

Student retention in engineering education - Examples of how it looks and what can be done

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Abstract—There is an ongoing effort to find better ways to measure, visualize and understand student retention. We have explored the retention pattern for engineering programmes at Uppsala University. We identify some distinctive features, such as the rapid decline of student numbers during the first two years of study, which is enhanced during summer holidays and a steadier situation after the first two years. A qualitative analysis yielded four reasons for student departure from our programmes: dissatisfaction with the study experience, problems to handle studies, conflicts of interest and lacking work connection. We related these reasons to the observed retention pattern and suggest implications for future practice.

Index Terms—Student departure, student retention.

I. INTRODUCTION

STUDENT RETENTION is a key issue for higher education. A goal for any education should be to help students succeed and reach their goals. Better understanding of student trajectories through our educational programmes and the reasons for student departure can help inform the educational development work. This is perhaps particularly relevant for current engineering education [1]. There is an outspoken demand for more engineers from both governments and companies, but the fraction of students reaching their degree on Master Programmes in Engineering has been declining [2]. This can be seen in Fig. 1.

Further knowledge is needed to improve engineering education in an informed way. One area of concern is developing tools to measure and

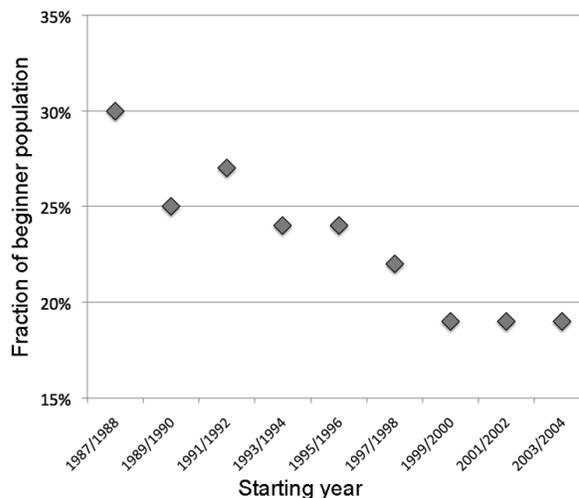


Fig. 1. The fraction of beginning student population on all Swedish Master Programmes in Engineering who has reached a master degree within five years of starting their programme.

visualize student retention in different ways. Two recent studies in this area are *Ung Ingenjör* [3] and *Mått på genomströmning* [4]. Another area is the exploration of reasons for student departure from programmes. This has been explored in great detail and the primary concerns have been identified as expectations, support, feedback and involvement [5]. Much remains however in exploring how these concerns manifest at different programmes and in different contexts. Our paper bridges these two areas in an exploration of student retention on engineering programmes at a Swedish university.

II. OUR STUDY

We have explored the large-scale retention patterns of engineering students at Uppsala University. This exploration draws on two different primary sources. Academic records provide quantitative data and qualitative data is gathered from a Third Year Questionnaire.

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A. Academic Records

The academic records provide a key source of quantitative information for studies of student retention. They contain information on student registration and achievement as well as changes between and departure from programmes. We used the academic records to create large-scale pictures for the patterns of student retention on engineering programmes at our university. The records were also used to check assumptions about changing and leaving patterns on different programmes.

B. Third year questionnaire

The Third Year Questionnaire is a large survey distributed to all Science and Technology students at Uppsala University. We used qualitative data from the questionnaire sent out at the end of the spring semester 2010. The response frequency for the questionnaire was 30%. We analyzed free text answers to a question regarding reasons for leaving programmes or seriously considering doing so. This question had been answered by 53 of the 154 responding students.

III. THE PATTERN OF STUDENT RETENTION

We retrieved retention data for all our engineering programmes for a number of starting years. The fraction of the initial population actively starting the programmes that were still enrolled on the same programme was determined for each semester during the nominal study time of the programme.

This strategy provides average patterns for very large populations. All effects from momentary causes, such as changing curriculum, disastrous courses and similar occurrences, should be eliminated from our patterns. The patterns in the pictures should be real and general for our programmes. We will argue for possible reasons behind these patterns in section V.

A. Master Programmes in Engineering

Retention data for Master Programmes in Engineering were retrieved for students actively starting between the autumn of 2000 and the autumn of 2006. This population contains 3993 students on nine different programmes.

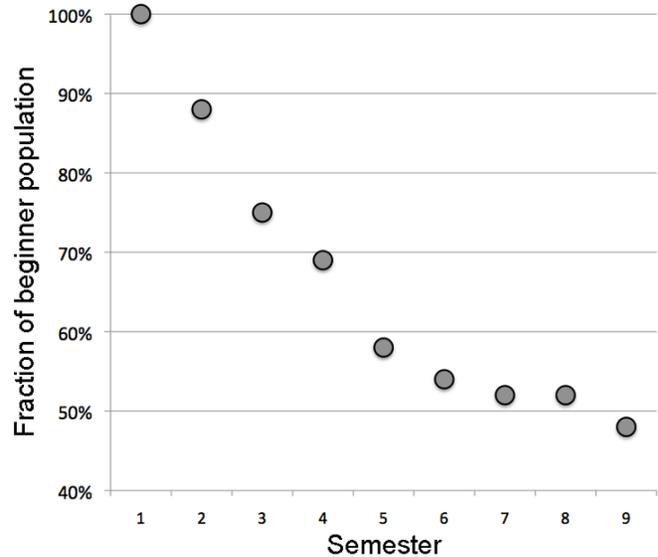


Fig. 2. The fraction of beginning student population on all Master of Programmes in Engineering at Uppsala University (2000-2006) who were still enrolled on their programme for the given semesters.

The retention pattern for this population, presented in Fig. 2, exhibit some significant features. The large decline in number of enrolled students during the first year roughly equals half the total student loss. The summer holiday between second and third semester seems to enhance this loss. The summer enhancement effect on student departure is even more pronounced between the fourth and fifth semester. The number of enrolled students level out towards the end of the programme, with a small dip during the ninth semester.

B. Bachelor Programmes in Engineering

Retention data for Bachelor Programmes in Engineering were retrieved for students actively starting their programmes between the autumns of 2000 and 2008. The population contains 1179 students on four different programmes.

The pattern for the Bachelor Programmes, shown in Fig. 3, exhibits similar features to those of the Master Programmes. The large initial decline has a similar magnitude and the summer enhancement effect on departure can be seen, particularly between the fourth and fifth semester. The decline in numbers of enrolled students are starting to stabilize but does not reach a steady state, primarily due to the shorter nominal time for the Bachelor Programmes.

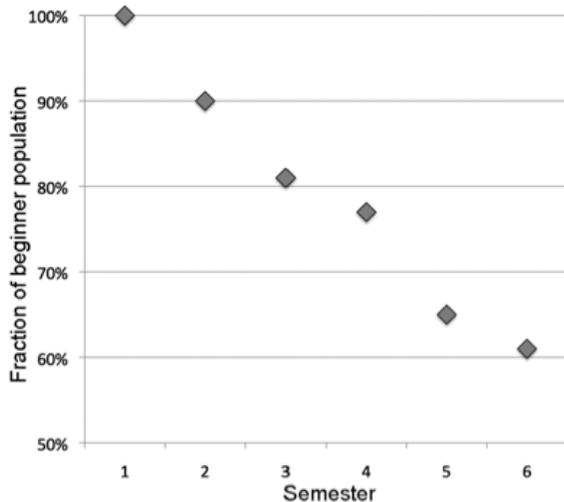


Fig. 3. The fraction of beginning student population on all Bachelor of Science in engineering programmes at Uppsala University (2000-2008) who were still enrolled on their programme for the given semesters.

IV. MOTIVES FOR LEAVING

The stories told by students, who either had changed programme or seriously considered to leave their programme, were analyzed using an iterative sorting procedure. This started with identification and coding of recurring themes found in the data. The themes were then brought together into four major reasons for leaving: dissatisfaction with the study experience, problems to handle studies, conflict of interest and lacking work connection. We present each of these four reasons in more detail together with illustrative quotes.

A. Dissatisfaction with the study experience

The most common reason given by the students was dissatisfaction with the study experience. The experience consists of many different factors, but is primarily constituted by perceptions of quality and feelings of belonging. About 40% of the student answers belonged to this category.

Is this really right, do I fit in here? I am probably not the type of person who becomes [one of these]. Boring and joyless with lectures and standard problems.

At different occasions the last two years, I have experienced that education as pointless and lacking quality, and I have experienced the environment as hard and unwelcoming.

B. Problems to handle studies

Many students expressed concerns about their ability to handle the studies and achieve the results they wanted. This often interplayed with the pace of the studies and perceived demands, which are experienced as hard to meet. This category contains about 30% of the student answers.

I could not handle the exams. I had studied for weeks in advance, and I have always done well at school before, so it was a hard blow.

In the beginning, when it was hard to get into the studies in the courses that started to become more difficult.

C. Conflict of interest

The conflict between student interest and what actually is experienced at the program is another important issue. Sometimes students believe other programmes would be more interesting, sometimes their interest change and sometimes programmes just fail to deliver what initially caused the student interest. This category gathers all such conflicts of interest and is made up by about 20% of the student answers.

I realised that the programme actually contains very little of what I am interested in, although I thought this was what the programme was all about. So I found another programme, which felt more right for me.

Why all this math? Why did I not study economy instead?

D. Lacking work connection

Some students on the engineering master programmes feel that the connection between education and future work life is lacking. This concerns issues such as information about future work possibilities, relevance of courses in relation to future work and a general lack of professional focus in courses. About 10% of the students answers belong to this category, and they come exclusively from the master programmes.

The information about what one can work as after the programme has been very scarce. We have had very few professional excursions and such thing makes it easy to loose the drive. Then some people

working here say it is common for engineers like us to work at a bank. Such information makes you wonder whether we have any place on the labour market.

It was hard to see any interesting future professional working directions during the first two years.

V. EXPLAINING THE PATTERN

As discussed earlier, the key concerns for student retention has been identified as expectations, support, feedback and involvement. Our qualitative data analysis on student reasons for departure indicates the areas where these concerns are especially important for our students. These results provide a foundation for tentative arguments about the observed features of the retention patterns.

A. *The critical first year?*

The first year of study is a well-known critical period for new students (see for example [5]). This is the time when students' expectations should be met and when students encounter new social and academic systems. This is a time when students need positive involvement with their studies and surrounding activities. They require support and feedback that address the issues seen in our qualitative study: Do I belong at this programme? Is my programme of good quality? Can I handle my studies? Is the programme interesting for me? Will this programme lead to relevant future work?

Students receiving unsatisfying answers to these issues might decide to leave. As students experiencing the largest conflicts between themselves and their programmes are prone to leave early it is natural for the student departure to be largest during the first year. We also observe that programmes marketing a clear picture on what they entail and who would belong there exhibit a smaller decline during the first year.

The issues students struggle with are however equally relevant during their whole education. We actually see that the fraction of remaining students departing is largest between the fourth and fifth semester, both for Master and Bachelor Programmes.

B. *The summer enhancement effect*

We observe an enhanced student departure during summer holidays for both programme types. This is an interesting feature, which to our knowledge has not been discussed previously. A tentative explanation for this effect might be that the students disengage from their study systems during the holiday. They are thus, at least partially, disconnected to important retention factors such as support, feedback and involvement at their institute. At the same time, the holiday provides time and opportunity to reflect on study experiences and consider other options.

C. *The stabilization*

The retention pattern for the Master Programmes in Engineering shows stabilization towards the end of the education. Most of the remaining students have by this time found sufficient conditions and reasons to remain on their programmes. There is also the added factor that invested time and effort makes them more reluctant to leave.

Now, when I have come this far into the programme, I have no plans to change or leave.

D. *The dip at the end of the Master Programmes*

The student departure observed between the eight and ninth semesters on the Master Programmes in Engineering originate from two different effects. Some ambitious students manage to complete their studies before the nominal time, as can be seen from the academic records. There are also some students who find jobs, based on their almost complete education, and leave to start their career early without a completed degree [6].

VI. IMPLICATIONS FOR PRACTICE

The reasons for student departure found in our study and the observed patterns of retention provide a useful foundation for discussions on improved practice for increasing student retention. We will discuss the implications and suggestions we find most important in this section.

A. *Living up to expectations*

Much effort is spent on recruiting students to engineering programmes. Programmes are profiled

and marketed in different ways to attract potential students. The students applying to the programmes have expectations formed from a number of sources, but primarily marketing information from the institutes. A key concern for improved student retention is the ability of programmes to live up to the expectations. This is particularly true as we often market our programs with promises connected to what the students want - *This is an interesting high-quality education with a relevance to your future career where you will feel at home and succeed.*

B. Creating a positive experience

We must use the different tools of student retention to create a positive study experience where the students have many inclusive possibilities for involvement. A combination of relevant feedback and support is important here. Different initiatives that can provide this during the first year of study, when many programmes have large student populations with little possibilities to student-teacher interaction, is especially relevant.

C. Bridging the summer holidays

Institutes should try to find ways to prevent the enhanced student departure during summer holidays. One way could be activities at the end of spring semesters, pointing forward towards coming semesters. Such activities could strengthen commitment, sense of community and also build a feeling of continuity.

D. Helping students to finish

The retention pattern for Master Programmes highlights the issue of helping students to actually finish their programmes. The same problem also exists on the Bachelor Programmes, although it is not as visible in the figure. Students who depart prematurely to start jobs are not, in a sense, failing but they will lack the formal degree in the future. Initiatives helping these students to complete their degrees could be of great value.

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