Vidyodaya J. of Sci, (2002) Vol. 11, pp 63-78

The impact of the change in the medium of instruction on the performance of undergraduates in university examinations

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Received on 09.08.03
Accepted on 12.22.03

Abstract

The objective of the present study is to determine the impact of the medium of instruction on the performance of undergraduate students in university examinations. The results of six Biological Science course units in Zoology and Microbiology and six Physical Science course units in Physics and Statistics & Computer Science of two groups of undergraduates who entered the Faculty of Science of the University of Kelaniya in years 2000 and 2001 were considered in the analysis. Those who have entered in 2000 followed all course units in Zoology, Physics and Statistics & Computer Science in Sinhala medium and Microbiology in English medium. Those who entered in 2001 followed all Microbiology course units and those in other subjects from 2nd semester onwards in English medium. Analysis of results using the Kolmogrov - Smirnov tests revealed that the medium of instruction has no significant effect on the performance of undergraduates in university examinations.

Key words: undergraduates, medium of instruction, grades, examination, performance, English.

1. Introduction

The need to link University education to employment is emphasized increasingly due to prevailing unemployment and underemployment among the university graduates and the criticisms made by the prospective employers regarding the quality of the graduates produced by Sri Lankan Universities (Gunawardene and Gunawardene, 1993). The quality is defined as the totality of features and characteristics of a product or service that bear on its ability to satisfy a given need (Connel, 1995).

One of the complains made by prospective employers, on the quality of graduates produced by the Sri Lankan Universities is that the product is lacking proper communication ability in English.

A recently conducted tracer study of science and technology graduates passed out from Sri Lankan Universities has identified lack of knowledge in English as one of the major obstacles faced by graduates in finding suitable employment (NSF. 2002). Raheem and Gunasekara (1994) showed that English is among one of the factors that affect the graduates in finding suitable employment.

In most Universities in Sri Lanka, students in the Faculties of Science follow their courses for the B.Sc. (General) degree either in Sinhala or Tamil medium. However, in all Universities, B.Sc. Special degree courses in Science are offered in the English medium as in other Science based faculties such as Engineering, Medicine, Architecture, Agriculture and Veterinary Science. Studies have shown that lack of proficiency in English has handicapped the performance of students who have been educated in their mother tongue, i.e., either Sinhala or Tamil, at the Faculties of Medicine and Engineering (Kottahachchi, 1992). Gunawardene (1993) has also identified the insufficient knowledge of English as one of the major factors that hinder the students' performance at University examinations when the medium of instruction is English.

At the University of Kelaniya, some of the subjects for the B.Sc. general degree programme are taught in English medium from the 1st semester. These include Microbiology and Industrial Management. However, up to 2000, the other subjects namely, Botany, Chemistry, Pure Mathematics, Applied Mathematics, Biochemistry, Physics, Electronics, Statistics & Computer Science and Zoology were taught in Sinhala medium for the B.Sc. General degree. At the end of the 2nd year, i.e., after following 4 semesters in Sinhala medium, those who perform well are selected to follow the B.Sc. Special degree programme. The courses for the B.Sc. special degree are conducted in English medium.

In 2000, the Faculty Board of the Faculty of Science of the University of Kelaniya, decided to conduct the courses for the B.Sc. General degree programme in the English medium. During the 1st semester, teaching would be done in the bilingual mode (Anon. 2003) and from the 2nd semester onwards, the medium of instruction was changed from Sinhala to English in all course units conducted by the Departments of Botany, Chemistry, Mathematics, Physics, Statistics & Computer Science and Zoology. For the

other two Departments, i.e., Departments of Microbiology and Industrial Management such a change was not required as they were conducting courses in the English medium from the 1st semester it self.

With the change of medium of instruction from Sinhala to English, an opportunity arose to carry out a scientific study to determine whether the change of medium of instruction has affected the performance of students at the examinations. Therefore, the present study was carried out to statistically compare the performance of students at the course unit examinations before and after changing the medium of instruction from Sinhala to English.

The specific objective of the study was to determine whether the distribution pattern of grades of the students who have followed a particular course unit in Sinhala medium is significantly different from that of those who have followed the same course unit in English medium

The hypothesis tested was that there is no statistically significant difference between the results of the course unit examinations and the medium of instruction.

2. Materials And Methods

The course units selected for the present study were of Physics, Zoology, Microbiology and Statistics & Computer Science. Of these, the former 2 subjects do not have any restrictions on admission. However, for the latter 2, the students are selected using the same criteria applied by the University Grants Commission to select students to the national Universities, i.e., 40% on merit, 55% on district basis and 5% from underprivileged districts (UGC. 2000). Further, 2 subjects i.e. Physics and Statistics & Computer Science are offered by Physical Science students while Zoology and Microbiology are offered by the Biological Science students.

During the period of study, the course units offered in any one of the semesters did not change with the year. The course units used for the study were either of 3 or 4 credits, where 1 credit is defined as equivalent to 15 hours of lectures. The evaluation of the student performance of the units of 3 credits was carried out by the end of semester examinations and that of the units of 4 credits was carried out by end of semester examination and assignments. The examination time for each course unit was 3 hours. Students had the option of answering in Sinhala or English medium. The titles of each of the course units used for the present study are given in Table 1.

Table 1: The course units which were used in the present study

Subject	Semester	Title of the course unit
Physics	1 (1st semester - 1st year)	General Physics*
	2 (2nd semester - 1st year)	Modem Physics *
	3 (1st semester - 2nd year)	Thermal Physics and Physical Optics *
Statistics & Computer Science	I (1st semester - 1st year)	Probability and Statistics **
	2 (2nd semester - 1st year)	Introduction to Programming and Programme Design **
	3 (1st semester - 2nd year)	Data Structures and Algorithms **
Microbiology	I (1st semester - 1st year)	Introductory Microbiology and Bacterial Taxonomy *
	2 (2 semester - 1st year)	Microbial Physiology and Biochemistry *
	3 (1st semester 2nd year)	Microbial Genetics, Virus and Diversity of Euearyotic Microorganisms *
Zoology	I (1st semester - 1st year)	Invertebrate Diversity *
	2 (2nd semester 1st year)	Vertebrate Diversity *
	3 (1st semester 2nd year)	Human Biology *

* 3 credit hour courses; ** 4 credit hour courses.

For the Statistical analysis, the distributions of grades of the students who entered the University in 2 successive years, i.e. in 2000 and 2001, at the examinations of each of the above course units were considered.

As any kind of substantial differences between two distributions either in terms of location, spread or more generally the shape will result in the corresponding differences between their cumulative distribution functions (Neave and Worthengton, 1992), the Kolmorogov-Smirnov tests (K-S tests) were used to compare the distributions of grades at the examinations of each of the above course units between the two batches of students.

Earlier studies have shown that there is no significant difference in the examination performance among the three groups of students, i. e. those who get selected on merit, on district basis and from underprivileged districts (Hewapathirana, 2003). Therefore, the best students of each of these categories get selected to the University each year. Further, the selection

criteria were also the same for the two batches of students considered. Hence, it was assumed that the level of intelligence is not significantly different in the 2 batches of students considered in the present analysis.

3. Results

The distribution of grades of the three course unit examinations in Physics for both batches of students is shown in Figure 1: When the 2000 batch is considered, in the lst semester examination, 44 % have failed (obtaining D or E grades i.e. < 40 % marks), and only 4 % have obtained grades of A (i.e. ≥70 marks). In the 2nd semester examination, 28% have failed and 10 % have obtained grades of A. During their 3rd semester, i.e., the 1st semester of the 2nd year, 35 % have failed while only 1% has obtained grades of A (Fig.l).

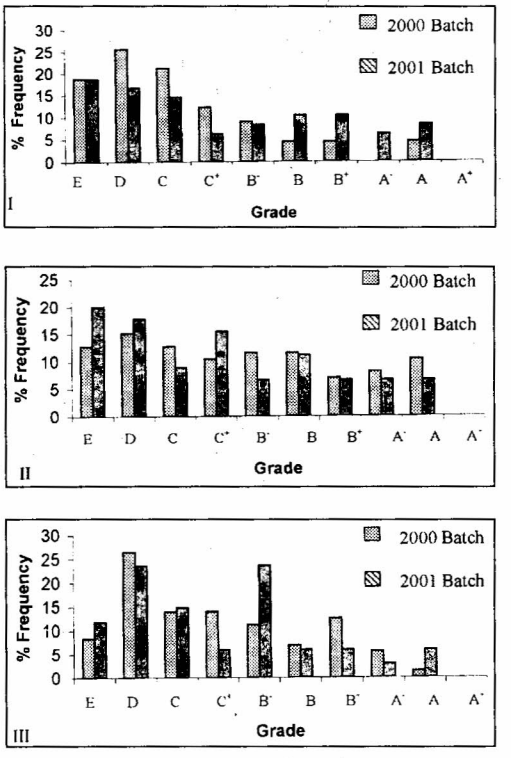

Figure 1- The distribution of grades of the first three course units followed by the undergraduates during their undergraduate career in Physics I-1st semester examination II - 2nd semester examination. III- 3rd semester (1st semester of the 2nd year) examination.

When the 2001 batch is considered, during the 1st semester, 35 % have failed and 8 % have obtained grades of A, while in the 2nd semester, following the course unit in English, 38 % have failed and 7 % have obtained grades of A (Fig. 1). When compared with the results of the 2000 batch who have followed this course unit in Sinhala medium, the % of failures in the 2nd semester examination has increased and the % of those who have obtained A grades has decreased. At the 3rd semester examination 34 % have failed and 6% have obtained A grades (Fig. 1). Therefore, during this semester, although they have followed the course unit in English medium, the % of those who have failed was more or less equal to those who have followed that course unit in Sinhala medium and the % of A grades have increased considerably.

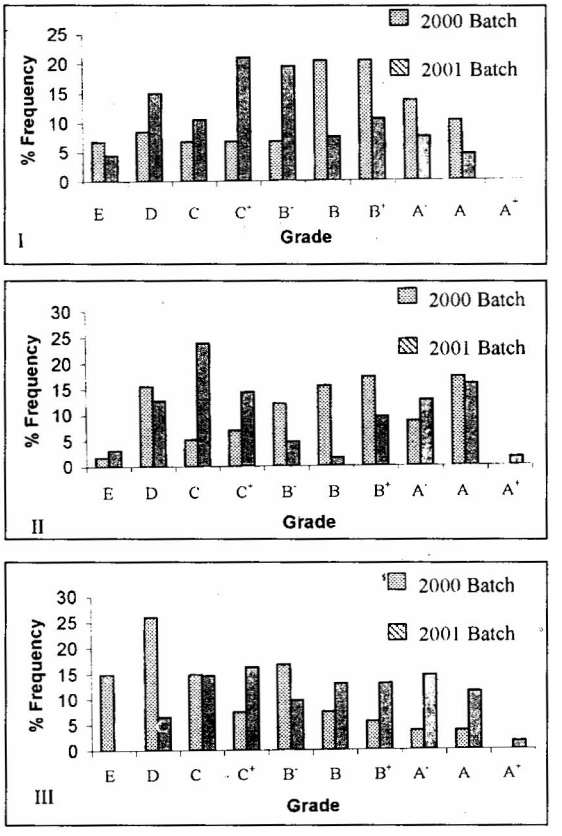

Figure 2- The distribution of grades of the first three course units followed by the undergraduates during their undergraduate career in Statistics & Computer Science I - 1st semester examination. II – 2nd semester examination. III - 3rd semester (1st semester of the 2nd year) examination.

The distribution of grades of the 2000 batch and 2001 batch in the three course units in Statistics & Computer Science, which is a limited enrollment subject in the Physical Science stream, is shown in Figure 2. At the 1st semester examinations, 15 % of the 2000 batch and 19 % of the 2001 batch have failed and 10 % of the 2000 batch and 4 % of the 2001 batch have obtained A grades (Fig.2). When the distribution of grades obtained for the examinations of the 2nd semester course unit is considered, 17 % of the 2000 batch and 16 % of the 2001 batch have failed and about 17% of both

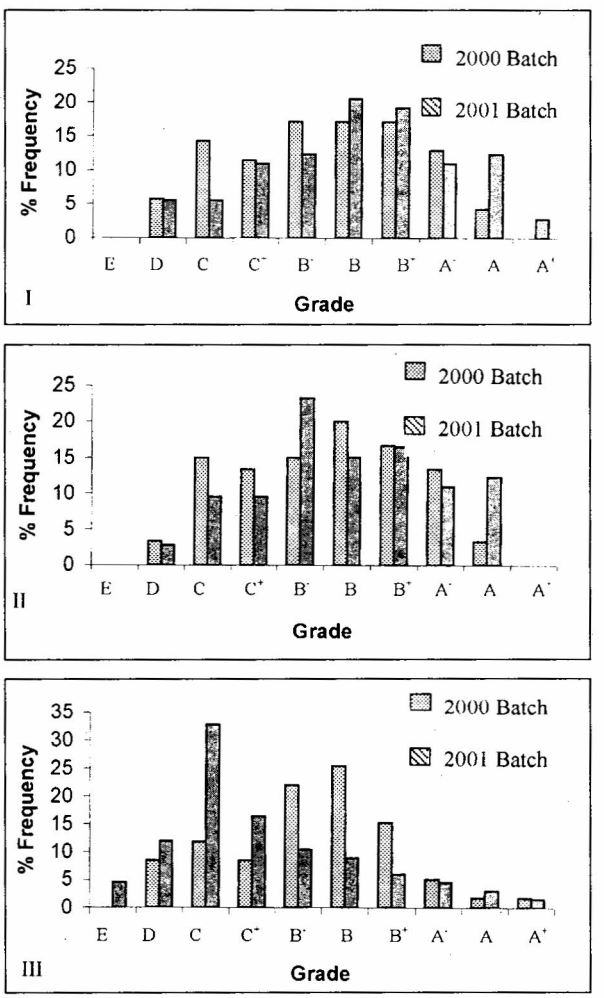

Figure 3- The distribution of grades of the first three course units followed by the undergraduates during their undergraduate career in Zoology I - I semester examination. II - 2nd semester examination. III - 3rd semester (Ist semester of the 3rd year) examination.

batches have obtained grades of A or A^+ (Fig.2). Therefore, although the 2001 batch has followed this course unit in English medium, the % of failures has decreased slightly and % of A grades and above have remained unchanged. In fact, in the 2001 batch, 2 % have obtained the grade of A^+, while in the 2000 batch none of the students have obtained a grade of A^+. In the 3rd semester the % of failures in the batch which followed the course unit in English medium i.e., 2001 batch was very much lower (6 %) than that of those who have followed it in Sinhala medium (41 %). Similarly the % of A and A^+ grades was also higher in 2001 batch (13%) than that of 2000 batch (4 %) (Fig.2).

When the distribution of grades in Zoology, which is a subject in the Biological Science stream without entry restrictions, is considered, % of the failures in the 1st semester course unit and 2nd semester course unit

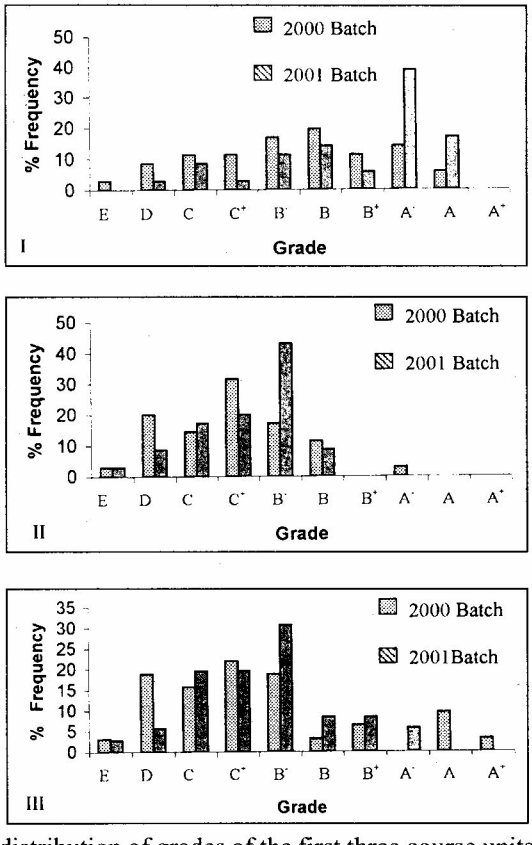

Figure 4- The distribution of grades of the first three course units followed by the undergraduates during their undergraduate career in Microbiology I- 1st semester examination. II-2nd semester examination. III-3rd semester (1st semester of the 2nd year) examination.

was more or less similar in the two batches considered (Fig.3). However, in the 3rd semester examination the % of failures in the 2001 batch was nearly twice as that of the 2000 batch. But however, in all three semesters the % of A and A+ grades were higher in the 2001 batch than that of the 2000 batch (Fig.3).

The distribution of grades in the examinations of the course units offered in the 1st three semesters in Microbiology is given in Fig.4. The % of failures in all examinations were higher in the 2000 batch than that of the 2001 batch. The % of A grades in the 1st semester examination was higher in the 2001 batch than in the 2000 batch. However, in the 3rd semester examinations % of A grades was higher in the 2000 batch than in the 2001 batch.

Table 2- Results of Kolmogrov - Smirnov test carried out for the student performance at 1st three semester end examinations in Physics.

Grade	First semester		Second semester		Third semester	
	2001 batch $F_{n1}(x)$	2000 batch $F_{n2}(x)$	2001 batch $F_{n1}(x)$	2000 batch $F_{n2}(x)$	2001 batch $F_{n1}(x)$	2000 batch $F_{n2}(x)$
E	.1875	.1889	.2000	.1279	.1176	.0833
D	.3542	.4445	.3778	.2791	.3529	.3472
C	.5000	.6556	.4667	.4070	.5000	.4861
C+	.5625	.7778	.6223	.5117	.5588	.6250
B-	.6458	.8667	.6890	.6280	.7941	.7361
B	.7500	.9111	.800 1	.7443	.8529	.8055
B+	.8542	.9555	.8668	.8141	.9117	.9305
A-	.9167	.9555	.9335	.8955	.9411	.9861
A	1.000	1 .00()	1.000	1.000	1.000	1.000
A+	1.000	1.000	1.000	1.000	1.000	1.000
D =0.2209. n_1 =48 n_2 = 90 p>.05			D =0. 1106. n_1 =45. n_2 = 86. p>.05		D =0.0662, n_1 =34. n_2 =72. p>.05	

$F_{n1}(x)$ = Cumulative probability of 2001 batch.

$F_{n2}(x)$ = Cumulative probability of 2000 batch.

n_1 = Sample size of 2001 batch.

n_2 = Sample size of 2000 batch.

$D = \text{Max}\left|F_{n1}(x) - F_{n2}(x)\right|$

The results of the K-S tests carried out on the performance of students of the two batches at the course unit examinations in Physics in the first three semesters are given in Table 2. These results indicate that in all semesters, the distribution of grades in the 2000 batch was not significantly different from that of the 2001 batch ($p > 0.05$).

Table 3 - Results of Kolmogrov - Smirnov test carried out for the student performance at 1st three semester end examinations in Statistics & Computer science.

Grade	First semester		Second semester		Third semester	
	2001 batch $F_{n1}(x)$	2000 batch $F_{n2}(x)$	2001 batch $F_{n1}(x)$	2000 batch $F_{n2}(x)$	2001 batch $F_{n1}(x)$	2000 batch $F_{n2}(x)$
E	.0448	.0678	.0317	.0172	.0000	.1481
D	.1941	.1525	.1587	.1724	.0645	.4074
C	.2986	.2203	.2203	.2241	.2097	.5555
C+	.5076	.2881	.2881	.2931	.3710	.6296
B-	.7016	.3559	.3559	.4138	.4678	.7963
B	.7762	.5593	.5593	.5690	.5968	.8704
B+	.8807	.7627	.7627	.7414	.7258	.9260
A-	.9553	.8983	.8983	.8276	.8710	.9630
A	1.000	1.000	1.000	1.000	.9839	1.000
A+	1.000	1.000	1.000	1.000	1.000	1.000
$D = 0.3457$. $n_1 = 67$ $n_2 = 59$, $p < .05$			$D = 0.2466$. $n_1 = 63$. $n_1 = 58$, $p > .05$		$D = 0.3458$, $n_2 = 62$. $n_2 = 54$. $p < .05$	

$F_{n1}(x)$ = Cumulative probability of 2001 batch.

$F_{n2}(x)$ = Cumulative probability of 2000 batch.

n_1 = Sample size of 2001 batch.

n_2 = Sample size of 2000 batch.

D = Max $|F_{n1}(x) - F_{n2}(x)|$

The results of the K-S tests carried out for Statistics & Computer Science are given in Table 3. These results indicate that the distribution of grades of the 2000 batch and 2001 batch are significantly different from each other in the 1st semester and 3rd semester examinations. However, in the 2nd semester, in which the medium of instruction was changed for the 2001 batch, the distribution of grades between the two batches was not significantly different from each other.

Table 4 - Results of Kolmogrov - Smirnov test carried out for the student performance at 1st three semester end examinations in Zoology.

Grade	First semester		Second semester		Third semester	
	2001 batch $F_{n1}(x)$	2000 batch $F_{n2}(x)$	2001 batch $F_{n1}(x)$	2000 batch $F_{n2}(x)$	2001 batch $F_{n1}(x)$	2000 batch $F_{n2}(x)$
E	.0000	.0000	.0000	.0000	.0448	.0000
D	.0548	.0571	.0274	.0333	.1642	.0847
C	.1096	.2000	.1233	.1833	.4926	.2033
C^+	.2192	.3143	.2192	.3166	.6568	.2880
B^-	.3425	.4857	.4521	.4666	.7613	.5083
B	.5480	.6571	.6028	.6666	.8509	.7625
B^+	.7398	.8285	.7672	.8333	.9106	.9150
A^-	.8494	.9571	.8768	.9666	.9554	.9658
A	.9727	1.000	1.000	1.000	.9853	.9827
A^+	1.000	1.000	1.000	1.000	1.000	1.000
$D = 0.1432$. $n_1 = 73$ $n_2 = 70$, $p > .05$			$D = 0.0974$. $n_1 = 73$. $n_1 = 60$, $p > .05$		$D = 0.3688$, $n_2 = 67$. $n_2 = 59$. $p < .05$	

$F_{n1}(x)$ = Cumulative probability of 2001 batch.

$F_{n2}(x)$ = Cumulative probability of 2000 batch.

n_1 = Sample size of 2001 batch.

n_2 = Sample size of 2000 batch.

$D = \text{Max}\left|F_{n1}(x) - F_{n2}(x)\right|$

The results of the K-S tests carried out for the course unit examinations in Zoology are given in Table 4. No significant differences in the distribution of grades between the two batches were observed for the course unit examinations of the first and second semesters ($p > 0.05$). However, these were significantly different in the third semester examinations ($p < 0.05$).

The results of the K-S tests carried out for Microbiology are given in Table 5. The distribution of grades of the 2000 batch and 2001 batch are significantly different from each other in the 1st semester examinations. However, in the 2nd semester and 3rd semester examinations, significant differences were not recorded in the distribution of grades between the two batches.

Table 5 - Results of Kolmogrov - Smirnov test carried out for the student performance at 1st three semester end examinations in Microbiology.

Grade	First semester		Second semester		Third semester	
	2001 batch $F_{n1}(x)$	2000 batch $F_{n2}(x)$	2001 batch $F_{n1}(x)$	2000 batch $F_{n2}(x)$	2001 batch $F_{n1}(x)$	2000 batch $F_{n2}(x)$
E	.0000	.0278	.0286	.0286	.0278	.0312
D	.0278	.1111	.1143	.2286	.0834	.2187
C	.1111	.2222	.2857	.3715	.2778	.3749
C^+	.1389	.3333	.4857	.6858	.4772	.5936
B	.2500	.5000	.9143	.8572	.7778	.7811
B	.3889	.6944	1.000	.9715	.8611	.8123
B^+	.4445	.8055	1.000	.9715	.94444	.8748
A	.8334	.9444	1.000	1.000	1.000	.8748
A	1.000	1.000	1.000	1.000	1.000	.9685
A^+	1.000	1.000	1.000	1.000	1.000	1.000
$D=0.361, n_1=36, n_2=36, p<.05$			$D=0.0858, n_1=35, n_2=35, p>.05$		$D=0.1164, n_2=36, n_2=32, p>.05$	

$F_{n1}(x)$ = Cumulative probability of 2001 batch.

$F_{n2}(x)$ = Cumulative probability of 2000 batch.

n_1 = Sample size of 2001 batch.

n_2 = Sample size of 2000 batch.

$D = \text{Max} \left| F_{n1}(x) - F_{n2}(x) \right|$

4. Discusssion

The Kolmogorov - Smirnov test was applied in the present analysis because in some categories such as E, D, A and A^+ and sometimes in B+ and B categories, the % of expected frequencies were < 1. As such the Karl Pearson's classical chi-square test could not be used (Sokal and Rohf, 1995).

Results of the present study indicate that there is no significant relationship between the distribution of grades of the examinations of any particular course unit and the medium of instruction. In Physics, which is a subject in the Physical Science stream without any enrollment restrictions, the results indicated that the distributions of grades for the 2nd and 3rd semester

examinations of the 2000 batch, who have followed the course units in Sinhala medium were not significantly different from those of the 2001 batch who have followed those course units in the English medium.

In Statistics & Computer Science, in the 1st semester examination, performance of the 2000 batch was better than that of 2001 batch as the % of grades of B and above were higher and the % of E grades were lower. However, both these batches have followed this course unit in Sinhala medium. Therefore, the difference in the distribution of grades has to be due to a factor other than the difference in the medium of instruction. In the second semester although the medium of instruction was different, there was no significant difference in the distribution of grades in the end of semester examinations between the two batches. This also indicates that the medium of instruction does not significantly affect the performance of students at the examinations. In the 3rd semester, i.e., 1st semester of the 2nd year, the significant difference in the distributions of grades between the two batches could be attributed to higher % of E and D grades and lower % of grades of B and above in the 2000 batch (Fig. 2) who have followed this course unit in Sinhala medium than those of the 2001 batch who have followed the same course unit in English medium. This also indicates that following a course unit in English medium does not adversely affect the performance in examinations as the batch that has followed that unit in English medium has performed better than the batch that has followed that unit in the Sinhala medium.

When Zoology is considered in the 1st semester examinations, there was no significant difference in the performance between the two batches. Similarly in the 2nd semester examination too, there was no significant difference in examination performance although the 2000 batch has followed the course unit in Sinhala medium and the 2001 batch has followed the same unit in the English medium. This also indicates that the performance at the examination is independent of the medium of instruction. In the 3rd semester, i.e., in the lst semester of the 2nd year, a significant difference in the distribution of grades between the two batches was evident. This has resulted mainly due to the higher % of grades of C+ and below and lower % of grades of B and above in the 2001 batch than those of the 2000 batch (Fig.3). In other words, the 2001 batch has not performed as good as the 2000 batch at the end of semester examination for this course unit. However, in the immediately preceding semester in which teaching was started in English medium, there was no significant difference in the distribution of grades between the two batches. Therefore, the difference observed in the 3rd semester may be due to some factor or factors other than the medium of instruction.

Similarly in Microbiology, where the medium of instruction for both batches was English from the 1st semester onwards, a significant difference in the distribution of grades was observed in the 1st semester examinations. This is mainly due to the higher % of grades of A⁻ and above in 2001 batch than in the 2000 batch. In other words the 2001 batch has performed better than the 2000 batch in the examination. Since both batches have followed the course units in the same medium, i.e., the English medium, this difference cannot be attributed to the medium of instruction.

Therefore, the results of the present study clearly indicate that the medium of instruction and performance of students at the examinations are not significantly related to each other. Earlier researchers have attributed the low performance at the examinations in the Faculties of Medicine and Engineering to the lack of proficiency in the English medium (Kottahachchi, 1992). However, the present study indicates that in the Faculty of Science of the University of Kelaniya when the medium of instruction is changed from Sinhala to English, the performance of students at the examinations has not changed significantly. Further, in the 1st semester examination in Physics, although the medium of instruction was Sinhala, the failure rate was high being 44 % for the 2000 batch and 35% for the 2001 batch. Further, in Microbiology, where the medium of instruction is English from the 1st semester itself, the failure rate at the lst semester examination was low being about 11 % in 2000 batch and about 3% in the 2001 batch. Therefore, the in-depth analysis of results using appropriate statistical methods clearly shows that the examination performance is not affected by the medium of instruction.

Many other factors may influence the performance of students at the University examinations. These include factors such as the inability of students to cope with increased volume of teaching material since the selection in solely based on aggregate marks at the G.C.E (Advanced Level) examination (Kottahachchi, 1993), the inability of parents to prepare the students in advance for University education (Kottahachchi, 1993), financial difficulties (Gunawardena, 1993), insufficient reading (Hewawitharana, 2001) and poor attendance (Hewawitharana, 2001). Recent studies have also shown that the performance at the University examinations is not related to the method of selection and if exposed to similar facilities, students selected from underprivileged districts and on district basis, perform equally well as those who get selected on merit (Hewapathirana 2003).

5. Conclusion

Therefore, from the results of the present study it can be concluded that the change in the medium of instruction does not significantly affect the performance of students in the University examinations as evident in the Faculty of Science of the University of Kelaniya. Many other factors such as attendance and mental stress due to financial difficulties and other problems may affect the student performance in the University examinations in a bigger way than following the course units in English medium. More research in a well planned scientific manner should be carried out to study the influence of these factors on the student performance at the University examinations.

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