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The relationship between undergraduate education system and postgraduate achievement in statistics

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ABSTRACT

The present study focuses on the relationship between undergraduate education system and the students' achievement in statistics. The data was collected from 34 master students in Management Sciences who took an "inferential statistics" course. The history of their past education (long distance vs. traditional), the type of exam questions and their mark on "inferential statistics" course were the important variables studied. The results showed a significant difference in achievements between those with long distance undergraduate education and those with traditional system ($P<0.05$). After doing analysis of covariance, using the pre-term evaluation mark, it still showed a significant difference between statistics achievement in two groups ($P<0.05$).

Keywords: distance education; statistics achievement; analysis of covariance.

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1. Introduction

The Open and Distance Learning (ODL) has become an integral part of higher education globally. It is an effective tool for the provision of education to a heterogeneous group of learners as well as an alternative channel to democratize education all over the world. The origin and growth of Distance Education (DE) has its roots in the familiar circle to be squared. The development imperative of providing health and education facilities to the people in the poor countries, which they can hardly afford and without which they cannot develop such economic resources (Macmillan, 1938). ODL has grown because of its inbuilt advantages. First is its economy: School buildings are not required and teachers and administrators can be responsible for many times more students than they can accommodate in a school. Its second main advantage is its flexibility: People who have jobs may study in their own time, in their own homes, without being removed from their work for long periods. Its third advantage is its seven-league boots: It can operate over long distances and cater to widely scattered student bodies (Dodds, et al, 1972). The governments all over the world have started investing heavily in ODL. The international agencies like UNESCO, European Commission, World Bank, and Asian Development Bank have begun to provide support to distance education. Expenditure on ODL, its volume of academic literature, its appearance in legislation, all are markers of a new legitimacy to the ODL system. The decade of the 1980s was an important period in the history of distance education in India. It was during this period that open universities were established. The first Indian open university, the Andhra Pradesh Open University (later re-designated as Dr B. R. Ambedkar Open University) was started in the year 1982. The first national open university, Indira Gandhi National Open University (IGNOU), was set up in 1985. Now, India has 66 conventional universities and 10 open universities (one at the national level and nine at provincial level), offering courses under the distance education programme. These institutions serve about 13 percent of the total students in Indian higher education. (Krishnan 2004).

For the last decade, distance education has attracted educators and policy makers as a new measure of educational provision. Especially in Asia and the Pacific, distance education institutions and/or programmers have developed rapidly and played an important role. Despite its importance and wide scope of practice in many countries, not enough is known about distance education in this region. In light of this, UNESCO and the National Institute of Multimedia Education (NIME), Japan have completed this project, "Distance

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Education in Asia and the Pacific to add to our knowledge of where distance education stands at the present time(Kato & Wong 1993). There is a big debate about the efficiency of long distance education compared to traditional education systems. Different studies have been made about this matter. Bernard et. al (2004) have done a meta analysis on several researches on comparison between traditional and long distance education. In their meta analysis study 232 studies containing 688 independent achievement, attitude, and retention outcomes were analyzed. They found evidence, in an overall sense, that classroom instruction and DE are comparable, as have some others.

Undergraduate educational systems may influence the achievement of students in postgraduate study. Research indicates that the instructional format itself (e.g., interactive video vs. videotape vs. "live" instructor) has little effect on student achievement as long as the delivery technology is appropriate to the content being offered and all participants have access to the same technology. Achievement on various tests administered by course instructors tends to be higher for distant as opposed to traditional students (Souder, 1993). Conventional instruction is perceived to be better organized and more clearly presented than distance education (Egan, et al., 1991). Future research should focus on the critical factor in determining student achievement: the design of instruction itself (Whittington, 1987). Learners benefit significantly from a well-designed syllabus and presentation outlines (Egan, et al., 1991). Distance education also has relation to motivation of learners (Wilks & Burnham 1991).

Since the Islamic Revolution of 1979 in Iran, the educational system of the country has gone under qualitative and quantitative changes. The school system is under the jurisdiction of the Ministry of Education and Training. The Ministry of Education employs the highest number of civil servants (42 per cent of the total) and receives 21 per cent of the national budget. The two Ministries responsible for most post-secondary education are the Ministry of Culture and Higher Education (MCHE) and Ministry of Health and Medical Education (MHME). However, as indicated before, the Ministry of Education also has jurisdiction over some post-secondary programs such as primary and guidance teachers training colleges and Higher Institutes of Technical and Vocational Education. Payaam-e Noor University was established in 1987 providing distance education only. It began admitting students in 1988. Its central campus is located in Tehran, and it has 29 campuses throughout Iran. It offers associate diplomas and bachelors degrees in 10 fields of study

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(Potashnik & Capper 1998). This university has many students in different fields of science especially in social sciences. Every year a considerable number of its graduates will succeed in master degree entrance exams. The examination in this university is centralized and is based on multiple choice questions. Therefore all the branches of this university must have the same standards of teaching and examinations. In this study, we compare the achievements of Payaam-e Noor graduates with other traditional university graduates in a postgraduate statistics course.

This study aims to focus on the relationship of undergraduate long distance learning and the students' achievement in statistics in postgraduate level. This study may help to modify both traditional and long distance learning system to have a better achievement.

2. Material and Methods

The participants consist of 34 master degree Management Students taking an "inferential statistics" course. They were taught the course 3 hours a week and treated the same during the semester. The final exam consisted of 20 multiple choice exam and 5 analytic problems. The sample consisted of 16 long distance (Payaam-e Noor) and 18 traditional students. In terms of age distribution, all participants' age was between 23 and 26 with mean age of 24.4. The age difference between two groups was not statistically significant. The number of boys and girls in the study were 15 and 19 respectively. We considered the following variables in the analysis:

total_mark	the final exam mark on both multiple choice and analytic part
mc_mark	the final exam mark on multiple choice questions
an_mark	the final exam mark on analytic questions
ed_his	the undergraduate education system (traditional – long distance)
sex	the gender of the student
pre_mark	the mark of the student in pre-term evaluation exam

The data was analyzed using SPSS 11.0 software (Norusis 2002). We used two-sample t-test for comparing the student achievements in both groups. We also used the t-test to compare the achievement for both sexes. The analysis of covariance was used to test the difference in achievements controlling for undergraduate statistics mark (Levin and Rubin 1997).

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3. Results

The variable *total_mark* **for** each student consisted of two numbers (A mark for multiple choice questions and a mark for analytic problems). The following analyses were done on this data. First we applied two-sample t-test for comparing the achievement on both multiple choice questions and analytic problems for two sexes. The results are shown in Table 1 and Table 2. The tables show that there is a significant difference between two sexes in achievement in the mark of total (p=.038) and multiple choice questions (p=.001).

It showed that girls had significantly better achievement than boys.

Table 1. Descriptive statistics for numerical variables of the study

		total_mark	mc_mark	an_mark	pre_mark
N	Valid	34	34	34	34
	Missing	0	0	0	0
Mean		27.5294	13.2353	14.2941	21.3824
Variance		19.105	19.276	22.881	125.637

Table 2. Results of t-test for comparison of students' performance by gender in total exam and its two parts

	sex	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig(2-tailed)
total_mark	male	15	25.8000	4.52296	1.16782	-2.161	32	.038
	female	19	28.8947	3.82818	.87824			
mc_mark	male	15	10.6000	3.79473	.97980	-2.118	32	.001
	female	19	15.3158	3.71263	.85174			
an_mark	male	15	15.2000	5.17135	1.33524	-3.632	32	.334
	female	19	13.5789	4.46363	1.02403			

A t-test for comparison of student's achievement between undergraduate distance educated and traditional showed a significant difference on total, multiple choice and analytic marks. Table 3 shows the results and the corresponding p-values. Payaam-e Noor students did significantly better on multiple choice questions, while the traditional students did significantly better on analytic problems.

Table 3. Comparison of students' performance by gender in total exam and its two parts Group Statistics

	ed_his	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig(2-tailed)
total_mark	traditional	18	26.1111	4.17117	.98316	-2.109	32	.043
	distance	16	29.1250	4.14528	1.03632			
mc_mark	traditional	18	10.2778	3.52813	.83159	-5.959	32	.000
	distance	16	16.5625	2.44864	.61216			
an_mark	traditional	18	15.8333	4.91397	1.15823	2.089	32	.045
	distance	16	12.5625	4.11451	1.02863			

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To control for the effect of pre-term statistical knowledge of the students, first a correlation test was done of numerical variables. Results showed a significant correlation between pre-term evaluation and the final marks. The correlation coefficient between pre-term evaluation marks and the final marks was r=0.447 which was significant with p-value of 0.008(Table 4). Therefore, to adjust for effect of pre-term evaluation mark on total mark an analysis of covariance was applied on the data. The results are shown in Table 5. The results show that even after controlling for the pre-term variable, it is still a significant difference in achievement between distance and traditionally educated students.

Table 4. Bivariate correlations of numerical variables in the study

		total_mark	mc_mark	an_mark	pre_mark
total_mark	Pearson Correlation	1	.404(*)	.543(**)	.445(**)
	Sig. (2-tailed)		.018	.001	.008
mc_mark	Pearson Correlation	.404(*)	1	-.549(**)	-.243
	Sig. (2-tailed)	.018		.001	.166
an_mark	Pearson Correlation	.543(**)	-.549(**)	1	.630(**)
	Sig. (2-tailed)	.001	.001		.000
pre_mark	Pearson Correlation	.445(**)	-.243	.630(**)	1
	Sig. (2-tailed)	.008	.166	.000	

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Table 5. Analysis of covariance of total mark controlled for pre-term evaluation exam

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	304.860(a)	3	101.620	9.363	.000
Intercept	3288.308	1	3288.308	302.967	.000
ed_his	46.224	1	46.224	4.259	.048
sex	.528	1	.528	.049	.827
pre_mark	219.206	1	219.206	20.196	.000
Error	325.611	30	10.854		
Total	26398.000	34			
Corrected Total	630.471	33			

a R Squared = .484 (Adjusted R Squared = .432)

(Table 2). As the final analysis, the difference between pre-term and final exam(start-end comparison) was compaed between subgroups. Table 6 shows the result of t-test comparing the start-end mark difference between male and female students. There was a significant difference in terms of gender(p=0.023). To compare the difference mark between Payaam-e Noor students and others, we used a t-test. The result of the test in Table 7 shows a

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significant difference (p= 0.001). Based on Tables 2,3,6 and 7, we conclude that there is a significant difference in marks between males-females and traditional-distance students.

Table 6. Comparison of students' performance by gender in start-end mark

	sex	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig(2-tailed)
Start-end mark difference	male	15	1.8000	7.94805	2.05218	-2.394	32	.023
	female	19	9.5789	10.39934	2.38577			

Table7. Comparison of students' performance by education system in start-end mark

	sex	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig(2-tailed)
Start-end mark difference	traditional	18	1.1667	7.87588	1.85636	-3.565	32	.001
	distance	16	11.7500	9.43398	2.35850			

4. Discussion and Conclusions

The history of educational system can affect student's achievement. Long distance education has some advantages and some limitations that may influence the learner's performance. Payaam-e Noor students as a long distance learners have the advantage of centralized multiple choice final exams. This system helps the students to learn the details of the course content. Therefore, they will achieve higher in multiple choice questions. On the contrary, because of lack of supervision by the instructor, they can not do well on analytic problems. This suggests that in quantitative courses, we may have to use a combined method of teaching. In traditional (Conventional) system of education, the instructor can manage the learners to learn analytically and can arrange the lectures based on in-class performance of the learners. Conventional instruction is perceived to be better organized and more clearly presented than distance education (Egan, et al., 1991). The results of this study show that long-distance students do better on multiple choice questions. This finding agrees with Souder(1993). The significant difference in exam marks between subgroups may be due to other characteristics of the sample individuals. Although there was no significant difference in age distributions of subgroups, the mathematical background of the students may have affected the results. Because the field of management is a inter-disciplinary field, undergraduate students from several fields with very different mathematical background can enter the masters level and therefore can have different achievement in quantitative courses.

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There are some suggestions for management of traditional systems of education at least for quantitative courses. First of all, the long distance educational institute can manage to have some live online communications with their students to figure out the their needs in study strategies. Secondly, the final exams can somehow be designed to have combinations of multiple choice and analytic questions. As a final suggestion, the educational systems can evaluate their performance to achieve better approaches in instruction and examination of the courses they offer.

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