

A Study of the Effects of Ordered Training and Disordered Training on Ping-Pong Player's Responding Ability

Zeng Zhen-hao, *Department of Physical Education, Zhongshan University, Guangzhou, China.*

1. Preface

The specific characteristic of table tennis demands of player's the best responding ability. Its training needs two methods: the ordered and disordered. Past researches tell us that each of the two ways of training has its own effects on enhancing players' competition skills and responding ability. They also tell us that the players should take ordered and disordered training again and again so that they can truly master and handle competition skills of ping-pong and then bring them into play during the game. However, this understanding is perceptual and empirical, lacking quantitative analysis and theoretical study. So at present, many people don't fully realize the benefit of ordered and disordered training. It's not good to give full play to the two training methods and to improve the training quality as well. In view of this, this paper, mainly adopting the methods of experiment research, goes further into whether ordered training and disordered training have their own effects on enhancing players' responding ability. What will be the training result if the two training methods are put in different orders? What we did is to make the table tennis specific training theory rich and perfect.

KEY WORDS: table tennis, disordered training, ordered training, responding ability

2. Research method

2.1 Study of reference material

2.2 Study of investigation and interview.

2.3 Study of experiment.

This paper takes three experiment steps: First, after each group takes ordered training or disordered training, we can determine which training method will be better to enhance players' responding ability. Second, after each group takes from ordered training to disordered training and from disordered to ordered training, we can get the result which arrangement is better to enhance players' responding ability and give full play to competition skills when they are playing. Third, after the players' competition skills are tested for the first, middle and last times, which training arrangement enhances players competition skills unceasingly.

2.3.1 Test equipment: LASER-310 specific computer for psychology test.

2.3.2 Test target: taking one simple reaction time, six multiple reaction time and three technical targets of competition skills.

2.3.3 Subjects and group division: twenty-four juvenile ping-pong players (12 aged from 11-12, 12 aged from 13-15). Before the test, we determined the subjects and go their early targets mentioned above. Then they were divided into groups C1, C2, D1

D2. In Groups C1 and C2, the players' conditions were almost the same. The same as in Groups D1 and D2. See tables 1-5:

2.3.4 Experiment method, request and content: in the experiment, the two groups corresponding should have the same training time and times, only different training request and contents. The group (aged 11-12) took the first step: 12 times of training, once each day and 80 minutes each time. The group (aged 13-15) took the second step: 24 times of training (12 for ordered training, 12 for disordered training), training request is the same as that of step one, but the number of times is twice that in step one. After the players in the two groups finished their own training, they changed their training contents. The third step is to use the result, which got from testing the subjects' competition skills through the first, middle and the last test, to react the subjects' changeable condition after they took training arranged differently.

During the experiment training, the subjects got ordered training and disordered training separately. The content is following:

- a. training of ordered changeable placement
training of disordered changeable placement
- b. training of ordered changeable spinning
training of disordered changeable spinning
- c. training of ordered foot movement
training of disordered foot movement

When the test ended, the data from the tests were handled through statistics.

3. Result and Analysis

3.1 Analyze and compare how ordered training and disordered training enhanced the players' responding ability.

After the subjects in Groups C1 and C2 finished 12 times of training, they were tested for the last time. See the results in Tables 6 and 7.

From Table 6 we know that all the targets of Group C1 are better than these of Group C2. In all these differences of each group's reaction time after the test, five differences reach very great level ($P < 0.1$). Table 7 tells us the scores and the test after the subjects were tested for their competition skills three times. From Table 7, we can see that the score of Group C1 is much higher than that of Group C2 and its differences get to great level. The results prove that disordered training is better to enhance players' responding ability than ordered training. See Table 8.

From Chart 1, we can see the score change of the two groups before and after the test. Before the test, there is little difference between the two groups' average scores. Since Group C1 took disordered training for 12 times, the subjects' average skill test score got from 93 to 107.5. While Group C2 took ordered training for 12 times, their average skill test score only got from 93 to 95.8. Compare the two groups after the test; the subjects in Group C1 made more progress than those in Group C2. So we get the result that disordered training has greater effect on players' responding ability, while ordered training has a little effect.

Ordered training and disordered training have its own effects on enhancing players' responding ability. After studying, we found that it is mainly related to two aspects:

3.1.1 The responses needed are different.

During the ordered training, the players in both groups know fairly well the batting direction, placement of the ball, spinning function and batting rhythm as well. So they are prepared for the coming ball and have very good responding abilities. Since during the disordered training, there is no compulsory or appointment to the players' batting

Table 1: Comparison of Subjects' basic condition in groups C1, C2, D1, D2 before experiment

(1)

Statistics	Age		Training years				place in team				Education					
	C1	C2	D1	D2	C1	C2	D1	D2	C1	C2	D1	D2	C1	C2	D1	D2
\bar{x}	11.5	11.5	13.67	13.67	4.33	4.5	6.67	6.67	6.67	6.33	6.5	6.5	5	5	7.33	7
t	0	0	0	0	0.554	0	0	0	0.156	0	0	0	0	0	0.3	0.3
P	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

(2)

Statistics	Health Condition			Training Attitude		
	C1	C2	D1 D2	C1	C2	D1 D2
Excellent	3	3	4 4	2	2	3 4
Good	2	3	2 2	3	2	2 1
Middle	1	-	-	1	2	1 1
Poor	-	-	-	-	-	-
\bar{x}	3.33	3.50	3.67 3.67	3.33	3.00	3.33 3.50
t	0.425	0	0	0.494	0.619	0.619
P	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

(3)

	Sex			Play Type		
	C1	C2	D1 D2	C1	C2	D1 D2
Male	3	4	3 3	Pen-hold grip	4	4 4 3
Female	3	2	3 3	Open arin	2	2 2 2

Table 2 : Comparison the first test
reaction time and derivative targets groups C1, C2 before experiment

Targets	Groups	\bar{x}	S	t	P
A (sec)	C1	195	17.9	0.301	>0.05
	C2	192.7	6.4		
B (sec)	C1	0.4268	0.051	0.712	>0.05
	C2	0.4562	0.087		
C (sec)	C1	0.5878	0.0699	0.1148	>0.05
	C2	0.592	0.0509		
D (sec)	C1	0.4412	0.0465	0.3377	>0.05
	C2	0.4498	0.0423		
E (sec)	C1	0.756	0.0835	0.5457	>0.05
	C2	0.730	0.0465		
F (Times)	C1	12.5	3.08	0.1787	>0.05
	C2	12.87	3.37		
G (sec)	C1	5.33	1.46	0.228	>0.05
	C2	5.15	1.35		

Note: A in the table stands for simple reaction time, (R.T).
 B for two points passive R.T, C for four points passive R.T,
 D for two colors choice R.T, E for four colors choice R.T,
 F for the whole time of four complex reaction error times,
 G for the time used to revisit the wrong doing. (The following
 is as same as this).

Table 3 : Comparison of the first test reaction
time and derivation targets of groups D1, D2 before the experiment

Targets	Groups	\bar{x}	S	t	P
A	D1	173.3	7.84	0.2808	>0.05
	D2	170.5	23.44		
B	D1	0.3187	0.0229	0.7051	>0.05
	D2	0.3312	0.0369		
C	D1	0.5323	0.0542	0.1776	>0.05
	D2	0.5392	0.0771		
D	D1	0.3748	0.0363	0.969	>0.05
	D2	0.3957	0.0382		
E	D1	0.5982	0.0351	0.6148	>0.05
	D2	0.6168	0.0665		
F	D1	11.17	4.262	0.1316	>0.05
	D2	11.5	4.506		
G	D1	4.09	1.104	0.0876	>0.05
	D2	4.15	1.386		

Table 4. Comparison of the Subjects three technique test score in groups D1, D2 before experiment

	C1						C2					
	One	Two	Three	Four	Five	Six	One	Two	Three	Four	Five	Six
I	47	45	42	46	44	45	45	46	38	47	42	45
II	6	11	3	13	-7	-4	15	-4	9	-5	10	8
III	41	45	45	45	47	44	48	43	42	44	44	45
Individual amount	94	101	90	104	84	85	108	85	87	86	95	98
The group amount	558						560					
The group average	93						93.3					
t							0.061					
p							>0.05					

Note: In the table I stands for the responding ability of placement changing, II for the responding ability of receiving changeable serve, III for the responding ability of movement. (The same as table 5, table 7, table 11 and table 12.)

Table 5. Comparison of Subjects three technique test score in groups D1, D2 before experiment

	D1						D2					
	One	Two	Three	Four	Five	Six	One	Two	Three	Four	Five	Six
I	48	43	43	42	45	40	44	45	43	45	45	44
II	5	-3	9	1	10	13	11	14	10	-9	-8	8
III	49	45	40	45	42	36	42	45	38	43	45	44
Individual amount	102	85	92	88	97	89	87	104	92	79	82	96
The group amount	553						549					
The group average	92.2						91.5					
t							0.15					
p							>0.05					

Table 6 : Statistics of last test reaction time and derivative targets of groups C1, C2 after the experiment

Targets	Groups	\bar{x}	S	t	P
A	C1	187.8	15.05	0.6173	>0.05
	C2	191.8	5.04		
B	C1	0.3198	0.0351	2.176	<0.1
	C2	0.3605	0.0294		
C	C1	0.495	0.0563	12.219	<<0.01
	C2	0.5987	0.0435		
D	C1	0.3902	0.0346	5.812	<<0.01
	C2	0.4438	0.0387		
E	C1	0.6012	0.0474	12.57	<<0.01
	C2	0.7078	0.067		
F	C1	5.83	1.72	3.754	<<0.01
	C2	11.00	2.898		
G	C1	2.215	0.7855	4.1426	<<0.01
	C2	4.648	1.205		

Table 7. Comparison of the Subjects three technique test score in groups C1, C2 after the experiment

	C1						C2					
	One	Two	Three	Four	Five	Six	One	Two	Three	Four	Five	Six
I	44	47	45	47	49	46	46	43	48	43	46	45
II	9	27	14	7	33	15	19	3	13	5	13	0
III	47	45	44	49	48	43	46	39	45	46	43	34
Individual count	100	110	103	89	130	104	111	85	108	84	102	85
the group count	645						575					
the group average	107.5						95.8					
							9.93 <0.05					

Table 8. Change Situation Statistics of reaction time and derivative targets within groups C1, C2 before and after the experiment

Targets	Groups	Before experiment	After experiment	Test t	within the group p
		X	X		
A	C1	190.5	187.8	0.7509	>0.05
	C2	192.67	191.8	0.2512	>0.05
B	C1	0.4268	0.3198	4.237	<<0.01
	C2	0.4562	0.3605	2.547	<0.05
C	C1	0.5878	0.4950	2.625	<0.05
	C2	0.5923	0.5987	0.1884	>0.05
D	C1	0.4412	0.3902	2.254	<0.05
	C2	0.4498	0.4438	0.2564	>0.05
E	C1	0.756	0.6012	4.021	<<0.01
	C2	0.730	0.7078	0.5072	>0.05
F	C1	12.50	5.830	5.811	<<0.01
	C2	12.80	11.00	1.101	>0.05
G	C1	5.330	2.215	4.613	<<0.001
	C2	5.150	4.648	0.6762	>0.05

Table 9 : Statistics of last test reaction time and derivation targets of groups D1, D2 after the experiment

Targets	Groups	\bar{x}	S	t	P
A	D1	172.6	11.22	0.1278	>0.05
	D2	174.0	21.77		
B	D1	0.2864	0.0173	4.206	<<0.01
	D2	0.3422	0.0241		
C	D1	0.4226	0.0129	5.7536	<<0.01
	D2	0.5046	0.0292		
D	D1	0.3608	0.0183	3.7251	<<0.01
	D2	0.4100	0.0232		
E	D1	0.5248	0.029	2.255	<0.05
	D2	0.6088	0.0783		
F	D1	4.000	1.414	7.3638	<<0.01
	D2	12.20	2.049		
G	D1	1.352	0.3480	8.4418	<<0.01
	D2	4.268	0.6896		

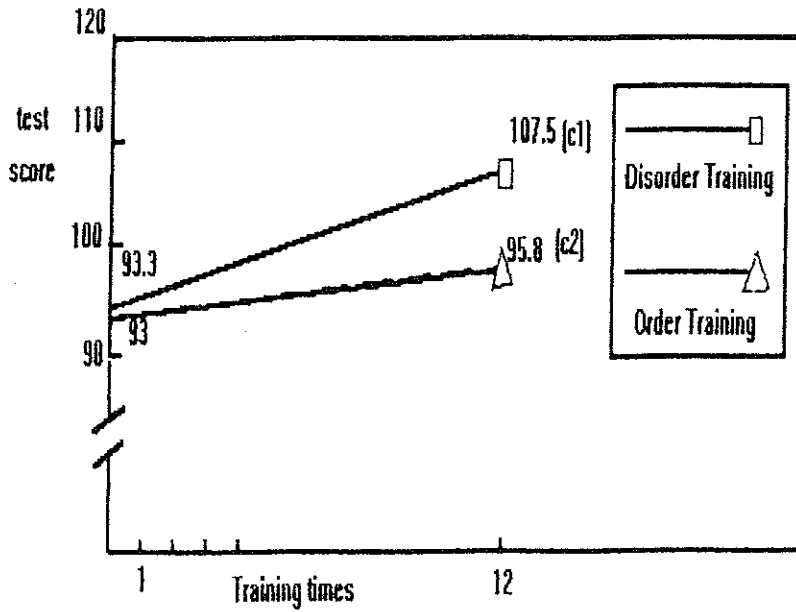


Diagram one : Before and after technical the score change of the groups of C1, C2.

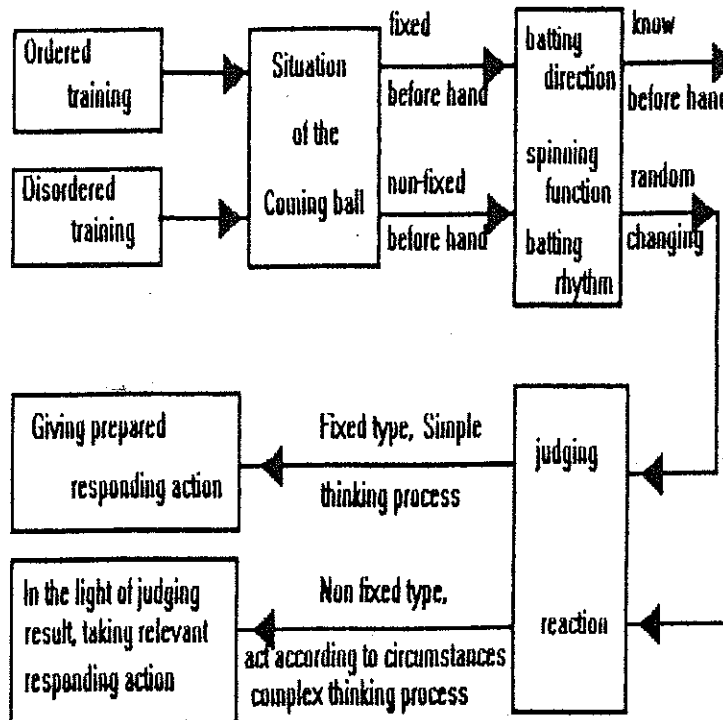


Diagram Two: Difference between the responding types of ordered training and idrordered training

direction, placement of the ball, spinning function and batting, what reaction the player should take depends on his or her responding ability to the changeable situation on that point. According to physiology, when taking ordered and disordered training, the intensity of players' cortical nerve activity is different. The style of response needed is different, either. See the difference between the two in Chart 2. Ordered training needs simple style, and disordered training needs complex one.

3.1.2 The degree of the two signal systems which participate in the activities is different.

During the ping-pong game, the skills and tactics players used are complicated with the first and second signals' participation in the activities. But according to the characteristics of ordered and disordered training, the degree of players' two signal systems which participate in activity is required differently. During the ordered training, the coming ball's situation (direction, spinning and rhythm) is known to the players before-hand, they needn't concentrate on it all the time. So the players' attention is diverted apparently, but they still can bat the ball. In fact, at that time the action skills the player have do not belong to the two signal systems.

The second signal system has relatively separated from the action skills. In the disordered training, because the situation of the ball is happening at any time and complicatedly changing, players have to concentrate on it all the time, grasp quickly all kinds of signal stimulation in a flash, use their cerebral cortex to analyze and give a response, decide which way should be taken to fight back. during this process players' first and second signal systems must participate in the activities, otherwise they can't bat the ball back well.

See Chart 3.

3.2 Compare and analyze the training result, which arrangement is better, from ordered training to disordered training or from disordered training to ordered training.

According to the requirement of the test design, after the subjects of each group finished the different order of ordered and disordered training separately, they were asked to take the last test. The results of all kinds of reaction time target are in Table 9. Table 9 shows that the average level of the subjects' responding ability in Group D1 is higher than that in Group D2. (Group D1 took from ordered training to disordered training; Group D2 took disordered training first and then ordered training).

Table 10 shows the changeable situation of reaction time among each group before and after the test and the comparison of enhancement between the two groups. The results suggest that in comparison with the arrangements of two ways of training, from ordered training to disordered training, it is improving and enhancing players' responding ability. There are two reasons:

One: from ordered training to disordered training accords with a scientific principle that progress is made from the simple to the complex step by step.

Two: from ordered training to disordered training accords with the "development" law that every change goes from quantitative change to qualitative change.

3.3 Compare and analyze the arrangement of the two ways of training when they are put to use together.

According to the test design, the subjects of the two groups take the training of ordered-disordered and disordered-ordered, they are asked to take the skill test before the training, in the middle of the training and after the training. The scores of three tests react the changeable situation of the subjects' skills and technical ability. Then analysis is made as to what developing tendency appears in the subjects who have taken the two different arrangement to enhance the players competition skills.

Table 10. Change Situation Statistics of reaction time and derivative targets within groups D1, D2 before and after the experiment

Targets	Groups	Before experiment		After experiment		Test within the group	
		X		X		t	p
A	D1	173.3		172.6		0.1232	>0.05
	D2	170.5		174.0		0.2545	>0.05
B	D1	0.3187		0.2864		2.588	<0.05
	D2	0.3312		0.3422		0.572	>0.05
C	D1	0.5323		0.4226		4.388	<<0.01
	D2	0.5392		0.5046		0.9409	>0.05
D	D1	0.3748		0.3608		0.7809	>0.05
	D2	0.3957		0.4100		0.7314	>0.05
E	D1	0.5982		0.5246		3.7310	<<0.01
	D2	0.6168		0.6086		0.1856	>0.05
F	D1	11.17		4.000		3.5715	<<0.01
	D2	11.50		12.20		0.3189	>0.05
G	D1	4.0867		1.352		5.2827	<<0.01
	D2	4.1500		4.268		0.1724	>0.05

Table 11 : Comparison of the subjects three technique test score in groups D1, D2 in the middle experiment

	D1						D2					
	one	two	three	four	five	six	one	two	three	four	five	six
I	48	40	45	48	46	44	49	47	47	44	47	47
II	16	13	12	7	10	3	16	15	17	16	14	11
III	44	43	42	48	41	44	46	48	47	44	44	44
Individual amount	108	96	99	103	97	91	111	110	111	104	105	102
The group amount	594						643					
The group average	99						107.2					
t							5.52					
p							<0.05					

Table 12 : Comparison of the subjects three technique test score in groups D1, D2 after the experiment

	D1					D2				
	one	two	three	four	five	one	two	three	four	five
I	49	49	47	47	45	47	48	41	44	47
II	19	38	17	15	20	20	6	6	2	4
III	48	47	47	45	44	49	47	45	40	41
Individual amount	116	134	111	107	109	116	101	92	86	92
The group amount	577					487				
The group average	115.4					97.4				
t						5.52				
p						<0.05				

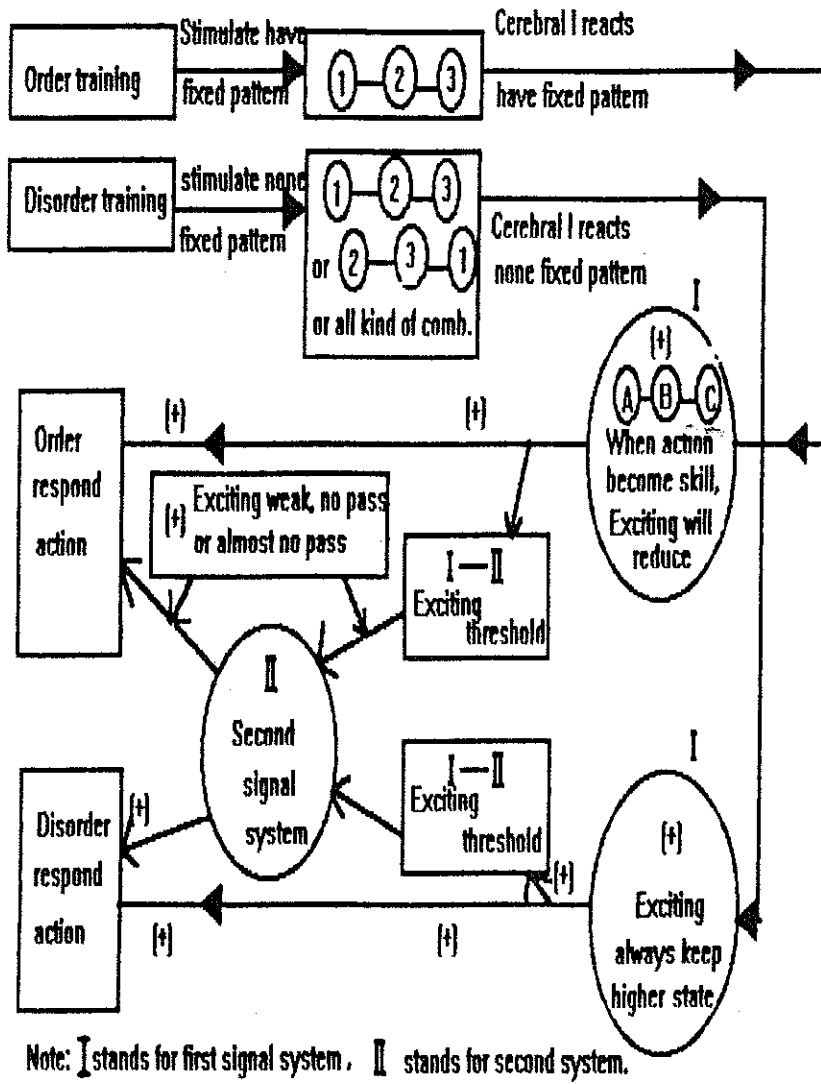


Diagram Three : the sketch of the first signal system and the Second signal

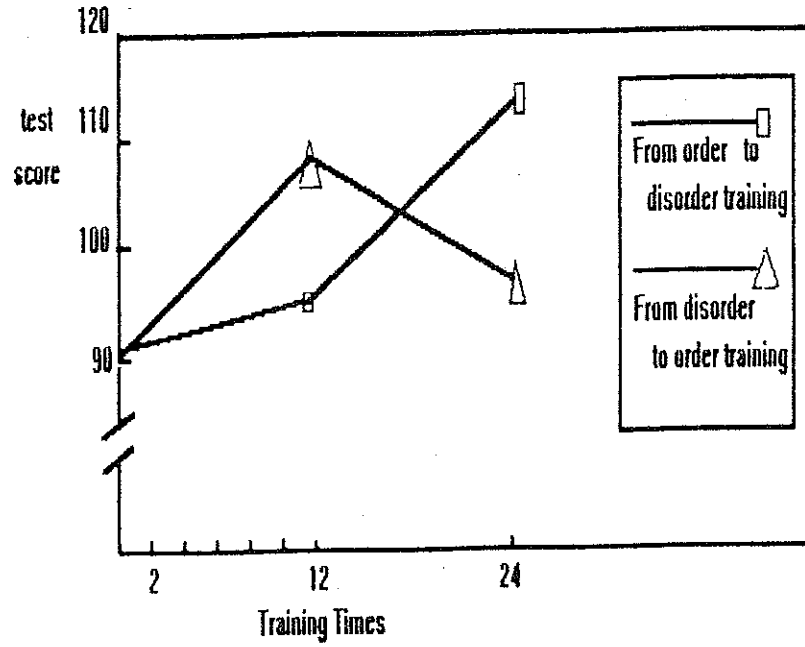


Diagram 4: The test score of D1, D2 before, during, after the experiment

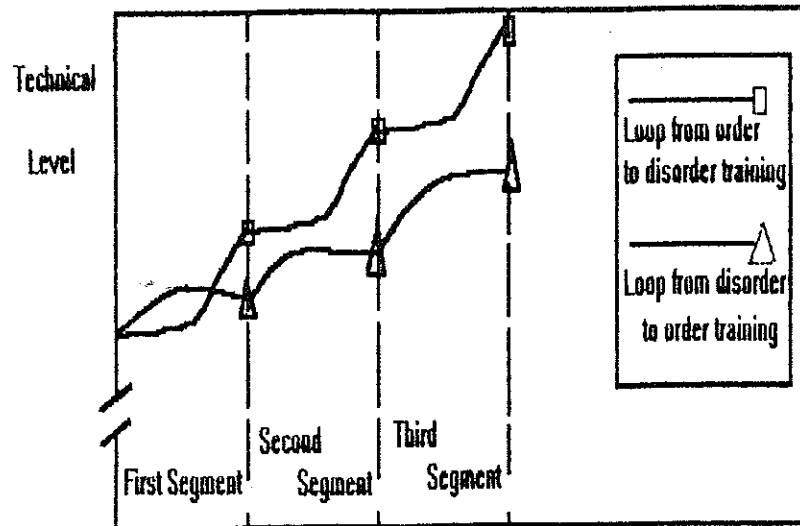


Diagram 5: The different effect and development trend while using different combination of order training and disorder training

The two groups change training content; after each of them finish the training for 12 times they take the final test. The results are in Table 12.

When putting ordered training and disordered training to use together, the result of taking different arrangement is not the same in enhancing the players' competition skills. Taking ordered training first and then disordered training can get the result of successive enhancement, while taking the arrangement from disordered to ordered training the result we get is changeable.

From Chart 5 we can see: taking the arrangement from ordered-disordered then ordered-disordered the enhancement of competition skills is going up successively. While taking the arrangement from disordered-ordered then disordered-ordered, the enhancement of competition skills is like a wave. From those above, we know that in systematic ping-pong training, it is more advantageous to take the arrangement from ordered-disordered then ordered-disordered training to enhance successively players' competition skills.

4. Conclusion

4.1 Ordered training and disordered training make the effects on enhancing ping-pong players' responding ability. After many researches, we get the result that the effect of disordered training is more notable than that of ordered training. The difference between them comes to notable level.

4.2 After the two arrangements of test from ordered to disordered training and from disordered to ordered training, we get the result that the former can get a better result than the latter to enhance ping-pong players' responding ability and to give full play to competition skills.

4.3 In the systematic ping-pong training, it will be more advantageous to enhance players' competition skills successively by taking the arrangement from ordered-disordered and then ordered disordered training.