

# What Motivates Engineering Students in IT in Bhutan to Learn Programming

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**Abstract**—This research to practice work-in-progress paper discusses some environmental and background factors that motivate the IT students of the College of Science and Technology (CST), Royal University of Bhutan (RUB), to learn programming. Programming is gaining popularity in Bhutan, especially due to the increasing number of opportunities in the IT field. CST is one of the few colleges at RUB providing IT courses to students pursuing undergraduate degrees. Previous studies have revealed that the competence and enthusiasm of first year IT Engineering students at RUB differ between individuals when it comes to learning programming, but the reasons for this are still to be determined. In this paper, we explore factors that influence students of CST to learn programming and what can be done by the college to instil more enthusiasm to learn to program. In this case study, a qualitative research methodology was used to analyse the experiences and opinions of eight IT students of CST. Data was collected through semi-structured interviews and their responses were discussed and jointly analysed by the first three authors. The study revealed several factors such as knowing about future opportunities in IT and partaking in or wanting to partake in activities, social groups and other study related resources which were related to the students' motivation and their encouragement within their studies. Dissimilarities in the attitude towards programming were noted in students despite them having access to the same lecturers, college facilities and other activities. The findings also showed a correlation between the interest in IT and having family or friends engaged in IT related occupations. The study also found that students sometimes felt demotivated by certain factors, such as the initial difficulty of programming, especially among students without prior experience of programming. A similar feeling of discouragement was described when students felt that their peers performed better than them in classes and examinations.

**Keywords**—introductory programming, study motivation, semi-structured interviews, higher-education in Bhutan, confidence in programming

## I. INTRODUCTION

The skills to do computer programming depends on both the theoretical foundations and practice [1],[2]. Despite having the same theoretical and practical classes allocated to

all the students in computing courses, the students show a different attitude toward learning programming whereby some students continue to learn programming while a number of students lose motivation or interest and fail or drop out from computer science programs [3],[4].

The goal of this Work-in-Progress case study is to provide a better understanding of the motivating and demotivating factors that affect the interest to learn programming among Bhutanese engineering students in IT. As IT/programming education is rather new, and relatively small in Bhutan, only a few studies have been done on the topic.

The aim of this study is to provide help to design improved methods to attract and retain students to learn programming. We also hope that the findings will provide new insights for policy makers like Royal University of Bhutan (RUB) and the Ministry of Education of Bhutan and also to the CS educators to intervene and enhance the undergraduate level and school level respectively.

## II. BACKGROUND

The ability to program is considered an increasingly important skill in Bhutan. The Bhutanese authorities are consequently planning to provide a significant amount of funding to incorporate the facilities required to ensure that students are given the opportunity to learn programming [5]. Along with the curriculum and necessary facilities, the students' personal interest to learn programming should also be considered. According to Feldgen and Clua [6], most students are unaware of why programming is important to learn, and therefore only study it as a part of their mandatory courses. Hence, most of the students could have a better understanding of the importance of programming by giving an early and clear introduction regarding introductory programming courses. Most students in Bhutan don't enroll in computer science related courses during their primary and secondary education because of which they might experience difficulties when they encounter it during their undergraduate studies. Difficulties might be encountered because programming is hard to learn without any prior experience as

mentioned in several papers, among them [3], and the classic papers [7] and [8].

RUB is the dominating university in Bhutan. It was established in 2003, offering tertiary level education to students at various locations throughout the country. It has ten constituent colleges and two affiliated colleges. Among these, four colleges provide programming courses and IT education to students from their first semester.

### III. METHODOLOGY

In this paper, a qualitative approach is used for data analysis. Semi-structured interviews were the primary data collection method for this study. A set of questions were prepared for the interviews. The interviews were carried out online to follow social distancing protocols due to the COVID-19 pandemic and as two of the authors were in Bhutan, while the others were in Sweden during the time of the study.

#### A. Interviewees

A total of eight interviewees were selected, all of them first year students at the Bachelor level Engineering programme in IT at CST at RUB. Out of the eight interviewees, five were female and three were male, all with different high school backgrounds and selected from either rural or urban parts of Bhutan. This was done mainly to gain insights on possible differences in the learning of programming from students of different socio-economic backgrounds.

#### B. Interviews

The first three authors carried out the interviews of the participants virtually using the Zoom platform. Each interview was recorded with the explicit permission of the participants. The interview script that was prepared can be found in the appendix to this paper. We then transcribed the interviews verbatim. Further, we read the transcripts and analyzed them, searching for particular themes and patterns. As the results are interpreted at a collective level, we aimed for a high degree of variation among the interviewees. This was mainly obtained by achieving a high geographic diversity of the interviewees, which, with the socio-economic situation of Bhutan, is a strong indicator of variation.

### IV. FINDINGS

The interviews of the first-year students gave an insight into several factors that played a role in their interest, motivation and confidence in their IT studies. For the sake of keeping the interviewees' identities anonymous, the pronoun 'she' will be used for all mentions of the interviewees.

#### A. Knowing about career opportunities

One of the most common motivators among students to pursue a degree in IT was believing it to be a good career choice with future job opportunities. Here one of the students, Student 1, makes the following remark on her motivation to study IT:

*Student 1: I chose IT because of the scope [...] Also, a lecturer in CST advised me to take IT, suggesting it has a good scope in the job market.*

Student 1 here discusses her studies in terms of the job market. Knowing there might be an attractive job market after

graduation seems to be a motivator for most students. Another interviewee expresses a similar experience:

*Interviewer: Does anyone in your family and friends work in the IT field or has knowledge on programming?*

*Student 5: [...] Some of my seniors and also some of my friends who are currently studying IT engineering encouraged me to take this course. They told me about the opportunities this could give me in the future. This developed my interest in IT programming.*

Student 5 mentions encouragement from friends and other students, who proposed IT engineering as a good career choice. Similarly, to Student 1 and Student 5, a majority of the students expressed that some extent of motivation and encouragement was given by seeing it as a good career choice with many job opportunities down the road. On the contrary however, this seemed to have little correlation with how enthusiastic students were about their future in IT. This might be because some of the interviewees seemed to be convinced by others that it was a good career choice rather than reaching that conclusion themselves.

#### B. Having family and friends in IT

Another positive factor was having friends or family in the IT field. While only about half the students had any close friends or family in the IT field, it seemed to consistently be a motivating factor for those students to pursue IT. One example of how family and friends helped motivate the choice of IT engineering as a career can be seen from the answer given by Student 5 in the previous extract. Another student whose family helped inspire the pursuit of IT engineering was Student 2, who gave the following response when being asked about what motivated her to pursue the study:

*Student 2: Actually, all my brothers in laws are IT- engineers, and I have a twin brother. He is also pursuing (IT) [...] I've seen all my brothers in law and my own brother getting motivated by computers and all these gadgets and stuff. It really inspires me and then it just makes me interested in pursuing IT.*

Here student 2 talks about how her close family being in the IT field inspired her to pursue IT. She expresses how being surrounded by technology during her life has led to developing an interest in IT as a career path.

#### C. Having access to resources and social events

There were also certain external factors that helped encourage and motivate students. Among them were various activities, social groups and resources, which seemed to play a major role in both challenging and helping students. One interviewee, who had such an experience, is Student 1:

*Interviewer: What motivates you to learn programming?*

*Student 1: What makes me interested in programming is the facilities in the college; labs, library books on coding and also when I reach 2nd or 3rd year, I want to participate in the Technology based Business Idea Pitching competition.*

Here Student 1 describes how having access to various facilities at the college made the student interested in programming. She also had a desire to participate in an upcoming competition related to her studies. Similarly, programmes and clubs related to IT also seemed to provide a positive influence on the students' motivation in their studies.

#### D. Initial difficulty of programming

One factor that affected students' motivation was the initial difficulty of programming. This was most prominent among students who had no prior experience with programming. One of the students who had this challenge is Student 3:

Interviewer: *What were your initial thoughts about programming*

Student 3: *First time when I learnt programming, we were taught C programming. First time when I was introduced to it, I found it very difficult. I even thought that I made a mistake by opting for IT [...]*

Interviewer: *What about now?*

Student 3: *Now, I am a bit motivated that I can manage to do well as I start learning and investing more.*

Here Student 3 mentions that the initial difficulty of programming discouraged her from continuing pursuing IT engineering. Similar problems are reported in [9]. Student 3 did however mention that after the initial challenges had been overcome, the studies became more comprehensible. While this initial difficulty to do programming seemed to affect many of the students, most of them noted that they were performing better over time to varying degrees. Our findings were similar to the findings in [9] where the demotivating factor is reflected as students having no prior knowledge of programming. The initial difficulty seems to also affect some students' capability to participate in other school related activities. One of them was Student 4, who answered the following when being asked about her initial thoughts of programming:

Student 4: *I didn't have any idea about programming initially and now that I am introduced to C Programming in college, it is very tough for me. [...]*

Interviewer: *[...] Are you a part of the ACM club in CST?*

Student 4: *I am a part of ACM club, but I can't keep up with the exploring part because I don't get any free time to do that as I have other modules to focus on too.*

Here Student 4 explains how she has little opportunity to engage in IT related clubs due to the time limitations.

#### E. Confidence in programming

Another aspect which demotivated some students was experiencing a lack of confidence when observing other students performing better than them. One student gave the following remarks on their confidence in programming:

Interviewer: *How confident are you in programming?*

Student 3: *I am not very confident.*

Interviewer: *Why?*

Student 3: *Umm.. Because most of my friends have experience regarding programming from before itself and when they are ahead, I lose confidence in myself. I end up comparing and feeling low.*

Here Student 3 explains how she feels demotivated by seeing other students performing better than her. Student 3 was then asked if there was something that could have improved her confidence in programming.

Interviewer: *Do you have any other comments on how you could have gained more confidence in coding?*

Student 3: *I think that if I explored more during grade 11 and 12, I would have been doing better. When others are already familiar with it, I feel unmotivated and low.*

Student 3 expresses how she would have been more confident if she would have started with programming earlier. This also ties to Student 3's earlier mention of how she perceived the initial studies to be very difficult.

#### F. Social background

The social background of students also played a role in their interest in programming. One student answered the following when being asked when she started using computers:

Student 4: *I started using laptops or computers only after reaching college. It was my first experience with laptops.*

Later in the interview, Student 4 expresses that she is interested in programming, but not entirely interested since it is perceived as very difficult. Another student who has a similar experience is Student 6:

Interviewer: *What was your prior experience with laptops and computers before joining your college?*

Student 6: *Actually, it was my first time because I came from a remote place and IT is quite difficult. It is my first time. [...]*

Interviewer: *[...] So how was your experience coming into contact with programming?*

Student 6: *Yeah yeah, because it's my first time. Actually I was quite regretful, because I just chose the wrong choice. First time I was quite nervous. But, by learning from others I feel quite confident. So still now, I have not that much knowledge, but now I know I will try my best by learning from others. I think there will be some improvement.*

Here Student 6 expresses that she initially felt regretful about choosing IT, since she had no prior experience. However, she also mentioned that she has gained confidence from having others who could help her overcome the initial difficulties of programming.

### V. SIGNIFICANCE

This study is significant as it helps to understand what motivates or demotivates the students to learn programming. Others have found that most of the Bhutanese students do not perform well in introductory programming [10]. This study aims at analysing the qualitative responses of some students and to give an insight on how Bhutanese students view the benefits and challenges of learning programming, and to help the university to refine methods that motivate students to learn programming.

### VI. CONCLUSION AND SUGGESTIONS

The study mainly focuses on what influences Bhutanese students to learn programming by identifying the factors that motivate and demotivate them to learning programming. Through interviewing some first-year students pursuing IT engineering, we were able to identify factors that had helped them start, and that had hindered learning programming. The study also highlights certain situations that could make students feel less motivated to learn programming.

The primary motivation to learn programming is the recommendation of family members and acquaintances along with better opportunities for the future. The factors that demotivated the students from learning programming were the difficulties faced while learning programming for the first time and the lack of confidence in programming when observing other students doing better than them. The social background of students also played a role for their interest in programming, as it seemed to greatly affect their initial confidence and knowledge of programming. This shows the room for improvement in the introduction of programming to students, along with focus on the environment in which the students are taught.

The aim of this research project is to get an accurate and detailed picture of the participants' experiences. In the analyses, we strived to keep close to the interviewees' utterances to avoid adding our own interpretations. In Nepal [11], a similar study was done amongst undergraduate students, but with a focus on learning strategies. Still the two studies, from similar geographic, cultural and economic situations, point towards similarities in the students' learning of programming.

Learning to program is generally hard ([3],[4],[7]). As mentioned earlier Bhutanese students do not learn programming before studying at college, since programming is not taught during their primary and secondary education. An easier introduction to programming might encourage beginner students to learn programming as having to learn difficult concepts usually result in students feeling less encouraged to learn, an earlier study by Ozoran et al. showed that complexities faced by the students while learning programming for the first time may become a source for lack of motivation [12]. Introducing the programming course prior to the start of the course through guest lectures and non-mandatory lectures where people can share the benefits of taking the course may also encourage students to concentrate on programming. Social events that encourage bonding between the college students can help new students to adapt and gain more insight into the courses they are taking. Learning programming from friends is mentioned to be helpful than learning it alone, which is similar to what is mentioned in [13] and [14], about students learning better in groups. Hopefully, this work may be of help in improving the already existing frameworks for teaching programming, and in maintaining students' interest in learning programming.

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#### APPENDIX

Lead questions for the semi-structured interviews:

- 1) What was your prior experience with laptops and computers before joining CST?
- 2) When did you hear about programming?
- 3) Does anyone in your family do programming?

- 4) Does this person inspire you in any way to learn programming?
- 5) What do you like or dislike about programming, and why?
- 6) What motivates you to learn programming?
- 7) Do you feel confident in learning programming? Why or why not?
- 8) Why did you choose to pursue engineering in IT?
- 9) Did your perception of programming change since coming to CST?

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