

EFFECT OF CHANGE IN THE ORDER OF OPTIONS IN QUESTIONS ON RESULTS IN MCQS BASED EXAMINATIONS

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(Abstract)

To study the variation in scores of the candidates in the MCQs based examinations due to change in the sequence of the questions and by altering the positions of the distracters, without making any change in the questions and the distracters. Data of the annual examination of HSSC-II (Physics) held during 2019, under Federal Board of Intermediate and Secondary education, Islamabad was analyzed where four different versions of the MCQs paper were prepared by altering the sequence of the questions and positions of the distracters. An OMR (optically marked result) data of the MCQs paper was obtained from the Federal Board where a total of 33778 candidates appeared who were given four different versions of the paper at random. In all the four versions of the question papers the questions given at the end of papers were brought one by one in the beginning and distracters which were in last positions were shifted to the first positions in the similar way to create new versions of the paper. Therefore, the last three questions of the question paper were brought in the beginning and the first distracter was shifted to the fourth position in the fourth version of the paper. This systematic shift of creating new versions of question papers limited the scope of the study as their shift was unidirectional.

Procedure

The Facility Index (FI) and Discrimination Index (DI) of all questions were calculated. The FI of the distracters of all questions were also calculated. The overall facility indices of all questions when correct options were placed at different positions within the MCQs in different versions of the question paper were also calculated. In addition, FI of the distracters when placed at different positions in different versions of the paper were also calculated.

Question-wise FI and DI – Paper Version 4081

Q/No	1	2	3	4	5	6	7	8	9
FI	0.31	0.46	0.75	0.51	0.57	0.76	0.74	0.72	0.35
DI	0.24	0.71	0.52	0.65	0.62	0.57	0.46	0.58	0.57
Var	16.28	1.4	4.56	1.9	6.18	3.17	5.51	5.82	7.73

Q/No	10	11	12	13	14	15	16	17	O/A
FI	0.00	0.73	0.68	0.75	0.59	0.46	0.59	0.70	0.63
DI	0.00	0.52	0.61	0.55	0.75	0.74	0.60	0.63	0.57
Var	7.42	5.58	8.65	5.93	6.97	3.51	4.71	4.82	0.59

Question-wise FI at different positions – Paper Version 4081

Q/P	1	2	3	4	5	6	7	8	9
A	0.27	0.45	0.75	0.49	0.54	0.75	0.79	0.78	0.36
B	0.36	0.45	0.73	0.49	0.57	0.78	0.76	0.77	0.35
C	0.32	0.45	0.72	0.51	0.60	0.76	0.77	0.72	0.33
D	0.20	0.46	0.71	0.49	0.54	0.75	0.74	0.72	0.29

Q/P	10	11	12	13	14	15	16	17	O/A
A	0.64	0.73	0.73	0.77	0.64	0.46	0.58	0.73	0.62
B	0.63	0.73	0.71	0.81	0.61	0.47	0.59	0.69	0.62
C	0.66	0.70	0.68	0.79	0.59	0.44	0.59	0.70	0.61
D	0.58	0.67	0.64	0.75	0.57	0.44	0.55	0.69	0.58

Question-wise Guess Correction (%) – Paper Version 4081

Q/P	1	2	3	4	5	6	7	8	9
A	24.30	18.42	8.29	17.04	15.32	8.42	6.85	7.44	21.25
B	21.22	18.43	9.05	17.05	14.50	7.36	8.14	7.82	21.69
C	22.83	18.33	9.36	16.49	13.26	7.90	7.79	9.17	22.32
D	26.65	17.96	9.81	17.12	15.31	8.33	8.69	9.38	23.83

Q/P	10	11	12	13	14	15	16	17	O/A
A	11.97	8.99	9.13	7.71	11.85	17.97	13.92	8.84	12.81
B	12.44	9.14	9.68	6.40	12.87	17.63	13.56	10.35	12.78
C	11.39	10.10	10.74	6.99	13.52	18.80	13.58	10.14	13.10
D	13.86	10.95	12.01	8.37	14.18	18.65	15.13	10.45	14.16

The questions were grouped based on their values of FI and DI as under:-

- a. **Group I:** Questions having both FI and DI values higher than 0.6.
- b. **Group II:** Questions having FI greater than 0.6 and DI between 0.4 and 0.6.
- c. **Group III:** Questions having FI between 0.4 and 0.6 whereas DI greater than 0.6.
- d. **Group IV:** Questions having one out of the two values of FI and DI higher than 0.4 and the other lower 0.4.

- e. **Group V:** Questions having both FI and DI values between 0.4 and 0.6.

% Results at different Positions of Correct answer

Group (Qs)	A	B	C	D
I (2)	73.05	69.95	68.67	66.31
II (6)	76.15	76.05	74.34	72.24
III (6)	52.74	52.98	53.01	50.83
IV (1)	36.25	34.94	33.05	28.52
V (2)	45.59	49.52	32.92	39.24
O/A	61.58	61.65	58.84	57.53

% Difference in results when compared with that position D

GP/Positions	I	II	III	IV	V	O/A
A	6.74	3.91	1.91	7.73	6.35	4.05
B	3.63	3.81	2.16	6.42	10.3	4.12
C	2.36	2.11	2.18	4.53	-6.32	1.31

Question-wise Effect (%) on Distracters when shifted from position A to B
and C to D – Paper Version 4081

Q/P	1	2	3	4	5	6	7	8	9
A	20.39	10.09	12.57	10.97	11.24	10.46	4.55	5.71	14.67
B	26.94	10.22	11.70	11.58	12.75	11.31	2.95	6.93	12.99
Diff	6.55	0.13	-0.87	0.61	1.51	0.85	-1.60	1.22	1.68

Q/P	10	11	12	13	14	15	16	17	O/A
A	12.89	6.43	14.76	5.04	15.19	39.3	2.7	12.64	12.33

B	10.69	8.30	16.85	6.87	15.59	43.99	2.98	10.25	13.11
Diff	-2.20	1.87	2.09	1.83	0.40	4.69	0.28	-2.39	0.78

Q/P	1	2	3	4	5	6	7	8	9
C	28.34	8.74	4.29	23.55	22.98	5.58	6.80	5.95	46.79
D	23.06	8.32	2.83	20.37	15.95	5.16	4.40	4.84	48.04
Diff	-5.28	-0.42	-1.46	-3.18	-7.03	-0.42	-2.40	-1.11	1.25

Q/P	10	11	12	13	14	15	16	17	O/A
C	18.40	8.98	8.69	6.61	10.39	5.19	33.62	5.52	14.73
D	15.50	7.41	5.68	4.27	8.71	3.35	28.96	3.64	12.38
Diff	-2.90	-1.57	-3.01	-2.34	-1.68	-1.84	-4.66	-1.88	-2.35

Observations

- a. The score of the candidates is the maximum when correct answer is at the position A and is the minimum when it is at position D except for Group-V (questions 1 and 10). The score of the candidates reduces gradually from the maximum score at the position A to the minimum at the position D in case of groups I and II (6 questions), where FI is equal or greater than 0.6 and DI greater than 0.4 whereas in, case of group III (6 questions), where FI is between 0.4 and 0.6 and DI equal or greater than 0.6 the score of the candidates first increases from the position A gradually to the maximum at the position C and then falls abruptly to the minimum at the position D. In case of group IV (one question), where FI is less than 0.4 and DI greater than 0.4 the score is again the maximum at the position A which reduces gradually to minimum at the position D. In case of

group V (two questions), the score of the candidates follows an irregular Pattern.

- b. The average rate of reduction in the scores of the candidates from their scores at the position A towards D is faster in case of group I when compared with groups II, having six questions each. However, this rate of reduction is the maximum in case of group IV, having one question only.
- c. The average rate of increase of scores as compared to average scores at D in case of group III (6 questions) is slower as compared to the rate at which score reduces in case of group II (6 questions).
- d. Changes in the selection of the distracters adjacent to the correct options were observed when the group was shifted from their positions at A,B&C to B,C&D, keeping the correct option in the middle. It was observed that the selection of option before the correct option at A increased by an average of 0.78 % per question when shifted to the position B whereas the selection of the option after the correct option at C reduced on the average by 2.35 % per question when shifted to the position at D.
- e. In case of group I, selection of the distracters which lie before the correct answer were reduced on the average by 0.15% when shifted from position A to B while the distracter immediately following the correct option reduced on the average by 2.45% per question when shifted from position C to D. This group contained two questions only, in case of question 12, the number of candidates who selected option

which lied before the correct option increased by 2.09% when shifted from position A to B whereas it reduced by 3.01% when the distracter immediately after correct option was shifted from position at C to D. However, a reduction in the number of candidates who selected when the option was at the position A as compared to that when it was shifted to the position at B by 2.39% whereas it reduced for the option at C when shifted to the position at D by 1.88%.

- f. In case of group II, which is comprised of six question, the selection of the option before the correct option increase on the average per question by 0.55% when it is shifted from the position at A to B whereas it decreases by 1.55% when option is shifted from the position at C to D. In case of four questions (6,7,11&13) the selection of the option before correct option increases in the range from 0.85% to 1.87% whereas in case of two questions 3 and 7 it decreases by 0.87% and 1.6% respectively. However, the selection of the option at position C which is after the correct option decreases in all the cases when shifted from position at C to D in the range from 0.42% to 2.4%. The minimum increase in selection of option at A of 0.85% and decrease in option at C of 0.42 is observed when shifted to positions at B and D respectively in case of question 6, where FI is 0.76 and DI is 0.57.
- g. In case of the group III, which again include six questions, the selection of the option which is before the correct option increase on the average per question by 1.27% when it is shifted from the position at A to B whereas it decreases

by 3.15% when option after the correct option is shifted from the position at C to D. The selection of the option before correct option increases in the range from 0.13% to 4.69% whereas, the selection of the option at position C which is after the correct option decreases in all the cases when shifted to position D in the range from 0.42% to 7.3%. The minimum increase in selection of option at A of 0.15% and decrease in option at C of 0.42 is observed when shifted to positions at B and D respectively in case of question 2, where FI is 0.46 and DI is 0.71.

- h. The scores of candidates show dependence on the positions at which the correct option is located. An overall variation ranging from 1.4% in question 2 to 16.28% in question 1 was observed.
- i. An average variation per question observed in different groups is as under:-

Group (questions)	I (2)	II (6)	III (6)	IV (1)	V (2)
Ave Variation	6.74	5.15	4.11	7.73	11.85

The change shows dependence of variation on FI, higher is the facility and DI greater is the change, except for three questions included in groups IV&V.

- j. In case of Group-II, the minimum change is in questions 2 and 4, whereas maximum change is in questions 5 and 14. Similarly, in Group-III, the minimum change is in questions 3 and 6, whereas, maximum change is in questions 11 and 13. Details are given as under:-

GROUP - II

Q/No	Variation %	FI	DI	Max	Before	After
3	4.56	0.75	0.52	A	-	3.98
6	3.17	0.76	0.57	C	11.31	5.16
11	5.88	0.73	0.52	A	-	7.47
13	5.93	0.75	0.55	B	5.04	6.61

GROUP - III

Q/No	Variation %	FI	DI	Max	Before	After
2	1.4	0.46	0.71	D	9.86	-
4	1.9	0.51	0.65	C	11.58	20.37
5	6.18	0.57	0.62	C	12.75	15.95
14	6.97	0.59	0.75	A	-	12.56

GROUP - III

Q. No	Variation %	FI	DI	Max-At	P.D- At
2	1.4	0.46	0.71	B	C
4	1.9	0.51	0.65	C	D
5	6.18	0.57	0.62	A	B
14	6.97	0.59	0.75	A	BCD

- k. The selection of the distracters which are immediately before the correct option at A generally improve when shifted to position B on the average by 0.78%, whereas those which immediately follow the correct option at C reduce when shifted to position D by 2.35%. In addition,

higher is the value of FI of the distracter greater in the improvement and reduction in selection.

Discussion

- a. The candidates picked up the correct option easily when it was positioned earlier in the list of options as compared to that when it was positioned at the end. Further, questions which the candidates answered by guessing, having lower FI and DI values as in Group-V (questions 1 and 10) showed inconsistent variation. The question 1 was constructed around a data which is generally ignored and is less likely to be remembered whereas in question 10 all the given options were incorrect.
- b. There appears some dependence of variation in the selection of correct option on the values of FI and DI of a question. The chances in selection of the correct option in a question reduce randomly as the position of the correct option is moved from the first position at A to the last position at D. A greater reduction is observed in case of higher FI, in the range of 0.6 and above, having DI in the range between 0.5 and 0.6, as compared to those questions where FI is between 0.5 and 0.6 but DI is higher than 0.6, whereas the questions where both FI and DI is higher than 0.6, a much greater variation is observed.
- c. However, the pattern of variation becomes dependent on the type of the questions and options involved, when either FI or DI is less than 0.5. The inconsistency in variation is the maximum when both FI and DI are less than 0.4.

- d. The variation in selection of the correct option with change in its position in the order of options is different than that of the guess correction. The theoretically calculated guess correction increases with the decrease in FI value of a question whereas this variation opposed to this increases with when the FI of the question increases.
- e. The position dependent variation in selection of the correct option does not show visible relation on the quality of the distracters involved in the questions, before or after the correct option.
- f. The candidates generally start searching for the correct option from the beginning to the end. Therefore, they are more likely to be distracted from the correct option by a plausible distracter which is just before the correct option as compared to that which follow immediately after the correct one. Further, stronger is the distracter greater influence it will have on the selection of the correct option.

Inference

Psychologically the candidates are more likely to pick up the correct option when it is positioned at the start in the order of options and its chances keep reducing randomly when its position is moved down the order in case of good questions having higher FI and DI values. Further, the effect of the distracter on the selection of the correct option is more pronounced if it is positioned before the correct option as compared that option which follows the correct option. In

addition the magnitude of the effect has a correlation with the quality of the distracter.

Recommendation

The positions of the correct options in a question paper should be evenly distributed in different versions of the paper.