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## Exploring the Barriers to Independent Study and Learning in First Year Undergraduate Engineering Students?

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## **Title**

***“Exploring the barriers to independent study and learning in first year undergraduate engineering students?”***

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## **Abstract**

This mixed method case study was carried out in the Dublin Institute of Technology, Ireland and was conducted with the co-operation of four experienced lecturers of engineering and three groups of first year undergraduate engineering students.

The main aim of the research was to identify factors which represent barriers to the independent study and learning of first year engineering students.

Many first year engineering students do not return to college for the second year of their programmes. Many reasons for this are identified in the research, including the failure of students to pass assessments and exams as a result of the lack of independent study and learning. For this research qualitative interviews were carried out with four experienced lecturers to capture their views and experiences of the study and learning habits of first year students. The data gathered during these interviews, in conjunction with my own personal experiences, and knowledge gathered from the research literature on the subject, served to guide and inform the selection of the questions which were used in a student survey.

The Quantitative student survey consisted of two parts, the first included questions relating to the profile and study habits of the students, the second employed a set of questions titled “a brief measure of learner autonomy”. This resource provides a numeric value for the student’s learner autonomy which provided the mechanism used to explore the relationship between the level of autonomy of some students and their profile and study habits.

The analysis of the data gathered provides a detailed insight into the views of the engineering lecturers and the factors which represent barriers to the first year students study and learning.

Key Words: Independent study, independent learning, first years, undergraduate, learner autonomy,

## **1. Introduction**

This paper outlines the findings of a mixed methods case study conducted as part of the research for an M.A. in Higher Education. There is much recognition that students in higher education must gather and develop competent study skills in order to succeed in their studies and later in their working lives. Tinto, (1993) [1]; Upcraft et al (1989) [2].when they first enter higher education is when their need is greatest. Many lecturers teaching in the third level system in Ireland express the view that the methods of assessment adopted in second level Irish education do not contribute to the preparation of the student for the independent study and learning required in third level education. This is reflected in the high number first year students who do not complete and submit the individual assignments.

Experienced lecturers would see this as an early indicator of how familiar the student is to engaging in independent study and learning. To be successful in higher education, students must develop the ability examine their behaviour and become more independent self learners Ritzen, (1996) [3]. A high percentage of under-prepared first year students is increasingly seen as a retention issue for programmes in engineering. This study focuses on attempting to establish the factors which constitute barriers to independent study and learning in first year engineering students studying engineering at the Dublin Institute of Technology In Ireland. This study was conducted as part of the research for an MA in Higher Education.

## **Research Methodology**

This research has been carried out from the position of one with a pragmatic world view. Pragmatists focus on the research question and allow it to inform the procedures, methods and techniques of the research that best meet their needs and purposes. Creswell, (2009) [4].

The case study approach was best suited to the mixed method design of the research methodology. For this research the “case” is regarded as being the failure of some students to engage independent study and learning.Henn et al, (2010) [5].Suggests that cases are units of investigation..individuals..communities..groups. A combination of both qualitative and quantitative forms of research was employed in the mixed method research approach. The qualitative and quantitative research data collection can be carried out in sequence or simultaneously Creswell, Plano Clarke, (2007) [6].

A Sequential mixed research method approach was selected for the collection of the research data, beginning with qualitative research element which involved the interviewing of four experienced lecturers of engineering. These interviews were exploratory in nature, the aim being to use the findings to guide and inform my selection of the questions used in a quantitative survey, which would be later completed online by a group of first year under undergraduate engineering students.

As part of this online survey, a quantitative research tool was utilised, this comprises of twelve questions and provides a numeric value of the students learning autonomy. This

resource which was developed and published online in May of 2010 is titled, "A brief measure of student autonomy"

Macaskill and Taylor (2010) [7].

This measure was incorporated into the student survey as a mechanism to identify students with varying levels of learner autonomy, which in-turn will allow further exploration into the relationship between the level of autonomy of some students and how they answered the other questions.

The Interviews were carried out over a period of four weeks, and all of those approached to be interviewed agreed without hesitation.

## **2. Analysis of the Qualitative data**

The methodology for the coding the qualitative data into themes which is championed by Taylor and Gibbs (2010) [8]. was selected for the analysis of the qualitative data for this research. The recordings of the four interviews were transcribed and the responses to each individual question were extracted and grouped together in a separate document generated specifically for analysis of the data. This facilitated the analysis of the data. This facilitated the analysis of the data one question at a time. Seidel (1998) [9] describes the basic process of qualitative data analysis as being cyclical in nature and consisting of three parts, noticing, collecting and thinking about interesting things. As the data was read, items were noticed and listed, these lead to further searching of the text for similar or related items and then their collection. The thinking involved in the examination of these resulted in the cycle starting over again.

These themes were,

1. The Students Profile,  
Age, nationality, whether they were in paid employment and if so how many hours they worked per week, whether were living away from home while attending college, and their CAO points level.
2. The students level of study skills,  
If they studied on their own, when and where and how long they studied, whether they thought they thought they spent enough time studying, whether they had ever been thought any study skills, whether they were aware that a study skills class was available to them
3. The students approach to individual assessments, whether they spread the work over the  
time available or leave it until near the time the assessments is due.
4. The students level of learner autonomy,

It became clear that the questions in the student survey needed to closely follow these themes. As was the intention at the outset of this research the emerging data combined with the research question itself guided and informed the selection of the questions which formed the online student survey.

## **Theme 1. The Students Profile,**

### **Age**

It was necessary to know the age of each student to be able to generate the students profile and to examine the comparisons between younger students who were coming directly from second level schools through the Irish College Application Office (CAO) system, and older students who may have spent some working in industry or studying other topics since leaving second level education.

In answer to the question “How do students respond to being given individual assignments to complete?” interviewee No2 made reference to the age of the students. He replied,

*“I find that young first year students don’t always respond well to formative assessments.”*

Interviewee No 4 said that, it was his experience that mature students are “*very applied*”. Although one’s maturity is defined in the literature in a variety of ways, for the purpose of this research it is accepted that the interviewee was making reference to older students when talking about mature students. I concluded that the inclusion of a question in the survey relating to the age of the student would contribute to overall student profile.

### **Nationality**

Interviewee No 4 mentioned non national students twice during the interview. When answering the question, “Does the assignment design influence their response? For example if the assessment is summative or formative?” The following formed part of his response,

*“some of the better students and non-national students come to me asking for formative feedback in advance of the deadline”*

In response to the Question “Do you feel students are familiar with studying independently, are they aware of the need to study outside of class?” His answer included the following,

*“Again I would have to say in my experience non-national and mature students seem to be very applied”*

The inclination of the interviewee to group “mature students” and “non-national students” together would indicate that in his view, non-national students along with mature students demonstrated a genuine interest in their performance on individual assessment which was not demonstrated by younger students.

These references prompted me to consider the inclusion of the question about nationality which I not previously considered. It has been my experience that most non national students actively seek feedback following both formative and summative assessments. I concluded that the inclusion of a question in the student survey which identified the student as a non national, or from Ireland, would provide an interesting additional comparator for consideration when it came time to carry out the analysis of the data.

## **Students being in paid employment.**

Interviewees No 1, 2 and 3 expressed the view that the student being in paid employment presented a barrier to their study and learning, Interviewee No 3 offered that,

*“they miss classes when they are in paid employment”.*

Interviewee No 3 suggested that,

*“student’s having jobs does present a barrier as it takes up a lot of their time”.*

Interviewee No 4 disagreed with these views and made reference to how well students on part time programs performed compared to students on whole time programs, He gave the opinion,

*“Students being in paid employment, I don’t see that as being a major problem. The proof is clear to see with part time programs that have whole time parallel courses running during the day, and I have personal experience of this. The higher marks in the whole time program will correspond with the lower marks on the part time program”.*

Harvey, Drew, Smith (2006) [10]. agrees with this position, suggesting that,

*“There is little evidence to suggest that moderate amounts of part time work adversely affects performance”.*

Both Interviewees No 1 and No 3 suggested that it is likely that some students would not be able to afford to come to college if they were not in paid employment. In my experience, I have observed that older students who are in paid employment often put in the additional effort required for them to succeed. It is possible that they value the opportunity to study more than those students who come straight from second level.

## **Students living away from home.**

For Interviewees No 1, 2 and 3, a student living away from home did not present a major barrier to their independent study and learning, Interviewee No1 suggested the contrary, he stated that,

*“Students tell me they have a lot of time on their hands in the evenings, I’d imagine that they would use this to do a bit of study or to do assignments”.*

Harvey, Drew, Smith (2006) [10] agrees with this position, suggesting that when considering this point maintained that,

*“Living on campus is presumed to be an important factor in social integration but there is ambiguous evidence about whether living in residence actually enhances grades. Some research shows students living at home perform better in the first year”.*

Interviewee No 4 disclosed that, he himself had moved out of the family home when he first went to college, but quickly moved back home where he found it easier to study. He continued saying,

*“So I suppose living away from home was a barrier to my study and learning, however that was just my experience”.*

Although he did suggest that a lot depended on the student’s personality. While the views expressed by the interviewees did not fall heavily in favour of one view or the other, I concluded that I should take the opportunity to ask the students about their living arrangements. This would provide a valuable aspect of the student’s profile which would

aid the comparisons I wished to make in attempting to establish factors which constituted barriers to the students' independent study and learning.

### **Cao points level.**

When asked the question, "Do you feel students are familiar with studying independently, are they aware of the need to study outside of class?" all four interviewees gave a negative response,

Citing the assessment methods used at second level as the cause of the problem. When asked, "Do you have any suggestions for survey questions relating to Barriers to independent study and learning that have we have not covered already in this interview and that would contribute to my research? Interviewee No 3 recommended the inclusion of a question in the student survey which would provide details of the CAO point achieved by the student at second level. It was his belief that the entry level points relate directly to the performance of the student, the higher the points the better the student performs. He revealed that,

*"While filling out questionnaire forms I have noticed the performance statistics of first years has disimproved considerably over the past 10 years. The entry points on courses is certainly a factor"*.

Mooney et al, 2010 [11], concurred with his views, his recommendations were taken as they would provide a valuable opportunity to compare the CAO point's level of the students with how they scored in the MLA.

### **Theme 2. The students level of study skills,**

#### **Do students study on their own?**

Although students often prefer to study with others, they must also develop the skills to learn on their own. They will ultimately be examined on the knowledge they have acquired as individuals.

When asked the question, "Do you feel students are familiar with studying independently, are they aware of the need to study outside of class?" interviewee No 1 suggested that, at secondary school, students do not focus on studying until it is getting close to exam time, and that this tactic is not effective at third level. He highlighted his awareness when he said

*"There are some subjects like technical subjects for which they tend to have assignments to be completed during the year, which is a good idea, I think. Whereas some subjects like mathematics may not traditionally have assignment work"*.

Although it was a departure from the focus of the question it merits consideration that the interviewee made reference to mathematics. Arguably mathematics is one of the most important subjects studied by students of engineering, and in my experience is the subject which students struggle with most. education in Ireland.

## **Student's awareness of the study skills classes available to them.**

The message I got from the interviewees was very clear, these lecturers believe that the students need to have already developed effective study skills and the habit of using them, long before they come to College. I decided to include a question in the survey enquiring if the students were aware of the study skills classes which are available to them. To establish the proportion of students who had taken study skills classes before, also to quantify the proportion of students who knew about them but had not availed of them.

## **Do you study on your own?**

As one of my aims was to establish the study habits of the students, it was essential that a question be included in the student surveys which enquired of them directly "Do you study on your own?" this question was to be followed by several questions relating to the independent study habits of the student, It was necessary to consider the course of action to be taken should the student's response be "No". While highlighting the importance of the development of a questionnaire which is properly organized and easy for the participant to use, Johnson, Christensen (2004) [12] suggest that in this scenario a contingency of filter question can be used. This,

*"directs people to different follow-up questions depending on their response".*

It allows the researcher to,

*"filter out participants from questions that these participants cannot or should not attempt to answer"*

It was necessary to include the question "Do you study on your own?" and to utilize this as a contingency or filter question. This served to redirect the students who answered no, further on in the survey to questions which related to topics other than study habits. This required re-arranging the order of the questions in the survey and changing the status of some of the questions from compulsory to optional.

## **When, where and how long students study?**

The inclusion of questions about when and where the students study would provide valuable information which would be compared and related to how they scored on the MLA. Of equal importance is the data about the amount of time the students spend studying on their own, it would be extremely interesting to learn if the students felt that they spent enough time studying on their own. Felder, (1998) [13] argues that most engineering students are active, sensing, visual and sequential learners. Excluded from this list are reflective learners, who learn best by thinking things through and working alone and a part of a group. It may be argued that, although engineering students may naturally fit into the former learning styles categories, they need to become reflective learners early in their third level education if they are to meet the learning needs of their programs and when working in industry. Students on engineering programs in the DIT are advised that they will need to spend an average of three hours per day studying, however the amount of time they should spend studying alone is not specified. I opted to design the question relating to how long students spent studying alone, into three



categories, 0 to 2hrs, 2 to 4hrs and more than 4hrs, this would inform the research as to how much time the students actually spend studying alone and would provide an opportunity to examine the relationship between the amount of time they spent studying alone and the other information gathered in the students survey.

### **Theme 3.**

#### **The students reactions and approaches to individual assessments,**

The responses of two of the interviewees, No 2 and No 4, to the question relating to how first year students respond when given an individual assignment, were very similar. They indicated they the students respond well. They suggested that they manner in which they respond is usually a good indicator of how they will perform for the rest of first year. If the first assignment is met with enthusiasm by the student, he/she is likely to do well. The variety of responses generated by the interview questions confirmed that people react in different ways to different situations, however when dealing with newly arriving first years there is another aspect to be considered. It has been my experience that the confidence of first year students builds as time passes. Student who behave in a self conscious way and are slow to contribute in their early weeks in college quite often come out of their shell within a few weeks. Until this happens, it is difficult to get to know them. Great care must be taken by lecturers not to form opinions on students too early in first year as their attitude and approach to the requirements of college life can change very quickly. I opted to include one multiple choice question on this topic to try and gauge the students approach to doing the study required for individual assignments, focusing on whether they spread the work for the assignments over the available time or whether they left the work until near to the time was due. This would give an indication if they had an understanding that the learning at third level needs to happen on an ongoing basis and not immediately prior to the deadline for the work.

#### **Assessment Design**

In response to the question "Does the assignment design influence their response? For example if the assessment is summative or formative". All four of the interviewees indicated that they do not give assignments which are formatively assessed to first year students. The reason being, as suggested by interviewee No 1, *"student's are motivated by scoring points"*,

Some would even ask

*"how many points is it worth"*.

Interviewee No 4 indicated that some

*"come to me asking for formative feedback in advance of the deadline"*

which he is more than willing to provide. He also indicated that some students who were less organized would not get the work done in time to get formative feedback, stating that,

*"formative feedback is available to those who come looking for it in time. A lot depends on their time management"*.

## **Theme 4.**

### **The student's level of learner autonomy,**

The quantitative students survey consisted of two parts, the first section addressed the questions arising from the themes which emerged from the qualitative analysis of the interviews as detailed in the previous paragraphs, the second was an assembly of twelve questions which combine to form an already established and recognised survey, which is titled "a brief measure of learner autonomy" (MLA) Mc Askill and Taylor (2010) [7]. This resource provides a numeric value for the student's level of learner autonomy using a Likert scale. This exploration would form an integral part of the identification of barriers to the independent study and learning in the students surveyed which was the primary aim of this research.

### **3.The Student Survey.**

Questions related to age, gender, living arrangements, employment, CAO point scores, the students MLA, study skills and habits were included in the student survey. Data was gathered under these headings and later was subjected to quantitative data analysis.

### **4.Findings of the Research.**

Identified by the research as being factors which constitute barriers to the independent study and learning of first year engineering students were,

- Lack of real commitment to study by the students. Findings indicated that 4% percent of students do not study alone at all. Only 12% study for more than 4 hours per week. 77% of students felt that they did not spend enough time studying.
- Lack of sound study skills such as note taking, organisation and time management and reflective thinking, 48% have never had any study skills training.
- students prefer to study at home; this might suggest that the college facilities are not conducive to study.
- 38% of the students were in paid employment. (19 of the 50)  
17% of the students in employment spend over 20 hours working per week; the research tells us that working more than 19 hours per week significantly increases the risk of attrition in first year students.
- Younger students and students with low CAO points are highly prone to attrition.
- The findings indicate that over 3% of the sample work more than 20 hours per week

The majority of the findings confirm much of the existing the literature on the topic.

## 5.Recommendations

The following are some recommendations which emerged from the research which would benefit first year engineering students, third level lecturing and administration staff and higher education in general.

Of benefit would be the early identification of at risk first year students.

First year Students need more structure, they need to be helped to find a suitable balance of social and academic activity.

Third level institutes need to recognize how crucial sound study skills training is to the success of first year students by making it a compulsory element of the induction process.

Study Skills training centers need to be set up address the problems students have with problem subjects such as Mathematics.

Staff need to be helped to develop greater awareness of the needs of first year students.

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