.000 |
| The approachability of your instructor | 24205 | 0.001 |
| Receiving encouragement from my parents/family/guardians assists my academic performance | 23322.5 | 0.001 |
| The use of in-class learning techniques (i.e. clickers, group activities) | 24241.5 | 0.002 |
| Developing and adapting study habits for university courses | 24762.5 | 0.01 |
| The number of students in the class | 25172 | 0.011 |
| Suggestions from parents, teachers and/or advisors influenced my decision to major in math and/or science | 24147.5 | 0.014 |
| My uncertainty in knowing what types and difficulties of problems will be asked on a midterm or final exam is a/an _____ factor limiting my academic performance. | 25336 | 0.021 |
| Ability for the instructor to make the course interesting | 26046 | 0.026 |
| My commute to campus limits the amount of time I spend studying | 16049 | 0.048 |

To determine whether male or female students expressed higher emphasis on the factors listed in Table 2.5, I created bar graphs displaying the frequency of responses for male and female students for each factor. These bar graphs are represented in Appendix K. In each graph, it was apparent that female students placed greater emphasis on all of the factors depicted in Table 2.5. For instance, Figures 2.3 and 2.4 respectively, are bar graphs comparing the percentage of males' and females' responses to the survey questions: "The lack of relevant practice problems to complete before an exam was a/an _____ factors influencing how well I performed on exams" and "Receiving encouragement from my parents/family/guardians assists my academic performance".

**Figure 2.3: A comparison of the responses for male and female students for the survey question: The lack of relevant practice problems to complete before an exam is a/an _____ factor influencing how well I perform on exams.**

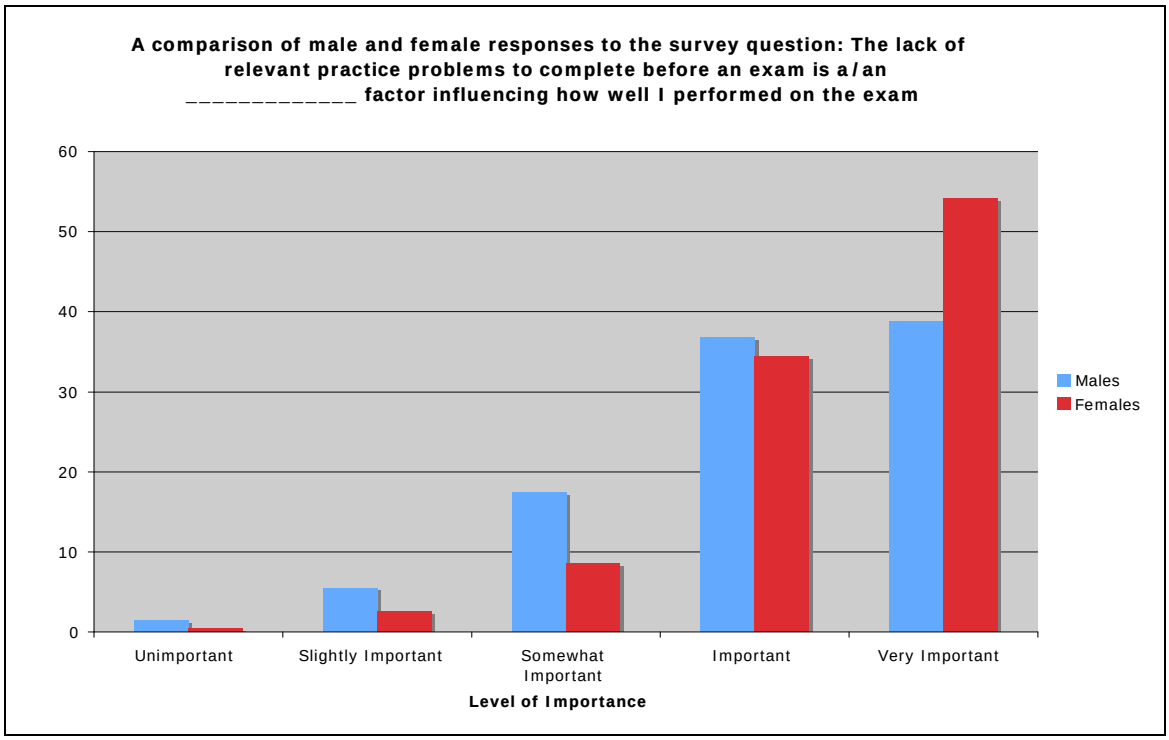
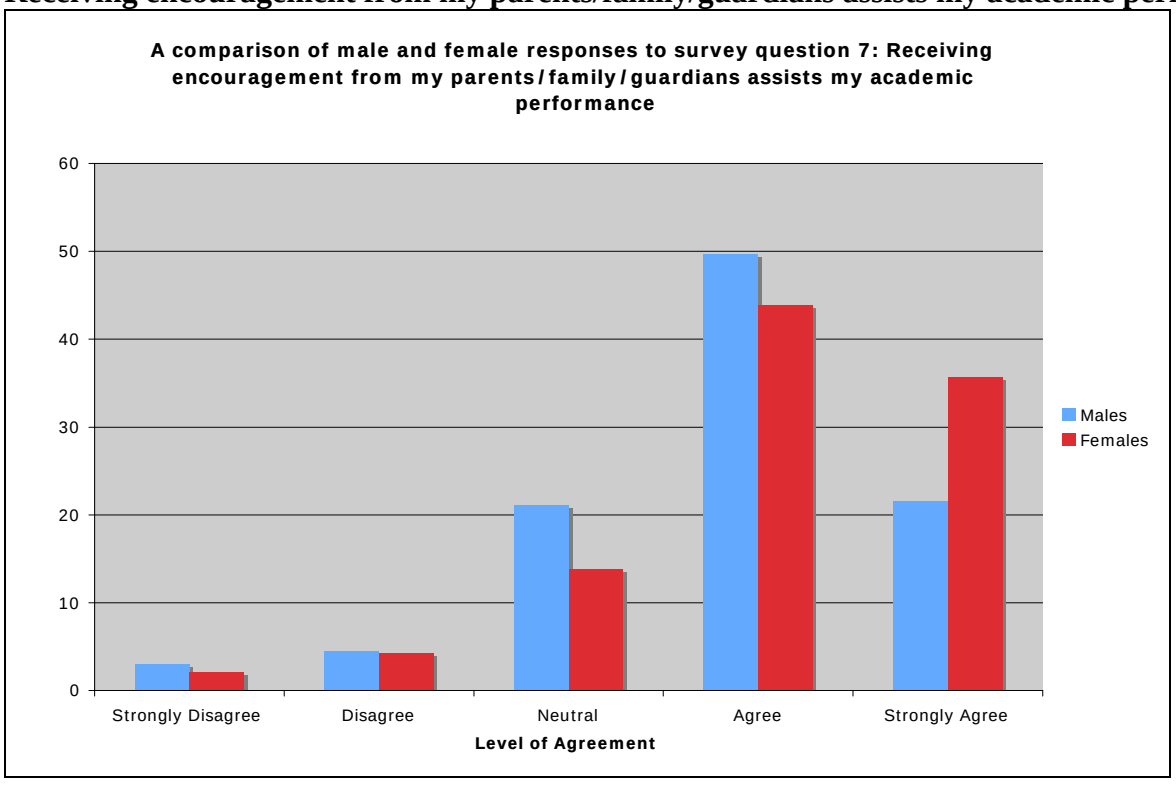



**Figure 2.4: A comparison of the responses for male and female students for the survey question: Receiving encouragement from my parents/family/guardians assists my academic performance.**



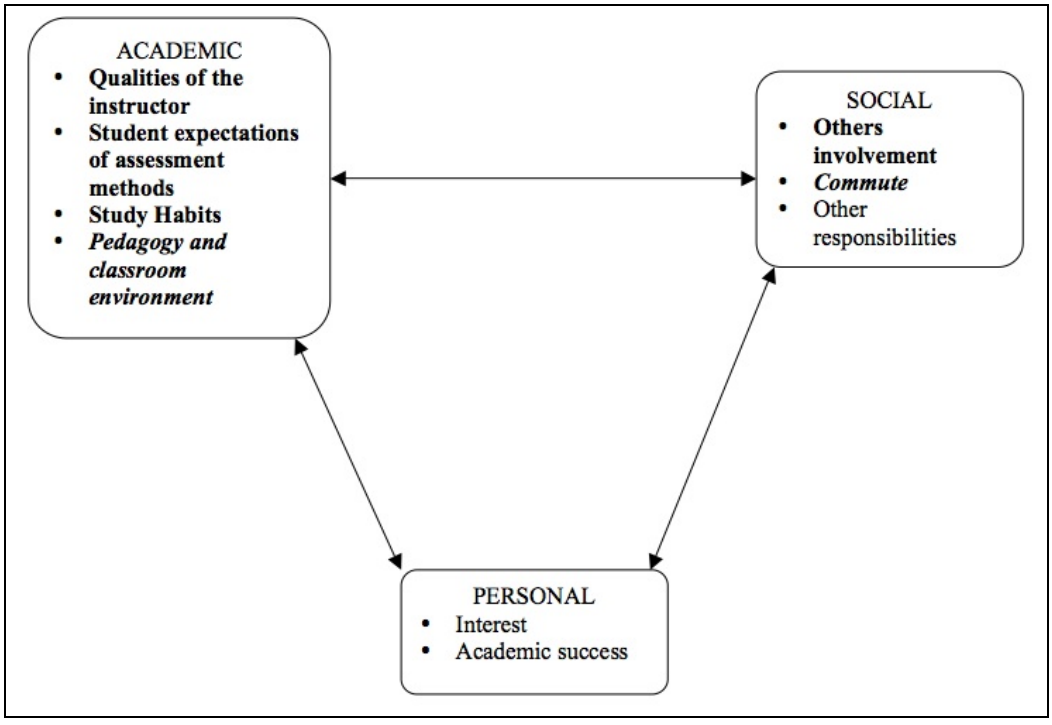
In figure 2.3, 54.1% of females in comparison to 38.8% of males perceived the lack of practice problems to complete before an exam as very important to influencing their academic performance. For figure 2.4, 36.2% of females in comparison to 21.6% of males perceived familial encouragement as being very important to influencing their academic performance. Overall, females were more likely to choose the Strongly Agree or Very Important categories in comparison to the male respondents.

The Mann-Whitney *U* results indicated a significant difference exists between male and female students' views regarding the influence that their study habits, the lack of knowing what to expect on tests/finals, and receiving encouragement from their family have on their academic performance. In addition, female students perceived factors related to the instructor and his/her teaching (their approachability, ability to convey interest, teaching techniques), the classroom environment (number of students in the class), suggestions from their family/advisors to pursuing a degree in the sciences and their commute to school as influential to their academic performance.

### 2.1.4 Summary

Based on the analysis of the survey data, it appears that males and females perceived a variety of academic, social and personal factors as important to influencing their academic performance with females placing more emphasis on particular factors. Figure 2.5 is adapted from Figure 2.1, which organized the survey questions into academic, social and personal factors.

**Figure 2.5: A summary of the academic and social factors that male and female students perceive differently as influencing their academic performance**




In Figure 2.5, the boldface represents those factors where gender differences were detected. The italicized and boldface factors were factors where gender differences were observed but these factors were not considered among the most important to students. These factors and their relationship to the interview and focus group discussion data will be more thoroughly discussed in Chapter 5 of the full thesis.

## 2.2 One-on-one interviews and focus group discussion

To provide a more in-depth look into the factors students perceive as influencing their academic performance, I conducted 24 one-on-one interviews and one four-person focus group discussion with students pursuing degrees within the Faculty of Science at UBC. The interviews and focus group discussion provided extensive data that was analyzed to extend the survey findings. My analysis of these data is discussed in the following section. I have organized my presentation of data under the headings of: academic, social and personal factors.

### 2.2.1 Academic factors

At the beginning of the one-on-one interviews and the focus group discussion, I asked students to describe their overall experience in the sciences. In most cases, students' responses reflected academic factors. Students talked about their struggle in keeping up with the coursework, their drop in grades in comparison to high school, trying to adapt to the academic demands of UBC science, and in general – they talked about being overwhelmed with their academic experience in the first couple of years. In this section I examine some of the academic factors students identified as influential. I specifically consider: the quality of the instructor, lecturing and note-taking methods, expectations, assessment methods, grades, conceptual difficulties, coursework/courseload, and study habits and high school preparation. I present these academic factors in three subsections: pedagogy and assessment, grades and study habits.

#### 2.2.1.1 Pedagogy and assessment

When students were discussing their academic experience several of them mentioned the importance of having a 'good' instructor. When I asked them to define what they meant by 'good', students typically reiterated the need for an instructor to be approachable, interesting, organized and clear. Approachable in the sense that the student was not intimidated to seek out academic help from the instructor in or outside of the classroom. Throughout the interviews and focus group discussion, 19 of the 28 students I talked to indicated that they would have sought help from their instructors earlier on in their degree, however they were too shy, intimidated or unaware of the benefits of seeking support. For example, a second year female student expressed that "when a student asked a question the professor stared at the student like he should know the answer and I don't want to feel like that if I go to office hours". As a result of this experience, this student still has difficulty seeking academic help or guidance from her course instructors.

When I probed as per what the students meant by interesting, they typically said they expected the professor to present the material in an intriguing, interactive and enthusiastic way. A third year male commented that for some students, "just lecturing might be more difficult to adapt to for people in general actually because you have to grasp how a professor puts emphasis on this point rather than another point". Students preferred lectures to be more interactive and organized. When discussing the term interactive the majority of students brought up the use of clickers in lecture. Students' reviews of clickers were mixed but most commented that in order for clickers to be facilitated effectively they needed to be used in a timely manner to tests students' understanding. Clickers allowed students to gauge their understanding of the course content by providing immediate feedback of particular important concepts or problems related to the course. Group discussions were usually used in conjunction with clicker questions and six students commented that this combination was effective if the question was challenging enough that they had no choice but to work with their peers. A second year female commented that in her computer science courses:

> *Putting us in groups and having us struggle through a problem that's when you learn the most about something and make all the connections to the problem... and we get to discuss why we're making certain decisions to come to a solution.*

Students also suggested the need for the professor to review the solutions regardless if 90% of the class answered the question correctly. A couple even admitted that sometimes they would guess an answer if they were unsure. If they guessed right and the professor did not review the answer then they were still at a loss.

Throughout my conversations I was surprised at the number of students who mentioned the importance for the professor to be 'caring' or considerate. With regards to a considerate professor, a graduating female stated that "the professor would say – a lot of students asked me this question so I'm going to go over it more because it seems a few of you don't understand it." Although a small gesture on the part of the instructor, this student continually reiterated how aware this professor was with regards to the class' level of understanding. If the students were expressing difficulties, the professor would attempt to address their misunderstandings.

The majority of students reflected on the need for the professor to be clear in both the oral and written presentation of the course material. Most of the students I spoke to expressed that professors tended to vary in their lecturing and assessment styles. When I probed further most indicated that Power Point presentations were the most common means for presenting the lecture material. Over half of the students criticized this method because in most cases, the professor would move too quickly through the slides and did not allow time for the students to personalize their notes or fully grasp the material. A fourth year male who took part in the focus group discussion commented that "by the end [of the lecture] half the people are not paying attention and the other people are scrambling to write down what was on the power point and not listening to what the professor is saying". Twelve students mentioned at one point or another that they preferred when the professor wrote the notes on an overhead or used skeleton notes. These techniques reduced the pace of the lecture and gave students sufficient time to digest what was being taught. Twenty students commented that if a professor used power point presentations, they'd appreciate if the notes were posted online ahead of the lecture. This would allow them to review them before class so they have an idea as to what it going to be covered in lecture.

Lecturing techniques or assessment methods that allowed students to test their understanding in a course was important to most the students. A fourth year female in general science indicated that with regards to teaching and assessment:

> *There are many different ways and each style depends on size and what you're doing. I have some favourite classes and they all had different styles but the key component is that they all had plenty of space to practice what you were doing.*

Twenty-three out of 28 of the students commented that receiving timely and regular feedback throughout the term was integral to helping them gauge their progress in the course and in ensuring they do not just "cram at exam time". Small, weekly or bi-weekly assignments worth marks were popular among the students because they allowed them to stay on top of the material.

Many students commented on assessment and on the weighting of midterms and finals. Nineteen students indicated that they preferred courses with two midterms primarily for three reasons. First, having two midterms allowed them to keep up with the material. Second, the first midterm prepared them for how the instructor would assess them in future tests/exams. Third, having two midterms put less weight on grades and reduced students' feelings of stress and anxiety. Eleven of the 28 students described feeling scared, overwhelmed and stressed by heavily weighted finals (those over 50% of the students' overall grade). Nine students indicated that heavily weighted finals might not be representative of the work they had done during the term and 11 commented that their performance on exams may be more representative of whether they were having a good or bad day. A third year male admitted that although a heavily

weighted final worth 70% of his overall grade worked in his favour, he was upset that he didn't learn anything and stated:

> *It wasn't very effective at assessing how well you know the material because I crammed a day before and I ended up with a 78% in the course. I probably can't recall anything I learned in that course. What I'm getting at is huge finals are redundant as to how well you understand the material because you can just cram right before and if you luck out and do well – I guess the big thing is in most cases you won't luck out and you might fail. In some courses I study well before a final worth that much but... basically it's whether or not you have a good or bad exam day.*

Students also comment that some of their anxiety came from their uncertainty regarding what would be tested on the midterm or final. If they had little feedback throughout the semester and were unfamiliar with the instructor's expectations they felt lost when reviewing the material. Eighteen of the 28 students brought up the importance for professors to have relevant practice problems or clicker question that paralleled the types of questions being asked of them on a midterm of final. Only two of the 28 students actually talked about the importance for professors to have learning goals that reflected what topics students needed to understand so they felt prepared.

In relation to pedagogy and assessment it appears that students really placed the most emphasis on instructors using interactive and organized techniques, providing small weekly or bi-weekly assignments to help gauge their progress in the course, moving away from heavily weighted finals, and providing clear expectations as to what will be tested. Only two students mentioned the role of learning goals, but they both commented on how essential the goals were to helping them prepare for their midterms and finals. Although students do not ask to be told the exact questions on the midterm or final, they indicated it would be helpful if instructors could provide them with a bit of guidance as to how they might be able to focus their attentions.

#### 2.2.1.2 Grades

One topic that was not probed in the survey was how students' perceived their grades and what emphasis they placed on their importance. When asked what they considered a 'good' grade, students' answers were quite varied. Some gave a percentage range (75-80% or 80+%), some a letter grade (B, B+, A+) and some indicated they strived to be above the class average. The majority of students admitted experiencing a grave drop from their high school to university grades which contributed to feelings of doubt, stress and panic. For example, two females commented that in their first couple of years:

> *I got like 62 and the average was 68 so I was in serious panic. Oh my gosh – I don't understand anything!... For me, failing means being below the average. My standards for grades are getting lower and lower and I'm aiming to pass my subjects – so getting the average.*
>
> Second year female in biology

> *I was probably doing fine but then you get to university and the standards change. When you're grouped together with the other top students and compared to the other top students your own evaluation as to how you're doing is really affected whereas in high school you were the bright students at the top of the class.*
>
> Third year female in computer science and physics

Just over half of the students I spoke with attributed this drop in grades to the vast amount of material they were expected to learn, their lack of effective study habits, and the fact that they were held responsible for their education. I was intrigued by a second year female's comment that "in high school

they told us to expect our marks to go down in university but they didn't say that if you try, you can keep them up!"

Although students tried not to place too much emphasis on their grades, for those hoping to apply to medical, pharmacy or graduate school, or who were hoping to retain scholarships, attaining high grades was quite important. Seven students discussed that they perceived their understanding of the material as the most important thing to take from a course however they admitted to still being quite concerned with the grade letter or number.

> *In second year I didn't care so much about my grades. Third year has been a bit different because I've been feeling the pressure that grades matter for graduate school. There's a battle between wanting to learn things and 'grad school will look at this'. When it sinks in, I get depressed – then it becomes about the mark versus understanding the concept. I sort of oscillate between the two.*
>
> Third year male in biochemistry

The difficulty with students placing so much emphasis on their grades is that they spend more time trying to figure out what is on the test or exam instead of learning the material.

> *A lot of times it's how well you adapt to the instructor so honestly sometimes I think I didn't deserve such a high grade and other times I worked so hard and there's no way I could have done any better and it's frustrating.*
>
> Third year male in physiology

Although the majority of the students talked about the importance of learning and understanding in university, the grades they achieved seemed to govern their behaviours and affect their confidence. One student somewhat jokingly, but earnestly commented that if she received a poor mark in one of her courses that was essential to what she hoped to do in the future than "it's the end of the world! My future is over". A couple of other students commented that grades could act as both positive and negative feedback. If they received a good grade, they experienced a confidence boost. On the other hand, if they were doing well in a course but did poorly on the midterm, their confidence "dive bombed". Over time, students found ways to cope with their low grades by accepting the grades they received, by focusing on understanding the material, and by developing and adapting appropriate study habits.

#### 2.2.1.3 Study skills and habits

From my perspective, study skills and habits was discussed most frequently during the interviews and focus group discussions. When I asked students to provide some advice for incoming science students, 25 out of 28 of them stressed the importance for students to develop and adapt appropriate study skills and time management early on in their degree. Several students expressed feeling overwhelmed with the coursework demands in their first and second year and lacking the study skills to do well in their courses. Most science students take five courses that on top of going to lecture typically have labs and tutorials associated with them. Half of the students I spoke to actually commented that during their first year experience they realized the importance of becoming more independent and taking on a new sense of academic responsibility. They no longer had a high school teacher reminding them to hand in their assignments or monitoring their class attendance. Students expressed however that they struggled with not knowing how to distribute attention to all of their courses throughout the term and especially during the exam period they would resort to 'cramming'.

*I would cram just before the exam and continued to do that because I didn't know how to change and I should have talked to some people and didn't seek guidance so I got bad marks in first semester.*

Third year male in biochemistry

*This term I was in panic because I had three exams in a row so after I was done the first I stayed up all night to study for the second one and then those two exams are affected very much… I guess I was scared.*

Second year female in biology

If a student had difficulty with understanding the course material or a particular concept they would become discouraged and start neglecting the material. For a third year male:

*If there's something I can't understand like when I'm reading a lecture slide that I thought I understood and then I go to the questions and can't do a single one. Right then and there I think I'm going to fail the course. When I put 1 or 2 hours into it and still don't understand anything then it affects my confidence and I just dive bomb.*

The majority of the students felt that it wasn't that they didn't understand the material, but that they didn't have sufficient time in a semester to fully comprehend all of the concepts they were expected to know. Students also expressed that in their first couple of years in university they rarely sought out help from professors and tended to consult the textbook or course notes to improve with their understanding. They claimed being too shy or intimidated to ask for help.

Four students mentioned going to study workshops to improve their study habits although they did not find them very helpful. The information was too general and didn't reflect the fact that they would need to use different study techniques for different courses. Students were aware that they would need to adapt their study skills and habits according to a particular course but found it difficult to do so.

*I actually felt lost sometimes. I don't know how to study for some courses and it would be nice it there was, I guess, support and advice in that because I don't think you can study for different courses in the same way.*

Second year female in general science

Interest was another factor affecting students study skills and habits. It was especially hard for students to focus their attentions on a course they did not enjoy it and as a result, they would focus their attention on the courses that peaked their interest.

*I find that I put the most emphasis on the subject I'm most interested in because if I have a homework assignment for two courses I would rather do the one I like and then the other one gets left off until the end.*

Third year male in computer science and biology

Eighteen students expressed that they did not like studying with their peers because they would become easily distracted. A few of the students did mention that in computer science, physics or biochemistry courses they would complete their assignments with their peers however most indicated that for conceptual courses such as biology, they would study individually. Only one student preferred studying with someone else rather than on her own:

*I like to study with someone else because if I'm by myself then I'm wondering, 'why do I have to do this?' But when I'm around others I see we're in the same boat. It kind of motivates me."*

Second year female in general science

Two males who lived in an on-campus fraternity house mentioned that they were academically motivated by their peers and would go to the library together to study their respective subjects. Just having someone else present while they were studying kept them focused.

Over time, students commented that their study habits improved. Twenty-two students mentioned that over the course of their degree they started reviewing the material on a more regular basis. They read their notes before and after class, completed suggested practice problems, and made summaries of their notes on a weekly or bi-weekly basis.

*I review much more early on and more frequently so before the final I have gone over the material at least once. Just knowing the material or the general concepts beforehand and filling in the details… just a couple of days before taking the exam.*

Third year male in physiology

*I try to know more of the lecture material before the exam time comes so I'm not completely panicked like when it's exam time and I can focus on remembering what I learned rather than just learning for the first time what was presented in class.*

Fourth year female in plant biology

*You have to make sure to study every section and course enough so by the time midterms roll around you don't get caught behind. If you keep up, then you can just review.*

First year male in computer science

The more senior students indicated that they became progressively more active at seeking out help with their conceptual difficulties right away instead of letting them fester until just before an exam. By doing so they would not fall behind and come exam time they would be "reviewing, not learning" the material. Students emphasized the importance of seeking help from their professors with one student indicating that good professors would "break down my steps and find the flaw in my thinking and suggest more practical examples". Seeking help from friends and professors was regarded as one of the most important pieces of advice that students suggested for incoming science majors.

Thirteen of the 28 students decided to lighten their courseload and switched from taking five courses a semester to four. Most made this change after their first year and attributed it to their being overwhelmed with the sheer amount of material they had to learn and the work they had to complete. Six students also suggested the administration or advisors to encourage first year students to take four courses in their first semester instead of five to ease them into university. The students who opted to take less than five courses a semester, either made up the loss of credits in the summer or added a fifth year to their degree. Decreasing their courseload left students with more time and energy to focus on their courses and studying.

Although rare, a couple of the students were quite aware of how they learned and went out of their way to create their own problems to test their understanding or would research effective learning techniques.

*I've realized I need a quiet place to study, I need to go over the material everyday, using the learning goals to derive questions and make up my own problems. It's very useful.*

Fourth year female in general science

*I find that I have been developing a lot more self-awareness. I know when I work best. I also actively seek [study habits] out and read them on the internet all the time. I'm kind of unusual in that respect.*

Third year male in computer science and biology

Developing and adapting the appropriate study habits for university science courses seemed to be essential for student success. Almost all of the students I spoke to discussed feeling overwhelmed in their first couple of years of undergrad and believed they lacked the appropriate skills and habits to manage their courses. The senior students seemed to be more aware of what 'worked for them' with regards to studying and 'knew how to adapt to the professor's testing methods'. The students in second year however were still struggling with balancing their attentions to and keeping up with their courses. It appears that if students know what is expected of them on a midterm or final, they can focus their studying and are less likely to waste significant time learning irrelevant material. Students also claimed that they had never been taught how to study effectively and mentioned that they would appreciate if professors or study workshops reviewed how students might tailor their studying to different subjects.

### 2.2.2 Social factors

I now focus on the social factors that emerged from the one-on-one interviews and the focus group discussion. I discuss social factors under four subsections: students' choice of major, living arrangements, additional responsibilities, and community.

#### 2.2.2.1 Choice of major

When asked why they chose to major in the sciences, the majority of students expressed that it was based on their interest in math and science. About half of the students also commented that in high school, math and science were the subjects they excelled in so it seemed only natural to pursue a degree in this field. Three ESL (English as a second language) females mentioned they disliked writing essays and reading novels (they related this to high school English and History) and as a result, chose a degree that placed less emphasis on writing. They also commented that in science, their poor writing skills did not affect their grades as significantly as they did in arts courses.

Twelve students I spoke with had changed their initial major or had added a major or minor to their current degree. Three female students who were initially in some form of biological science completed the introductory computer science course and as a result, switched to major in computer science or combined it with their initial choice of major. All three students commented that the professors teaching the course were extremely interesting and approachable and that the content itself was stimulating. For another student who had chosen a BA in English, her positive experience in a science elective course for arts students influenced her decision to switch from a BA to a BSc:

*I guess the teacher was really passionate about it and engaged with the class and it sparked my interest. It wasn't so cut and dry like memorize all these body parts – it was thinking deeper. Now that I'm in the sciences I'm looking at things way differently than I use to.*

Similarly, a fourth year female opted to specialize in plant biology because of the involvement of one of her female professors:

*She's inspiring – the way she talks about plants and makes things interesting. I just wanted to learn more about it and she told me I could specialize in it – I didn't know I could… so when I found out there was that option I was pretty excited.*

Students' experiences in particular courses or meaningful interactions with instructors seemed to have influenced students to reevaluate their major. Four of the students I spoke with discussed switching to the integrated science program because it allowed them more flexibility to pursue their varied interests in science. The general science program was also popular among students because it provided them the opportunity to take courses from various departments instead of being more narrowly focused in one subject realm.

Seven students discussed how their career goals were the main reason for their choosing to pursue a degree in the sciences. Students were striving to go to medical school to become a doctor and others were hoping to work outdoors as an environmentalist. This group of students saw their pursuit of a degree in the sciences as a natural fit to their career goals. When I asked students where they saw themselves after graduation, the reviews were mixed. About half of the students were fully aware as to where their degree would lead them, the other half seemed quite unsure. Those who were unsure would respond with rather vague responses such as "I guess I could be a researcher", "maybe I'll go to graduate school to help me decide". Most of the students with career direction had completed co-op work terms or work study placements in labs/industry. These experiences gave them a more concrete perspective of where their degree might lead them.

> *Co-op is reasonable because if you graduate and you have no experience at all you can't get into the field directly. It also helps you to get to know the field and see if you actually like it.*
>
> Graduating female in computer science & biology

> *Reading papers and getting information out of there and having discussions about papers. Taking apart what has been done. It's helping me see what's out there and the graduate students help me gain a new perspective so it's been really informative, educational and fun.*
>
> Third year female in general sciences

> *Most people in biology are planning to enter research and the more hands on experience you get while you're in undergrad the more valuable an experience getting your degree would be.*
>
> Third year female in integrated science

One criticism that 19 voiced about their courses was that there was not enough application of the material in a practical sense. Students longed to understand how what they were learning in their courses was relevant to situations they might experience in everyday life or in their career as a scientist. A fourth year female in hydrology expressed that "a lot of courses don't give you the applied side, which when you graduate it's kind of like, why – what am I doing and how is it going to be useful?" A couple students expressed their appreciation for professors who actually presented connections between the course material and practical applications. A third year male student talked about one of his professors who would put a medical symbol in the top right corner of the lecture slides to indicate that this particular slide dealt with course content related to the medical field. A fourth year female commented on an assignment in which the professor asked the students to design their own gene regulation experiment. She stated that "it was the first time I thought about something as a scientist – I think it was the first time that science made sense to me as a field and that was in third year!"

Ten students also expressed that they were interested in knowing more about their professor's research and even more about how it applied to the course they were teaching. Even if professors did not make the connection between their research and teaching, one of the interviewees commented on the need for students to seek out research experiences with professors.

*I would advise students to ask the professor for extra opportunities to learn material or to do anything extra. UBC as a research school has a lot of innovative professors and I don't think they get to share a lot of their ideas with us. If people are keen on doing school further they need to seek out other opportunities from professors.*

Fourth year female in general science

For a few students, their choice of major was influenced rather heavily by suggestions from their parents. For example, a second year female student majoring in biology expressed being pressured to become a doctor. "It's more like they told me so I started to accept it and then like it. I have adapted their choice to my own goal and have actually come to like it". A second year female student in the general sciences told me that her parents were extremely influential to her choice of courses. They would review the academic calendar and note what classes she should take. Although she was more inclined to take courses that would help with her goal of becoming a nurse, her parents would advise her to take pharmacy preparation courses because they did not think that nursing was a good enough job. As a result she would take the classes they advised her to take and expressed that "I feel a bit of pressure. Like I know they want me to do certain things but I want to find out for myself". This student longed for independence from her family, however she still felt the need to please her parents and struggled with the balance.

Although the students sensing pressure from their family enjoyed their degree, they could also experience feelings of guilt and being overwhelmed.

*They don't say it or act it out but it's just like – I know I have to live up to their expectations. It makes you feel guilty. I want to let them know I can do it.*

Second year female in biology

*The pressure comes from that they're never happy enough. It's like they're just not happy with what I've chosen. Like I don't think they know how to be supportive.*

Third year female in plant biology

*Their involvement wasn't huge but their opinion and how worried they were affected me a lot… I didn't want to make them worry. But not knowing how to make someone not worry is very difficult.*

Fourth year female in general sciences

*I can't see any external pressure – maybe not so much pressure but expectations. You don't want to – I guess it's irrelevant but as the first child – it's a psychology thing but as the first child you're supposed to conform more to your parents expectations.*

Third year male in computer science and biology

*It was kind of hard when they realized I wanted to research [undergraduate] education. They are researchers so they were thinking that if you can't do research you teach. They were like – you're throwing things away – but I like education. It was foreign at the time the notion of someone who has research potential choosing not to be a researcher.*

Third year female in computer science and physics

Receiving encouragement from their parents, family and/or peers was identified as important to students. Students expressed that when they were struggling with their grades in first year they turned to their parents for support and advice. Students also commented that this support was not only emotional, but financial.

*I actually have a very strong social support structure – my parents are fully for me doing education and financially support me as well. I live at home so they're very big on education throughout my life.*

Third year male in computer science & biology

When discussing students' choice of major several factors emerged including the influence of professors as role models, work related experiences and family involvement. Female students seemed to place more emphasis on all three of theses subtopics and in particular, five out of the six of the students expressing pressure from their parents were female. Most female students who switched their degree did so because of their interaction with or inspiration from particular professors whereas males switching was more based on interest. Males did talk about the importance of receiving encouragement from their parents but placed less emphasis on making their family 'proud' in comparison to their female peers.

#### 2.2.2.2 Commuting

The increased importance that students place on family involvement and commuting might be linked to the fact that 44.1% of the survey respondents lived off-campus with their parents. Students claimed that the main reasons they did not live on-campus were because there were not enough residence rooms available and it was too expensive. Some commuter students indicated that although they saved money by living at home or in cheaper rental accommodations, they thought the commute was tiring and a waste of their time. Students commuting from locations such as Surrey, Delta or White Rock, spent a minimum of three hours a day on the bus.

Eleven students indicated that commuting affected how they chose their courses and limited their involvement with on-campus extracurricular activities. To avoid rush hour traffic, students would arrange their timetable so their courses started at 8 am and ended at 1 or 2 pm. With this timetable they were better able to beat morning and afternoon rush hour. Due to their long commutes, students found it difficult to be part of an intramural team or to join a club. These activities usually took place in the evenings so if they stayed around to take part, it would take additional time to get home because transit did not run as frequently in the evenings. This was also the case for when a professor held office hours or a tutorial in the evenings.

Although commuter students expressed concerns with living off-campus, some have found ways to cope with it. For instance, one student who woke up at 5:30 am to arrive in time for her 8:00 am class would audio record the lecture and listen to it on the bus on her way home. She did this because at that time in the morning she was quite groggy and had difficulty paying attention to the lecture. Eight students used the bus as their downtime and would read for pleasure, sleep or chat with friends. This way, when they arrived home they were ready to get back to work. Nine students also commented that they would review their lecture notes or start writing outlines for projects or labs during their commute. Students typically did not read on the bus because they felt there were too many distractions and they would just have to re-read the information later on.

Students who lived at home with their families, typically expressed that they had to cope with many distractions. Their parents might ask them to fix the computer, their younger siblings might need to be picked up from school, or they were responsible for helping with the family business.

*My family can be quite a hindrance to my… it's a little bit difficult – I have a very young brother so I have a pretty important role in his education. Helping him with his studies, and just there's a lot of responsibility with the family – helping around the house. Also trying to cope with my mother at times if you know what I mean. And then the dog – so everyone was helping to take care of that. It can add up living with my family.*

Graduate female in mathematical sciences

Although living with their family could be stressful at times, it helped to keep students grounded and provided them with both financial and emotional support.

Students who lived on-campus were all quite content with their experiences and felt it kept them academically focused. A third year male who lived in a fraternity on-campus explained that "if I'm not motivated [to study] there are people [in the fraternity] to help me and almost force me to study". The only thing that students who live on-campus were concerned with was that they became distracted by the noise in residence when trying to study. To cope with this, most on-campus students mentioned going to one of the on-campus libraries to study. Students who lived on-campus claimed that they had better access to academic resources (libraries, office hours), more involvement with extracurricular activities, and were able to sleep more in comparison to their peers who commuted on a daily basis. Throughout these activities students were more likely to develop new friendships whereas commuter students (especially those living with their parents) commented that they typically kept the same friends from high school.

In summary, the time and energy that students spend commuting seemed to really affect their academic performance, the organization of their timetable, course selection and involvement in on-campus activities. Some students did mention that their long commute was an incentive to move on-campus however to afford living in residence they had to get a job.

#### 2.2.2.3 Additional responsibilities

The majority of students I spoke to had several commitments outside of their academic coursework. Over half of the students volunteered on- or off-campus, worked, or were involved with extracurricular activities (i.e. sports teams). The majority of students chose particular volunteer, work or extracurricular activities to enhance their degree and to gain career insight. For example, students interested in becoming a nurse or doctor volunteered at hospitals to expose themselves to the field. A third year female in the biotechnology program started a biotechnology club and organized events with various organizations in the industry. She claimed that:

*My involvement has been a great opportunity because I have got to meet all the leaders in the biotech industry in British Columbia and so I know it's opened doors because I'm in touch with people who are exposed to that. I don't get that from classes so I'm getting it from extracurriculars.*

When I asked students if their additional responsibilities interfered with their academic performance, the majority of students claimed that academics were their priority but that having downtime from courses was important.

*I've been really careful in choosing my commitments outside of school so they enhance rather than having a negative effect*

Third year female in integrated science

*Academics come first but you don't want to be studying all the time. You need something to balance it out.*

Third year male in physiology

A small number of students placed more emphasis on their extracurricular activities in comparison to their academics.

*Extracurriculars might have influenced my academic performance a little bit but seriously though, I would be bored without them!*

Second year male in computer science

*It's a balance that leans less towards school and more towards volunteering… and getting to know myself and making sure I have the best experience.*

Second year female in general sciences

*I feel motivationally different about my extracurriculars and academics. My extracurriculars enrich my degree quite a bit and are more interesting so I might neglect my assignments or work.*

Third year female in computer science and physics

Over half of the students I spoke with indicated that their extracurricular activities provided them a much-needed outlet from school. In addition, it was an opportunity for them to meet new people with similar interests as their own. Feeling part of an academic or social community was a theme that emerged from the interviews and was viewed as extremely important for all students.

#### 2.2.2.4 Community

In their interviews, students commented on the importance of having both an academic and social network. Nine students talked about their struggle to meet new friends or study partners in their first year and second years in science. This was also an issue for students transferring from college to UBC in their third year of study. Students typically attributed this to the large, impersonal class sizes and being to shy about meeting people.

*But the classes are so big in first and second year that it's hard to find someone and want to meet them. Like talking to the person next to you. Having that initiative to introduce yourself and say – hey, do you want to study together? It was really difficult.*

Graduate female in mathematical science

*In large classes individual voices just seem to get lost.*

Third year female in integrated science (transfer student)

*What I was missing was a learning community. Lecture halls being so big… personally I was a bit shier so saying hi to someone, I didn't do that before.*

Graduating female student in general sciences

It was important for students to have either a group of their peers, a teaching assistant or a professor to go to if they were having academic difficulties or were looking for degree guidance.

*In first year I didn't seek out help and I should have. I was shy and didn't realize how nice most of the professors were*.

Second year female in computer science

*It's important to have a social network of people to go to if I'm having difficulties.*

Third year female in integrated science

*Talking to upper year students to get the feeling of where you're heading or you can ask them about their experiences.*

Fourth year female in cell biology and genetics

In addition to developing a community to improve their academics, students discussed the importance of seeking the appropriate advising to help with the planning of their degree (i.e. what courses should they take, how to add a minor to their degree). Students commented on having received both good and bad advising during their time at university. Three students talked about their being 'footballed' around from person to person within advising or departments as per their transfer credits from previous institutions or assistance with changing their major.

*With science advising I was footballed around from person to person. People seemed frustrated and didn't want to talk to me and were trying to kick me out. I ended up taking courses I didn't need to.*

Fourth year female in geographical biogeoscience

Although few actually did, students expressed the importance for planning their degree and making appropriate changes when necessary. One student in particular was quite organized and had a degree plan upon arriving to UBC:

*I have had my degree planned since first year. I periodically review it and shift my courses. I'm pretty happy with what I have and I know where I want to go. In first year I didn't know what I wanted to do but now I know its computer science and biology.*

Third year male in computer science and biology

Thirteen students indicated that they wished they had sought out more help with planning their degree and courses. This might have saved them from taking courses they were not required to and to finish their degree in a timely manner.

*I wish I had a better idea of what to take in first and second year – floundered around less. Then I would have been able to space out my upper years and have more electives because I felt the need to retake some things I did in high school which I didn't need to.*

Third year female in integrated science

Several students talked about the importance of seeking out guidance from professors because their insight and experience was extremely enlightening and beneficially in helping students with their academics and career path.

*I have had great advising from two professors. They are two role models that have been close to me and quite the influence on how I view and act in the field.*

Third year female in computer science and physics

The community theme emerged from the interviews and focus group discussion and community was considered of great importance for most students. Having peers inside and outside of their program of study was integral to helping them cope with the stresses of academics while also enriching their overall undergraduate experience. Seeking guidance from professors and advisors was also important for ensuring the students received the appropriate academic and personal help they needed.

### 2.2.3 Personal factors

With regards to personal factors, several students expressed experiencing frustration, struggle, fear, stress and feeling overwhelmed with regards to the pedagogy and assessment, grades, their study habits, and with building a sense of community.

> *Ambition is important but it is related to a fear of failure which is not a good thing to be motivated because it's better to be motivated by passion but in the past few years it has been largely fear of failure. There's a fear that no matter how much I study it's not going to be enough.*
>
> Third year female in cognitive systems

Students also talked about how their personal health (i.e. depression, illness) had negatively affected their academic performance. Three female students talked about taking a year leave from school to regain their footing and to concentrate on their personal well-being. They commented on the need to take care of themselves before they could even fathom returning to university to continue their degree.

> [To one of her peers in the focus group discussion] *All of those non-academic concerns you mentioned [outside commitments, health, finances, and coping with them] are a big factor because a lot of the academics have to take a backseat to health, finances and other commitments. That is definitely important.*
>
> Fourth year female in cell biology and genetics

> *It's more about what is going on in your personal life that really dictates how much you do at school.*
>
> Fourth year female in hydrology

Six students (2 males and 4 females) also commented that relationships were another part of their personal life that appeared to influence how well they might have done academically. If they were experiencing difficulties in their relationship or if one had just ended, it was psychologically difficult for them to be fully invested in school. It was especially difficult for students whose partner was in the same course as them. Luckily all of the students who expressed these concerns sought out the appropriate counseling or advising to help them with their personal issues and they were able to once again focus on their undergraduate degree and experience.

The most prominent personal factor discussed during the interviews and focus group discussion was related to the influence that a student's interest in a course had on their academic performance. Twenty-five of the students discussed that as their courses became more specific to their major, they became more interested and invested in their academics and attributed their increase in grades to this. Interest seemed to be the biggest motivator for students to complete the work associated with a particular class and to attend class.

Overall, females seemed more open to discussing their feelings and candidly shared their family or personal difficulties with me. Two of the three females who took a year off stressed the importance for students to seek out the appropriate advising to help them with their emotional or academic problems. These students admitted to feeling lonely and lost, but once they realized other people were going through it too, they felt more at ease. This illustrates the importance for students to find a social or academic community that can help them through the challenges of their undergraduate program.

### 2.2.4 Summary

At the end of each interview I asked students to provide advice for incoming science students. The most common pieces of advice were related to study habits, seeking guidance from professors, and developing a community of peers. Twenty-five of the students suggested for incoming students to adapt and develop good study skills and habits. They also expressed the need for students to try different techniques to find what works best for them and for particular courses. Nineteen students said it was essential to seek guidance from their professors early on in their degree. Several of them wished they had taken the initiative because the guidance they received from professors in their later years was integral to setting them on the right track for improving their grades and knowing what to expect on tests/exams. With respect to the importance of developing community, 12 students suggested for incoming students to break out of their shells and to make new friends. In particular, they stressed the need to have friends in your courses because you can then discuss the difficult concepts or complete assignments together. Five students also suggested the need for incoming students to have fun and enjoy their time in university. A graduating female stated it so intricately with "you have to give yourself the playground to be curious, to be a good student and to entertain some of the places you can go".

## 2.3 Overall summary

The analysis of the quantitative and qualitative data in this chapter explored the academic, social and personal factors that males and females pursuing degrees within the Faculty of Science at UBC perceived as influential to their academic performance. Some of the more important factors included: the quality of the instructor, students' expectations of assessment methods, study skills and habits, the involvement of others, additional responsibilities, personal interest, and community. In the discussion chapter of my full thesis, I amalgamated the factors and themes that emerged from the analysis of the survey, one-on-one interviews and focus group discussion and discussed how they related to one another and the previous literature.

# 3 Conclusions

## 3.1 Summary

Researchers have stressed the importance for institutions of higher education to explore the experiences of their students in order to understand what factors impede or enhance students' success (Astin, 1993; Kuh et al., 2005; Watson & Stage, 1999). Emanating from the concerns of administrators in the Faculty of Science at UBC, a mixed method study was designed to explore the perceptions of students pursuing degrees within the Faculty of Science regarding the factors influencing their academic success. That study set out to answer the following research questions:

1. What academic, social and personal factors do male and female undergraduates within the Faculty of Science perceive as most influential to impeding or enhancing their academic performance?
2. How do male and female undergraduates differ in what they perceive as being most influential to their academic performance?

The survey designed for this study assisted in answering the research questions which aimed to determine what academic, social and personal factors undergraduates perceived as influential to their academic performance and if males and females differed in their perceptions. Completing one-on-one interviews and a focus group discussion helped in focusing on why students perceived these factors as important. I have summarized the findings of this research in Table 3.1. The columns describe the factors that were detected from the survey as being most important to students. The fourth column provides an overview of what students said about why they perceived particular academic, social and personal factors as influential to their academic performance. In the third column, **Y** (yes) represents if males and females perceived the particular factor as one of the most important to influencing their academic performance. **D** (difference) indicates that significant differences were detected in the responses of males and females. **Y/D** represents that students perceived this factor as one of the most important and that gender differences were also detected for this factor.

**Table 3.1: A summary of the findings from this research**

| Category | Factor | Factor was important to: | | Why do students perceive these factors as important? |
|---|---|---|---|---|
| | | Males | Females | |
| Academic | **Qualities of the instructor**<br>Interesting<br>Speak clearly<br>Approachability | **Y/D**<br>**Y**<br>**D** | **Y/D**<br>**Y**<br>**D** | • Qualities of an instructor can influence students engagement and interest<br>• Clarity and organization allowed students to follow what the instructor was saying in class<br>• Clickers provided feedback and indication of students' understanding<br>• Students regarded their interactions with and advising from professors as positive influences on their performance, career objectives and overall academic experience<br>• Females perceived developing relationships with faculty as important to their success |
| | **Student expectations of assessment methods**<br>Lack of relevant practice problems<br>Uncertainty in knowing what to expect | **Y/D**<br>**Y/D** | **Y/D**<br>**Y/D** | • Ongoing feedback helped with students understanding<br>• Heavily weighted finals were not representative of students' work<br>• In comparison to males, females expressed feeling more stressed, anxious, frustrated, and lost when they did not know what was expected of them as students |
| | **Study skills and habits**<br>Importance of developing and adapting skills and habits | **Y/D** | **Y/D** | • Most students struggled with developing and adapting their habits in first and second year<br>• Students expressed difficulty in tailoring their habits to different subjects<br>• Students' study skills and habits affected students' grades<br>• In comparison to males, females expressed feeling more stressed, anxious, and frustrated when they did not know how to study for a test or final exam |
| | **Pedagogy and the classroom environment**<br>In-class learning techniques<br>Number of students in the class | **D**<br>**D** | **D**<br>**D** | • Females preferred being active participants in their learning<br>• Techniques encouraging collaboration reduced females feeling isolated in large classrooms |

| Category | Factor | Factor was important to: | | Why do students perceive these factors as important? |
|---|---|---|---|---|
| | | **Males** | **Females** | |
| Social | **The involvement of others**<br>Encouragement from parents, family or guardians | **Y/D** | **Y/D** | • Family provided emotional support for students in tough circumstances<br>• Students perceived an academic and social community as extremely important to influencing both their performance in science courses and their overall university experience<br>• Females were more prone to relying on the suggestions from or their relationships with family/faculty/peers regarding their choice of major<br>• Females benefited from having female faculty as role models |
| | Suggestions from parents, family or guardians | **D** | **D** | |
| | **Additional Responsibilities**<br>Volunteering or work | **Y** | **Y** | • Students found it necessary to create balance between academic and social life<br>• Extracurricular activities and work can impeded students' performance<br>• Several students chose volunteering or work experiences to enhance their learning |
| | **Commute**<br>Limiting | **D** | **D** | • Students indicated that long commutes limited their involvement on-campus<br>• Commuter students might have more difficulty in building or belonging to a community |
| Personal | **Interest and academic success**<br>Interest drives them to do work | **Y** | **Y** | • Being interested in a subject influenced students class attendance, drive and even influenced some students to alter their majors<br>• It was important for students to succeed for various reasons (i.e. attaining appropriate grades for graduate school or medical school, to appease family) |
| | Desire to succeed academically | **Y** | **Y** | |

## 3.2 Conclusions

This study found that students perceived several academic, social and personal factors as influencing their academic performance. The survey data assisted with the identification of a range of factors while the interviews and focus group discussion provided a more personalized look into why males and females felt particular factors were more important than others. Based on an analysis of the quantitative and qualitative data, the most important factors that students perceived as influencing their academic performance were: development and use of appropriate study skills and habits; effective pedagogy (i.e. teaching that is clear and organized) and assessment methods (i.e. provision of regular feedback); achieving balance in academic and non-academic responsibilities; interest in the subject material; and the development of positive relationships with faculty, peers and family. Females, in comparison to males placed more importance on: their relationships with faculty (especially female faculty), peers and family; the need for interactive and engaging lecturing techniques; and ongoing feedback and guidance to relieve feelings of anxiety, stress and overwhelm. These findings convey the complexity of issues pertaining to student success and provide an indication as to the concerns and experiences of students pursuing degrees within the Faculty of Science at UBC.

## 3.3 Recommendations

The findings from this study have implications for practice that may improve the success of students in undergraduate science programs and courses. In the following subsections I will present how particular findings might be useful for different stakeholders and can be used to inform educational practice. Recommendations will be made for administrators, faculty and students within the Faculty of Science. I will also suggest areas for further research.

### 3.3.1 Recommendations for administrators

- Provide study skills workshops that reflect department-specific subjects. Students in this study indicated they felt they needed better study skills and that they didn't get this preparation in high school. Thus, providing study skill workshops linked to specific courses is strongly recommended. Such workshops may help students tailor their skills to particular courses. Involving faculty, teaching assistants or senior undergraduate students in these workshops might entice students to attend, and to change/adapt their study habits.
- Provide students with more personalized advising. Students admitted to feeling lost when planning their degree in first and second year. During this time students typically took courses that were not required or relevant to their program of study, and regretted this later. Thus, to help students plan their degree and assist them with academic problems (i.e. specific to a particular department or program) it is suggested that the Faculty of Science provide more personal advising to students throughout their undergraduate experience.
- Implement more interactive teaching and formative assessment in undergraduate courses. Students perceived regular feedback as integral to influencing their academic performance and interest in science courses. Based on students' comments, it is recommended that administration provide ongoing professional development for new and current faculty that focuses on the development and implementation of interactive teaching methods and ongoing formative assessment. It would also be beneficial to review how to accommodate the needs of different students (i.e. those of differing gender, ethnicity, living arrangements).
- Enhance communication between professional services (i.e. counseling, advising, medical services, learning commons) and faculty. Students tend to look to instructors for guidance and advice, so informing faculty of the on-campus resources would be beneficial.
- Examine the schedules of commuter students and provide more services during the morning or early afternoon. The large population of commuting students at UBC has particular need. Arriving and staying alert during 8 am classes was a concern of commuter students.

Accommodating the needs of this group of students might improve their sense of community, academic performance and experience in science programs.

- Actively counsel students on the number of courses they enroll in for first year. Remind students that they have an option of taking 4 courses in their first university semester (or even year) instead of the recommended 5 courses. This would allow students time to adjust to the academic and social demands of university.

### 3.3.2 Recommendations for faculty

- Provide additional opportunities for students to hear about or participate in real research. During teaching, share your research experiences and provide real world applications of course material. Students are intrigued as to the research that their professors conduct, but they rarely get the chance to hear about it or understand its connection to the course being taught.
- Reflect on the possible impact that presentation techniques might have on students' ability to stay focused in lecture. When using PowerPoint presentations, be sure not to move through the slides too quickly. Consider creating an outline of the key concepts for each lecture.
- Create an interesting and safe learning environment in the classroom. Students commented that they were more interested themselves and thus more motivated to learn when the professor was enthusiastic about the material and interacted with the students during lecture. The use of active learning techniques (i.e. clickers, Peer Instruction, demonstrations) may be used to improve instructor-student and student-students interactions in lecture.
- Provide regular, frequent feedback to help students assess their progress in the course. Students indicated that online quizzes, small assignments or additional midterms helped them to stay on top of the material and tested their understanding. In general, students appreciated when the questions reflected those found on a midterm or exam.
- Provide advice regarding studying techniques that would help students prepare for their midterms or finals. The majority of students expressed concerns with their lack of effective study habits and difficulty in tailor their habits to particular courses. Providing suggestions as to how they might study would help them to focus their studying to relevant material and relieve some of their anxieties.
- Become an advocate for science and a role model for students. Students in this study really admired and respected their professors. As a result, you should be aware of the influence that your actions have on students academically and personally. Students, especially females place a lot of importance on the relationships they develop with faculty and can be deterred by those who are intimidating, unapproachable or "don't seem to care".

### 3.3.3 Recommendations for students

- Develop and adapt appropriate study habits and time management skills early on in your degree. Review your lecture notes and readings on a regular basis, complete the assigned problems, seek help early on and try not to let your problems fester, and try to balance your focus on all of your classes regardless of their difficulty or your interest.
- Seek academic and personal guidance early on in your degree. The majority of students discussed that they would have built relationships with their professors earlier on. Professors were able to help them with their conceptual difficulties, course selection, additional work experiences or career advice.
- Engage with the academic and social community at the university. Speak with your neighbours in lecture or labs, get involved with clubs or extracurricular activities on campus, volunteer or work in a lab setting of interest or seek out support from professors.
- Create a tentative course plan for your program and adjust it accordingly over time. Science advisors, professors, and senior students might help you to choose your courses and provide additional research opportunities.

### 3.3.4 Recommendations for further research

The findings of this study prompt the need for additional research to explore particular results in more detail. For example, we might investigate whether students of different gender, ethnicity or major perceive the same factors as important to influencing their academic performance. Within the interviews I noticed that Asian students seem to express experiencing more pressure from their parents to succeed and it would be interesting to investigate this relationship further.

As noted in this study and in previous literature (OECD, 2008; Seymour & Hewitt, 1997; Sonnert et al., 2007) undergraduate females are underrepresented in physical science and computer science programs. These low proportions of females are attributed to the lack of women faculty and sense of community associated with these programs (Sonnert et al., 2007). In this study however, three females indicated that they switched into computer science or added it as a minor to their initial degree. Examining more thoroughly why females are attracted to the computer science program at UBC might be helpful in recruiting and retaining females in programs where the female population is underrepresented.

In the interviews I noticed that students with a long commute struggled in developing community and being involved on-campus. These findings encourage the need for additional research to examine the experiences of commuter students more thoroughly. It would also be interesting to investigate how commuter students' survey responses differed or were the same based on the length of their commute. In the interviews and the focus group discussion, students with a daily commute of over 2 hours seemed to express additional struggles in comparison to their peers who traveled only 30 minutes to school.

While this study provides some answers for those interested in the problem of student success in science, what students perceived as influential to their academic performance is just a start in understanding student performance. Additional research will help us learn more and help us establish if the factors that students describe as influential actually do affect their performance. What students perceive as influential might not be the reality.

## 3.4 Final thoughts

When developing and conducting this research, the number of students who willingly and candidly participated in this study surprised me. The students I spoke to directly were appreciative of this opportunity to share their perceptions and valued the fact that this research took their point of view into consideration. Moore et al. (2007) has commented that considering students' perceptions will allow us to improve how we will "challenge, inspire, support, advise, and witness students' own development" (p. 57). If we hope to improve students' experience in undergraduate science, it is essential for us to understand the complexity of student experience including the multiple factors influencing students' academic performance. It is also imperative that beyond investigation and understanding, professionals within higher education institutions begin to advocate on behalf of the students in order to tackle particular barriers and implement change.

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