

## Investigating the English Language Needs of Engineering Students

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### Abstract

The purpose of the study was three-folds: to evaluate students' needs, to evaluate the psychometric qualities of the developed questionnaire, and to explore the possibility of writing a textbook based on the insights gained from the study. To evaluate the students' needs, wants, and lacks (Hutchinson and Waters, 1987), a questionnaire was administered to 225 students at Sharif University of Technology when they took their final exams. Students' scores were made use of with respect to one dimension of the questionnaire which dealt with students' self assessment of themselves most of which correlate positively with their final scores. Another purpose of the study was to evaluate the questionnaire itself in terms of its statistical properties. In other words, a construct validation study was conducted. There were distinct parts to this questionnaire. A confirmatory factor analysis using Principal Components Analysis (PCA) with varimax rotation was applied to see if different needs were neatly delineated by the questionnaire (see Hatch and Lazaraton, 1991 for limitations of PCA). Having applied a CFA with PCA using a three-factor solution, it was seen that items loaded on the expected factors with high loadings. In terms of students' needs, here are the findings: Translation was not deemed appropriate. Note taking was not considered important in their future careers. Technical writing was considered to be very important. Unfortunately, the skill has been totally ignored in the English curriculum in the university.

**Key Words:** Needs Analysis, Varimax Rotation, Exploratory Factor Analysis, Confirmatory Factor Analysis

### Introduction

Sharif University of Technology is a renowned university which attracts the best students in almost any field of study. In terms of language, these students are often a cut above their counterparts in other universities. A piece of anecdotal

evidence is the fact the classes are run entirely in the English language as opposed to other universities where the medium of instruction is not often English in general English classes. To serve these well-picked individuals, great care should be exercised to provide them with learning materials that provide enough challenge to be engaging their interest (Kumaravadivelu, 2006) or in Krashen's (1982) words to be beyond their current levels of knowledge. In order to accommodate these students, it is incumbent upon us as teachers to delve deeper into the needs of students so that the right measures can be taken to embark on materials preparation. In order to do this, a questionnaire was administered to students in order to delineate their needs and wants.

### **Literature Review**

Perhaps a classic book that elaborates on the concept of needs analysis is that of Hutchinson and Waters (1987). They distinguish among three different terms: wants, needs and lacks. So, "want" is something is the learner requires from us. "Need" is something is that she or he needs no matter if that is required or not. Lack" is something that is the learner is lacks.

Furthermore a distinction is often made between objective needs analysis and that of subjective analysis. The former has to do with focusing on identifying learners' real world communicative requirements so that courses could be designed reflecting these and preparing users for their intended use of the target language (TL). Munby's model (1978) is the most well-known of this type. Munby's model comprises of nine components, relating to the learners' communicative requirements (participant, purposive domain, setting, interaction, instrumentality, dialect, target level, communicative event, and communicative key). As the existence and importance of psychological, cognitive, cultural and affective learning needs gained momentum in the 1980's and 1990's, a "*subjective*" interpretation was recognized in which needs are viewed in terms of the learner as an individual entity in the learning situation (Brindley, 1984).

The current concept of needs analysis in ESP, according to Dudley-Evans and St John (1998, p.125), includes consideration of the following aspects:

A. Professional information about the learners: the tasks and activities learners are/will be using English for- *target situation analysis* and *objective needs*.

B. Personal information about the learners: factors which may affect the way they learn such as previous learning experiences, cultural information, reasons for attending the course and expectations of it, attitude to English- *wants, means, subjective needs*.

C. English language information about the learners: what their current skills and language use are- present situation analysis- which allows us to assess (D).

D. The learners' lacks: the gap between (C) and (A)- lacks.

E. Language learning information: effective ways of learning the skills and language in (D)- learning needs.

F. Professional communication information about (A): knowledge of how language and skills are used in the target situation- linguistic analysis, discourse analysis, genre analysis.

G. What is wanted from the course.

H. Information about the environment in which the course will be run – means analysis.

In addition, Anthony (1997 as cited in Gatehouse 2001) notes that there is a fuzzy borderline between ESP courses end and General English courses; numerous non-specialist ESL instructors use an ESP approach in which their syllabi are based on analyses of learners' needs and their own personal, specialist knowledge of using English for real communication. Many ESP programs are examples of such curriculum development and course design. This is very much true in Sharif university of technology where classroom activities are often geared towards the needs of learners. For example, the author of this paper uses different materials for different types of general English classes that he is teaching. As a case in point, electrical engineering students may favor topics such as hybrid cars whereas the same topic is certainly out of place for chemistry students.

## **A research study**

There are many research studies pertaining to needs analysis. But one study is singled out for description. The study is that of Long (2005). The study deals with four flight attendants and four applied linguists. The former captures insider view and the latter has to with outsider perspective. The results of the study reveal that insiders have an advantage over outsiders in terms of certain structures used in the domain. This accentuates the need for probing into the minds of domain specialists when conducting needs analysis studies. The insiders even surpassed the outsiders in terms of formulaic expression used pertaining to fastening belts, for example.

### **Research question:**

The research question addressed in this study is "What are the current needs of Sharif University students?"

## **Methodology**

### **1- Participants**

The participants included 225 Sharif University students belonged to these fields of study: mechanical engineering, industrial engineering, electrical engineering, chemistry, mathematics, civil engineering, physics, computer engineering, aerospace engineering, and materials engineering.

### **2-Instrumentation**

The instrument used in the current study was a questionnaire. There are three parts to this questionnaire. The first part has to do with seven items tapping students' self assessment of their abilities in the English language. The second part has to do with students' ideas of their needs with respect to their fields of study. It falls into two broad categories. The first one has to with language skills and the second part has to with academic skills. And finally the last part of the questionnaire has to with evaluation of student needs with respect to their future career needs. The first section has 7 items. The second section has 15 items. Finally the last section has 23 items. All the items have been constructed on a likert basis. The first 7 items range from the scale of "very weak" to "very good". The 15 items for the second part range from

"very little" to "very much". The same holds true for the third part items which are, like it was mentioned, 23 in number. In order to insure understandability on the part of the participants the Persian version of the questionnaire was administered (Dorneyei, 2007 may be consulted for more information on administration issues in questionnaires).

### 3-Data collection

The data were collected while students were taking their final exams. The timing was deemed appropriate on the grounds that there was the maximum number of students and odds were slim for any questionnaires not to be returned.

### 4- Data analysis

Two types of analyses were employed. One was descriptive statistics. Standard deviations and means were used. The other type of analysis was a confirmatory factor analysis which was conducted with a three factor solution (see Preacher and MacCallum, 2003). The rotation strategy used was varimax. And the suppression value was .30. In other words, the loadings below .30 were not accepted. Furthermore, it is worth mentioning that the data reduction method was Principal Components Analysis (see Kline, 1994 for more information on factor analysis).

## Results

### Descriptive statistics:

Before proceeding to more complicated analyses, it is essential to deal with some descriptive statistics. Tables 1 and 2 show the means of males and females.

Table 1: Descriptive statistics for males

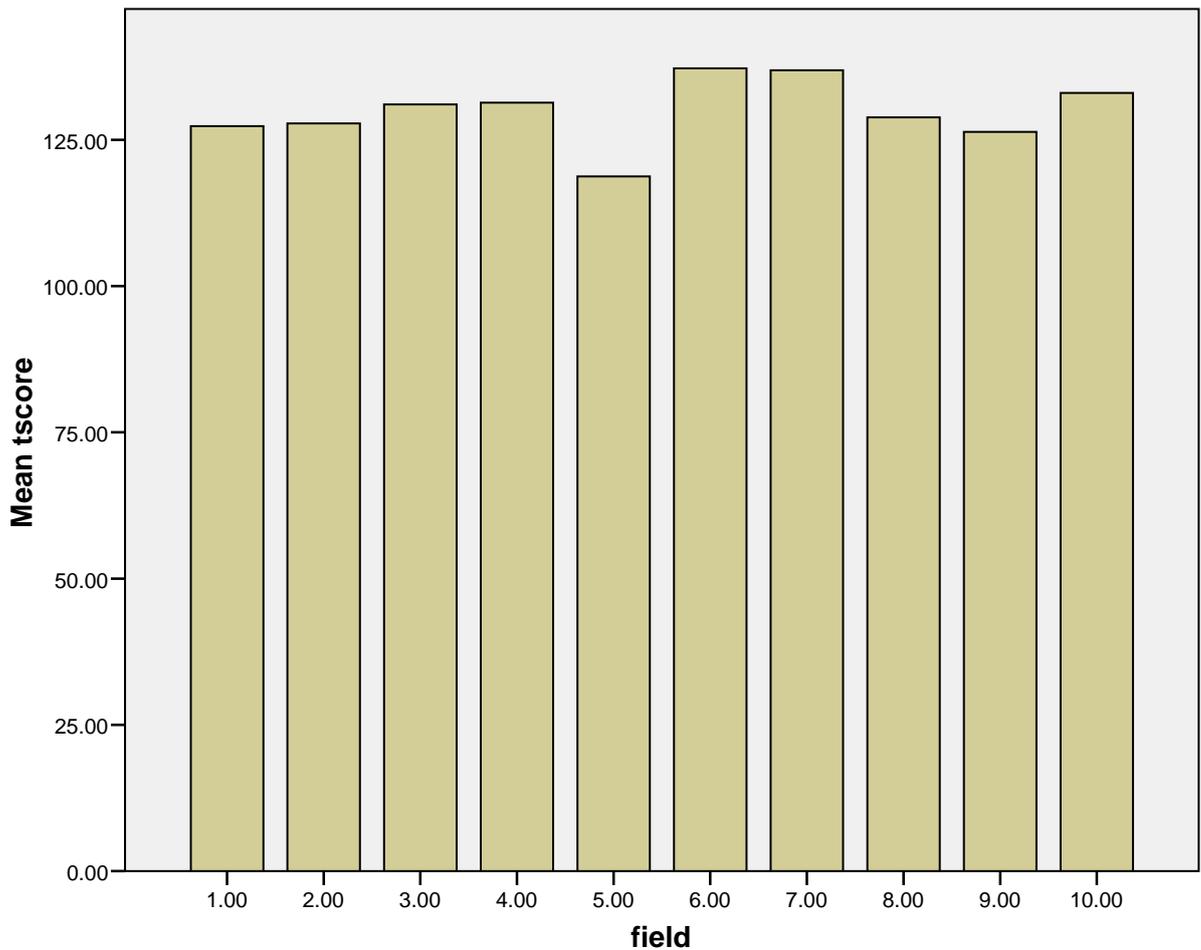
	N	Minimum	Maximum	Mean	Std. Deviation
Tscore	169	81.00	282.00	130.37	23.33
Valid N(listwise)	169				

Table 2: Descriptive statistics for females

	N	Minimum	Maximum	Mean	Std. Deviation
Tscore	55	85	162	128.72	15.08
Valid N(listwise)	55				

As it can be seen, the means of the two groups do not differ in magnitude. But the standard deviation for males are higher than that of females. The independent t-test value was not significant ( $t=.49$ ,  $df=222$ ,  $sig=.624$ ).

Table 3: The means of 10 fields of study on the questionnaire



1=Industrial engineering

2=Mechanical engineering

3=Electrical engineering

4=Chemistry

5=Mathematics

6=Materials engineering

7=Civil engineering

8=Physics

9=Computer engineering

10=Aero Space engineering

An eyeballing of the differences of the means of the students shows that students more or less are homogenous in terms of degree of their needs. The only group of students with the lowest mean is mathematics students. Furthermore, Table 4 shows that the mean differences are not significant among different fields of studies.

Table 4: ANOVA for mean differences among different fields

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	3383.064	9	375.896	.797	.619
Within Groups	100465.9	213	471.671		
Total	103849.0	222			

### **Evidence for the construct validity of the instrument**

Like it was explained before, a three-factor solution was adopted. As it can be observed in Table 5, most of the loadings are high. There are as high loadings as .80. But, there are also low loadings as well. Generally speaking, the loadings are high. This sheds light on the construct validity of the instrument. In other words, the three distinct parts in the questionnaire can be identified. There are however, a few incongruent items in the sense that they loaded on the wrong items. One such item is q15. It was expected to be loaded on another factor not factor three which is clearly a factor about future needs of the students. Other cases of incongruency include q11-14 which did not load on any of the categories or factors. It was perhaps due to suppression level. Had it been lower, the items would have certainly loaded on one of the mentioned factors as well.

Table 5: CFA on all items <sup>a</sup>

	Component		
	1	2	3
p1		.780	
p2		.689	
pp3		.760	
p4		.786	
p5		.782	
p6		.805	
p7		.548	
q1			.575
q2			.815
q3		.384	.615
q4			.748
q5			.322
q6			.461
q7			.459
q8			.653
q9			.564
q10			.450
q11			
q12			
q13			
q14			
q15	.453		
j1	.647		
j2	.712		
j3	.708		
j4	.746		
j5	.689		
j6	.699		
j7	.735		
j8	.714		
j9	.733		
j10	.759		
j11	.722		
j12	.762		
j13	.719		
j14	.757		
j15	.761		
j16	.788		
j17	.759		
j18	.778		
j19	.792		
j20	.802		
j21	.786		
j22	.747		
j23	.712		

Extraction Method: Principal Component Analysis.  
 Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 4 iterations.

**Item by item analysis:****Part One:**

If you recall, part one had to do with self assessments of students ranging from "very weak" to "very good". The first seven items coded as p1 to p7 embody the first factor or component. Table 6 shows the distribution of items p1 through p7.

Table 6: Distribution of responses in the first section

Item	How they evaluated themselves			
	very weak	Weak	good	very good
1	17	82	126	0
2	11	92	111	11
3	30	60	117	18
4	29	71	99	26
5	41	74	92	18
6	17	56	129	23
7	53	76	82	14

Item 1 is a vocabulary item. No student assessed himself as very good at it. The majority of students assessed themselves as good or average students when it came to vocabulary. Item 2 is a grammar item. The same number of students rated themselves as very weak and very good. But again the majority of them rated themselves as average. Item 3 is a pronunciation item. The number of students expressing themselves as "very good" has increased in comparison with the previous item. Items 4, 5, 6, 7, refer to listening comprehension, speaking, reading comprehension, and writing, respectively. The most frequent "very weak" goes to speaking and writing skills.

## Part two

As it was mentioned before this part has 15 items. The first 8 items are related to language skills and the next 7 items have to do with academic skills. Let's go through them:

Table 7: Distribution of responses in the second section

Item	skill or sub-skill	How much they thought the skills were important			
		very little	little	much	very much
1	general listening comprehension	7	29	141	48
2	technical listening comprehension	7	14	93	111
3	general speaking	7	24	144	50
4	technical speaking	7	35	116	67
5	general reading comprehension	1	24	137	63
6	technical reading compression	6	1	97	121
7	general writing	17	47	114	47
8	technical writing	8	36	108	73
9	surfing in the net	7	45	95	78
10	understanding tables and figures	1	58	121	45
11	note taking	2	57	118	48
12	note taking in lectures	9	78	103	35
13	summarizing	9	81	96	39
14	translation	11	78	103	33
15	writing research papers	13	80	84	45

A cursory look shows that the least important skill is translation for Sharif university students. And by the same token the most important skill for these students is the technical reading comprehension.

### Part three

This part contains 23 items related to future jobs and academic careers. The first 8 items are related to language skills and the second 15 items have to with specialized skills.

If we use "much" and "very much" as the criterion for the highly important skills or sub-skills, one can say that the skill that is the most important in the eyes of the students was "technical writing" with 176 cases. The next is "general speaking" with 168 cases. Still the next on the agenda is "technical listening comprehension".

**Table 8: Distribution of responses in the third section**

item	skill or sub-skill	How much they thought the skills were needed important			
		very little	little	much	very much
1	general listening comprehension	2	71	88	61
2	technical listening comprehension	4	55	104	59
3	general speaking	2	52	118	50
4	technical speaking	10	56	103	53
5	general reading comprehension	14	58	99	51
6	technical reading compression	12	51	91	68
7	general writing	12	59	89	62
8	technical writing	7	39	97	79

**Table continues**

**Table 8 continued**

item	skill or sub-skill	How much they thought the skills were important			
		very little	little	Much	very much
9	searching in the net	11	47	94	70
10	understanding figures and tables	7	69	83	63
11	note taking from the texts	12	90	79	41
12	note taking during lectures	17	94	67	44
13	summarizing	10	66	94	52
14	translation	12	73	95	42
15	writing research papers	7	57	106	52
16	letter writing and correspondence	11	71	101	39
17	preparing a report	10	70	101	41
18	preparing a CV	6	70	94	52
19	understanding films and tapes	7	68	98	49
20	writing research proposals	8	67	104	43
21	preparing catalog, bulletin, etc	11	87	80	44
22	marketing	25	83	72	42
23	presetting articles in conferences	15	60	88	59

Like it was mentioned, this part deals with future jobs and academic careers of students. An eyeballing of the table shows that note taking is the least perceived important skill for students. The most perceived skills are writing searching on the net and writing research papers.

### **Discussions and Conclusions:**

The study was conducted with the purpose of delving deeper into the needs of Sharif University students. It was important to see what the needs of these students are who happen to be select students in the whole country. There was a need for a well-developed and academically standard data elicitation device. The device used was a questionnaire developed by Farhady and his colleagues (permission was obtained to use the questionnaire). The questionnaire was also validated by the present researcher to gain insights into the construct validity of it. For this purpose, exploratory factor analysis was employed. The rotation strategy was varimax rotation with three factor solutions. A majority of items did load on the postulated factors which speak to the construct validity of the test or data elicitation instrument.

Having established the construct validity of the instrument under study, the researcher embarked on the delineation of the needs of the students. The students demanded the incorporation of more speaking tasks into the curriculum. This is exactly what our GE is lacking. It remains at the discretion of the teacher of the classroom to engage students in speaking tasks. The book itself does not offer any tasks for the aforementioned activity. This is both a blessing and a curse for most any teacher. On the brighter side, this gives the teachers a freedom of choice. The downside is that most teachers like a clear pathway for the classroom events. Different teachers will perform differently.

Predictably, translation did not fare well with most students. For their future jobs, they do need this skill. The reason is that they have been exposed to a lot of texts in English; the students do not need to be experts in translation. Hopefully, the skill is not capitalized on in this university. As a matter of fact, it is a cardinal sin to use Persian words in classes let alone translate them into English.

Another skill that is often lost of and referred to in students' evaluations is technical writing. The skill is of utmost importance for Sharif university students. Almost no attention whatsoever is paid to the skill in the curriculum. The writing tasks are all general. It is interesting that that these students have a long way to go before they find themselves in the job market, but they see the relevance of the task for their future careers.

One interesting observation was made. Note taking is often frowned upon in this university whereas in other universities it is a common if not the only strategy.

This goes to show that the strategy should not be adopted by the teachers as this is not to the liking of the students.

### **De(limitations) of the study**

The results of the current study might be treated with circumspection with regard to the following de(limitations):

1-First and foremost, the author used one type of gleaning information from the learners. Other types of data gathering techniques could have complemented the current results or would have revealed different results. As a matter of fact, there is a lot of value in triangulation or using multiple sources of data (see Anderson, Bachman, Perkins, and Cohen, 1991).

2-The instrument used as a data elicitation procedure was the one developed by Hossein Farhady and used with his authorization. Other instruments could have revealed different results or verified the existing ones.

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