Factors Affecting Motivation and Concentration of Engineering Students in Classrooms

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Introduction

This paper examines and presents the factors affecting the motivation and concentration span of engineering students in classrooms. Our work carries out most of the recommendations of the previous works but also deviates in the sense that it is studying the motivation of the students rather than their concentration span. This project also was conducted pre-pandemic and a long-term goal of this study is to be used to get a better understanding of engineering students in an all-virtual learning system like the one implemented during the pandemic. This project examines the results from a survey conducted among the total population of 510 students from year 1 to year 4 undergraduate students in three different universities. The students responded to a questionnaire examining the factors that motivate them to work hard on their studies. Motivation, concentration, and learning are highly complex aspects of a student's behavior. The relationship between student concentration in a class and learning has been a prominent research topic in educational studies.

Background

Motivation is an important key to a student's success [1-3]. Therefore, every learning-oriented entity aims to investigate the factors that affect the motivation of students to concentrate and learn better. Many researchers have been widely studied motivational theories, e.g. Expectancy Theory, which suggests that motivation has three main factors of expectancy, instrumentality (the perceptions of individuals as to get what they desire), and valence [3].

"Self-determination theory" addresses the reason for desire to work. It describes two sources of motivation to learn: the need for recognition, praise, and/or reward which aligns with extrinsic motivation [4]. Extrinsic motivation is a motivation that can be driven by fulfilling expectations of important people or by the desire to boost one's own ego (introjected regulation), to obtain remuneration for one's actions (external regulation) [5]. Extrinsic motivational learners are also known as "surface learner" [4]. Also, self-determination theory has another source called intrinsic motivation. Intrinsically driven students are said to have a "deep learning" approach, in which they endeavour to comprehend the reasons behind the academic work they are performing and perceive their growth as a person, wanting to achieve a personal goals [4, 5].

While student success is important at every educational level, it advances during the university years because this phase often represents the last formal education many students receive before competing for employment [6-8]. During their time at university, students develop their abilities and knowledge not only by attending the classes but also due to collaboration with stakeholders including companies and an interdisciplinary campus community which make them ready for the job market [11].

For this reason, education during these years is very important [1, 2]. However, as in other levels of their educational careers, due to a lack of motivation students sometimes fail to achieve adequate learning/program outcomes [1].

In a study by Smilkstein [5], a group of college students was asked to list the stages of the learning process. The students developed a six-step process, with the number one step being motivation. Motivation was considered to be the necessary foundation on which the other steps follow and build [1, 10]. Student motivation translates to the students' willingness to participate in the learning process. But it also concerns the reasons or goals that underlie their involvement or non-involvement in academic activities. Although students may be equally motivated to perform a task, the sources of their motivation may differ. Lack of motivation leads to loss of interest or desire to learn or attend a class which consequently leads to withdrawal or termination from the university. Therefore, to maximize students' learning process at Higher Education Level (HE), a study into the factors that affect the motivation of students is essential.

Research Methodology

An IRB approved anonymous survey form is designed and used as a method to collect the different views of students from the varying levels, disciplines, and universities. As shown in Table 1, in the questionnaire, 23 possible factors that our team believes would affect the student's motivation were listed. The factors are divided into four categories of Class Logistics, (Question 1, 2, 4, 16, 17 and 22) Lecturer Specific Variables (Question 3, 5, 6, 18, 19, 20 and 21), Subject Specific Variables (Question 7, 8, 9 and 10), and Students Specific Variables (Question 11, 12, 13, 14 and 15). These possible factors were not grouped according the four categories in the questionnaire to avoid any prejudgment. In addition, the students were asked to rank their response in the range of 1 "not affecting" to 5 "strongly affecting". The survey also considered the "never encounter this situation" as rank 0. For example, if the student selects "1" (not affecting) in Q20 it means the level of lecturer's friendliness whether he or she is friendly, strict or detachment doesn't really affect student's motivation but if the student selects "5" (strongly affecting) it means lecturer's friendliness has a huge impact on student's motivation. It's worth noticing that in these questions we are just measuring factors that would affect the student's motivation in general regardless of their positive or negative effects.

Data was collected from 3 different universities with total participation of 510 students from foundation level to year 4. At the end of the survey there was a comment column for the students to supply any other information relating to the survey. The survey was anonymous to encourage the students answering it honestly. It is worth noting that in this study we did not collect any personal data e.g., data on the gender or nationality of the students and the number of surveys received from year 1 and 2 were almost double of surveys received from year 3 and year 4 students. SPSS and Excel were used to analyse and plot the data.

Table 1: Survey form

	Factors	0	1	2	3	4	5
1	Time of the day – whether the class is in the early morning, late morning, early afternoon, or late afternoon.						
2	The duration of the lecture.						
3	The lecturer is/is not interacting with the students.						
4	The pace of the lectures.						
5	Teaching style of the lecturer.						
6	The personality of the lecturer.						
7	Difficulty of the subject.						
8	Relevancy of the subject to current industrial requirement						
9	Relevancy of the subject to latest and new technology.						
10	Your interest in the subject						
11	Your so-far performance in the subject						
12	Your classmate's seriousness (pay / do not pay attention)						
13	Your classmate's preference (like / do not like the class)						
14	Your classmate's diligence (work hard / do not work hard)						
15	Your Boy/Girl-friend interest.						
16	Number of students in the class						
17	Type of classes (Lecture, Tutorial, Lab, Project, Industrial visit)						
18	Method of teaching (Slides, White board, use of IT tools)						
19	Lecturer using industrial/practical/real-life examples in teaching						
20	Level of friendliness of lecturer (friendly, strict, detachment)						
21	Lecturer knowledge on the subject						
22	Type of assessment (100% exam, 50% coursework, etc.)						
23	Your close friends' attitude towards the subject						

Result and Discussion

Based on the results, the students responded differently to majority of the questions based on their year of study. The main two categories that the students thought affect their motivation

were lecturer specific variables and subject specific categories. As shown in Fig. 1 the most significant factors for first year students were one: difficulty of the subject with a mean of 3.64 under the subject category and two: Lecturer's teaching style under the lecturer category with an average of 3.37 out of 5.
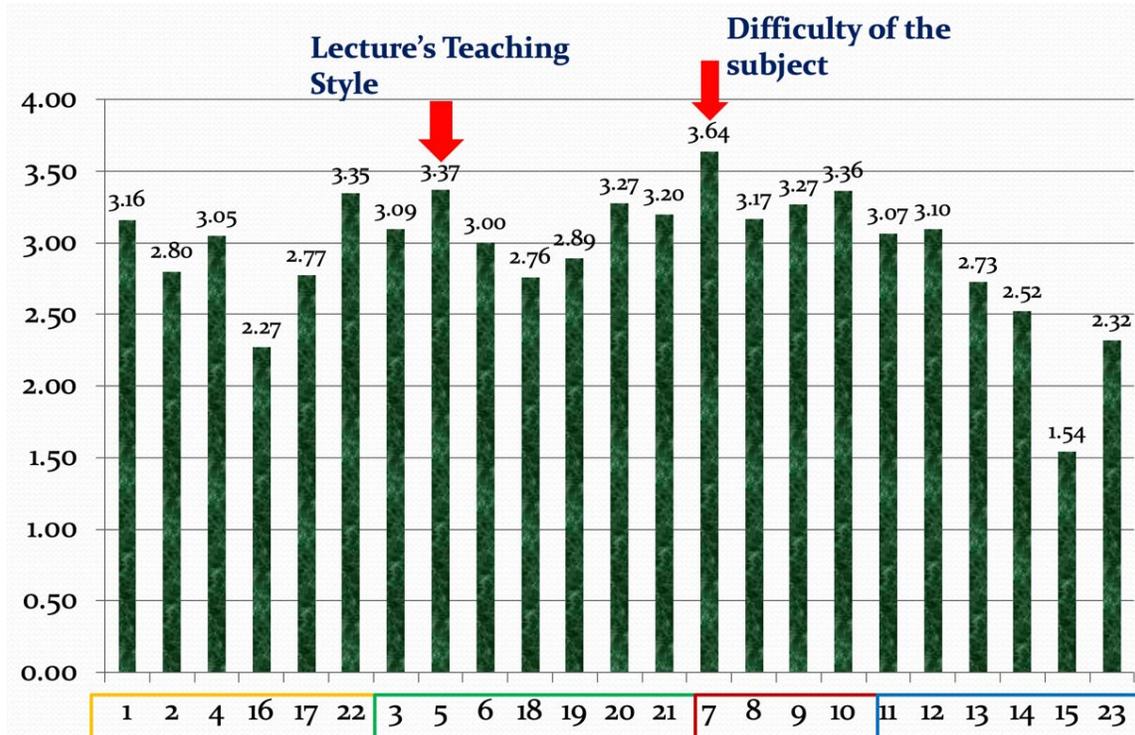

*Figure1. Most significant factors effecting motivation of **first year** engineering students. X axis represents Class Logistics (Questions1, 2, 4, 16, 17 and 22 in the survey), Lecturer Specific Variables (Q3, Q5, Q6, Q18, Q19, Q20 and Q21), Subject Specific Variables (Q7, Q8, Q9 and Q10), and Students Specific Variables (Q11, 12,13, 14, and Q15).*

According to Fig. 2, for the second-year students, the most significant factors were one: their interest in the subject with a mean of 3.74 under the subject category and two: Lecturer's knowledge under the lecturer category with an average response of 3.64.

As illustrated in Fig. 3 for the third-year students, the responses favored one: Lecturer's knowledge on the subject with a mean of 4.32 under the lecturer category and two: their interest in the subject under the subject category and lecturer's friendliness under lecturer category with an average response of 4.18.
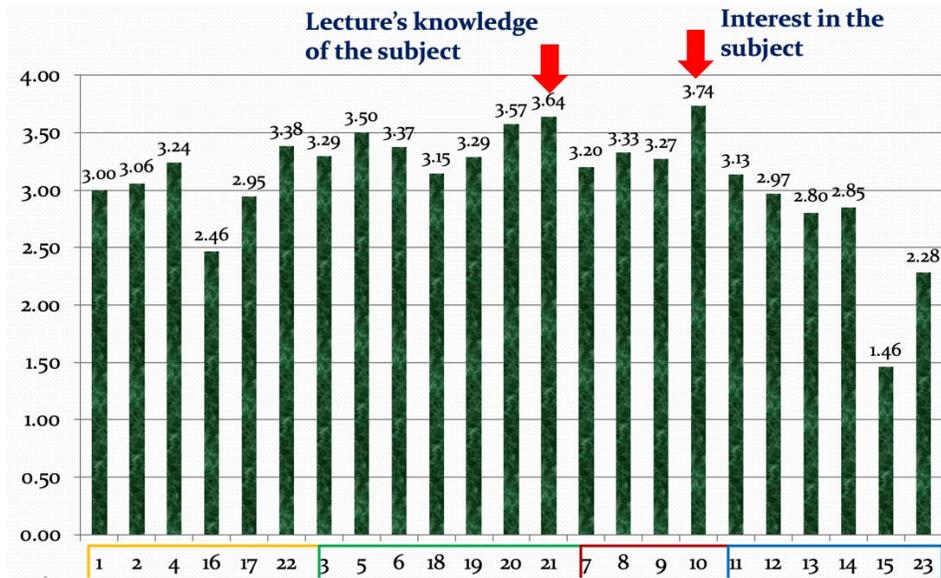
*Figure2. Most significant factors effecting motivation of **second year** engineering students. X axes represents Class Logistics (Questions1, 2, 4, 16, 17 and 22 in the survey), Lecturer Specific Variables (Q3, Q5, Q6, Q18, Q19, Q20 and Q21), Subject Specific Variables (Q7, Q8, Q9 and Q10), and Students Specific Variables (Q11, 12,13, 14, and Q15).*
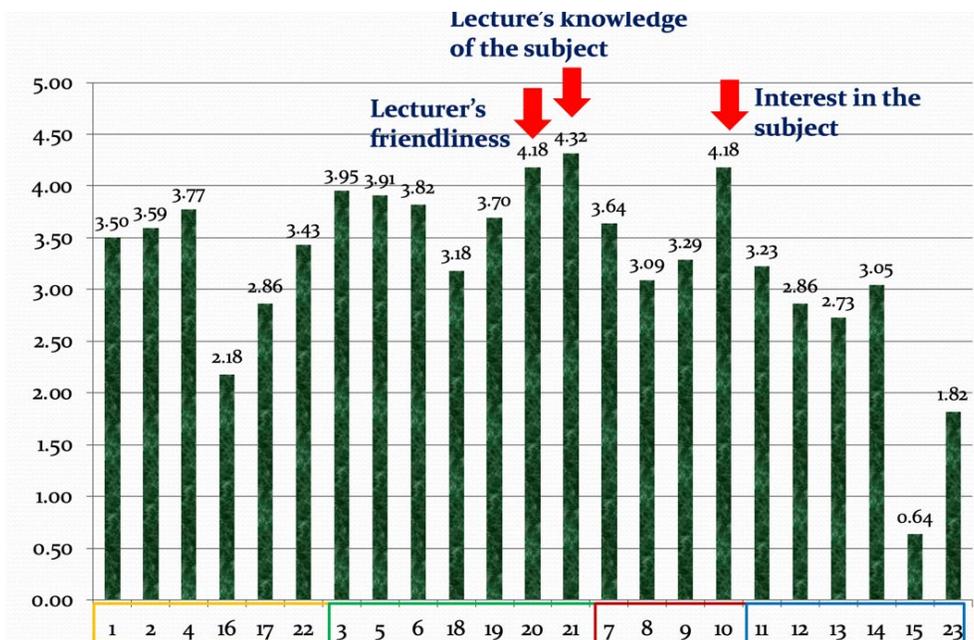

*Figure3. Most significant factors effecting motivation of **third year** engineering students. X axes represents Class Logistics (Questions1, 2, 4, 16, 17 and 22 in the survey), Lecturer Specific Variables (Q3, Q5, Q6, Q18, Q19, Q20 and Q21), Subject Specific Variables (Q7, Q8, Q9 and Q10), and Students Specific Variables (Q11, 12,13, 14, and Q15).*

As shown in Fig. 4 for the fourth-year students, the responses were very similar to year three students as they favored one: lecturer's knowledge on the subject with a mean of 4.33 under the lecturer category and two: their interest in the subject under the subject category with an average response of 4.17.
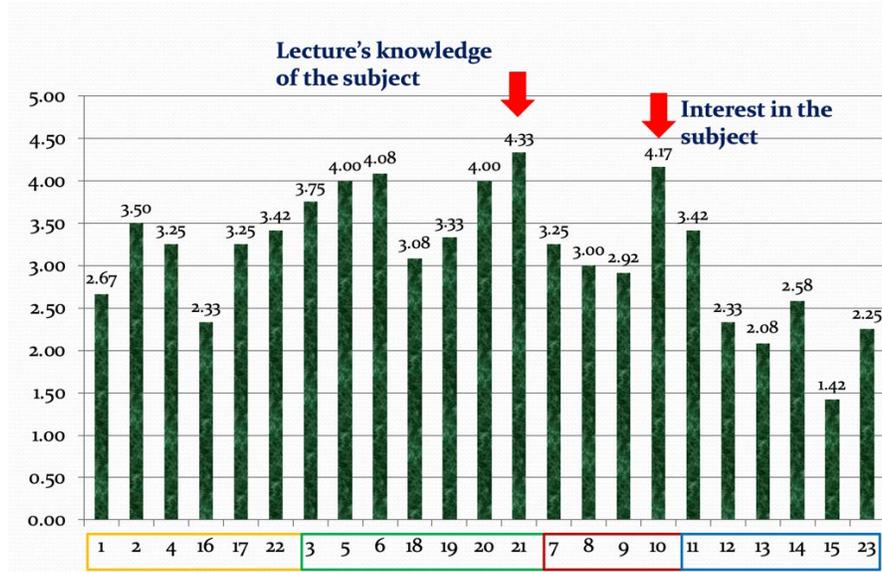

*Figure 4. Most significant factors effecting motivation of **year four** engineering students. X axes represents Class Logistics (Questions1, 2, 4, 16, 17 and 22 in the survey), Lecturer Specific Variables (Q3, Q5, Q6, Q18, Q19, Q20 and Q21), Subject Specific Variables (Q7, Q8, Q9 and Q10), and Students Specific Variables (Q11, 12,13, 14, and Q15).*

On the other hand, as shown in Fig. 5 the least affecting motivation factors among all years were "Your close friends' attitude towards the subject", "Number of students in the class", and "Your Boy/Girl-friend interest".
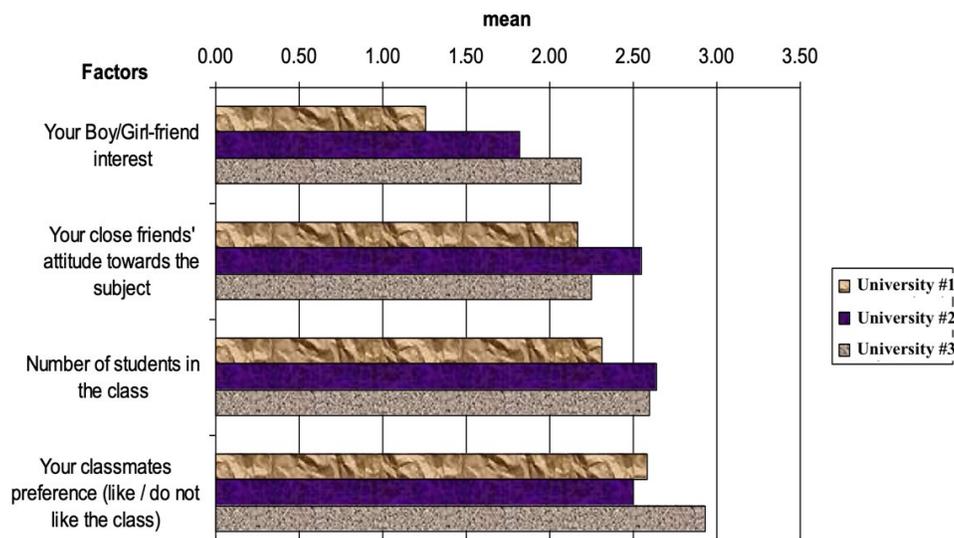

Figure 5. Least affecting motivation factors among all years

Table 2 and Fig. 6 summarize the top factors affecting students' motivation and the correlations between year 1 and years 2-4, respectively. In Figure 6 the three factors on each side represent the top three factors that affect students' motivation. Years 2-4 are on grouped together based on that they all share the same factors. Years 2-4 top three reasons are lecture's knowledge of the subject, interest in the subject and lecture's friendliness. Students who are in year 1 top factors are lectures teaching, difficulty of the subject, and interest of the subject. Year 1 and years 2-4 share the same factor in the same factor of interest in the subject

Table 2. Top 5 factors affecting students' motivation

Foundation	Year 1	Year 2
Interest in the Subject	Difficulty of the subject	Interest in the subject
Lecturer's Teaching Style	Lecturer's Teaching Style	Lecturer's knowledge on the subject
Lecturer's Knowledge on the Subject	Interest in the Subject	Lecturer's Friendliness
Difficulty of the subject	Type of Assessment	Type of Assessment
Type of Assessment	Lecturer's Friendliness	Relevancy to Industrial

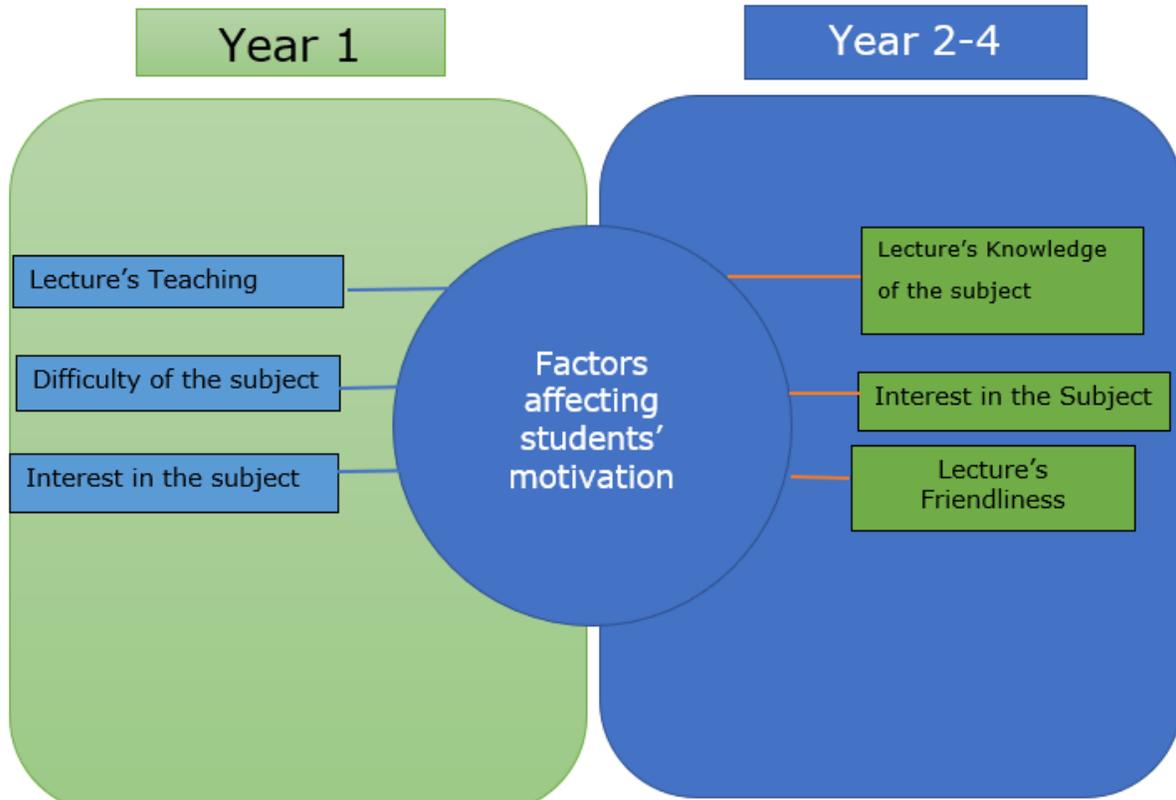| Year 3	Year 4
Lecturer's Knowledge on the Subject	Lecturer's Knowledge on the Subject
Interest in the Subject	Interest in the Subject
Lecturer's Friendliness	Lecturer's Personality
Lecturer's Interactions with Students	Lecturer's Teaching Style
Lecturer's Teaching Style	Lecturer's Friendliness

Figure 6. Factors affecting students' motivation and the correlations between year 1 and years 2-4.

Conclusion and Recommendations

The findings consistently show that there are different factors that affect the students' motivation depending on the year of their studies which reflects their thinking maturity as they spend more time in the university. Based on the reported results we think the following five points will increase the motivation and student satisfaction especially for year three and four students. 1- To assign subjects to those lecturers who are doing research in the same area (based on Q21); 2- To encourage lecturer's to discuss their research in the class and coursework (based on Q21); 3- To use teaching techniques that increase the interaction between the lecturer and the students (based on Q20 and Q3); 4- To introduce examples that make the subject more interesting (based on Q10) and 5- To ask the students for feedback on which teaching methods they prefer (based on Q5). It is worth noting that this research was carried out before the pandemic therefore all the classes were in person. Factors affecting the motivation and concentration span of engineering students in online classes will be considered in our future work.

Acknowledgment

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