

### The Role of Different Subject Materials on the Admission of PhD Candidates of Epidemiology, Bacteriology and Parasitology during 2006-2007

**Background:** Score worksheets have been extracted for PhD candidates in Epidemiology, Microbiology and Parasitology for the academic year of 1386-87. The main objective in this study is the impact and importance of different subjects on the discrimination results of admission.

**Methods:** Extracted scores from worksheets are analyzed by MINITAB15 statistical toolbox. The regression values of different subjects were extracted and sorted for each branch of study. All subject correlation coefficients were calculated in comparison to overall candidate performance. A redundancy measure was suggested on the basis of correlation of different subject performances. The distribution box plots were shown for different subject to visualize comparison.

**Results:** The repeatability and redundancy between different subjects were high in bacteriology. The different subjects in this branch of study had efficient and equal impact on discrimination. The bacteriology as a subject had shown lowest significance in epidemiology, therefore it has the lowest taxonomy. The bacteriology and fungicide subject despite its low weight showed the highest impact of 6.44 in parasitology.

**Conclusion:** In this study we realized that in branches such as epidemiology different subjects have equal impact. In subject cases which the significance of impacts are very low, there should be further consideration and analysis on the subject matter to whether wave the subject. In parasitology branch bacteriology and fungicide subject has higher impact on discrimination, it is worth to increase its weight and the number of questions on the subject.

**Keywords:** Score Coefficients, Written Exam, Basic Science, Subject Correlation, Density Distribution

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### درابه تأثیر موضوعات المختلفة الدرابه فی قبول طلاب مرهله الدكتوراه فی فروع البكتيريا و البيئه و الطفيليات فی عام ۱۳۸۶-۸۷

**التمهيد و الهدف:** تم السعي في هذه الدرابه الى معرفة مستوى اليجابه عند البشتركين في فخص الدكتوراه لعام ۸۶-۸۷ في فروع البكتيريا و الطفيليات و البيئه لذن هذه الفروع يوجد فيها اشتراكات درابه اكترو يوجد في هذه المجالات عدد اكبر من البشاركين. أن الهدف هو دراسته مستوى الوزن و المواضيع المختلفة من حيث التمييز في تقييم العملى للمشاركين .

**الاطلوب:** في هذه الدرابه استخدم برنامج Minitab15 لتحليل و العوده اللفقيه بين الدروس المختلفة و العلامه الكتيبه في كل من الدروس و بعد ذلك تم استخراج الترابط بين الموضوعات المختلفة و تم تخمين الراهيه. تم استخدام الرسم البياني لتوضيح هذا الامر.

**النتائج:** قابلية التكرار و قابليه الاطمئنان كانت عاليه في فخص البكتيريا. كان هناك علامه منخفضه في درس البكتيريا فخص البيئه و كان يعتبر من الدروس الصعبه و لم يكن مؤثر قابل للتفكيك عند الممتحنين. في فخص الفيليات كان هناك ضربيب واحد لدرس البكتيريا و الفطر و كان الضريب اعلى من 6.44.

**النتيجه:** في هذه الدرابه نستطيع ان نلاحظ درجه التكرار بين الدروس و نلاحظ العله. يدل التأثير الكبير لدروس البكتيريا و الفطريات في فخص الطفيليات على الصيه الموضوع. يساعد هذا الدرس على تفكيك المتقدمين بطلب الفص بشكل اسلم و اوضح. و ايضا هناك مجال تأمل و نظري تأثير درس البكتيريا في فخص البيئه .

**الكلمات الرئيسية:** دورضريب الدرس. الفحص الكتبي. العلوم الراهيه. ترايط الموضوعات. توزيع المعلومات.

### پيراسيتالوجى، بيكتريالوجى، اور اپيڈى ميولوجى كے شعبوں ميں داخلے كے لئے ديگر موضوعات كى تاثير

**بيكا گراؤنڈ:** اس تحقيق ميں بيكتريالوجى، پيراسيتالوجى اور اپيڈى ميولوجى كے طلباء كى تعليم پر ديگر موضوعات كے اثرات كا جائزہ ليا گیا ہے۔

**روش:** اس روش ميں سب طلباء كے نمبروں كا منى ثيب پندرہ سے جائزہ ليا گیا اور ريگوريشن كے بعد پر موضوع كے نمبروں كا جائزہ ليا گیا۔ اس كے بعد اضافى موضوعات ميں حاصل شدہ نمبروں كا بهي جائزہ ليا گیا اور امتحان ميں ان كى اہميت كى جانچ كى گئي۔ باكس پلاٹس ميں نتيجے ظاہر كئے گئے ہيں تا كہ موضوعات كى اہميت كا اندازہ ہوسكے۔

**نتائج:** بيكتريالوجى ميں موضوعات كى تكرر كى بهر پور توانايى پائي جاتى ہے۔ اپيڈميولوجى ميں بيكتريالوجى كى كوئى خاص اہميت ظاہر نہيں ہوتى۔ پيراسيتالوجى ميں بيكتريا لوجى اور فنگس كى شناخت كے مسائل كسى حدتكم كام آتے ہيں۔

**سفاارش:** اس تحقيق ميں يہ واضح ہوا ہے كہ اپيڈميولوجى پر مختلف طرح كے موضوعات اثر انداز ہوتے ہيں۔ جن موضوعات كے اثرات كم ہيں ان پر نظر ثانى كى جاني چاہيے۔ پيراسيتالوجى ميں بيكتريالوجى اور فنگس كے موضوعات كو زيادہ كور كرنا چاہيے تا كہ بہتر نتيجے حاصل ہوں۔

**كليدى الفاظ:** امتحانات، بيكتريالوجى، پيراسيتالوجى۔

### بررسى نقشى موضوعات مختلف درسى در پذيرش دانشجويان دوره دکترى در رشته هاى انگل شناسى، باکترى شناسى و اپيدميولوجى ورودى ۱۳۸۶-۸۷

**زمينه و هدف:** در اين مطالعه سعى شده كه روند پاسخگوى داوطلبان آزمون دکترى سال ۸۷-۸۶، رشته هاى باکترىشناسى، انگلشناسى و اپيدميولوجى كه اشتراك درسى بيشترو تعداد داوطلب بيشتري نسبت به ديگر رشته ها برخوردار بوده اند، بررسى گردد. هدف بررسى وزن و تعيين كندگى موضوعات مختلف در ارزايى علمى داوطلبان ميباشد.

**روش:** در اين بررسى نمره كتبي استخراج شده از كار نامه داوطلبان را با استفاده نرم افزار MINITAB15 تجزيه و تحليل و رگرسيون خطى بين دروس مختلف و نمره كتبي ضربيب هر كدام از دروس را استخراج نموده وسپس همبستگى بين موضوعات مختلف را استخراج نموده و اهميت آنها را در آزمون مربوطه حدت بزنيم. با استفاده از نمودار جمعي اى سعى كرديم كه نقش هر كدام از دروس را با توجه به توزيع دهك هاى مربوطه بررسى نماييم.

**يافته ها:** در آزمون باکترىشناسى تكرر پذيرى و قابليت اطمينان جمعي بالا است. در آزمون اپيدميولوجى درس باکترىشناسى از نمره پائينى برخوردار و براى داوطلبان دشوار و از شاخص قابل ملاحظه اى در تفكيك داوطلبان برخوردار نيست. در آزمون انگلشناسى درس باکترى و قارچ با ضربيب يك از ضربيب تاثير بالای ۶/۴۴ برخوردار است.

**نتيجه گيرى:** در اين بررسى به درجه تكرر بين درسى دردروس مختلف پى برده و ميتوان علت را بررسى نمود. تاثير بالای درس باکترى و قارچ در آزمون انگل شناسى بيانگر اهميت و زيربنائى آن است. اين درس با ضربيب بالاتر در تفكيك داوطلبان ميتواند نقش اساسيترى را ايفا كند. همچنين عدم تاثير قابل ملاحظه درس باکترىشناسى در آزمون اپيدميولوجى جاى بررسى دارد.

**كليد واژه ها:** نقش ضربيب دروس، آزمون كتبي، علوم پایه، همبستگى موضوعات، توزيع دانسته ها

**INTRODUCTION**

In most countries university admissions are based on the previous applicant performance. But in some countries such as India there is a special exam called GATE, or in China there is Goa Koa, the most competitive in the world. In Iran also, there are several competitive entrance exams (1,2).

This exam has been generalized for the admission of almost all of university branches. This area seems to have involved a vast majority of Iran's population, but there are not any distinct published research works in this area. The possible reason for this shortage could be the access restriction to the consensus and results of these exams.

Fortunately, in the case of this study applicant performance worksheets were available on the official site of Ministry of Health and Medical Education for the proposed year of study. The author of this report has been involved in one of the exam committees of the board of exam for almost twelve years. Therefore, it was realised that published researches in this area are few and it was worth investigating worksheets thoroughly.

One of the major issues in an exam could be the subject permutation in the exam sheet, or the taxonomy order(3-6). In competitive exams there are different effective factors which challenge applicant mentality. One of the mentality issues is the coverage of background study experience of the applicant with exam materials. Another issue could be the consistency of exam references all over the country. The other issue could be the board of exams' familiarization with new references. The tough competition and former issues result in big competitive market for private institutes. There are huge social consequences laid down behind it. The matter of either acceptance or rejection causes mental conflicts for the rejects and suspicious judgment follows.

One of the anxieties in the exam is the exam time plan for applicants. Irregular question taxonomy permutation could suppress moderate prepared applicant performance. Entangled taxonomy in all questions reduces exam result contrast for applicant discrimination. Therefore the exam output bend toward inconsistency. The unveiled procedure and analysis of the data could satisfy rejects and avoid their rumor for examiners and committees of the exam. In this study it is supposed to investigate the statistical parameters of applicants in some branches of study which have more common subjects and moderate number of attendance. It is proposed to find inter correlation between different

subjects in each branch of study. Also the discriminate factor of each subject is to be considered.

**METHODS**

By the investigation of all 29 branches of study in the proposed Iranian educational year of study (86-87) in Ministry of Health and Higher Education, it was found out that three branches of study had more common subjects and applicant attendance. Targeted branches were bacteriology, parasitology and epidemiology. Mark sheets of all applicants in these three areas were downloaded and sorted for each subject (7,8). Subjects in bacteriology were bacteriology(M1), virology(M2), parasitology and mycology(M3), biochemistry(M4), molecular biology(M5) and immunology(M6). In parasitology, the subjects were cetology(M1), helminthology(M2), medical insectology(M3), hematology(M4), immunology(M5), bacteriology and mycology(M6) and biochemistry. Subjects in epidemiology were biostatistics(M1), epidemiology(M2), parasitology and mycology(M3), bacteriology(M4), virology(M5) and immunology. The max score level in all subjects was 100 in percentage. Statistical investigations were carried out through Minitab 15 statistical tool box(9).

**RESULTS**

Most of the subject mark distributions are close to normal distribution therefore mean value and all of all of subject marks are listed in table 1.

Total earned score of written exams are evaluated versus mark subjects through linear regression analyzer. Their equations are as follow.

*Scores for bacteriology:*  $- 0.00038 + 2.24 M1 + 0.450 M2 + 0.450 M3 + 0.450 M4 + 0.450 M5 + 0.450 M6$

*This equation was extracted from work sheets of 68 bacteriology candidates.*

*Scores for parasitology:*  $0.680 + 1.79 M1 + 1.81 M2 + 0.592 M3 + 0.605 M4 + 0.591 M5 + 0.574 M6 + 0.605 M7$

*This equation was extracted from work sheets of 50 parasitology candidates and the following equation is extracted from 38 worksheets of epidemiology.*

*Score for epidemiology:*  $- 0.00038 + 2.24 M1 + 0.450 M2 + 0.450 M3 + 0.450 M4 + 0.450 M5 + 0.450 M6$

By observing the extracted equation for bacteriology it is obvious that the score weight of the first subject(M1) is five times of the other subjects in this branch of study. Therefore the most important and discriminative subject could be bacteriology in this branch. By looking at the regression equation of parasitology we will find out the

**Table 1: Statistical parameters of different subject scores in different branches of study**

	(score)	(M1)	(M2)	(M3)	(M4)	(M5)	(M6)	(M7)
Bacteri-	146±71	31±17.7	41±22.3	27±19.1	41±23.5	18.3±16.7	42.8±27	-----
Parasit-	290±96	53.7±21	43±17	62±17.2	33±20.3	32.7±33	25.7±10	39.5±23
Epidem-	218±92	57±20.5	29±15.8	19±14.2	-0.4±8.4	31±22	21.5±22	-----

weight score of the first(M1) and second(M2) subjects are triple times of other subjects in this branch of study. Therefore, these two subjects could have more impact than the other on the acceptance discrimination. Also in this respect, by taking a look at epidemiology equation it is realized that the first(M1) and second(M2) subjects are

weighted twice the others. In comparison to other two former branches of study, in epidemiology the subjects are more balanced.

With the correlation tool the correlation between subjects and total score are extracted. Subject importance is extracted with respect to their P-Value.

Table 2: Pearson correlation coefficients of each subject with total score in bacteriology.						
	M1	M2	M3	M4	M5	M6
Corr(score)	0.94	0.73	0.55	0.79	0.53	0.78
P-Value	0.00	0.00	0.00	0.00	0.00	0.00

Table 3: Linear regression of score versus single subjects.		
Bacteriology	Parasitology	Epidemiology
Score = 28+3.79M1 = 50+2.33M2 = 90+2.1M3 = 47+2.4M4 = 104+2.27M5 = 61+2.0M6	Score = 179+2.8M1 = 72.3+5.0M2 = 149+2.27M3 = 244+1.37M4 = 219+2.16M5 = 124+6.44M6 = 178+2.8M7	Score = -0.1+3.82M1 = 78.4+4.86M2 = 137+4.3M3 = 219+2.67M4 = 131+2.8M5 = 160+2.68M6

Table 4: Pearson correlation coefficients of each subject with total score in parasitology							
	M1	M2	M3	M4	M5	M6	M7
Corr(score)	0.86	0.90	0.40	0.29	0.74	0.66	0.67
P-Value	0.00	0.00	0.00	0.04	0.00	0.00	0.00

Table 5: Pearson correlation coefficients of each subject with total score in epidemiology						
	M1	M2	M3	M4	M5	M6
Corr(score)	0.86	0.84	0.66	0.25	0.68	0.64
P-Value	0.00	0.00	0.00	0.14	0.00	0.00

Table 6: Pearson correlation M4 with other subjects in epidemiology						
	Total(score)	M1	M2	M3	M5	M6
Corr(M4)	0.25	0.14	0.40	0.08	0.12	0.27
P-Value	0.14	0.39	0.81	0.63	0.47	0.10

Box plots are plotted for all the three exam branches. These box plots are showing decade distribution of different subjects against each other.

**DISCUSSION**

As correlation coefficients of different subjects with total score in table 2 and table 3 and their statistical distribution in figure 1 show, exam subjects in bacteriology are reasonably balanced. Also small P-Values of correlation coefficients are in agreement with reasonable balancing. In bacteriology the correlations within subjects are comparably high with small P-Values. Therefore, there could be some information redundancy between different exam material subjects.

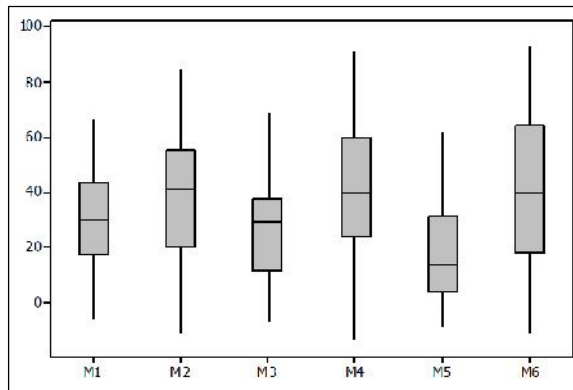
In parasitology as it is given in table 3 and shown in figure 2, the bacteriology and mycology subjects are(M6) highly weighted in one directional linear regression. Its coefficient is 6.44, which in comparison to other subjects is very large. If we look at its correlation with other subjects in

parasitology as given in table 4, we will find that it is highly correlated with cetology(M1) and helminthology(M2) which have weighted by three. It could be concluded that the exam material of this subject should be repeated and redundant to these two subjects. As the overall score highly correlated with this subject(M6), there should be a close look at question paper or the material overlap in these subjects.

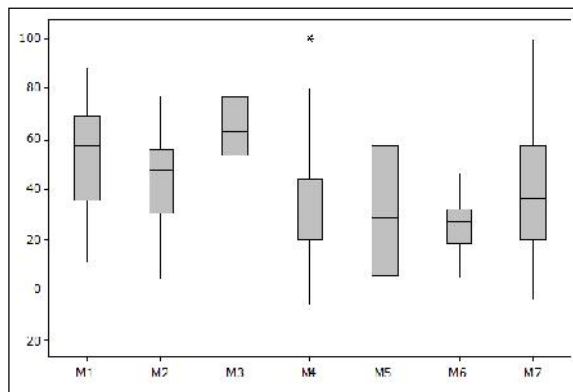
In epidemiology branch of study, bacteriology as given in table 1 earned minimum regression coefficient value(-0.4) and lowest standard deviation. It means that this subject has the lowest contribution in total score and lowest discrimination impact. On the other hand it has the lowest correlation with other subjects in this branch as it is shown in figure 3 and given in tables 5 and 6. Therefore, this subject either is strange to applicants or its taxonomy is ill organized.

**CONCLUSION**

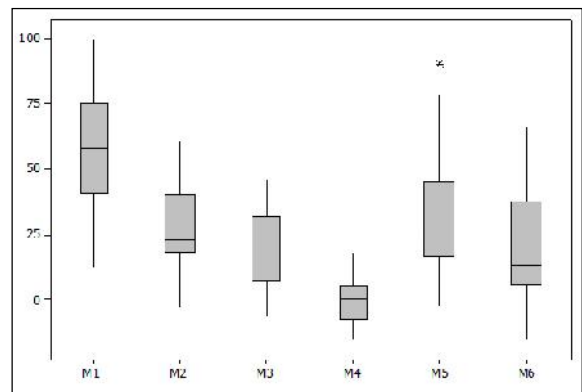
Inter subjects overlap and redundancy could be guessed by correlation coefficient investigation between different subjects. The high redundancy between subjects could be effective and less discriminative. A subject is while discriminative which could enhance the overall score variation. In this study we found out that bacteriology and mycology in parasitology against its low score weight has earned the highest correlation with total score. Therefore it is either the core subject for this branch or wrongly designed in this exam. Also we found that the bacteriology subject had the lowest correlation with the total score and other subjects. Therefore this subject is either strange to applicants or its taxonomy is ill organized. In the case of unfamiliarity of applicants it should be omitted or in case of improper taxonomy, concerned board of exam should be informed. In the end it is suggested that for the generalization of this study, previous years and next year exams data be considered.



**Figure 1:Box plot of different subjects in bacteriology**



**Figure2: Box plot of different subjects in parasitology**



**Figure 3: Box plot of different subjects in Epidemiology**

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