Effect of 8- Weeks Coordination Training on Adaptive Spatial Ability of Young Cricket Players

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ABSTRACT
The purpose of the study was to investigate the effect of 8- weeks coordination training on adaptive spatial ability of young cricket players. A total of 16 male (8 players in each group) cricket players age ranged from 12-15 years with mean & SD 14.23±1.67 years, from LNIPE cricket nursery, Gwalior selected as subjects for the study. The purposive sampling technique was used to attain the objectives of the study. Vienna test system (VTS), a leading computerized psychological assessment tool was used for measuring adaptive spatial ability. The Vienna Test System SPORT is perfectly designed for sports psychology assessment. The psychometrically valid tool for profile analysis, talent assessment and development of training plans gives players and athletes a clear picture of their sports psychology profile – in terms of both skills and personality (Vienna Test System sports, 2017). Researchers analyzed the adaptive spatial ability in which how consistently in term of the same latent ability dimension is assessed in all respondents. Pre test post test control group design was adopted for this study. The training programme was carried out for a total duration of eight weeks. All subject, after having been informed objective of the study, gave their consent and volunteered to participate in this study. The training was carried out thrice a week on alternate days of the week for experimental group. ANCOVA was applied as statistical technique to analyze the effect of 8- weeks coordination training on adaptive spatial ability, the alpha level was set at 0.05. Statistical analysis of the data revealed there is significant difference in adaptive spatial ability as the f value found significant (p<0.05), Hence it may be inferred that 8- weeks coordination training is effective for improving adaptive spatial ability of young cricket players.

Keywords: Coordination Training, Vienna Test System, Adaptive Spatial Ability, Cricket.

I. INTRODUCTION

Sport is conceived as a psychophysical phenomenon in modern times. When analyzing sports skills, almost all motor movements are supported by one or another psychological factor. There is no doubt that sports performance is based on cognitive and perceptive skills, as well as on motor and physical skills (Schwab and Memmert 2012) Athletes and coaches claim that athletes who undergo systematic and well-organized training programs, such as children and young people, generally get the best performance. Coordination is the ability to repeatedly execute a sequence of movements in a fluid and precise manner. This can involve the senses, muscle contractions and joint movements. Everything we participate in requires the ability to coordinate our limbs to achieve a positive result, from walking to more complex movements of athletic events such as pole vaulting. All sports require the coordination of eyes, hands and / or feet and perhaps a tool and eyes and racket to connect the racket to the incoming ball and place our body in a proper position to return the ball efficiently and effectively. Hockey requires the coordination of hands, eyes and hockey stick to connect with the ball, soccer requires mainly the coordination of feet, eyes and ball and rugby, the coordination of hands, eyes and ball (Mackenzie, 2017).

Spatial ability consists of spatial perception, spatial visualization (mental rotation and manipulation of objects in two or three dimensions) and spatial orientation: awareness of the current position of simple figures within complex figures (Bergqvist, 2015; Lord & Garrison, 1998). Spatial ability is a sub-category of cognitive processes that affects various aspects of human life. It has no definite value, since it consists of persistent changes that occur in brain neurons and involves more than one part of the brain. Many factors participate in the morphological changes of the brain, including sports and exercise, which are part of physical activities. (Nakata, Yoshie, Miura and Kudo, 2010, Erickson et al., 2011). Spatial orientation is an aspect of intellectual capacity such as the ability to perceive and mentally manipulate figures in various dimensions from a new perspective, quickly and correctly; organize thoughts based on mental images - visualization (Bratfisch, Hagman and Bognar, 2004); understanding imaginary movement in two-dimensional or three-dimensional space; remain disconcerted in the changed orientation of a spatial configuration (Risma, 2013); to form and use cognitive maps: complex mental representations of the environment based on environmental reference points and spatial relationships (Bergqvist, 2015).

Scientific method of training and coaching is one of the key areas, which all the successful teams have concentrated and maintained for great results. Even though there are numerous methods of training available, the role of coordination training in developing spatial ability is undisputed. Recent studies have supported the...
theory that coordination training, when executed for the appropriate duration at the appropriate intensity, meets the criteria for developing performance of cricket, tennis etc. But less information is available on this area of research on cricket players. Hence, the investigator was interested to find out the effects of 8 weeks of coordination training on spatial ability of young cricket players.

II. MATERIALS AND METHODS

Selection of Subjects
To systematize the study, subjects were divided into two groups (experimental group and control group). A total of 16 male (8 players in each group) cricket players age ranged from 12-15 with mean & SD 14.23±1.67 years, from LNIPE cricket nursery, Gwalior selected as subjects for the study. The purpose of the research was explained to all the subjects and subjects were motivated to put their best during each trial.

Selection of Variables
- Independent Variable
  - 8-Weeks Coordination Training

Dependent variable
- Adaptive Spatial Ability

Criterion Measures
Adaptive spatial ability was measured through Vienna Test System (VTS). The Vienna test system is leading computerized psychological assessment tool. VTS ensures the highest possible level of objectivity and precision, including aspects that cannot be measured by traditional paper-and-pencil tests. The scoring of test results is fast and accurate.

Table 1: Criterion Measures

| VARIABLE                      | TEST                        | UNIT |
|-------------------------------|-----------------------------|------|
| Adaptive Spatial Ability      | VIENNA TEST SYSTEM          | Sec  |
| (Mean item working time)      | S1 (Short form screening)   |      |

Experimental Design
Pre test post test control group design was adopted for this study. Further the subjects are divided into two groups experimental and control group. The experimental group participated in training program. No treatment was given to control group. The training programme was carried out for a total duration of eight weeks. Duration of training programme was of 45 minutes.

Administration of Training Programme
The training schedule prescribed by the researcher was applied to experimental group and training was personally supervised by the researcher. The training was carried out for a period of eight weeks, three days a week excluding the time consumed for conducting pre-test and post test. The scholar demonstrated the training for experimental group. Each subject of the experimental group performed their respective training. Sufficient and required recovery was provided between the tests. The scholar demonstrated each exercise with its movement structure. The control group was not allowed to undergo the training program. From the first week to the eighth week, the volume of training load and training increased gradually for the experimental group.

Table 2: Exercise Protocol

| Exercise                     | Week 1 &2 | Week 3&4 | Week 5 &6 | Additional progression | Week 7 & 8 |
|------------------------------|-----------|----------|-----------|------------------------|------------|
| Warming up (in min)          | 3         | 3        | 3         | 3                      | 3          |
| Ball Drops Catches           | 30        | 2x20     | 2x30      | 3x20                   |            |
| Alternate Hand Wall Drop Catch | 30    | 2x20     | 2x30      | 3x20                   |            |
| Mirror drill                 | 30sec     | 45 sec   | 60 sec    | 75 sec                 |            |
| Push up and catch            | 15        | 2x10     | 3x10      | 2x20                   |            |
Administration of Test

- Adaptive spatial ability (A3DW)
- Purpose: To measure the spatial perception ability
- Test form: S1 (Short form screening)
- Testing duration: 29 minutes

Mean Item-Working Time (MIWT)

This variable specifies the mean working time (=mean of all item answering times) per item. For individuals with the same person parameter this variable can be used to determine which of them performed better.

Administration of the Test

The test items consist of a reference cube shown on the left-hand side of the screen. On each of these reference cubes there are six different patterns of which three are visible. On this basis of these patterns the respondent must check whether one of six comparison cubes shown on the right—hand side of the cube could be the same cube as reference cube. The right cube is selected by placing a mark in the corresponding box. The respondent also has a option of selecting one of the two other options: “No die matches” and “I do not know the answer”. As the test precedes adaptively, a new estimate of the respondent’s ability is calculated after each item on basis of the answers given thus far. This estimate provides the basis for identifying which item in the item pool is best suited, in term of its difficulty, to provide the greatest possible additional information about the respondent for solution. The test ends as soon as the pre-set termination criterion met.

Scoring

The following variables were calculated: quotient of spatial perception, Mean item working time and Dispersion of item working time.

Reliability

The numerical values of the individual samples and reliability coefficients determined by various methods (split-half, Cronbach’s Alpha) lie between $r= .82$ and $r= .91$.

Validity

Numerous results of statistical correlation analyses and inter-group comparisons provide evidence of test’s convergent and discriminant validity and allow different assessment of many validity aspects of the A3DW.

The differences in the means of experimental group and a control group for adaptive spatial ability was tested for significance by applying Analysis of co-variance (ANCOVA), and the level of significance chosen was 0.05.

III. RESULTS

The main purpose of the study was to see the effect of 8 Weeks coordination training on adaptive spatial ability of young cricket players. To analyse the effects of coordination training on adaptive spatial ability ANCOVA was applied.

In this study effect of coordination training was analysed on Adaptive Spatial Ability.

Different types of descriptive statistics such as mean and standard deviation was computed to describe each variable statistically. The level of significance was set at 0.05. Its results have been depicted in following tables.

| Skipping | 30 | 50 | 70 | variation | 90 |
|----------|----|----|----|-----------|----|
| Cool down(in min) | 3 | 3 | 3 | 3 |

Figure 1: Screenshot of Adaptive Spatial Ability Test on Vienna Test System Statistical Technique
Table 3: Descriptive Statistics of Adaptive Spatial Ability

| GROUP               | Mean   | SD   | Pre  | Post  |
|---------------------|--------|------|------|-------|
| EXPERIMENTAL GROUP  | 37.32  | 3.36 | 30.87| 5.15  |
| CONTROL GROUP       | 36.88  | 3.29 | 33.81| 4.41  |

Table 3 indicates mean and standard deviation of adaptive spatial ability on of experimental and control group. Mean and SD of pre test and post test of experimental group is 37.32 ± 3.36 & 30.87 ± 5.15 respectively and Mean and SD of pre test and post test of control group is 36.88 ± 3.29 & 33.81 ± 4.41 respectively.

Table 4: Levene's Test of Equality of Error Variances

| df1 | df2 | p-value |
|-----|-----|---------|
| 4.299| 1  | 14 | .076  |

To test the equality of variances adaptive spatial ability, Levene’s test was used. The F-value was insignificant as the p-value (.076) was more than 0.05. Thus the null hypothesis of equality of variances might be accepted, and it was concluded that the variances of the two groups were equal. The results were presented in Table 4.

Table 5: ANCOVA Table for the Data on Adaptive Spatial Ability

| Source | Type III Sum of Squares | df | Mean Square | F   | p-value |
|--------|-------------------------|----|-------------|-----|---------|
| Pre Test| 241.44                  | 1  | 241.44      | 38.56 | 0.000*  |
| Group  | 48.42                   | 1  | 48.42       | 7.73  | 0.016*  |
| Error  | 81.40                   | 13 | 6.26        |       |         |
| Total  | 17093.33                | 16 |             |       |         |
| Corrected Total | 357.38 | 15 |             |       |         |

*significant at 0.05 level

Table 5 shows the F-value for Pre is significant as p-value (0.000) is less than 0.05. It shows that the initial conditions of both the groups are not same.

The f-value for comparing the adjusted means of the two groups (experimental and control group) during post testing. Since p-value of statistics is 0.016 which is less than 0.05, it is significant. Thus the null hypothesis of no difference among the post means of the data on adaptive spatial ability of both groups may be rejected at 5% level.
IV. DISCUSSION AND FINDINGS

From the above results it may be concluded that coordination training of 8-week is effective to improve adaptive spatial ability. Adaptive spatial ability showed significant results. So form this it is inferred that if we provide 8-week Coordination training to young cricketer than there would be significant improvement in their adaptive spatial ability.

Spatial ability is an important skill that student need to have (Delice et al., 2009; Revina et al., 2010; Yue, 2006; Walker et al., 2011). Hegarty & Waller (2005) supported that spatial abilities are important for both constructing and comprehending abstract spatial representations. Piaget (1951) was one of the earliest scholars to suggest that play is an important part of child development, helping to develop children’s motor skills and spatial abilities. Moreau et.al. (2012) conducted a study on enhancing spatial ability through sport practice and findings demonstrate the significant effect of training in particular sports on mental rotation performance, thus showing consistency with the notion of cognitive plasticity induced from motor training involving manipulation of spatial representations. They are discussed within an embodied cognition framework. Cognitive processes are important for successful practicing of sport. Longer period of sports training was related to better spatial orientation (Stoyanova, Ivanchev & Petrova, 2016).

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