QUALITY OF UNDERGRADUATE EDUCATION IN THE COLLEGE OF ENGINEERING

AT THE UNIVERSITY OF WISCONSIN-MADISON

by

Scott J. Conrad
University of Wisconsin

ABSTRACT

This paper summarizes a project undertaken by three undergraduate students at the University of Wisconsin-Madison to assess the quality of engineering education. The project involved developing a survey instrument to measure "quality" and administration of the survey to undergraduates, recent graduates and faculty. Results and highlights of recommendations generated by the survey are also presented.

INTRODUCTION

Budget cuts and rising enrollments in Colleges of Engineering across the nation are becoming facts of life. The question is what effects are these two recurring problems having on the quality of engineering education?

Within the past 1-2 years, there has been increasing concern over rapidly rising enrollments in the College of Engineering at the University of Wisconsin-Madison. Projections made by the engineering administration showed the expected enrollments to be far above the number of students the College could effectively teach with the faculty and facilities available. During the period of increasing enrollments (1974-present) the College of Engineering experienced an enrollment increase of more than 100% with no significant budget increase. Furthermore, in July of 1980 the College budget was cut approximately 4% and an additional 1.4% cut was assessed to the College in February 1981. As a result of this no increase budget during a period of increasing enrollments and the budget decreases experienced by the College, it has been necessary for almost all departments in the College to make significant changes in their modes of instruction of undergraduates. Some of these changes are evidenced in the use of undergraduates in certain teaching and advising roles, considerable increases in class size and a reduction in the number of courses being offered. As enrollments continue to increase, additional cost-cutting measures will be required.

Undergraduates seem to be the group most affected by the circumstances currently taking place in the College of Engineering. In the fall of 1980, it seemed necessary to assess the effect of policy changes in engineering. Specifically, the authors, all undergraduates, decided to conduct a controlled study to determine how the quality of education was changing, if at all, in the College of Engineering. This study was designed to measure changes in education primarily or indirectly due to rapidly increasing enrollments. Since it was not actually known, for instance, how increases in class size have affected undergraduate education, the undergraduates themselves were asked for their opinions in the form of a survey. Additional documentation was obtained by surveys of faculty members and recent graduates. Cross analysis of the results from these three groups gave the best overall assessment of whether the enrollment and budget problems are having a significant impact on the quality of undergraduate education.

Since there will undoubtedly be more changes in the way engineering undergraduates are taught at Wisconsin, it is important to evaluate the current program. This will enable policies that have been successful in reducing spending without reducing education quality to be further expanded. Other policies that have reduced spending while compromising education should be reviewed or rejected. Through this type of analysis, education programs can become more streamlined and cost efficient while maintaining the same degree of excellence.

DEFINING QUALITY

The idea for this project began with a conversation between one of the authors, Scott Conrad, and an Associate Dean of the College of Engineering, Dean Robert Ratner. The focus of the conversation was that the author felt a recent 4.4% cut in the College's budget and continued rises in enrollment were eroding the quality of his education. The Dean asked the author to define a quality education. A list of various criteria such as class size, advising, faculty competence, and up-to-dateness of lab equipment quickly came to mind. However, the list was incomplete and quite myopic. The Dean pointed out two problems with the list:

1. It was only one person's perspective, i.e., another student would probably generate a different list.
2. It was value laden--is there any proof a student learns more in a class with 30 students than 40?

The unanswered question remained: What is a quality engineering education?

Reviewing the literature it was found that most studies done in the past to measure the quality of engineering education simply asked engineering college administrators to define several objectives of education and then assess which colleges they felt best met those objectives (Cartter 1966, Roose-Anderson 1971, and The Gourman Report 1980). In general, these studies emphasized the amount of research done and the prestige of the faculties. While these criteria may be important, there appears to be little correlation between these factors and the quality of undergraduate engineering education.

It was felt that the best definition of quality for our purpose could be derived by asking a sample of students and faculty what criteria they felt composed a quality undergraduate engineering education. The underlying idea was that if a large sample of various criteria were collected from people with various perspectives a list of most important criteria could be derived. This list could then be used to develop surveys to measure the quality of undergraduate engineering education at Wisconsin.

Definitions of a quality engineering education were initially solicited via a memo to the faculty, and articles published in the <u>Wisconsin Engineer</u> and the engineering student council newsletter, the <u>EX-Change</u>.

Approximately 50 responses were received. A better response was desired so arrangements were made to have the technical writing classes write essays outlining the criteria each student felt composed a quality engineering education. Two hundred essays were obtained. These essays, as well as the fifty initial responses, were analyzed by noting the frequency of the rather wide range of criteria mentioned. The results are tabulated in Table 1.

DEVELOPING THE SURVEY

Once a list of "important" criteria had been generated, development of a survey instrument to measure those criteria began. The instrument was used on three groups: faculty, recent graduates, and current junior and senior undergraduates. The first group, the faculty, was surveyed because they are responsible for teaching undergraduates and should be most aware of the recent problems caused by rising enrollments and budget cuts. The second group, graduates of the College within the last three years, helped provide some level or base from which any change in the quality of education could be measured. The third group, upperclassmen undergraduates, were surveyed because these are the people who have been most affected by the recent changes in the College. The three groups of respondents allowed assessment of the current state of the educational program and some evaluation of how the quality of the program is changing.

The actual survey questions were developed from the previously generated list of criteria (Table 1). Dr. Harry Sharp, Director of the Wisconsin Survey Research Laboratory (WSRL), provided consulting on the design of the survey, selection of the sample and data analysis. All questions were constructed with the following null hypothesis in mind to minimize bias:

> "Despite budget cuts and rising enrollments, the quality of undergraduate education in the College of Engineering has not significantly changed."

The surveys were designed to take between ten and fifteen minutes to administer. Nearly identical questions were asked of the three respondent groups. No open-ended questions were asked, and all responses were designed to be numerically coded for data analysis using the computer. Several biographical questions were asked of each group. For example, undergraduates were asked their major, GPA, and expected date of graduation. These questions allowed subgrouping of the data, i.e., the answers of electrical engineers could be compared to those of mechanical engineers.

The faculty were given a written survey via the campus mail system, since this was felt to be the most cost-effective method of reaching the faculty. A 45% response rate was obtained (105 respondents). A random sample of 10% of the graduates within the last three years was generated by Jane Niece, WSRL, with the help of the UW Bureau of Graduate Records. A mail survey was sent out with a 60% response rate (210 respondents). Finally, a random sample of 10% of the upperclassmen engineering students was generated through the Bursars Office. These students were given phone interviews to insure a high response rate (90%, or 205 respondents). The phone interviews were conducted with the aid of trained volunteers from Tau Beta Pi and AIIE.

DATA ANALYSIS

There were two objectives to the data analysis. The first objective was to establish a measure of how students, current and past, and faculty feel the University is doing with respect to each criterion; i.e., calculate means and standard deviations for all questions. These "standards" can be used for comparisons with a later survey or as indicators of what the current state of each criterion is perceived to be. The second objective of the data analysis was to detect trends in the various criteria; i.e., compare the response histograms of the recent graduates to those of current undergraduates. In this way, a feel is developed for what criteria are changing the most and in what direction.

The results of the surveys were coded into strings of single digit numbers in three computer files as follows:

FACULTY

Columns = Questions (Criteria being measured)

Rows = Respondents

	1	2	3	4	....
1102					
1103					
. . .					

Surveys given to the three groups varied slightly, but adjustments were made for this so that a particular column in each of the three data files would correspond to the same criterion for each group. This aided data analysis between the groups.

Data analysis was carried out by column-wise manipulations of the number strings using MINITAB, a program developed at Penn State. Histograms, means and standard deviations were calculated for all input data. An abbreviated summary of the results for each question is found in Table 2. The original data files have been saved on magnetic tape for future reference.

RESULTS

Referring to Table 2 one will notice that most of the criteria were rated as good or even slightly above average. However, examination of the histograms and comments made by faculty and alumni on the written surveys indicated the following major results.

Faculty Accessibility (Student Ability to see Professors)

The surveys indicated that the faculty members do make themselves available to students in spite of larger teaching loads. It also appears that the increased time they spend counseling undergraduates yields less time to conduct research, teach graduate students and attend conferences. One professor wrote that the increased teaching loads are only part of a bigger problem which he said includes more administrative duties, lower salaries in real dollars and decaying faculty morale. If heavy teaching loads continue, they may cause long term problems for the College.

Class Size

Students and faculty both prefer smaller classes with a professor as a lecturer. Be that as it may, the trend is toward ever larger lectures supplemented by discussion sections.

Engineering Labs

Engineering labs are becoming both overcrowded and outdated. The overcrowding is a result of rising enrollments. The out-of-dateness is due to lack of replacement of old equipment and rapidly changing technology.

Theory vs. "Real World" Education

The current trend is to teach more theory and fewer "real world" applications such as case studies. It appears that theoretical teaching is easier to prepare and teach to undergraduates. Undergraduates feel it is "real world" applications, such as case studies, which help them understand how to use the theories they are learning.

Communication Skills

Faculty and students feel communication skills are both important and somewhat lacking in the College of Engineering. Several faculty emphasized that although everyone is aware of the need, there is no room in the engineering curriculum for additional communications courses.

Homework

The assigning and grading of homework were perceived as the two most important criteria in the survey. The trend in the College has been toward both less assigning and grading of homework. This trend is perceived by all parties as a deterioration in the quality of education.

Engineering Organizations

The results of the survey indicate that engineering organizations like IEEE, AIIE, Tau Beta Pi, etc. are of little importance. This could indicate a failure of engineering organizations to make any significant contribution to engineering education, or a failure of these organizations to reach the students and faculty.

CONCLUSIONS AND RECOMMENDATIONS

The results of the survey are not surprising. They are a documentation of what most people felt was happening. What follows is a highlight of some of the conclusions and recommendations generated by the survey.

Faculty

Numerous faculty members wrote comments about the fact that declining budgets and rising enrollments would not severely affect their teaching directly, but would decrease faculty morale and activities in other areas, such as research. They emphasized that professors are really paid to do research and with increased teaching loads they do less research, which yields less money for the college and compounds problems. The final result is a possible decline in both the quality of the College and engineering education.

Class Size

Class sizes can be controlled by restricting enrollment, but there is no quantitative evidence to prove a student learns less in a large class. Perhaps the question is one of professors learning how to teach a large class. Teaching methods used for 20 students may be inappropriate for 100 students. On the other hand, the technical nature of most engineering courses may be such that the optimal class size really is only 20 or 30.

Labs

Overcrowded, out-of-date labs are frustrating to both students and administrators. It is the labs which make an engineering education so expensive, yet it is these same labs which are deemed to be of critical importance by faculty and students to a high quality engineering education. Perhaps more corporate help could be sought in updating and maintaining labs.

Theory vs. "Real World" Education

The trend by professors to teach more theory and fewer practical applications within courses tends to make the courses easier for the professors to teach, but less interesting for students. Such a trend in teaching methods may also make it harder for the student to make the transition to the "real world" after graduation. Students need to learn the present state of their field and must be able to apply their knowledge to practical situations. Since a college education is a preparation for a career, it is important that references be made to future work whenever possible.

Communication Skills

Engineers appear to be under constant accusation of having poor communication skills, and perhaps many of these accusations are justified. The faculty claim there is no room to add communications courses to the engineering curriculum. However, they could place more emphasis on communication skills within the existing engineering courses.

Homework

Assigning and grading of homework was perceived as very important to the majority of survey respondents. Unfortunately the trend has been toward less homework, particularly grading of homework. Faculty members should take a close look at the effects of this trend on the quality of education. If at all possible, the assigning and grading of homework should be continued.

Engineering Organizations

Engineering organizations should look at the role they play in a student's college career. The surveys indicated that these organizations are perceived as unimportant. This is probably an indication of the limited participation in these organizations. Engineering organizations need to publicize their activities and their relationship to the education of students. If these organizations do not serve the majority of students, then they may need to restructure their activities.

SUMMARY

Project reports were distributed to the deans, department chairmen, interested professors and several recruiters. The objective of this distribution was dissemination of the information and recommendations generated by the project. Hopefully, the reports were read and will be taken into consideration with respect to future changes in the College.

Finally, this project was the first survey of the consumers and producers of engineering education ever conducted at Wisconsin. The product, engineering education, was being evaluated by both the producers (professors and administrators), and the consumers (students) to determine the state of the product and how it may be improved. This survey will have been useful only if it aids in the improvement of the College. To date, several department chairmen have indicated that the results of the project have been helpful to them in their efforts to deal with budget cuts and rising enrollments. They felt the input generated from the students was particularly enlightening. However, to continue to improve the quality of the product, engineering education, future surveys of this nature should be conducted. These surveys, which could be done an a biannual basis, will be the judge of the success or failure of this project.

REFERENCES

1. K. D. Roose and C. J. Anderson, A Rating of Graduate Programs, American Council on Education (1971).

2. A. M. Cartter, An Assessment of Quality in Graduate Education, American Council on Education (1966).

3. J. Gourman, The Gourman Report, National Education Standards (1980).

4. New Engineer, Staff Report, December (1976).

5. D. D. Glower, Engineering Education, May (1980).

6. C. F. Elton and S. A. Rodgers, Science, 174:565-568 (1971).

Table 1. Criteria suggested by students and faculty as important determinants in undergraduate education.

Instruction	Number of Times Suggested
Faculty teaching ability (e.g., communication)	31
Faculty competence (technical)	31
Faculty accessibility	19
Class size	12
Faculty motivation	9
Professional, academic advising	7
Student "feedback" to faculty	6
Textbooks	3
Student/Faculty ratio	2
Instruction done by professors, rather than T.A.'s	2
Facilities	
"Up to dateness" of lab equipment	18
Accessibility of libraries, labs and classrooms	17
Curriculum	
Relevance of course	30
Relevance of labs and projects	24
Opportunity to participate in co-op program	12
Option to specialize or broaden education	11
Ability to get needed courses	10
Leading technology courses	5
Program flexibility	4
Continuity of classes	1
Program organization	1
Post-Graduation	
Graduate technical ability	24
Graduate communication ability	14
Employer satisfaction with graduate	14
Ability in one's field	11
Graduate employability	9
Graduate opinion	4
Performance on Professional Engineering Exam	4
Miscellaneous	
Grade competition	7
Exams, homework assignment/grading	6
Grade point average	6
Reputation of school	3
Freedom of thought	3
Entrance requirements	3
Engineering organizations	3
Amount of research	3
Educational funding	2
Cost	1

Table 2. Summary of Results--Quality of Education Survey

Question	Survey Question #	n	$\bar{x}$	s
Faculty				
1. Availability of faculty 1. Always 2. Usually 3. Seldom 4. Never	U(1)	187	2.0	0.5
	G(1)	173	2.1	0.4
	F(1)	104	2.0	0.5
2. Time for advising compared to 3 years ago 1. More 2. Same 3. Less	F(2)	93	2.7	0.4
3. Importance of advising on a scale of 1 to 5 (one is least important, 5 is most)	U(2a)	194	3.4	0.9
	G(2a)	92	2.9	1.2
4. Importance of academic advising on a scale of 1 to 5	U(2b)	194	3.7	0.9
	G(2b)	92	3.1	1.2
	F(3b)	44	3.5	1.2
5. Importance of discussion with professors about lecture material on a scale of 1 to 5	U(2c)	193	3.6	0.9
	G(2c)	92	3.7	1.1
	F(3c)	44	4.0	1.3
6. Importance of discussion with TA's about lecture material on a scale of 1 to 5	U(2d)	178	3.6	1.1
	G(2d)	91	3.6	1.1
	F(3d)	44	3.4	1.3
7. Importance of discussion sections on a scale of 1 to 5	U(2e)	176	3.4	1.2
	G(2e)	92	3.2	1.2
	F(3e)	44	3.6	1.4
8. In the past, how often have you had professors who were teaching outside of their area of expertise? 1. 6 or more courses 2. 3-5 courses 3. 1-2 courses 4. Never	U(3)	197	3.3	0.6
	G(3)	174	3.1	0.7
	F(4)	105	3.5	0.7
TA's				
9. Did you ever have a TA who could not speak English effectively? 1. Yes 2. No	U(4)	198	1.5	0.5
	G(4)	174	1.3	0.4
	F(5)	107	1.3	0.4

Table 2 continued.

Table 2 (continued)

Question	Survey Question #	n	$\bar{x}$	s
a) If so, how often?	U(4a)	94	3.3	0.8
1. Usually 2. Often 3. Occasionally 4. Seldom	G(4a)	128	3.2	0.7
	F(5a)	72	2.9	0.7
b) How did this affect your ability (student's ability) to learn	U(4b)	95	2.0	0.8
the material?	G(4b)	128	2.1	0.9
1. Significantly 2. Somewhat 3. Little 4. Not at all	F(5b)	72	1.6	0.7
10. How often did you have a TA who did not know the course material?	U(5)	192	4.1	0.8
1. Usually 2. Often 3. Occasionally 4. Seldom 5. Never	G(5)	174	3.8	0.7
	F(6)	100	3.6	0.8
11. TA's functioning as principal instructors in certain undergrad	U(6a)	193	2.3	0.8
engineering courses are effective substitutes?	G(6a)	175	2.4	0.8
1. Strongly agree 2. Agree 3. Disagree 4. Strongly Disagree	F(7a)	105	2.7	0.9
12. Undergrads used as homework graders, consultants and discussion leaders	U(6b)	184	2.5	0.7
are effective substitutes for grad students?	G(6b)	172	2.6	0.7
1. Strongly agree 2. Agree 3. Disagree 4. Strongly Disagree	F(7b)	103	2.6	0.8
13. Is the College of Engineering moving toward the use of:	F(8)	70	1.6	0.7
1. More TA's 2. Less TA's 3. No change				
14. Do you feel the faculty is motivated to teach undergraduates?	U(7)	195	2.0	1.2
1. Usually 2. Often 3. Occasionally 4. Seldom	G(7)	175	2.0	0.8
Class Size	F(9)	102	2.0	0.9
15. Ideal class size of basic engineering courses?	U(8)	197	2.3	0.6
1. <10 2. 11-30 3. 31-60 4. 61-100 5. >100	G(8)	174	2.4	0.7
	F(10)	104	2.3	0.5
16. Ideal class size for higher level professional elective	U(9)	187	1.7	0.5
engineering courses?	G(9)	174	1.7	0.5
1. <10 2. 11-30 3. 31-60 4. 61-100 5. >100	F(12)	103	1.8	0.4
17. Actual class size for basic engineering courses?	U(11)	198	3.1	0.8
1. <10 2. 11-30 3. 31-60 4. 61-100 5. >100	G(11)	173	3.1	0.8
	F(11)	98	3.2	0.9

Table 2 continued.

Table 2 (continued)

Question	Survey Question #	n	$\bar{x}$	s
18. Actual class size for higher level professional electives?	U(12)	140	2.3	0.6
1. <10 2. 11-30 3. 31-60 4. 61-100 5. >100	G(12)	174	2.1	0.5
	F(13)	95	2.2	0.6
19. Are the junior and senior level engineering courses:	U(10)	186	1.6	0.6
1. Larger than expected 2. About as expected 3. Smaller than expected	G(10)	174	1.8	0.5
	F(15)	92	1.4	0.5
20. Are students inhibited to ask questions in large lectures?	U(13)	193	2.4	0.8
1. Always 2. Usually 3. Seldom 4. Never	G(13)	171	2.4	0.9
	F(14)	93	2.3	0.7
21. Do you prefer a large lecture with discussion sections or a small lecture without discussion sections?	U(14)	183	1.7	0.5
1. large/with 2. small/without	G(14)	153	1.7	0.5
	F(16)	96	1.8	0.4
<u>Facilities</u>				
22. Do you find needed reference materials in the Engineering Library? 1. Always 2. Usually 3. Seldom 4. Never	U(15)	197	2.4	0.9
23. How "adequate" are the hours of the Engineering Library? 1. Excellent 2. Adequate 3. Inadequate 4. Poor	U(16)	183	2.6	0.7
24. Is lab equipment well maintained?	U(17)	188	1.9	0.5
1. Always 2. Usually 3. Seldom 4. Never	G(15)	175	1.9	0.5
	F(17)	82	2.3	0.7
25. How often is there not enough lab equipment for the number of students?	U(18)	181	2.7	0.9
1. Usually 2. Frequently 3. Seldom 4. Never	G(16)	175	2.8	0.7
	F(18)	68	2.6	1.0
26. Is lab equipment sufficiently up-to-date and modern?	U(19)	174	2.2	0.6
1. Always 2. Usually 3. Seldom 4. Never	G(17)	171	2.3	0.6
	F(19)	81	2.6	0.6

Table 2 continued.

Table 2 (continued)

Question	Survey Question #	n	$\bar{x}$	s
27. Importance of class size on a scale of 1 to 5, one being lowest and 5 highest	U(20a)	198	3.6	0.8
	G(18a)	103	3.4	1.3
	F(20a)	65	3.7	1.2
28. Importance of libraries on a scale of 1 to 5	U(20b)	198	3.5	1.0
	G(18b)	103	2.8	1.4
	F(20b)	65	3.2	1.1
29. Importance of labs on a scale of 1 to 5	U(20c)	196	3.7	1.1
	G(18b)	103	3.5	1.2
	F(20b)	65	4.1	0.9
<u>Curriculum</u>				
30. In selection of courses within your major to what degree are you able to specialize? 1. Very much 2. Somewhat 3. Very little	U(21)	193	2.2	1.0
	G(19)	171	2.1	0.6
31. To what extent are real world applications being integrated into course material? 1. Always 2. Usually 3. Frequently 4. Seldom 5. Never	U(22)	191	2.7	0.8
	G(20)	173	3.1	0.8
	F(21)	94	2.6	0.7
32. How would you describe your freedom to take courses outside of Engineering? 1. Very Restrictive 2. Non-restrictive 3. Somewhat restrictive 4. Very non-restrictive	U(23)	197	2.9	0.9
	G(21)	172	2.8	0.8
33. Importance of specializing within your major on a scale of 1 to 5, one being least important and 5 most	U(24a)	198	3.2	1.0
	G(22a)	107	3.3	1.3
	F(25a)	61	2.8	1.3
34. Importance of taking a broad set of courses within your major on a scale of 1 to 5	U(24b)	198	3.7	0.8
	G(22b)	107	4.0	1.0
	F(25b)	61	4.1	1.1

Table 2 continued.

Table 2 (continued)

Question	Survey Question #	n	$\bar{x}$	s
35. Importance of real world applications presented in courses on a scale of 1 to 5	U(24c)	198	4.3	0.8
	G(22c)	107	4.0	1.2
	F(25c)	61	3.8	1.0
36. Importance of taking a broad set of courses outside of one's engineering major on a scale of 1 to 5	U(24d)	197	3.2	1.0
	G(22d)	107	3.0	1.2
	F(25d)	61	2.9	1.1
37. How well is the undergrad education preparing students' communication skills? 1. Very well 2. Adequately 3. Inadequately 4. Poorly	U(25)	193	2.5	0.7
	G(23)	176	2.5	0.8
	F(24)	94	2.8	0.4
38. How well is the undergrad education preparing students' technical skills? 1. Very well 2. Adequately 3. Inadequately 4. Poorly	U(27)	190	1.8	0.7
	G(25)	174	1.8	0.7
39. Do this year's graduates have more, the same, or less "practical" engineering knowledge than graduates of three years ago? 1. More 2. No change 3. Less	F(22)	74	2.3	0.7
40. Do this year's grads have more or less theoretical knowledge than their peers of 3 years ago? 1. More 2. No change 3. Less	F(23)	78	1.9	0.7
<u>Miscellaneous</u>				
41. How often is homework graded? 1. Always 2. Usually 3. Seldom 4. Never	U(26)	197	1.8	0.6
	G(29)	175	1.9	0.6
	F(26)	96	1.7	1.0
42. Have you noticed a change in the amount of graded homework? 1. Increase 2. Little or no change 3. Decrease	F(27)	64	2.7	0.5
43. Importance of assigned homework on a scale of 1 to 5, one being least important and 5 most important	U(28a)	198	4.0	0.8
	G(26a)	115	4.1	1.0
	F(28a)	61	4.3	1.0

Table 2 continued.

Table 2 (continued)

Question	Survey Question #	n	$\bar{x}$	s
44. Importance of grading assigned homework on a scale of 1 to 5	U(28b)	198	3.7	1.0
	G(26b)	115	3.6	1.3
	F(28b)	61	3.8	1.2
45. Importance of special projects on a scale of 1 to 5	U(28c)	191	3.6	0.9
	G(26c)	115	3.6	1.1
	F(28c)	61	3.1	1.4
46. Importance of engineering organizations on a scale of 1 to 5	U(28d)	196	2.9	1.0
	G(26d)	115	2.1	1.2
	F(28d)	61	2.1	1.0
47. Importance of entrance requirements into the College of Engineering on a scale of 1 to 5	U(28e)	192	3.1	1.1
	G(26e)	115	1.9	1.1
	F(28e)	61	3.6	1.2