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## Flexibility Change in Students of Dance as Compared to Students in Other Physical Education Activity Classes

Betty J. Allen  
*Central Washington University*

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FLEXIBILITY CHANGE IN STUDENTS OF DANCE  
AS COMPARED TO STUDENTS IN OTHER  
PHYSICAL EDUCATION  
ACTIVITY CLASSES



A Thesis  
Presented to  
The Graduate Faculty  
Central Washington State College



In Partial Fulfillment  
of the Requirements for the Degree  
Master of Education



by  
Betty J. Allen  
August 1969

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Everett A. Irish, COMMITTEE CHAIRMAN

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Linwood E. Reynolds

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Daryl Basler

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## CHAPTER I

### INTRODUCTION

Although all authorities do not agree on the specific elements that should be included in physical fitness, most will include strength, endurance and flexibility. This study deals with one of these three elements, flexibility, as it relates to modern dance.

Dance is included in the area of physical education in many colleges and universities; however, some educators have indicated that dance has little relationship to the functional or the physical and that it is merely an art form. Some dance instructors look upon their work only as art and do not relate what they are doing to physical education. On the other hand, many students who plan to teach physical education, enroll in dance only because they are required to do so. They approach this skill in a perfunctory manner and later go out to teach dance in the same way.

It is true that dance is an art, but this may also be said of many sport skills, even though the purposes of sport and dance may differ. Dance is created through movement and physical educators deal mainly in movement. This writer feels that dance make important contributions to physical fitness and that it surely belongs in the area of physical education.

Research in dance is limited. Most published studies deal with cultural and historical aspects of the dance and little has been done to relate dance and physical fitness. Even the studies investigated, which



dealt with aspects of physical fitness, employed few objective measures. More research is needed and it is hoped that this study and others of a similar nature will lead to a recognition of dance as an integral part of the physical education program.

### I. PURPOSE OF THE STUDY

The purpose of this study was to determine flexibility changes in women students enrolled in a modern dance class as compared to flexibility changes in women students enrolled in badminton, golf, swimming, tennis, volleyball, and bowling classes, as measured by the bend and reach test.

### II. DEFINITION OF TERMS

Flexibility. "The range of possible movement in a joint or series of joints". (7:360)

Modern Dance. "... a form in which movement is consciously used to express ideas, feeling and emotion for communication". (9:66)

### III. LIMITATIONS OF THE STUDY

1. The study was completed at Central Washington State College.
2. One quarter, a period of ten weeks was allowed for collection of the data.
3. Each activity class was taught by different instructors.
4. All students were college age, approximately 18 to 23 years.
5. Only women students were used in the study.

#### IV. BASIC ASSUMPTIONS

It was assumed that the bend and reach test used to measure back and hip flexibility is a valid and objective test.

#### V. HYPOTHESES

1. Students of Modern Dance would show a significant increase in hip and lower back flexibility.
2. Students of Modern Dance would show a more significant increase in hip and lower back flexibility than students enrolled in other physical education activity classes.

## CHAPTER II

### REVIEW OF THE LITERATURE

According to Cureton, (6:390), flexibility is a component of physical fitness and is of primary importance in many activities. Competitive swimmers must have flexibility of shoulders and ankles, divers must be flexible to go into a pike position, and it is important to track for running and jumping. Perhaps, to the gymnast, flexibility is equally as important as strength, in order to perform skillfully. Even the average non-athlete must be flexible to run and to walk efficiently. "More importantly, considerable evidence indicates that maintenance of good joint mobility prevents, or to a large extent removes the aches and pains that grow more common with increasing age."

All movement involves a stretching of muscles and ligaments. Lack of flexibility keeps joints rigid, muscles tight, and efficient motion is opposed. Fatigue is brought on when the body must work harder to overcome this resistance of muscles and ligaments to movement. (6:381) Cureton also states that flexibility is not general. "Each major joint has a high degree of specific condition of it's own." (6:390). Quoting from DeVries, "We cannot speak of a flexible individual, as flexibility is specific to a given joint." (7:360).

Jack Leighton speaks of the significance of flexibility to physical educators and of interest in this element of physical fitness brought on by the Kraus Weber physical fitness test battery which, in Leighton's words, "...purports to measure flexibility". (12:27)

Physical educators are mainly interested in the effect factors such as age, activity and the like might have on flexibility. Leighton's paper summarizes some research findings which deal with these questions. All of the studies were those made by Leighton, or others using his flexibility measurement. His summary is as follows: (12:70).

1. Flexibility varies more with activity patterns than with age.
2. Limiting range of movement may enhance more skills in track, basketball and baseball.
3. Very little evidence supports the theory that age, such as from ten years to maturity will determine flexibility as it relates to performance.
4. A flexibility pattern appears in groups which relates to skills and habits of body movement.
5. There is evidence that a proper flexibility pattern must be planned for effective development of skills.

Leighton ends this summary by stating, "Current research has revealed situations and characteristics concerning flexibility in sufficiently important perspective to warrant a great deal of exploratory research and daily attention to flexibility characteristics as important factors in teaching." (12:70).

#### I. RELATED STUDIES

Studies of a similar nature to the one undertaken are sparse in number. After a diligent search of the literature, only a meager handful of such published studies was found and it is felt that certain

weaknesses in design and methods of measurement may have resulted in a lack of significance in the findings.

According to Bushey (4:313), there is no relationship between modern dance and flexibility. Three dance instructors observed the final performance of a group of students enrolled in modern dance, and made a subjective judgment of their flexibility. Since no objective measure was taken, it is thought that these conclusions were of little significance. A review of conclusions of several unpublished studies reported by Bushey follows:

Lemon found a low but significant correlation between rhythmic ability and motor ability. Beal concluded that the only two anthropometric measurements showing significance to modern dance performance, were length of upper arm and length of thigh. Long segments of arms and legs were found to impede successful execution of modern dance techniques ...especially in recovery from falls. Schwartz found that posture achievement, weight normalization and improvement of vital capacity were not significantly related with participation in modern dance. Schwartz found no difference between the contribution of dance and gymnastics to these qualities. Considerable increase in pulse rate and extreme variations in circulatory responses were found to result from a single lesson in modern dance. Modern dance techniques were found to include a fairly even distribution of exercises for speed, strength, and endurance. Benton found that dance movement was not based entirely on rhythm, but that other elements such as balance, motor education, agility, and strength were also important. Mathew's study showed that modern dance had a significant effect upon general motor ability as measured by the Humiston Motor Ability Test. (4:314).

Bennett's (1:253) study was to "...determine the relative contributions of modern dance, folk dance, basketball and swimming to selected and general motor abilities of college women".

Seventy nine college women were divided randomly into four classes, modern dance, folk dance, basketball and swimming. Valid and reliable tests were selected from the literature to measure traits

developed by the four activities: trunk flexion, forward hip flexibility, leg strength, power, arm and shoulder girdle strength, balance, endurance, and general motor ability. Tests were administered at the end of sixteen weeks of training (1:253-254). Findings of Bennett's study follow:

The modern dance class was found to be significantly superior to the folk dance group on the development of agility and coordination, general strength, hip flexibility, and back flexibility at the end of sixteen weeks of instruction. Modern dance was equally as effective as swimming and basketball in the development of all the traits measured...In general it may be concluded that at the end of sixteen weeks or thirty-two periods of instruction, the relative status of the four activities in the development of specific abilities of college freshmen women is first, swimming and modern dance, second basketball and third, folk dance.

It is interesting to note that participants in Bennett's study were selected by the investigator. All subjects had to be deep water swimmers, but the study makes no mention of any other criteria used in selection of subjects. The modern dance, folk dance and basketball classes were for beginners, but the swimming class was taught at intermediate level. All classes were taught by Bennett (1:254). It is believed the selection of subjects, differences in levels of classes and the fact that Bennett taught all classes may have had an influence on the findings which perhaps may have been more significant if these factors had been more objective.

## II. FLEXIBILITY TESTS

The Sit and Reach test, developed by Wells and Dillon (13:118) consists of a box against the end of which subjects place their feet, while assuming a long sitting position on the floor. The flexibility

measure extends toward the subject and measurement is taken as subject leans and reaches as far forward as is possible. Conclusions reached are listed:

1. A high reliability is indicated by an r of .98.
2. This test is valid in so far as validity is measured by the Standing Bobbing Test. An r of .90 was found.
3. Scores for the Sit and Reach tend to be consistently higher than are scores for the Standing Bobbing Test. (15:118)

Jack Leighton (11:207) states that a simple and objective flexibility measure had been particularly needed in the corrective activities field and that much research had been held back because of this need. Leighton studied range of movement made by the different parts of the body during natural movements and claims that skeletal structure or muscles may limit freedom of bodily movements.

The measuring instrument devised by Leighton was a flat circular dial,  $4\frac{1}{2}$  inches in diameter and marked off in degrees ( $360^\circ$ ). To the center of this dial was attached a weighted needle, which always pointed downward, perpendicular to the floor, when the dial was held on edge. This is the only position in which the dial may be used, as it is the only position in which the needle will register. On the back of the instrument is fastened a strap. This ...was fastened around a portion of the subjects body, depending on the measurement to be taken. Further development of the instrument resulted in one with a weighted dial and weighted needle. When placed in the starting position...the dial immediately comes to rest with the zero uppermost. The dial is locked in this position and the movement is then performed to its extreme limit, where the needle is locked in position. The direct reading of the needle on the dial is the area through which the movement takes place. The posts on the instrument contain the locking devices...it is not affected by minor tilting in the process of movement because the moving parts are nicely balanced on ball bearings.

...its validity as a device to measure flexibility of ranges of motion is based upon the condition that most of the bending done... is assumed to take place around the joint or joints of the segments.

The findings of the Leighton study are as listed:

1. The measurement had sufficient reliability to be used to measure individuals or groups.
2. Thirteen different movements could be measured.
3. The average time required for the measurement of each subject was twenty minutes.
4. The procedure is not complicated or technical.

In general, conclusions were that the instrument and method were objective, reliable, and valid. (10:215).

DeVries (7:363-369) states that "Jack Leighton's flexometer records flexibility or range of motion in respect to a perpendicular established by gravity." "It has been shown that both slow and fast stretching are effective and that there is no significant difference between them." After a flexibility program has been completed, cessation of the exercise does not cause immediate loss of flexibility, but the effects of such a program may last for at least eight weeks.

The Bend and Reach test by Harvey and Scott (9:28-33) showed reliability coefficients on four consecutive trials ranging from .86 to .98.

This test is a version of the Sit and Reach by Wells and Dillon and was assumed to be valid in so far as the Sit and Reach is valid. Equipment used to take this measure consisted of an eighteen inch bench with a flexibility board anchored vertically on the end of the bench. Zero scores were indicated at the bench level with minus score above and plus scores below this level. Measurements were taken to the nearest  $\frac{1}{4}$  inch.



Harvey and Scott assert that no significant differences occurred between trial three and the best trial. Because of limited time for the administration of such a test, it is recommended that no more than three trials be given and the best score be recorded when administering the test.

## CHAPTER III

### PROCEDURES

The subjects tested were women enrolled in the general education activity classes at Central Washington State College the spring quarter of 1969. The number of students participating in activity classes are listed:

1. Twenty-four in badminton
2. Eleven in bowling
3. Eleven in golf
4. Twenty in modern dance
5. Ten in tennis
6. Seventeen in swimming
7. Fifty-five in volleyball

The number of students participating in the pre-test totaled 148. Because of illness or drop-outs, the number of students participating in the post test totaled 138. Classes met twice weekly for nine weeks. Each class met for approximately forty minutes, making a total of twelve contact hours spent in the activity during the quarter. Each class was taught by a different instructor. The writer did not teach any of the classes.

#### I. MEASURING INSTRUMENT AND PROCEDURE

The Bend and Reach flexibility test as discussed in Chapter II was used for the measurement. A pre-test was administered the second

week and a post test the ninth week to all women students. This left a total of sixteen class periods or ten hours and forty minutes participation time between the two tests. All measurement was done by the writer.

## II. TESTING OF SUBJECTS

Subjects were instructed to remove shoes and to perform the following exercise as a warm up. Standing with feet about twenty-four inches apart, the subjects bent from the waist, keeping knees straight, and touched right hand to left foot; returned to starting position and repeated to the other side. This exercise was executed ten times to each side.

The measuring device consisted of an eighteen inch bench, to the center of which was attached a yardstick. Subjects were instructed to stand on the bench and with knees held straight, to bend forward, reaching down as far as possible with fingers straight and hands on either side of the yardstick. This position was held for three seconds and a thin metal rule was placed at the tips of subject's fingers, horizontal to the yardstick. This thin rule made it possible to take measurement without including length of fingernails. Measurement was taken to the nearest  $\frac{1}{4}$  inch. Each subject was allowed three trials and the best of the three trials was recorded for pre and post tests.

## CHAPTER IV

### ANALYSIS OF DATA

The hypotheses tested were that:

1. Students of the modern dance group would show significant increases in hip and lower back flexibility.
2. Students of modern dance would show a more significant increase in hip and lower back flexibility than students enrolled in badminton, golf, swimming, tennis, volleyball and bowling classes.

Differences between the means of the pre-test of the dance group and the pre-test of each of the other groups were calculated and compared. The difference between the mean of the dance group was also compared to the total of all other groups. A Fisher  $t$  was used to measure the amount of significance in all cases. The .05 level of confidence was set as the level beyond which differences would be significant.

Pre-test means differences,  $t$ 's and levels of significance are shown in Table I.

TABLE I

PRE-TEST MEANS, DIFFERENCES BETWEEN THE MEANS,  
t's AND LEVELS OF SIGNIFICANCE FOR EACH GROUP

ACTIVITY	MEANS	DIFFERENCE	<u>t</u>	LEVEL OF SIGNIFICANCE
Dance	4.60			--
Volleyball	3.40	1.20	1.54	--
Swimming	2.40	2.20	2.32	.05
Golf	3.23	1.37	1.61	--
Tennis	2.60	2.00	5.41	.01
Badminton	2.42	2.18	2.53	.01
Bowling	3.70	.90	.83	--
All Groups Excepting Dance	3.14	1.46	1.97	.10

Differences between the means of the post test of the dance group and the post test of each of the other groups were calculated. The difference between the mean of the dance group was compared to the total of all the other groups. Post test means and differences, t's and levels of significance are shown in Table II.

TABLE II

POST TEST MEANS, DIFFERENCES BETWEEN THE MEANS,  
t's AND LEVELS OF SIGNIFICANCE FOR EACH GROUP

ACTIVITY	MEANS	DIFFERENCES	<u>t</u>	LEVEL OF SIGNIFICANCE
Dance	5.03			
Volleyball	2.93	2.10	3.89	.01
Swimming	2.93	2.10	2.63	.01
Golf	3.73	1.30	2.13	.05
Tennis	2.20	1.30	2.13	.05
Badminton	2.96	2.07	2.83	.01
Bowling	3.30	1.73	1.71	.10
All Groups	3.05	1.98	4.40	.01

The differences between the means of the pre and post test of the dance groups were calculated to determine if improvement had taken place. All of the other groups were also calculated between the pre and post test to determine if any improvement had been made. Table III shows differences between pre and post test means, t's and significance levels.

TABLE III  
DIFFERENCES BETWEEN PRE AND POST TEST MEANS,  
STANDARD DEVIATIONS,  $t$ 's AND LEVELS  
OF SIGNIFICANCE

GROUP	PRE-TEST		POST TEST		DIFFERENCE	$t$	SIGNIFICANCE OF DIFFERENCE
	M	SD	M	SD			
Dance	4.60	1.72	5.03	1.60	.43	.45	--
Volleyball	3.40	2.47	2.93	2.68	.47	.92	--
Swimming	2.40	2.55	2.93	2.93	.53	.55	--
Golf	3.23	1.41	3.73	1.41	.50	.76	--
Tennis	2.60	2.75	2.20	2.60	.40	.30	--
Badminton	2.42	2.20	2.96	2.77	.54	.61	--
Bowling	3.70	2.49	3.30	2.83	.40	.38	--
All Groups	3.14	2.46	3.05	2.41	.09	.18	--

#### I. INTERPRETATION OF THE DATA

Compared with pre-test means of other groups, the mean score of students of dance showed the highest degree of flexibility. Relative listing of all the classes, places dance with the highest mean of 4.60, followed by bowling at 3.70, volleyball 3.40, golf 3.23, tennis 2.60, badminton 2.42, swimming 2.40, and combined groups excepting dance 3.14. When the Fisher  $t$  was used, no significant difference was found between dance and volleyball, golf or bowling. A significant difference was found between dance and swimming at the .05 level, between dance, tennis and badminton at the .01 level and .10, the level of the combined groups

was not significant. This may be interpreted in different ways. Flexibility characteristics of students in the various groups may be attributed to chance, due to the random selection of subjects through registration. Perhaps some students had participated in dance before the study was undertaken. It may be, that people having certain physical characteristics, such as a high degree of flexibility, may be more apt to enroll in a dance class, as such flexibility helps with freedom of movement, a factor important to success in dance. With more control used in selection of subjects, the means of the groups may not have varied so widely.

The mean of the dance group was .90 higher than the group showing the next highest degree of flexibility, bowling, and the dance mean was 2.18 higher than the lowest of the badminton group.

There was no significant difference between modern dance and volleyball in the pre-test. In the post test there was a significant difference at the .01 level of confidence in favor of the dance class. Comparing each group with dance, swimming increased from the .05 to the .01 level. Golf was not significant in the pre-test but it was at the .05 level in the post test. Tennis dropped from .01 to .05, badminton and bowling stayed the same. All combined groups increased from no significance to .01. This would indicate that dance did increase flexibility significantly more than volleyball, tennis or the combined groups. Conversely, badminton and bowling added to flexibility as much as did dance.



Another way to view these relationships is to consider that of the eighteen students enrolled in modern dance, fourteen showed an increase in flexibility, as did seven out of ten students enrolled in golf and eleven out of seventeen enrolled in swimming. An interpretation by the investigator would be that apparently certain activities, because of the movements involved, will increase the flexibility of participants.

Formulas used to calculate the mean, standard deviation, standard error of the mean, standard error of the difference, and the Fisher  $t$  are shown.

$$M = \frac{\sum X}{N}$$

$$\sigma = \sqrt{\frac{\sum X^2}{N} - M^2}$$

$$\sigma M = \frac{\sigma}{\sqrt{N-1}}$$

$$\sigma \text{ DIFF} = \sqrt{\sigma M_1^2 + \sigma M_2^2}$$

$$\underline{t} = \frac{\text{DIFF}}{\sigma \text{ DIFF}}$$

Tables IV, V, and VI show the results of all calculations used in the study.

TABLE IV

PRE-TEST MEANS, STANDARD ERROR OF THE MEAN SQUARED,  
 DIFFERENCE, STANDARD ERROR OF THE DIFFERENCE,  
 FISHER  $t$  AND SIGNIFICANCE LEVELS

GROUP	$M$	$\sigma M^2$	GROUP	$M$	$\sigma M^2$	DIFFERENCE	$\sigma$ DIFFERENCE	$t$	SIGNIFICANCE LEVEL
Dance	4.60	.50							
			Volleyball	3.40	.12	1.20	.78	1.54	--
			Swimming	2.40	.41	2.20	.95	2.32	.05
			Golf	3.23	.22	1.37	.85	1.61	--
			Tennis	2.60	.94	2.00	.37	5.41	.01
			Badminton	2.42	.24	2.18	.86	2.53	.01
			Bowling	3.70	.69	.90	1.09	.83	--
			All Groups	3.14	.05	1.46	.74	1.47	.10

TABLE V

POST TEST MEANS, STANDARD ERROR OF THE MEAN SQUARED,  
 DIFFERENCE, STANDARD ERROR OF THE DIFFERENCE,  
 FISHER  $t$  AND SIGNIFICANCE LEVELS

GROUP	$M$	$\sigma M^2$ GROUP	$M$	$\sigma M^2$ DIFFERENCE	$\sigma$ DIFFERENCE	$t$	SIGNIFICANCE LEVEL	
Dance	5.03	.15						
			Volleyball	2.93 .14	2.10	.54	3.89	.01
			Swimming	2.93 .53	2.10	.80	2.63	.01
			Golf	3.73 .22	1.30	.61	2.13	.05
			Tennis	2.20 .85	2.83	.10	2.83	.01
			Badminton	2.96 .38	2.07	.73	2.84	.01
			Bowling	3.30 .88	1.73	1.01	1.71	.10
			All Groups	3.05 .05	1.98	.45	4.40	.01

TABLE VI

MEANS, STANDARD DEVIATIONS, STANDARD ERRORS OF THE MEAN  
 STANDARD ERRORS OF THE MEAN SQUARED, DIFFERENCES  
 BETWEEN MEANS, STANDARD ERRORS OF DIFFERENCES  
 OF PRE AND POST TEST,  $t$  AND  
 SIGNIFICANCE LEVELS

GROUP	N	$\sqrt{N-1}$	M	S.D.	PRE-TEST			POST TEST					$t$	SIG. L.
					$\sigma M$	$\sigma M^2$	M	S.D.	$\sigma M$	$\sigma M^2$	DIFF.	$\sigma$ DIFF.		
Dance	18	4.12	4.60	1.72	.42	.50	5.03	1.60	.39	.15	.43	.96	.45	--
Volleyball	52	7.08	3.40	2.47	.35	.12	2.93	2.68	.38	.44	.47	.51	.92	--
Swimming	17	4.00	2.40	2.55	.64	.41	2.93	2.93	.93	.53	.53	.99	.55	--
Golf	10	3.00	3.23	1.41	.47	.22	3.73	1.41	.47	.22	.50	.66	.76	--
Tennis	9	2.83	2.60	2.75	.97	.94	2.20	2.60	.92	.85	.40	1.34	.30	--
Badminton	21	4.47	2.42	2.20	.49	.24	2.96	2.77	.62	.38	.54	.88	.61	--
Bowling	10	3.00	3.70	2.49	.83	.69	3.30	2.83	.94	.88	.40	1.04	.38	--
All Groups	121	1.08	3.14	2.46	.23	.05	3.05	2.41	.22	.05	.09	.005	.18	--

## CHAPTER V

### RECOMMENDATIONS AND CONCLUSIONS

The purpose of the study was to determine flexibility changes in women students enrolled in modern dance as compared to flexibility changes in women enrolled in volleyball, swimming, golf, tennis, badminton, and bowling classes.

A pre and post flexibility test was given to 139 girls enrolled in seven activity classes at Central Washington State College, a period of seven weeks intervening between tests.

The hypothesis that students of dance would show significant increases in flexibility was rejected, as there was found to be no significant difference in flexibility between the pre and post test means of the dance group. The hypothesis that students of dance would show more significant increases in flexibility than students enrolled in other physical education activity classes was accepted, as significant differences were shown in the post test between dance and volleyball, tennis or the combined groups.

### RECOMMENDATIONS FOR FURTHER STUDY

1. A longer period of time be allowed between pre and post tests.
2. Students be excluded who had previously studied dance.
3. Control of variables in instructors.
4. More numbers in the dance group.

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