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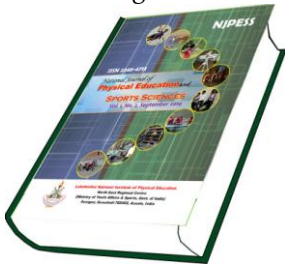
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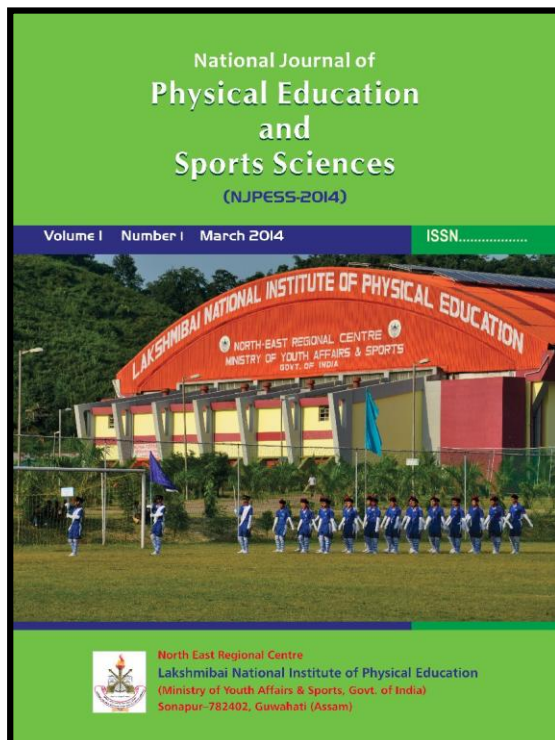
Editorial

Epicenter Voyage of a Myth Institute-Lakshmibai National Institute of Physical Education North East Regional Center



Lakshmibai National Institute of Physical Education, NERC is amongst the most admired centers of world-class education to foster academic excellence, physical fitness and research in sports committed to helping scholars, researchers and sports scientist leap into the 21st century. The present endeavor is a tribute to the holy symbol of Lakshmibai National Institute of Physical Education, NERC as the same was long precious aspiration. The journal shall symbolically signify the essence of quality research thereby appropriate in the ambition of the institute. The journal shall offer a much desired platform to publish quality research being undertaken in the whole world on the area in question. The journal shall bring the academicians and researchers from all over the globe to share their accumulated experiences and perceptions in order to realize new scientific and original innovation focused on aspects of the sports sciences and sports performance.

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Relationship of Shooting Accuracy with Selected Anthropometric Variables in Male Basketball Players

**Abhishek Kumar Yadav*

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Abstract

The purpose of the study was to analyze the relationship of selected anthropometric variables to the performance of free throw shooting in basketball. The subjects for this study were ten male basketball players who represented Lakshmi Bai National Institute of Physical Education, Gwalior, in Inter-University Championship. The technique of the subjects was recorded by experts using objective judgment. To measure the required variables for the study i.e.- height, arm length, leg length, hand length, torso, arm girth relax and arm girth flex, the instruments like sliding caliper, gully tape were used, all the players were right handed and were of approximately the same height. The average height was 180.9 cm and players were having the similar kind of shooting action and they represented university team. To determine the relationship of selected anthropometric variables Pearson's product moment correlation was used. The values of coefficient of correlation of selected anthropometric variables with free throw shooting accuracy, along with their respective p-value are: Height $-0.303(0.394)$, Leg length $0.158(0.64)$, Arm length $0.292(0.413)$, Hand length $-0.459(0.182)$, Torso $-0.043(0.907)$, Arm girth relax $-0.244(0.496)$, and for Arm girth flex $-0.348(0.324)$. The results have exhibited that the obtained value coefficient of correlation relationship of selected anthropometric variables has shown insignificant relationship to the performance of free throw shooting accuracy in basketball.

Key Words: Anthropometric, Shooting, Basketball.

Introduction

Basketball is a team sport, played by five players. One of its characteristics is also the division of the players according to playing positions. This separation is necessary to optimize the organization of attack and defense and thus increase their efficiency. Three main types of players are known in basketball: guards, wings and centre. Each of these types divides further into several sub-types. They differ in the game according to the position on the court and their playing role in the attack and defense team tactics.

Basketball is a complex technical game and performance differences between players of varying ability levels have been identified in the anthropometric and physiological domains. Previous research has indicated that anthropometric characteristics can be useful in the profiling of basketball players at the elite senior level (Hoare, 2000). Number of researchers dealt with anthropometric characteristics of sportsmen, trying to reveal optimal morphological profile for specific sport activity. From those researches, it is evident that the body weight gives a significant contribution to the need for the emergence of strength.

The free throw should be one of the easiest shot in Basketball (Okubo & Hubbard, 2006). Since the player is all alone, 15 feet from the basket, with no defense and no close distractions. All the player has to do is to get ready, aim, cock the ball and shoot.

Shooting is the principal method used to score points in Basketball and for this reason it is the most frequently used technical action (hay 1994). The free throw shot is distinguished as the most important of all the shooting actions (Hess 1980). efficacy in shooting is identified with the ability to perform well in this sport and consequently it is extensively practiced.

Since free throw has become a very important part the game and cannot be neglected by any player at any level. Hence, it becomes necessary for the coaches to make sure that his players are perfecting the art of free throw shooting, and to ensure that the above mentioned equipments can be used. From the above discussion, it can be understood that Biomechanics provide a great help in understanding the technical aspects of skills and techniques, also help in improving the skills. The research scholar hereby makes an effort to broaden the horizon of knowledge by bringing new facts and thoughts about use of IC3 training tool in free throw shooting by this study, which will add on or may give a new direction to the field.

Selection of Subjects

For the purpose of the study a total of 10 male Basketball players age ranged from 18-25 years, who have represented their team in west zone intervarsity competition of LNIPE, were purposely selected.

Selection of Variables

The selection of variables was done by using the following criteria: -

The research scholar gleaned through the scientific literature on related topic from different library sources available at the library of LNIPE, Gwalior and also consulted experts. According to administrative feasibility of available instruments and expertise the following anthropometrical and physiological variables were selected.

- ❖ Anthropometric variables
- ❖ Arm length
- ❖ Hand length
- ❖ Height
- ❖ Leg length
- ❖ Torso
- ❖ Arm girth

Procedure

To measure the Negative Breath Holding Capacity, the subjects were instructed to place the nose clip tightly. They were asked to exhale through the mouth to the maximum capacity. As soon as the subjects exhaled and closed the lips, the stopwatch was started. As soon as the subjects opened their lips to inhale, the stopwatch was stopped. Score: The time given by the stopwatch was recorded as the score for the Negative Breath Holding Capacity.

Free Throw Shot Test

The students were instructed to shot the ball at the goal from behind the free throw line. Two trials, each trial consists of 10 throws, with one point recorded for every point scored, and the best of the two was counted as the final score.

Administration of Test

Variables	Unit of measurement	Test description	Instrument
Arm girth	Centimeter	Circumference was taken at the level of the midpoint between the acromion and the olecranon processes and was measured while the subjects were standing in proper anatomical position and the flex arm girth and relax arm girth were measured.	Gulick tape
Torso	Centimeter	Length of C7 veterbrae base of the neck to the top most of iliac crest taking the starting point from the C7 vertebrae to the iliac crest while the subject is standing with a slight tilted head.	Gulick tape
Height	Centimeter	The subjects were standing straight in stadiometer and the Maximum distance from the floor to the highest point on the head (apex), when the subject is facing directly ahead and stands erect.	Stadiometer
Arm length	Centimeter	The subjects were standing staright and The distance from the marked acromial to the marked radiale,with the arms at the sides, palms against the thighs.	Anthropometric compass

Hand length	Centimeter	The distance from the marked mid-styilion to the dactylion were measured with minimum human errors as far as possible with at most perfection.	Small bone caliper
Leg length	Centimeter	All the subjects were standing staright and the vertical distance between the Trochanterion to the base of the foot.	Anthropometric tape

Statistical Technique Employed

The Pearson Product moment correlation coefficient was used as the statistical technique and the level of significance was set at 0.05.

Results

The statistical analysis of the data, collected on ten basketball players and the results of the study have been presented in this chapter. Pearson's product moment correlation was used to find out the relationship of selected anthropometric variables with the performance of free throw shooting accuracy in Basketball. The level of significance was set at 0.05.

Table 1
Mean And Standard Deviation Of Anthropometric Variables

Variable	Mean	S.D
Height	1.817	.0483
Leg length	96.00	3.55
Arm length	80.87	3.87
Hand length	19.69	1.546
Torso	52.05	50.38
Arm girth relax	26.75	1.722
Arm girth flex	30.10	1.87

The descriptive statistics of anthropometric variables are presented in table-1. The mean and standard deviation for anthropometric variables were as follows:
- Height 1.817 ± 0.0483 , Leg length 96.00 ± 3.55 , Arm length 80.87 ± 3.87 , Hand length 19.96 ± 1.546 , Torso 52.05 ± 50.38 , Arm girth relax 26.75 ± 1.722 , and for Arm girth flex 30.10 ± 1.87 .

Table 2
Mean And Standard Deviation Of Free Throw Shooting Performance

Variable	Mean	S.D
Shooting performance	6.80	1.686

The descriptive statistics of free throw shooting performance presented in table 2. The mean and standard deviation for free throw shooting performance were as follow: - Shooting performance 6.80 ± 1.686 .

Table 3
Relationship Of Selected Anthropometric Variables With Free Throw Shooting Accuracy

Variables	Coefficient of correlation (r)	P-value
Height	0.714	0.020
Leg length	0.759	0.011
Arm length	0.699	0.024
Hand length	0.631	0.047
Torso	0.628	0.048
Arm girth relax	-0.84	0.812
Arm girth flex	0.026	0.942

The coefficients of correlation of anthropometric variables along with their p-value are presented in table-3. The coefficient of correlation for anthropometric variables with free throw shooting were as follows:-Height 0.714(0.020), Leg length 0.759(0.011), Arm length 0.699(0.024), Hand length-0.631(0.047), Torso 0.628(0.048), Arm girth relax-0.84(0.812), and for Arm girth flex -0.026(0.942).

Discussion of Findings

Shooting is the most important skill in basketball. The fundamental skills of passing, dribbling, defence, and rebounding may enable you to get a high percentage shot, but you must still be able to make the shot. A large part of shooting is mental attitude. In addition to shooting skill, you must have confidence in yourself to shoot well. The integration of the mental and mechanical aspects of shooting fosters shooting success. Shooting is a skill you can practice by yourself. Once you understand correct mechanics, all you need is a ball, a basket, and an eagerness to improve.

The purpose of the study was to find out the “Relationship of shooting accuracy with selected anthropometric variables in male basketball players.” The variables

were Height, Arm length, Hand length, Leg length, Torso and Arm girth.

As shown by the study, the height of the subject had definite relationship with free throw shot performance in basketball. The reason that releasing the ball from a higher point above the ground increases the chances of making a shot. In theory it makes sense to shoot with an exaggerated high arc, thereby increasing the size of your target. However, higher arc requires more force at the time of release to propel the basketball higher, which makes it more difficult to control the shot. In addition, the shot will no longer be a 'soft shot' because gravity increases the speed of the ball as it falls. For each 0.1 second the basketball falls through the air, it increases in speed. The faster the ball is moving, the greater the collision with the rim. Thus more the height of a player betters his chances of making a free throw.

As the height increases so do the arm length, torso and leg length of an individual increases thus providing them to release the basketball from a higher point from the floor than their smaller counterparts thus increases the chances of making a free throw. So the study showed a significant relationship between these variables to the shooting free throw accuracy.

Hand length of the subject had definite relationship with free throw performance. It might be due dimension of hand and its surface area where ball had been placed. This will help in generating more force and help in controlling the ball better.

Arm girth relax & flexed of the subject had no significant relationship to the shooting accuracy because it does not matter how big arm girth one have, it does help in distance shooting where strength is required but free throw required precision.

Discussion of Hypothesis

It was hypothesized that there would be significant relationship of Height, Leg length, Arm length, Hand length, Torso, Arm girth relax and Arm girth flex to the free throw shooting accuracy in basketball hence the null hypothesis is rejected in case of height, arm length hand length, leg length & torso but failed to be rejected in case of arm girth flexed and relaxed.

Conclusions

Based on the analysis and within the limitations of the present study, following were the conclusions drawn:

- ❖ Height showed significant relationship to the performance of free throw shooting accuracy in basketball.
- ❖ Arm length showed significant relationship to the performance of free throw shooting accuracy in basketball.
- ❖ Leg length showed significant relationship to the performance of free throw shooting accuracy in basketball.

- ❖ Hand length showed significant relationship to the performance of free throw shooting accuracy in basketball.
- ❖ Torso showed significant relationship to the performance of free throw shooting accuracy in basketball.
- ❖ Arm girth showed no significant relationship to the performance of free throw shooting accuracy in basketball.

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Analysis of Forehead Jump Smash in Badminton Among Different Skill Level

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Abstract

The purpose of the study was to investigate the comparison of selected kinematic variables with the performance in execution of forehand jump smash. The subject for the study was ten male badminton player of Lakshambai National institute of physical Education, NERC Guwahati, who had the good command on the particular skill. The mean height and weight of university player was [68.2±5.11kg and 172.43±4.76cm] and mean height and weight of non-university player was [67.6±4.613 and 170.61±6.70] respectively.

Videography technique was employed in order to register the performance of the subject in execution phase of forehand jump smash. The Nikon D-3100 camera was used with the frequency of 30 frame per second and the subject were video graph in horizontal plane from the right side. Each subject was given four trails and the best trail used for analysis. The selected phase were taken out from the video by using Kinovia software. Stick diagram method was involved in order to assess the centre of the gravity of the body during execution in forehand jump smash. The data was analysed by using independent t-test to ascertain the relationship of the selected kinematic variable with the performance in execution of forehand jump smash. The following kinematic variables (linear and angular) were selected, linear kinematics variables, Height of the centre of gravity, jump time, shuttle travel time, and shuttle distance. Angular kinematics variables are; angle at right elbow joint, angle at right shoulder joint, angle at right hip joint, angle at right knee joint, angle at right ankle joint.

Introduction

Bio mechanics is the science of movement of living body including how muscles, bones, tendons and ligaments work together to produce movement.

Biomechanics is part of the large field of kinesiology, specifically focusing on the mechanics of movement. It is both a basic and applied science, encompassing research and practical use of its findings. Sports biomechanics studies human

motion during exercise and in sports. Physics and the laws of mechanics are applied to athletic performance,

Badminton is a racquet sports played by either two opposing players (single) or two opposing pair (double), who take positions on opposite half of a rectangle court that is divided by the net. Player score points by striking a shuttlecock with their rackets so that it passes over the net and land in their opponent's half of the court. A rally ends once the shuttlecock has struck the ground and the shuttlecock may only be struck once by each side before it passes over the net. The shuttle is blown off course by even slightest breath of wind. That's why competitive badminton is always played indoors.

The Perfect Badminton Smash Shot - The badminton jump smash is a powerful offensive and attacking shot in the game. All professional use it as part of their activity of short in back. You have to have some idea of "Centre of gravity" to understand badminton biomechanical principles. Centre of gravity is a point in the body which is pivotal in balancing the entire body. At that point, your body will be in perfect balance without any need to change posture or rotate to keep it in balance.

The centre of gravity is approximately located in the terminal portion of the spinal cord called the sacrum; especially in its upper one-third portion. The centre of gravity in a female is at comparatively lower level than a male. Similarly, height and age also affect the location of the centre of gravity. The centre of gravity important because, by lowering it you can increase your balance when playing badminton.

Methodology

For the purpose of present study in total 10 i.e five male badminton player played inter-university tournament and 5 male badminton player's those does not played in the university of tournament belonging to Lakshmi Bai national institute of physical education Guwahati were purposely selected. The average height, weight were [68.2±5.118 cm] and [67.6±4.613 kg] of mean and standard deviation respectively. Age is between 18 to 24-year-old professional badminton players.

The following can Kinematic variables (linear and angular) were selected, linear kinematics variables, Height of the centre of gravity, jump time, shuttle travel time, and shuttle distance.

Angular kinematics variables are; angle at right elbow joint, angle at right shoulder joint, angle at right hip joint, angle at right knee joint, angle at right ankle joint.

Statistical Technique

To find out the comparison between selected kinematics variables with the performance of LNIPE (NERC) inter university badminton player and non-university badminton player, two sample independent test was used. All the

data was analysed by statistical package for social science (SPSS) version 20. For testing hypothesis and level of significance was set at 0.05 level.

Results

The score of each independent variables of angular kinematics variable were abstract from the videography by using digitization and then compare the subjects with two different level of performance in jump smash. The movement used for analysis was forehand jump smash. The outcome of the study has been shown below Graph.

Variable players	University player		Non- University (Angle at)	
	MEAN	STD. DEVIATION	MEAN	STD. DEVIATION
Elbow joint	174.200	6.648	173.200	9.984
Shoulder joint	174.600	8.848	174.800	10.663
Hip joint	154.000	13.32	153.200	7.224
Knee joint	141.400	13.183	156.400	26.707
Ankle joint	116.400	10.807	119.200	17.195

The table show the mean and standard deviation as a descriptive at statistics of university player

Further to know the with-in group variability of the data, the levene's test was employed which is present below in table 2

VARIABLE	F	Sig
Angle at Elbow joint	.249	.631
Angle at Shoulder joint	.616	.616
Angle at Hip joint	2.321	.166
Angle at Knee joint	1.264	.294
Angle at Ankle joint	.786	.401

The result of Levene's test in table 2 was found insignificant as the above table shown the p-value was more than the significant value ($p < 0.05$) so assumption of sphericity has not been in violated [$F=1.0472$ and $p = 0.3849$]. In that case t-test was proved as valid to apply for further analysis.

To find out the between group difference in selected kinamatic variables, the two sample independent t-test was applied as a comparative statistic as given below table 3

VARIABLE	N	D.F	M.D	T	SIG
Angle at Elbow joint	5	8	1.000	.186	.857
Angle at Shoulder joint	5	8	- 1.200	- 1.96	.851
Angle at Hip joint	5	8	.800	.118	.909
Angle at Knee joint	5	8	-15.000	-1.112	.293
Angle at Ankle joint	5	8	-2.800	-.308	.766

As above table shown it has no significant comparison with the performance of subject in forehand jump smash among university and non-university player. In that case the null hypothesis which was formulated to test the research hypothesis is failed to be rejected as 0.05 level significance

The score of each independent variables of linear kinematics variables were compared with the performance of subject in jump smash.

VARIABLE	UNIVERSITY PLAYER		NON- UNIVERSITY PLAYER	
	MEAN	STD.DEVIATION	MEAN	STD.DEVIATION
CG AT STANCE	93.858	3.300	93.788	5.974
CG AT CONTACT	174.620	4.703	140.956	12.784
JUMP TIME	.560	.065	.386	.079
SHUTTLE TRAVEL	.483	.019	.624	.026
SHUTTLE DISTANCE	4.350	.165	4.700	.077

Further to know the with-in group variability of the data, Levene's test was employed which is presented below table 5

VARIABLE	F	SIG
CG AT STANCE	6.680	0.03
CG AT CONTACT	3.863	0.85
JUMP TIME	.278	.612
SHUTTLE TRAVEL	.819	.392
SHUTTLE DISTANCE	1.629	.238

The result of levene's test in table 2 who found insignificant except C.G at stance as the above table shown the p-value was more than the significance value so assumption of sphericity has not been violated [F=2.6538, P=0.4244]. In that case t-test was proved as valid to apply for further analysis and in case of CG at stance phase the correlated degree of freedom was used comparative statistics.

To find out the between groups difference in selected kinetic variables, the two sample independent t-test was applied as a comparative statistics as given below in table 6

VARIABLE	N	D.F	M.D	T	SIG
CG AT STANCE	5	6.234	0.760	.023	0.03
CG AT CONTACT	5	8	33.664	5.526	0.85
JUMP TIME	5	8	.174	3.774	.612
SHUTTLE TRAVEL	5	8	-.1860	-12.83	.392
SHUTTLE DISTANCE	5	8	-.420	-5.127	.238

Since the value of t-test required to be significant in less than 0.05 level of significant. The above table clearly showing that the statistic of centre of gravity instance was 0.03, it was less than 0.05 level of significance at linear kinematics. And statistics of C.G in contact, jump time, shuttle travel time, and shuttle distance in greater than the 0.05 level of significance except C.G of a stance, therefore the other linear kinematics variables did not show any significant comparison with the performance of subject in forehand jumps smash among University and NON-University player. In that case the null hypothesis which was formulated to test the hypothesis fail to rejected at 0.05 level significant.

Discussion and Conclusion

In case of selected angular kinematic variable. The value of t-test in selected moment were found insignificant, but this trend does not mean the angle at different joints at selected moment do not play any important role while executing or performing jump smash.

The comparison of selected linear kinematic variable with the performance of the subject at selected moment was also found insignificant. Except C.G in content, jump time. Time travel and shuttle distance with the performance of subject in fore jump smash but significant comparison may be obtained by studying the path or displacement of C.G in whole moment. The above table shows that the comparatives statistic of both the group shows a significant in C.G at stance through it was less than the significant value 0.05. So it means that the university player has better cg at stance as compared to non-university players and there may be 5theresaon behind that the university player has better leg strength, reaction force, and better stability position which help them to jump high during forehand jump smash

Based on the analysis and within the limitation of present study following conclusions were drawn:

All the selected angular kinematics variables did not show any significant difference in university and non-university in execution of forehand jump smash.

All the selected linear kinematic variables also did not show any significant difference in university and non-university, except C.G at stance with the performance in execution of forehead jump smash.

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Effect of Interval Training on the Cardiac Efficiency of Female Boxing Players

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Abstract

The purpose of the study was to investigate the effect of interval training on the cardiac efficiency of female boxing players with age group of 20 to 25 years from HMV College Jalandhar. Total 40 female boxing players were the sample of the study. 20 subjects were in experimental group and 20 were control group. The all female boxing players were Inter-college level players. T-test was the statistical technique and results shows the significance difference in Pre and post test on cardiac efficiency of female boxing players.

Keyword: Cardiac Efficiency, Boxing Players.

Introduction

Support is commonly defined as an organized, competitive and skillful physical activity requiring commitment and fair play. To achieve any goal in sports physical fitness is an essential variable. Fitness is an essential aspect for the higher performance in sports competition which includes speed, strength, endurance, flexibility, & coordinative ability. As other component endurance is one of them, which is also known as cardiovascular endurance. Cardiac Efficiency is defined as the ratio of the energy delivered by a system to the energy supplied to it. Cardiac-efficiency mainly depends on the cardiac output, the pulse rate and the blood pressure. Heart is the vital organ of our body. The muscle of the heart and the blood vessels must be strong enough to send the required amount of oxygen and nutrition through the blood. Physical fitness is the capability of the heart blood vessels, lungs and muscles to function at operative efficiency.

Objective

To find out effect of interval training on cardiac efficiency of the female boxing players.

Hypothesis

There exists significant difference on cardiac efficiency of the female boxing players.

Method & Material

The total sample of forty female boxing players was selected through purposive sampling technique. The data was collected from the female boxing players of H.M.V. Jalandhar aged 20 to 25 years. They were divided into two groups: group A (20 Boxing Players) worked as experimental group and group B (20 Boxing Players) as control group. Group A perform eight weeks interval training program. Pre test and post test was taken by the researcher.

Tool

Harvard Step Test: To measure the cardiac efficiency of female football players

Statistical Technique

The raw data was arranged in tabulated form for the further statistical treatment. Collection data was analyzed with the help of t-test because the sample size was less than thirty (30) and two groups were there. The results were tested at 0.05 level of confidence.

Results

Table No. 1.1

Table No.1.1: Comparison Between Pre And Post-Test Data Of Control Group

Test	N	Mean	SD	SEM	df	t
Pre-test	20	47.13	1.03	0.23	19	1.687
Post-test	20	47.57	1.01	0.22		

*** Significant at 0.05 level=2.09**

Table No.1.1 shows the pre–test and post-test mean scores of Cardiac Efficiency of control group female boxing players. The pre-test mean scores 47.13(SD=1.03) and post-test mean scores of 47.57(SD=1.01) show that there exists little difference in the pre-test and post-test cardiac efficiency scores of female boxing players who have not attended the 8-week Interval training programme. The calculated‘t’ value is 1.687 which is not significant at 0.05 level of confidence.

Graff: 1.1
Comparison Between Pre And Post-Test Data Of Control Group

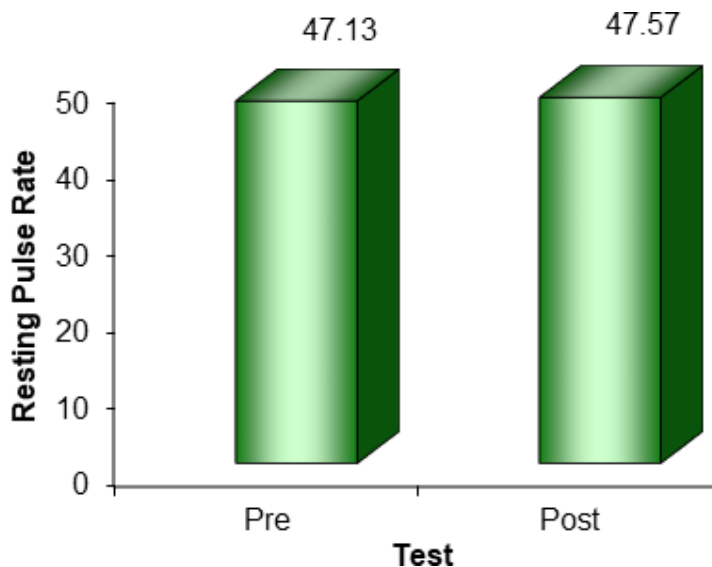


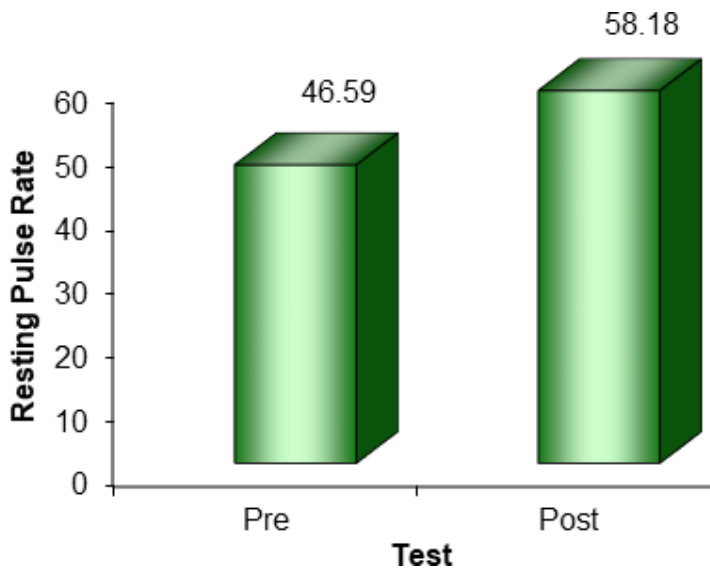
Table 1.2

Table No.1.2: Comparison Between Pre And Post-Test Data Of Experimental Group

Test	N	Mean	SD	SEM	df	t
Pre-test	20	46.59	1.11	0.24	19	34.218**
Post-test	20	58.18	1.73	0.38		

**** Significant at 0.01 level=2.86**

Table No.1.2 shows the mean scores of Cardiac Efficiency of pre test and post test of the female boxing players of the practitioner group. The pre-test mean scores 46.59 (SD=1.11) and post-test mean scores of 58.18(SD=1.73) show that there exists a significant difference in the cardiac efficiency of female boxing players after undergoing the 8-week Interval training programme. The calculated 't' value is 34.218 is highly significant at 0.01 level of confidence.

Graff: 1.2**Comparison Between Pre And Post-Test Data Of Experimental Group****Conclusion**

According to the results obtained it is established that there exists a statistically significant difference in the cardiac efficiency of female boxing players pre-test and after undergoing Interval training exercises. Cardiac Efficiency can be improved by imparting the systematic interval training.

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teamwork wins championships”.

Psychology is one such subject that studies the mind and behavior, according to the American Psychological Association. It is the study of the mind, how it works, and how it affects behavior. Psychology consists of many different unique and distinctive branches and each of them dealt with specific subtopics within the study of the mind, brain and behavior. Each branch looks at questions and problems from a different perspective.

In sports psychology, we deal with certain aspects that are beyond the physical qualities and are required by athletes. As competition gets tougher as athlete progresses, it becomes more difficult to win with physical ability only. In sports psychology, we study the psychological skills or factors that are required by athletes so that they are mentally prepared for competition. Some of these psychological factors include confidence, motivation, mental toughness, personality, individual difference and many others. We have seen athletes who fail to make it to the top level of competition and the main reason for this is not because they cannot perform physically but they lack the psychological skills required to perform at the top level of competition. For this reason the acquisition of these skills are very important for getting success in sports competition.

Team dynamics are invisible forces that binds the team members together so as to create a ‘we feeling’ among the teammates.” Excellence has been defined in terms of a team’s success. In high school it was whether our team from a very small school in a small town could defeat the bigger, city teams. In the pros, it was whether a team without a dominant star could be the best. In the Senate, I finally realized that the passage of legislation, like teamwork, required getting people with different backgrounds, different interests and different personal agendas to agree on a shared goal and to work towards it”(Bradley,1976). “The success of the Celtics is based on a philosophy wholly opposed to individualism. The basic Auerbach commandment is that to win, the individual must fit in; he must subordinate his desires and skills to those of the team. He must sacrifice himself, in his life on the court, to working of the team” (Auerbach, 1976).

Mental Toughness

According to Loehr (1986), “Mental toughness is the ability to consistently maintain and ideal performance state during the heat of competition”.

Self-Confidence:- According to Bandura (1986), “Self confidence is the belief that individuals have in their capability to perform a particular task”.

Negative Energy Control

According to Martha Crampton, “Negative energy is a psychological energy including attitudes, thoughts, emotions, psychological states, etc., which is antithetical to our own growth and/or growth of others”.

Attention Control

According to Posner and Peterson (1988), “Attention control refers to the individuals’ capacity to choose what they pay attention to and what they ignore”.

Visual and Imagery Control

According to Vealey and Greenleaf (1998), “Mental imagery is best described as the process of internalized rehearsal involving precise multisensory representation of the athletic experience”.

Motivational Level

According to Alderman (1974), “Motivation is the tendency for the direction and selectivity of behavior to be controlled by its connection to consequences and the tendency of this behavior to persist until a goal is achieved”.

Positive Energy

According to Martha Crampton, “Positive energy includes attitudes, thoughts, emotions which are beneficial to our growth”.

Attitude Control

Attitude control refers to the set of emotions, beliefs, and behaviors that are required towards a person or an event.

Team Dynamics

Team dynamics are the unconscious, psychological forces that influence the direction of a team’s behavior and performance.

Methodology

Selection of Subjects

For the purpose of the study total of 90 male State and National level male football players were selected from three categories that is under-15, under-17 and Senior level with their age ranging between 13-32 years. The total samples were further classified into 30 subjects each in the designated categories. For the U-15 category, the data was collected from players that have participated in the Subroto Cup competition; the data for the U-17 category was collected from the U-16 Youth I-league team and for the senior category and the data was collected from players that have participated in the Santosh Trophy competition.

Selection of Variables

The variables selected for this study was mental toughness, the data was collected by administration of the Psychological Performance Inventory (PPI) based on 7- sub factors developed by James E. Loehr (1982), containing 42 items.

Also, the variable of group cohesion was selected and the data was collected by the Group Environment Questionnaire (GEQ) as developed by Albert V. Carron (1985) containing 18 items under four scales: Individual Attraction to Group-

Task; Individual Attraction to Group-Social; Group Integration-Task and Group Integration-Social was used to find out the team dynamics of the three groups.

The Psychological Performance Inventory (PPI)

This questionnaire was developed by James E. Loehr (1982) is a useful psychometric tool to measure individuals' mental toughness. PPI is a personal awareness version which focuses on the score range for seven broad personalities and behavioral factors that are associated with the success in competitive activity. The subjects responded to each statement using a five ordinal scale. Hence the minimum point of response in each system stands at 1 and a maximum pole at 5.

This questionnaire measures various aspects of mental toughness such as:

- ❖ Factor 1 – Self Confidence
- ❖ Factor 2 – Negative energy control
- ❖ Factor 3 – Attention control
- ❖ Factor 4 – Visual/Imagery control
- ❖ Factor 5 – Motivational level
- ❖ Factor 6 – Positive energy control
- ❖ Factor 7 – Attitude control

The 42-item scale yields an overall mental toughness score, as well as 7-item subscale scores: (a) self-confidence; (b) negative energy control; (c) attention control; (d) visualization and imagery control; (e) motivation level; (f) positive energy and (g) attitude control. The subjects are asked to indicate whether each reason was almost always, often, sometimes, seldom, and almost never. Scores are recorded on a five point Likert scale. Sub-scale scores ranged from a low of 6 to a desirable high of 30 and total scores from 42 to 210.

The Group Environment Questionnaire (GEQ)

This questionnaire was developed by Albert V. Carron (1985) is designed to measure individual group member's perception of team cohesiveness. Specifically, four measures of cohesiveness are assessed:

- ❖ Individual attraction to group – task,
- ❖ Individual attraction to group –social,
- ❖ Group integration –task and
- ❖ Group integration –social.

Individual attraction to group – task is a composite measure of individual team member's feelings about their personal involvement with the group task, productivity, goals and objectives.

Individual attraction to group- social is a composite measure of individual team member's feelings about personal involvement, desire to be accepted, and social

interaction with the group.

Group integration –task- is a measure of the individual team member's feelings about the similarity, closeness, and bonding within the team as whole around the group's task.

Group integration-social - is a measure of the individual team member's feeling about the similarity, closeness and bonding within the team as whole around the group as a social unit.

The questionnaire is made up of 18 items. The total 18 items are grouped into 4 items in individual attraction to group task; 5 items in individual attraction to group –social; 5 items in group integration task; and 4 items in group integration –social.

Team members are required to respond to the 18 statements about their team on a 9-point scale which is anchored at two extremes by “strongly disagree” to “strongly agree”. The score on any specific scale is computed by obtaining the mean response for a subject from the pertinent items.

Administration of Questionnaire and Collection of Data

The subjects were briefed about the questionnaires in order to make them understand the purpose of the study which was to find out their mental toughness and team dynamics. The athletes were assured regarding the confidentiality of the answers they gave. Also it was intimated that whoever wished to know their score could collect the same from the investigator either in person or through e-mail.

Prior to the administration of the test the researcher had a meeting with the concerned team coaches and players. The questionnaires were administered to the players for the study was done by the researcher himself. The players were asked to respond to each and every statement and question as truthfully as possible, and were assured that the information, which it contained was entirely anonymous was assured to the players.

The research scholar demonstrated the procedure of the questionnaire to all the subjects and properly motivated them to give their best effort. The test was personally supervised by the researcher himself throughout. Any doubts and questions by the subjects regarding the questions in the questionnaire were properly explained to the subjects. The researcher explained to the subjects that their identity and response are to be kept confidential again.

Statistical Techniques

In order to examine the hypotheses of the study, descriptive statistics such as mean, standard deviation and comparative statistics such as one way ANOVA was employed and was tested at 0.05 level of significance. (SPSS 20 was used).

Analysis of Data and Finding of the Study

In one-way ANOVA, group means are compared by comparing the variability between groups with that variability within the groups. This is done by computing the F-statistic. The F-value is computed by dividing the variance of between group means by variance of within groups. Thus, if F-value is significant, it indicates that the variability between groups is significantly higher than variability within groups. In that case the null hypothesis is rejected.

Descriptive statistics such as mean and standard deviation and comparative statistics such as one way analysis of variance (ANOVA) was employed to assess the result of the comparison among the different levels of football players and tested at 0.05 level of significance.

The findings pertaining to the mental toughness and team dynamics among the three level or groups, their descriptive and comparative analysis has been presented in the following tables.

Part I- Analysis of Mental Toughness

Table 1
Descriptive Statistics of Mental Toughness of the Different Levels of Football Players

	N	Mean	Std. Deviation
under15	30	23.30	2.35
Self confidence under16	30	25.73	2.06
senior	30	25.33	2.18
Total	90	24.78	2.42
under15	30	21.70	1.93
Negative Energy Control under16	30	17.76	1.59
senior	30	18.60	2.55
Total	90	19.35	2.65
under15	30	21.63	2.44
Attention Control under16	30	19.93	2.67
senior	30	17.23	2.80
Total	90	19.60	3.18
under15	30	21.26	3.87
Visualization and Imagery under16	30	24.03	3.44
senior	30	24.73	2.39
Total	90	23.34	3.59
under15	30	27.53	2.31

Motivation	under16	30	26.40	1.42
senior		30	27.30	1.93
Total		90	27.07	1.96
under15		30	25.63	2.57
Positive Energy	under16	30	25.60	2.25
senior		30	26.23	1.94
Total		90	25.82	2.26
under15		30	22.23	2.51
under16		30	24.10	2.15
senior		30	25.63	2.83
Total		90	23.98	2.85

Table 1, indicates the mean score of mental toughness of the different levels of football players. In the Sub -factor of Self-Confidence the mean and SD of Under-15, Under-17 and Senior Level was $23.33 + 2.35$, $25.73 + 2.06$ & $25.33 + 2.18$ respectively.

In Negative Energy Control the mean and SD of Under-15, Under-17 and Senior Level was $21.70 + 1.93$, $17.76 + 1.59$ & $18.60 + 2.55$ respectively.

In Attention Control the mean and SD of Under-15, Under-17 and Senior Level was $21.633 + 2.44$, $19.33 + 2.67$ & $17.23 + 2.80$ respectively.

In Visualization and Imagery the mean and SD of Under-15, Under-17 and Senior Level was $21.26 + 2.44$, $19.93 + 2.67$ & $24.73 + 2.39$ respectively.

In Motivation the mean and SD of Under-15, Under-17 and Senior Level was $27.53 + 2.31$, $26.40 + 1.42$ & $27.30 + 2.39$ respectively.

In Positive energy the mean and SD of Under-15, Under-17 and Senior Level was $25.63 + 2.57$, $25.60 + 2.25$ & $26.23 + 2.51$ respectively.

In Attitude Control the mean and SD of Under-15, Under-17 and Senior Level was $22.23 + 2.51$, $24.10 + 2.15$ & $25.63 + 2.83$ respectively.

Table 2
Analysis of Variance on Mental Toughness of Different Levels of Football Players

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	102.156	2	51.078	10.509*	.000
Self confidence Within Groups	422.833	87	4.860		
Total	524.989	89			
Negative Energy Between Groups	257.756	2	128.878	30.233*	.000
Within Groups	370.867	87	4.263		
Total	628.622	89			
Between Groups	295.400	2	147.700	21.128*	.000
Attention Control Within Groups	608.200	87	6.991		
Total	903.600	89			
Visualization and Between Groups	201.622	2	100.811	9.264*	.000
Within Groups	946.700	87	10.882		
Imagery Total	1148.322	89			
Between Groups	21.489	2	10.744	2.894	.061
Motivation Within Groups	322.967	87	3.712		
Total	344.456	89			
Between Groups	7.622	2	3.811	.738	.481
Positive Energy Within Groups	449.533	87	5.167		
Total	457.156	89			
Between Groups	173.956	2	86.978	13.733*	.000
Attitude Control Within Groups	551.033	87	6.334		
Total	724.989	89			

***Significant at 0.05 level**

Tabulated value of F.05 (2, 87) = 3.95

Table 2, revealed that the calculated F- value in the sub-factors Self- Confidence, Negative Energy Control, Attitude Control, Visualization and Imagery Control, Attitude Control was 10.509, 30.233, 21.128, 9.264, 13.733 respectively, which was found higher than the tabulated value 3.95 with df 2, 87 tested at significant level of 0.05. Therefore, since calculated F- value is more than the tabulated F-value,

there was a significant difference found in the sub factors of mental toughness viz., self-confidence, negative energy control, attitude control, visualization and imagery control, attitude control among the levels or groups.

Also, it was evident that the calculated F- value in sub factors of Motivation and Positive Energy was 2.894 and 0.738 respectively, which was found lower than the tabulated value 3.95 with df 2, 87 tested at a significant level of 0.05. Therefore, since calculated F- value was less than the tabulated F- value, there were no significant differences in the sub factors of motivation and positive energy among the levels or groups.

The pair-wise comparison of the factors of mental toughness among the different groups is presented in table 3.

Table 3
Pairwise Comparison of Mental Toughness among Levels or Groups

Dependent Variable (I) Groups of the (J) Groups of the Players	Mean Difference (I-J)	Std. Error	Sig.
under16	-2.43333*	.56922	.000
under15			
senior	-2.03333*	.56922	.001
under15	2.43333*	.56922	.000
Self confidence under16			
senior	.40000	.56922	.484
under15	2.03333*	.56922	.001
senior			
under16	-.40000	.56922	.484
under16	3.93333*	.53309	.000
under15			
senior	3.10000*	.53309	.000
Negative Energy under15	-3.93333*	.53309	.000
under16			
Control senior	-.83333	.53309	.122
under15	-3.10000*	.53309	.000
senior			
under16	.83333	.53309	.122
under16	1.70000*	.68268	.015
under15			
senior	4.40000*	.68268	.000

under15			-1.70000*	.68268	.015
Attention Control	under16	senior	2.70000*	.68268	.000
under15			-4.40000*	.68268	.000
senior	under16		-2.70000*	.68268	.000
under16			-2.76667*	.85173	.002
Visualization and	under15	senior	-3.46667*	.85173	.000
Imagery	under16	under15	2.76667*	.85173	.002

		senior	-.70000	.85173	.413
		under15	3.46667*	.85173	.000
	senior	under16	.70000	.85173	.413
		under16	1.13333*	.49748	.025
	under15	senior	.23333	.49748	.640
Motivation		under15	-1.13333*	.49748	.025
	under16	senior	.90000	.49748	.074
		under15	-.23333	.49748	.640
	senior	under16	.90000	.49748	.074
		under16	.03333	.58692	.955
	under15	senior	-.60000	.58692	.309
Positive Energy		under15	-.03333	.58692	.955
	under16	senior	-.63333	.58692	.284
		under15	.60000	.58692	.309
	senior	under16	.63333	.58692	.284
		under16	-1.86667*	.64981	.005
	under15				
		senior	-3.40000*	.64981	.000
		under15	1.86667*	.64981	.005
Attitude Control	under16				
		senior	-1.53333*	.64981	.021
		under15	3.40000*	.64981	.000
	senior				
		under16	1.53333*	.64981	.021
* The mean difference is	significant at the 0.05 level				

Table 3 displays the pairwise comparison groups of football players of the sub-factors of mental toughness. Pairwise comparison when done between groups with the sub- factors of mental toughness; statistically significant result was found in self confidence between under 16 and under 15 & under 15 and senior (MD= 2.43; $p= 0.000$ & MD= 2.03;

$p= 0.001$) respectively.

Statistically significant result was found in negative energy control between under 15 and under 16 & under 15 and senior (MD= 3.93; $p= 0.000$ & MD= 3.10; $p= 0.000$) respectively. Statistically significant result was found in attention control between 16 and senior (MD= 2.70; $p= 0.000$).

Statistically significant result was found in visual and imagery under 16 and under 15 & under 15 and senior (MD= 2.76; $p= 0.002$ & MD= 3.46; $p= 0.000$) respectively. Statistically significant result was found in motivation between under 15 and under 16 (MD= 1.13; $p= 0.002$). Statistically significant result was found in positive energy between under 15 and under 16 & under 15 and senior (MD= 1.86; $p= 0.005$ & MD= 3.40; $p= 0.000$) respectively. Statistically significant result was found in attitude control between senior and under 15 & senior and under 16 (MD= 3.40; $p= 0.000$ & MD= 1.53; $p= 0.002$) respectively.

Part –II – Analysis of Team Dynamics

Table 4

Descriptive Statistics of Team Dynamics of the Different Levels of Football Players

	N	Mean	Std. Deviation
under15	30	35.76	4.52
under16	30	36.56	4.15
senior	30	31.90	6.05
Total	90	34.74	5.33
under15	30	23.26	2.75
under16	30	28.76	4.08
senior	30	24.70	6.73
Total	90	25.57	5.30
under15	30	18.33	2.94
under16	30	24.10	5.14
senior	30	18.40	5.20
Total	90	20.27	5.25
under15	30	30.10	4.64

under16	30	33.53	4.19
Group Integration Task	30	31.20	5.67
senior			
Total	90	31.61	5.03

Table 4, indicated the mean and SD of Team dynamics of different levels of football players. The mean and SD in sub-factor of attraction to group- social of under- 15, under-17 and senior level was $35.76 + 4.52$, $36.56 + 4.15$ & $31.90 + 6.05$ respectively.

The mean and SD in sub-factor of attraction to group- task of under-15, under-17 and senior level was $23.26 + 2.75$, $28.76 + 4.08$ & $24.70 + 6.73$ respectively.

The mean and SD in sub-factor of group integration social of under-15, under-17 and senior level was $18.33 + 2.94$, $24.10 + 5.14$ & $18.40 + 5.20$ respectively.

The mean and SD in sub-factor of group integration task of under-15, under-17 and senior level was $30.10 + 4.64$, $33.53 + 4.19$ & $31.20 + 5.67$ respectively.

Table 5, revealed that the calculated F- value in the sub-factors Attraction to Group Social, Attraction to Group Task and Group Integration Social was 7.535, 10.531 and 15.867 respectively, which was higher than the tabulated F-value 3.95 with df 2, 87 tested at a significant level of 0.05. Therefore, since calculated F- value was found more than the tabulated F- value, there was significant difference seen in the attraction to group social, attraction to group task and group integration social among the levels or groups.

Also, it was evident that the calculated F- value in sub factor Group Integration Task was 3.870 was lower than the tabulated F- value 3.95 with df 2, 87 tested at a significant level of 0.05. Therefore, since calculated F- value was less than the tabulated F-value, there was no significant difference seen in the Group Integration Task among the levels or groups.

Table 6 displays the pairwise comparison groups of football players of the sub-factors of team dynamics. Pairwise comparison when done between groups with the sub- factors of team dynamics; statistically significant result was found in attraction to group social between under 15 and senior & under 16 and senior (MD= 3.86; $p= 0.003$ & MD= 4.66; $p= 0.000$) respectively.

Statistically significant result was found in attraction to group task between under 16 and under 15 & under 16 and senior (MD= 5.50; $p= 0.000$ & MD= 4.06; $p= 0.002$) respectively.

Statistically significant result was found in group integration social between 16 and under 15 & under 16 and senior (MD= 5.76; $p= 0.000$ & MD= 5.70; $p=$

0.02) respectively. Statistically significant result was found in group integration task between 16 and under 15 (MD= 3.43; $p= 0.008$) respectively.

Discussion of Findings

As per the findings of the present study is concerned, factors of mental toughness were found significant while only in two sub factors the result insignificant in the mental toughness among the different levels of football players. Also, in the factors of team dynamics there was significant result seen while only in one factor insignificant result was seen in the team dynamics among different levels of football players. Many previous studies have showed that on comparing the mental toughness of players there was a significant difference in mental toughness while in some studies there is no insignificant difference (Singh et.al. 2017; Balaji et.al., 2011). This was mainly due to the behavioral and social aspects of the players. In the same way, previous studies have showed that on comparing the team dynamics of players there was a significant difference in team dynamics while in some studies there was no significant differences seen (Thakur et.al., 2015; Wang et.al.,2011). This was also due to the behavioral and social aspects of the players.

Mental toughness is a term used in psychology to refer to the resilience and strength that people possess to fight with struggles and succeed. The significant results obtained in this variable revealed the ability of the football players of all levels to push past exhaustion, opposition, and injury to score and to win. Players might typify the sort of mental toughness that makes them winners, but the same skills can apply to many areas of everyday life. The players were mentally tough to be able to succeed, and they knew they can do it. The result revealed mental toughness or willpower that can be thought of as a combination of intention, effort and courage.

The primary reason behind obtaining a significant result in team dynamics was because in order to play any team games especially in case of football there needs to be a bonding between the team members for getting the best outcomes. Team dynamics is the bond that pulls team mates toward membership in a particular group and resists separation from that group. The interpersonal attraction based on social or task reasons revealed that they had the preference or want to interact with each other. Group members enjoyed this interaction and seek it out. The matter of group pride may be another reason of getting the result as significant as members viewed their membership to the group with fondness. They felt proud of their group membership, and staying in the group felt valuable. The major reason of getting significant result was the team member's commitment to the work of the group as they value the work of the group and believe in its goals. They were willing to work together to complete tasks which were assigned with these group goals, even through adversity.

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