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Effects of Fundamental Schools on Mathematics Performance: Iraq as a Model

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Abstract

Sometimes when the pupils pass the elementary stage may suffer from fear factor before they begin the intermediate stage. This factor certainly causes, what is called the transitional gap. Of course this gap would affect the scientific performance of the students for this reason; the idea of Fundamental Schools (FSs) appeared to application space in Iraq since 1996. The purpose of this type of schools is to lessen the influence of the transitional gap and develop the scientific performance of the pupils. The researchers study in this research, the success or the fail of this experience. The criterion of success or fail is based on prior information so that the researchers use Wiakar shrinkage estimation for normal mean. After that estimate the MSE of shrunken mean and it's compared with prior knowledge. The results prove that the experience is successful therefore; the conclusions and recommendations have concentrated on applying the experience of fundamental schools widely.

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Keywords: Waikar Estimation; MSE; Fundamental school and prior information

1. Introduction

Sometimes when the pupils pass the elementary stage may suffer from fear factor before they begin the intermediate stage. This factor certainly causes, what is called the transitional gap. The Ministry of Education of Iraq began applying the Fundamental Schools (FSs) experience since 1996. The Iraqis educational researchers proposed this type of school to reduce the influence of the transitional gap on the students when they pass from elementary to intermediate stage. Some schools headmasters said that "as a result of studying the psychological state of the pupils who have transferred to another schools, we discovered that the students suffer from the fear factor and their fear increases when there is a change in the environment of study that is why, this situation affects negatively on the academic performance) with relying on this idea, the target of the ministry's plan is to improve the performance of pupils.

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The education system in Iraq is divided into four main stages: elementary (6 years), intermediate (3 years), upper intermediate (3 years) and university stage. Sometimes, both intermediate and upper intermediate schools are merged in one school is called the secondary school (6 years). The idea of Fundamental Schools (FSs) in Iraq is to merge the elementary and the intermediate schools in one school. In this case the pupils will continue their study at the same schools from first stage to the ninth stage (9 years).

The conception of FS means that student is continuing with his study from first stage to ninth stage (elementary and intermediate together in the same school), while the schools which are Non Fundamental (NFSs) means the traditional system that separates the elementary from the intermediate schools.

The FSs experience have given the attention of researchers recently and applied in many countries with different styles. Larry et al (1984) pointed out that FSs rated better on learning climate, discipline and suspensions. Tahir and Hind in 2009 made a comparison between schools which follow the fundamental system and another do not for the first graduated patch in 2007 by using discriminant analysis to discover the advantages and disadvantages of this system. Tahir and Hinds' study involved all subjects which are studied by pupils including mathematics .However, the study found a preference of fundamental schools especially in the subjects "Biology, Mathematics, Physics" these subjects have a scientific tendency, the teachers due this result to the absence of fear factor when the pupils are shifted from school to another and meet new teachers and pupils ,this situation affect in their psychological mood because they prefer their previous schools in which they spent six years before they moved to new one.

The NFSs means split elementary (6 years) and intermediate (3 years) into two schools). They choose four schools, two of them are FSs. After that, they selected randomly sample from the recorded marks for (164) pupils. After 14 years from the application of this experience, the researchers try to examine, in this study, the success or the fail of this experience. The criterion of success or fail is formed by one question; does this experience develop the students' performance in the course of mathematics?

For this purpose, we have collected the results of final examinations in mathematics for four schools: two are FSs and other two are NFSs. The schools are selected randomly and the pupils are at the ninth stage of FSs and the third stage of NFSs from each type and we have compared these results by using the shrinkage technique. Thompson (1968) proposed a shrinkage technique to obtain the improved estimator.

1.2 Shrinkage Estimator

Let the statistical population (X) is distributed normal with unknown mean μ and standard deviation σ . Assume that a prior estimate μ_0 of μ . The shrinkage estimator of estimating μ that incorporate prior estimate μ_0 is proposed. Although the shrinkage estimators are biased estimates; these estimates can significantly decrease the mean squared error. Further the shrinkage estimator, a trade-off between the bias and the estimation error, incorporates uncertain prior estimation on the parameter. This information may be available in the form of some guess value due to past experiences and knowledge which can be incorporated in the process of estimation to increase the efficiency of the estimates (Al-Hemyari et al, 2009). A popular one among a variety of shrinkage approaches, that has been proposed for the estimation of mean in normal population is Waiker estimation.

2. Methodology

2. 1. Two- Stage Estimation for Normal Mean (Waiker Estimation)

Waiker estimation (1984) is one of shrinkage methods that is used to obtain improved estimator which can be summarized as follow:

- 1. Select first random sample with size n_1 from X.
- 2. Let \overline{x}_1 denote their mean.

3. Find

$$Z = \frac{(\bar{x}_1 - \mu_0)}{\sigma / \sqrt{n_1}} \tag{1}$$

Test the hypotheses : $H_0: \mu = \mu_0$ versus $H_1: \mu \neq \mu_0$ at level \propto .

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If H_0 accepted the estimator of μ is defined as

$$\hat{\mu}_{w} = K\bar{x}_{1} + (1 - K)\mu_{0} \tag{2}$$

where

$$K = \frac{|Z|}{Z_{(\alpha/2)}}$$

and $Z_{(\alpha/2)}$ is the upper 100($\alpha/2$) percentage point of standard normal distribution.

4. If H_0 is rejected, then select the second random sample with size n_2 from X and take the estimator of μ as a pooled sample mean,

$$\hat{\mu}_w = (n_1 \bar{x}_1 + n_2 \bar{x}_2) / (n_1 + n_2) \tag{3}$$

2.2 The comparison criterion

MSE estimator is to measure the difference between an estimator and the true value of the quantity being estimated. The difference occurs because of randomness or because the estimator doesn't account for information that could produce a more accurate estimate. The target of statisticians or statistical practitioners is minimizing MSE as possible. Therefore, they are considered MSE as comparison criterion among many statistical procedures to prove the best one. In this paper the comparison have been between the MSE of shrinkage estimator and variance of population. Since, the sample mean E(x) is unbiased estimator for population mean μ . The bias is the difference between the parameter estimator and the parameter as follow,

$$Bias = E(x - \mu)$$

$$\therefore E(x) = \mu$$

hence

$$Bias = \mu - \mu = 0$$

Therefore,

$$MSE(x) = Bias^{2} + V(x)$$

$$\therefore Bias = 0$$

hence

$$MSE(x) = V(x)$$

It's obvious that the comparison will be between $MSE(\hat{\mu}_w)$ and MSE(x).

If the null hypotheses H_0 is accepted, the MSE of $\hat{\mu}_w$ will be as follow,

$$MSE(\hat{\mu}_w) = Bias^2 + V(\hat{\mu}_w) \tag{4}$$

where

where

$$W(\hat{\mu}_w) = K^2 * \sigma^2 / n_{1^*}$$
$$Bias^2 = \hat{\mu}_w - \mu_0$$

- If H_0 is rejected, the MSE of $\hat{\mu}_{w}$ will be as follow,

$$MSE(\hat{\mu}_w) = Bias^2 + V(\hat{\mu}_w)$$

$$V(\hat{\mu}_w) = \sigma^2 / (n_1 + n_2)$$

$$Bias^2 = \hat{\mu}_w - \mu_0$$
(5)

2.3 Data Analysis

Data are collected from four schools which are FSs and other are NFSs. The FSs are (Al_Azhar Al_Shareef) and (Bangazy) are selected randomly; at the same procedure selecting (Al-Hussien) and (Al-Jumhoryia) as NFSs. The sampling is involving (97) pupils for FSs at ninth stage while NFSs are (111) pupils at third stage. We have taken the marks of mathematics examination of all pupils who perform the same examination of mathematics. The prior information about the mathematics marks of FSs pupils which have normal distribution with $\mu_0 = 77.01$ and $\sigma = 15.65$ while NFs have the same distribution with $\mu_0 = 65.09$ and $\sigma = 13.43$.

3. Results and Discussions

3.1. Waiker Shrinkage Estimators of FSs

Table 1 shows the **MSE** $(\hat{\mu}_w)$ values of math marks of FSs. For five times, we have taken two samples at each time with different sizes. The results show the null hypothesis $H_0: \mu = \mu_0$ is accepted at each time. That means the computed Z is less than table Z. Thus the value of K will be less than one. So that **MSE** $(\hat{\mu}_w)$ are consistent with the variety of sample sizes.

FS	n ₁	<i>n</i> ₂	μ̂ _w	ΜSE (μ̂ _w)
1	30	70	74.93	7.33
2	40	60	75.81	2.95
3	50	50	74.27	10.63
4	60	40	75.77	2.79
5	70	30	76.07	1.77

Table 1 The MSE for $\hat{\mu}_{W}$ of math marks of FSs

It's obvious in Table 1 when the sample size equals to (30), the $MSE(\hat{\mu}_w)$ equals to (7.33), while $MSE(\hat{\mu}_w)$ equals to (1.77), when the sample size is (70).

3.2 Waiker Shrinkage Estimator of NFSs

Table 2 shows $MSE(\hat{\mu}_w)$ of NFSs math marks. Actually, we have followed the same procedures that are applied in FSs. For five tomes, we find that algorithm rejects the null hypothesis $H_0: \mu = \mu_0$. It's refer to the value of computed Z is larger than table Z which causes K is greater than one. So that, the algorithm selects another random sample. According to Waikar algorithm $\hat{\mu}_w$ is computed as a pooled mean with the first sample. The *MSE* would depend on Its pooled mean.

NFS	n_1	n_2	μ̂ _w	$MSE(\hat{\mu}_w)$
1	30	70	66.40	3.36
2	40	60	69.47	20.99
3	50	50	70.11	27.00
4	60	40	69.95	25.42
5	70	30	59.54	21.61

Table 2 The MSE for $\hat{\mu}_{w}$ of math marks of NFSs

Five times later running the program on NFSs data. We denote that the null hypothesis is rejected and the pooled mean is computed.

4. Conclusions

We denote in Table 1 that all $MSE(\hat{\mu}_w)$ values are less than the prior variance of population. In this case we conclude that the pupils performance become high homogenous with time, While table -2- show $MSE(\hat{\mu}_w)$ values are less than the variance of prior information. Our conclusion of this situation that there is non-homogenous in math marks of NFSs. But it is more homogenous than its past time. The reason of this result the pupils spent three years together. So the effect of fear factor is reduced. That is mean; they have whole effective of this factor. Furthermore, the results in table-1- and table-2- refer to that $MSE(\hat{\mu}_w)$ of FSs is less than NFSs. This result has come because the pupils of FSs did not suffer from transitional gap which leads to raise their performance.

5. Recommendations

- 1. We recommend generalizing this experience in Iraq.
- 2. We have not study the differences between male and female achievements. So, it may be an axis for new researches.
- 3. The relation between teachers and students of FSs can be studied.

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