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THE EFFECTS OF COACTION ON THE SKILL DEVELOPMENT LEVELS OF LOW SKILLED AND HIGHLY SKILLED GYMNASTIC STUDENTS

The Ohio State University

Ph.D. 1984

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THE EFFECTS OF COACTION
ON THE SKILL DEVELOPMENT LEVELS
OF LOW SKILLED AND HIGHLY
SKILLED GYMNASTIC STUDENTS

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

Johannah Casey, B.S. Ed., M.A.

*****

The Ohio State University

1984

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CHAPTER ONE
THE EFFECTS OF COACTION
ON THE SKILL DEVELOPMENT LEVELS
OF LOW SKILLED AND HIGHLY
SKILLED GYMNASTICS STUDENTS

Educational research has produced evidence that many factors influence the way in which children learn. Social facilitation theory, particularly the paradigm of coaction suggests that learning might be affected by group composition (Zajonc, 1965 and Cottrell, 1968). The coaction effect is thought to energize students, producing a great deal of effort and unwanted or incomplete responses. This energizing is said to be caused by the perception of an evaluative potential by members of the group. The theory suggests that students might be more attentive during instruction when all members of the group are at the same skill level. There is the possibility that more highly skilled students would be perceived as evaluative in the sense of rating ability, and thus increase or stimulate others to emit a dominant response. That response could be either positive or negative depending upon previous experience.

The purpose of this study was to test whether or not coaction within homogeneous and heterogeneous groups made a difference in the rate of group learning.

It was felt that the phenomena might be controlled by the use of a direct teaching method that afforded all members of the group an equal opportunity to learn and perform.
Importance of the Study

Coaction is part of the Social Facilitation Theory described by Robert Zajonc (1965). The theory was developed further by Cottrell as Learned-Drive theory in 1968. Coaction is a general term that refers to the positive and negative effects that occur due to the mere presence of coactors. Coactors are those members of a group involved in learning the same task as the subject being studied.

This dissertation involves the coaction paradigm found within Social Facilitation Theory. The coaction paradigm looks at responses that occur individually within a shared learning environment (Martens, 1985, 24-25).

Forces that enable coaction to occur are called drives. These drives are said to increase arousal and elicit a dominant response. That is, when aroused a subject confronted with a stimulus that permits a wide selection of responses will emit the response that is most familiar or well learned.

Zajonc recognized this idea and insisted that response is a function of excitatory potential; a force activated by a coactor that produces a reaction that is stronger than the normal effort that the person might put forth during learning.

Zajonc believed that this excitatory potential was a cumulative function of drive state times habit strength and not due to the potential for evaluation that might exist within the performance setting. (Spence, 1965).

Thus Zajonc's formula: \( R = f(E) = f(Dxh) \)

Where:
Under Zajonc's theoretical conditions the mere presence of a coactor would stimulate the dominant response. It was recognized that a subject would physically coact producing a dominant behavioral response. However, there appeared to be two flaws in Zajonc's reasoning. First, that the dominant responses may not be the desired responses. And second, that coaction might have a psychological side. In short, the subject might perceive the coactor as evaluative. This perception too was found to excite the subject and increase the rate but not the quality of performance output (Cottrell, 1968).

For the purpose of this study, both the physical and the psychological aspects of coaction are considered within heterogeneous and homogeneous groupings.

Performance scores have historically been used to measure the physical signs of coaction. However, these scores did not measure the evaluative potential that might exist within a group. It is possible that homogeneous groups would elicit the dominant correct response more often than a heterogeneous group. This possibility exists because highly skilled members of the group might be perceived as evaluative by low skilled members in a heterogeneous group. This psychological side of the coaction paradigm would have an energizing
effect on the heterogeneous groups, particularly the low skilled members. If the low skilled members felt that they were being evaluated by their highly skilled peers, then theoretically their dominant response rate would increase.

Two questions were generated concerning the psychological aspects of coaction.

First, could coaction be negated by the use of a very structured teaching method?

And second, if unchecked by teaching method, would the dominant responses be correct or incorrect?

If coaction research could provide evidence that homogeneous or heterogeneous groups facilitate the emission of a correct dominant response, teachers would be able to more effectively set up learning groups.

Further, if a direct teaching method was found to override the harmful effects of coaction it would enable teachers to avoid potential coaction problems found within learning groups.

Therefore, research to further explore the coaction phenomena would enable teachers to be more effective in grouping students and in choosing teaching methods to work with each member of the group.

The Problem

The problem undertaken in this study was two fold. Under the condition of equal opportunity to perform:

1. Would low skilled students in the Initial stages of learning coact non-verbally in a positive or negative way with (A) highly
skilled students, and (B) other students of equal ability?

2. Would highly skilled students in the initial stages of learning coact non-verbally in a positive or negative way with (A) other highly skilled students and (B) low skilled students?

The hypotheses for this study were:

1. When the heterogeneous groups are compared with the homogeneous groups there is a significant difference between performance scores.

2. When control and treatment groups are compared there is a significant difference between performance scores.

3. When low skilled students in homogeneous groups are compared with low skilled students in heterogeneous groups there is a significant difference.

Limitations

1. Physically handicapped students were not included in this study. This was thought to reduce contamination of physical skill variables which might lead to a skewed distribution of statistical results.

2. Students from 4 to 6 and 13 to 16 years of age were not included in this study. Students, ages 7 to 12 were selected because of a higher chance of similar growth and developmental characteristics.

Limitations

This study was limited in the following areas:

1. The population sample was small.
2. To a group made of of children of Ohio State University faculty, staff and students.

Definitions

**Arousal** - a state of increased excitement that enhances performance in the coaction condition.

**Coaction** - two or more subjects simultaneously and independently engaged in identical tasks in the presence of each other.

**Confidence Spot** - a safety spot that is used when the subject is judged to be out of control or when the subject requests a potential spot for a skill that is difficult for the subject to perform.

**Dominant response** - The response that is repeated consistently in the learning situation. If the skill level is low, dominant response is incorrect or incomplete; if the skill level is high, dominant response is generally correct.

**Evaluative coactor** - A subject simultaneously and independently engaged in the same activity that possesses superior ability. That superior ability may or may not be perceived as potentially evaluative due to prior experiences.

**Evaluative potential** - The ability to convey evaluation verbally or non-verbally based on physical presence, performance or cues for skill performance.

**Highly skilled subjects** - subjects falling in the upper 33.3 percent of the population range score.

**Low skilled subjects** - subjects falling in the lower 33.3 percent of the population range score.
Incorrect responses - the dominant response emitted during the initial learning as a substitute for the requested skill. Degree of success and quality of response vary until learning is complete.

Intervention - The introduction of the independent variable. In this case the intervention is the series of gymnastic skills taught in the careful and systematic manner with progress notes recorded during each class period.

Performance levels - a system based on a progressive system of learning. Justified by the nature of the skills presented in this study.

0 - Balk - A refusal to perform the requested skill
1 - A skill attempt totally dependent upon a spotter for safety and/or completion.
2 - A skill attempt partially dependent upon a spotter for safety and/or completion.
3 - A skill attempt independent of a spotter that is mechanically incorrect.
4 - A skill attempt independent of a spotter that is mechanically correct.

Note: A confidence spot for a mechanically correct skill was counted as a 4. However, none of the instructors recorded the use of such a spot during the intervention period.

Reliability - the percentage of agreement between three independent observers of a behavior emitted at a given time.
Social facilitation - a change in the dominant correct or incorrect response due to coaction with others.

Well-learned response - a skill level that is mechanically correct and constant over performance trials.

Select randomization - subjects selected from a given ability group for randomization.

Randomization - Assignment of subjects in such a way that each has an equal chance of being assigned.
CHAPTER TWO
LITERATURE REVIEW

A literature review concerning coaction must identify the principle findings that pertain to group composition and the current theories of group interaction which might affect group learning. After this is done, an examination of research methodologies should be made to determine the direction of future research based on past accomplishments and mistakes. This directionality is particularly important for the present work because it is based in a naturalistic setting and because its purpose is to test whether or not coaction within homogeneous and heterogeneous skill groups is really a key difference in the rate of group learning.

To these ends the following literature review is divided into three sections.

Section One examines theories concerning group interaction and performance, namely Social Facilitation Theory and Learned Drive Theory.

Section Two considers the following areas as they relate to Social Facilitation Theory: 1) Coaction, 2) Audience Effect, 3) Age and Ability, 4) Number of Coactors, and 5) Perceived Power to Evaluate.

Section Three outlines the research methodologies historically used to test these theories. A summary concludes the chapter.

Principle Theories

Social Facilitation is one of the oldest experimental theories
In social psychology, this type of research examines learning as it relates to the presence of or absence of others. The research defines "others" in two ways: those watching (audience) and those involved in the same task as the learner (coactors). Although there were many socio-psychological theories that developed from 1897 to the late 1960's, few played as central a role in current social facilitation beliefs as did the work of Robert B. Zajonc.

**Social Facilitation Theory**

In 1965 Robert Zajonc published "Social Facilitation" in *Science* magazine. After reviewing past literature, Zajonc proposed a general hypothesis. This hypothesis suggested that there were two experimental paradigms with which to view the social facilitation phenomena. The first, an audience effect that occurs when subjects perform in view of an audience. The second, a coaction effect that occurs in the presence of others engaged in the same activity as the experimental subject.

Zajonc concluded from his literature review that "arousal activation, or drive all have as a consequence the enhancement of dominant responses (1965, 273)." This conclusion led Zajonc to explore a third relationship between the presence of others and arousal which he felt directly related to Spences' (1956) theory of drive effects. In brief, increase the drive or the motive to perform and you will increase the emission of the dominant response, which was thought to depend upon the intensity of drive factors and habit strength.
Zajonc and Nieuwenhuyse (1964) first tested arousal level in a research setting using word recognition tests (Zajonc and Sales, 1966, 161). A group of subjects in the aroused drive setting was compared to a group in the low-drive setting (alone). Results indicated that the dominant response was enhanced in the audience setting which was also called the mere presence setting (Zajonc, 1965).

In 1966 Zajonc and Sales replicated the study on 39 subjects. Their important conclusion was that others were necessary to provide behavioral cues for appropriate and inappropriate responses. This conclusion led to the development of Learned Drive Theory and suggests that the concept of mere presence was insufficient to singularly account for increased performance.

The present study is an investigation of this conclusion as it proposes that coactors of a higher skill level could more powerfully influence the reception and retention of behavioral cues, particularly in low skilled performers, unless controlled by teaching method.

Cottrell's Learned Drive Theory

Research by Cottrell, Wack, Skerak and Rittle (1968) concluded that the presence of an audience of two individuals will affect performance by enhancing the emission of the dominant response. In their effort to test Zajonc's ideas concerning mere presence it was shown that the presence of persons who are not members of a formal audience or coactors would not induce high performance levels. It
was also indicated that the presence of an audience increases subject response. This is consistent with Zajonc's theory. However, when audience did not respond in an evaluative manner, performance levels decreased.

From these results Cottrell and his colleagues formulated Learned Drive theory. The theory states that the mere presence of others is not sufficient to increase drive level. According to Cottrell, the individual must learn "that other people are signs for positive or negative outcomes (1968, 195)." If the performer feels the audience will reward his efforts by clapping or cheering, he will increase his efforts. However, if the performer feels the outcome of having an audience present will be negative, possibly causing embarrassment, effort will be decreased. Cottrell referred to this condition as evaluation apprehension (1968, 195). But which people create more apprehension, the peer group or the teacher? This raises the question, would evaluation apprehension be more affected by group composition or the students' perception of the importance of the material being presented?

**Audience Effect**

In the audience situation researchers found that performing in front of an audience tended to increase speed and endurance. However, decision making became difficult and subjects rated as highly anxious had difficulty performing.

One of the early reports that first noted the effects of audience presence was that of Georgina Stickland Gates (1924). Dr.
Gates attempted to measure quantitatively the effect of audience presence on performance. Her study examined spectator effect, audience influence, reaction caused by the audience's mere presence and audience effect on simple motor and associative processes.

Two major findings from the Gates' study directly relate to the present work. First, there was an indication that the tasks were too easy to be affected by the mere presence of observers. In a study of this nature it seems that the tasks should be novel, new or unique; and at or slightly above the baseline capabilities of the subject. Second, the researchers clearly had difficulty with inter-rater reliability (1924, 334-336). Gates found that behaviors should be clearly defined and raters trained to identify and code behavior before the study is undertaken.

J.F. Dashiell (1930) found that audience presence could affect the speed of performance at the expense of accuracy. His study also noted the qualitative aspect of performance. The result of a study by Pessin and Husband (1933) was similar in its findings.

Pessin and Husband found evidence that learning in the presence of an audience produces greater variability of performance. The unique aspect of their work was in data collection. A traditional method of quantitative analysis was used to record the number of trials errors and time of performance. However, qualitative analysis that involved questioning subjects about their experiences was also used. The latter type of analysis permitted the researchers to probe possible areas that could become contaminated during an experiment,
such as subject understanding of the task to be performed and/or the physical condition of the subject at the time of performance.

This suggests that a researcher using behavioral observation would profit from a subject post performance interview.

Wapner and Alper (1952) replicated the findings of Dashiel (1930) and Pessin and Husband (1933) and also concluded that audience presence could affect the time involved in making a choice. Their important conclusion was that "there is a driving force which acts upon the subject in the direction of each alternative (152, 288)."

The difficulty in a homogeneous or heterogeneous group is that coaction forces may move the students away from the skill objectives desired by the teacher, producing unwanted dominant responses which are used to placate other members of the group. This is important to the present study because it suggests that a very exacting teaching style might enable the teacher to overpower the forces of coaction, no matter the composition of the group.

In summary, it appears that the tasks tested ought to be novel and start at the baseline capabilities of the subjects involved in the study. Before judging the tested skills, observers need to be pretrained and reliability levels established. It is also important to measure the quality of the performance experience as well as the quantitative aspects. This would produce important insights concerning validity of the statistical analysis. And finally, there is a possibility that coactive forces can be controlled by the use of a carefully designed teaching strategy.
Coaction

Studying the coaction paradigm, researchers found that learning as a member of a group increased the speed of performance at the cost of quality.

Allport (1920) was one of the key pioneers of Social Facilitation research to produce evidence that problem-solving tasks were facilitated by coactors when quality of work was not considered. In order to increase his understanding, Allport studied mental processes (association and thought) in the alone and coaction condition. A population of twenty-six college students were studied. Results indicated that two out of three subjects worked better in a group. However, when quality was assessed, scores were higher in the alone condition. Therefore, it appears that coaction increases the quantity of responses at the expense of quality.

In 1930 J.F. Dashiel also found that competition and audience presence combined, increased speed at the expense of accuracy. The literature points to a need for decreasing competition during learning. If highly skilled coactors create a feeling of competition the low skilled students may attempt skills more often but pay less attention to the mechanics of the stunt.

Gurnee (1939) replicated Dashiel's results and concluded that communication was a key factor. "Those who learned in the group situation proved to be superior in both maze learning and numbers...those in the group profited by suggestions from their fellows, and that the fixation of their correct responses and
elimination of their errors were reinforced by a social factor (1932, 532)." These results were replicated by Hunt and Hillery in 1973.

These studies raise several important questions about the present work. First, will verbal and non-verbal communication be positive or negative? Second, if the condition of equal opportunity to perform is maintained in the treatment group will the effects of coaction increase or decrease?

Along with communication, motivation appeared to be an important factor determining performance outputs. Triplett (1897) noted motivational factors as "dynamogenetic factors" (1897, 531). French researcher Fere had also noted dynamogenetic factors in Sensation at Movement. According to Fere, the stimulation of other participants competing in the same event would increase the energy or effort put into each movement (1897, 531). Triplett also believed that physical and psychological factors also influenced performance. Trippelett noted all these factors in an experiment designed to time measure subjects as they wound fishing reels. Results indicated the competitive setting caused some loss of control. Tripplett noted that this phenomena "seems to be brought about in large measure by the mental attitude of the subjects. An intense desire to win, for instance, often resulting in over-stimulation (1897, 523)." The present study does not encourage competition, therefore over-stimulation may not be a problem.

Researchers Seldman (1959), Martins and Landers (1969) found that coacting as a member of a group also increased the subjects physiological limits.
The first experiment by Seldman, uses the presence of another coactor to increase tolerance to electrical shock (Seldman, 1959, 112). The researchers wanted to know if one person's ability to endure shock would increase with the addition or presence of another person.

Results indicated that an audience of one would raise the subjects' tolerance to electrical shock significantly over the alone condition. Therefore, it was concluded that the perception of sharing stressful situations with a coactor would make stress more tolerable. The question this study poses for the present work is will the differing group compositions increase or decrease the rate of physical tolerance as the skills are being learned? In gymnastics there is generally some discomfort in the initial stages of learning.

Two other studies in coaction contribute to the present work. The first is another experiment by Martins and Landers (1969) which investigated the effect of an audience on learning and performing a complex motor skill. Subjects were grouped and identified as highly anxious and low anxious. Results indicated that highly anxious subjects in the alone condition performed better than the low anxiety subjects after the initial stages of learning. Anxiety might play a part in the present work if highly skilled performers really can affect the low skilled.

The second work by Martens and Landers (1969) investigated the coaction effect on a muscular endurance task. Each subject was required to extend the dominant leg in a horizontal position over a bench and to maintain that position as long as possible. Three test
conditions were used: alone, in pairs, and in groups of four. Results showed that groups of four performed significantly better than performance in alone and pairs conditions. In their conclusion section the authors postulated that the results indicated some competition, a desire not to be negatively evaluated by others and the possible increase of arousal resulting from the presence of others might increase a subject's physiological limit (1969, 733-737). If this conclusion is applied to the present work, highly skilled coactors might be found to increase the desire not to be negatively evaluated which might boost performance rates of low skilled subjects grouped with highly skilled subjects.

It appears that coaction may affect the quality of performance more than quantity of response. Applied to the present study, highly skilled control subjects may create a competitive or possible anxious state that would decrease the quality of group performance. This state could be caused by verbal, non-verbal or a combination of communication signals within groups. How this will affect motivation within a group is uncertain. There is a possibility that low skilled subjects will endure more physical pain when coacting with highly skilled subjects. However, the pain factor may also be controlled when the opportunity to perform remains constant.

In Search of the Perfect Number

Many of the earlier social facilitation studies involved animals of the same species. While it was impossible for researchers to determine an animal's increased appreciation for what they were
eating, they did measure the amount ingested in the alone and coaction settings.

Bayer (1929) placed an experimental animal in a container of wheat and allowed the hen to eat until satiated. Another hen was then placed along side the first. When the second hen began to eat, the first attacked. The attack failed to stop the second hen from eating, therefore the first, already satiated hen, began to eat again.

Results indicated that hens would eat more when coacting with other hens. These results were replicated on rats by Harlow (1932), on puppies by James (1953) and on ducks by Clayton (1976).

On learning behaviors such as maze running and discriminative learning, Gates and Allee (1933) used female Periplaneta Americanna (roaches) in a series of maze experiments. Roaches were isolated in milk bottles plugged with cotton, given bananas for food and kept in the darkened testing area before experimentation. Mazes were constructed of galvanized iron, using water as a punishment for leaving the maze. Results indicated,

"paired roaches interfere with the initial speed of running the maze, but that later speed increases with successive trials, in fact the improvement but not the actual rate may be more rapid than if the roaches are isolated (1933, 351)."

As a result of experiments similar to Bayer and Gates work, it was noted that there are different phases of learning in which coaction may or may not inhibit learning. The works of Klopfer (1958), Allee and Masure (1936), and Welty (1935) replicate the work of Bayer, Gates and Allee and indicate mixed results in the search for the perfect number.
Chen (1937) replicated their work using ants and became the first to note factors concerning the complexity of task. As a result of his findings, social facilitation researchers started to ask if task complexity and learning phase were affected by group composition, particularly the number of coactors in a group. These questions demanded a behavioral analysis approach that would permit analysis of outside considerations, now called external validity. The problem of external validity is particularly present when human subjects are involved.

Burwitz and Newell (1972) encountered the problem of external validity when they investigated the concept of the perfect number of coactors. The difference between their study and other number studies was the use of human subjects. Unlike their animal counterparts, humans are much more difficult to control because they can acquire experimental apparatus and communicate the importance of a particular skill being evaluated.

Results of the Burwitz and Newell study indicated that subjects performed a fine motor coordination task best when coacting with two other individuals. The problem with this study is the high probability of contamination due to the availability of the test apparatus (a very popular toy). In reality, contamination is generally a problem when human subjects are involved in testing, particularly in a naturalistic setting using familiar skills and/or apparatus. However, validity concerns demand a close examination of possible exposure to test apparatus and verbal or non-verbal communication and feelings that might affect the statistical results (Campbell and Stanley, 1963).
Perceived Power to Evaluate

Perhaps the most powerful force in a group learning situation is the perceived power for evaluation held by a teacher or fellow student. Because gymnastics involves a group of individual performances, each coactor becomes an audience for the other members of the group. Social facilitation research has shown audiences to be a powerful force in performance rate but the question remains, what force or set of forces elicit correct responses? Perhaps the student perceives their peers as more evaluative than the coach or instructor. The answer to this question may be found in the work of German experimenter Meumann (1904) who accidentally observed that subject output increased dramatically when the principle investigator entered the testing area. This observation is significant because in the type of work Meumann was studying (muscle endurance) the subject was thought to be working at their maximum performance level no matter who was present (Zajonc, 1966, 10).

A possible speculation is that the degree of performance output is dependent upon the rank or power of the coactors and/or instructors present.

In 1963 Bergum and Lehr found evidence that Meumann's observation was correct. The researchers developed a procedure for measuring the effects of authoritarianism on vigilance. Subjects were tested in test booths using a light panel and intercom. Vigilance was monitored under two experimental conditions. In the permissive condition talking was permitted and no supervisor was present. Results indicated performance was highest in the authoritarian condition where talking was not permitted and a supervisor was constantly present.
Bergum and Lehr's results were replicated by D.W. Carment and Margaret Latchford in 1970. Their results also indicated that the presence of the experimenter has an energizing effect on the performance of solitary and coacting subjects.

Coaction-evaluation studies enhanced the notion of perceived evaluation by suggesting that an audience or coactor or teacher have an evaluative potential.

Paulus and Murdock (1971) developed a study of anticipated evaluation and audience presence in the enhancement of the dominant response. The researchers tested the hypothesis that an evaluative condition would enhance the emission of the dominant responses. Testing was done in three experimental stages: 1) training, 2) alone - no evaluation, 3) alone - with evaluation.

Results indicated support for the hypothesis that anticipated evaluation would enhance the dominant response. Paulus and Murdock found evidence to indicate that audience presence alone did not significantly affect the emission of the dominant response. It was concluded that "the presence of an audience appears to be a source of drive only when it is accompanied by anticipated evaluation (1971, 288)."

The next study marks the beginning of modern social facilitation research within the physical education setting. Classroom learning (i.e. gymnasium) was now considered to be directly affected by evaluative coactors and spectators.

Testing 45 highly and low skilled gymnastics students in the presence of 17 coactors and casual spectators, Paulus and Cornelius (1974) predicted that more highly skilled students would decrease performance in
an evaluative setting. Their ideas were based on a Broen and Storms (1961) proposal that response tendencies have a response strength ceiling. Therefore, highly skilled students would more readily reach their ceiling than low skilled. It is important to note that the researchers concluded that this proposal "applied only to complex tasks which are relatively well learned (1974, 62)."

The results also indicated that in a "warning condition," where subjects were told that they would be evaluated by an audience, the more highly skilled subjects showed greater decrements in performance than the less skilled subjects. The present study does not contain a warning condition that might affect performance during pre- or post-testing.

One other study of evaluation in a coercion setting is important to the present study, primarily because it considered the presence of an evaluator as the presence of a conditioned stimulus. Theoretically, it was believed that the subject was conditioned to respond at a high level when the evaluator directly observed performance.

Rittle and Bernard (1977) tested this theory by measuring response rate on a simple word construction task. They used three experimental conditions: 1) evaluator facing away, 2) evaluator behind a barrier, and 3) evaluator facing subject.

Results indicated response rates increased significantly in the evaluator facing subject condition. The researchers attributed the increase to "discriminative stimulus properties" possessed by the evaluator. Whether or not skill level determines the intensity of that perception is not clear. Possibly the evaluative potential of highly skilled students could adversely affect low skilled students within the
group. However, there is also the possibility that the teacher could be found more stimulating and/or evaluative than the other members of the group.

**Age and Ability**

Recent coaction research has emphasized the importance of age and ability as a determinant of performance level. One study in particular should be noted in this review.

In 1981 Mary Jane MacCracken examined the effects of coaction and spectator presence on young children performing a balance skill.

Results indicated the children performed best in the audience and coaction conditions and that performance levels increased with age and skill level. This finding is important to the present study as it defines the importance of subject identification and codification during the research process.

**Research Methodologies**

Social facilitation researchers were primarily interested in the quantity of performance in both the audience and coaction situations. All studies reviewed here contain some form of statistical analysis with qualitative concerns reported in the discussion section of each work.

The research methodologies used were primarily true experimental with very little carry over to a naturalistic learning environment. In many instances the tasks studied were non-academic: i.e. maze learning, Gates and Allee (1933), Pessin and Husband (1933), Klopfer (1958); eating habits, Bayer (1929), Harlow (1932), James (1953), Clayton (1976); and fine motor control, Burwitz and Newell (1972).
Zajonc and Cottrell's theories, however, evolved not only from statistical analysis of their work and previous works but from experimenter notes, observations of research associates and subject interviews (Zajonc, 1965, 273; Cottrell, 1968, 195). Their techniques for theoretical model formulations were not unique within Social FACilitation research, there were some exceptions in earlier studies. Trippett (1897) noted subject motivation in relation to performance in competitive and non-competitive settings. Gates (1924) noted behavioral changes that appeared in varying audience settings. Travis (1928) was the first to note the need for a uniform behavioral coding and rating system. Wapner and Alper (1952) developed tests that emphasized the personality of the subject in relation to performance factors.

Two methods of subject codification for use in subject and population identification also evolved. The first, involved the use of pre-experimental data, such as skill records and test scores, Paulus and Cornelius (1974), Hunt and Hillery (1973), Williams (1975) and Martens (1969). The second method was more closely aligned with present day behavioral research in that it uses baseline data to group subjects for experimental purposes. The latter method has been employed in the present study because of the quasi-experimental design in use and the naturalistic setting involved.

The major differences between previous works and the present study are:

1) A classroom setting based on a commercial venture where students pay to attend.

2) A quasi-experimental design constrained by the nature of the program.
Note: It was important that the parents and the students felt that they were receiving just as much instruction during the study as they received throughout the normal course of previous programs.

3) And, the use of qualitative data as a check for external and internal validity.

Summary

Social facilitation research to date has provided many pieces to the coaction puzzle but is far from outlining a complete picture of the forces that increase performance within groups in a learning environment. The literature review presented here is divided into three sections.

Section One examined two theories that affect performance within a group. The first, Social Facilitation theory was developed by Robert Zajonc in 1965. His theory contains two paradigms with which to view subject performance. The first is an audience effect that occurs when subjects perform in front of an audience. The second is a coaction effect that occurs in the presence of others engaged in the same activity as the experimental subject. The important conclusion of his work was that others were necessary to provide behavioral cues for appropriate and inappropriate responses.

The second theory, Learned Drive Theory was developed by Nicholas B. Cottrell in 1968. The theory states that the mere presence of others is not sufficient to increase drive level. According to Cottrell the subject must learn or perceive that other person(s) can affect the outcome or reward for performance.

Section Two examined major research findings in five key areas of Social Facilitation research.
The first area, research involving audience effect provided suggestions for technical input into the present experimental design. Key points include:

1) Tasks to be performed should be new, unique and/or slightly beyond the baseline capabilities of the subject.
2) Measures for quantity and quality of performance should be taken.
4) Contamination of internal and external validity was traditionally controlled by the use of a true experimental design. As the designs became quasi-experimental to accommodate the naturalistic setting, there was a need for interviews and questionnaires to perform this function.

The second area, research involving coaction effect provided evidence that relates to the present study. Key points include:

1) Learning as a member of a group increased the speed of performance at the cost of quality.
2) Student communication was thought to be a positive force.
3) Coaction increased the desire to compete.
4) Coaction increased the subjects physical limit to pain.

The third area, "the search for the perfect number" of coactors, produced mixed results. Learning appeared to be more dependent on the type of task presented and the phase of learning, than on the number of subjects in the group.

The fourth area, perceived power to evaluate, was perhaps the most powerful force in group learning. The perceived evaluation strength of a supervisor, audience or researcher had a direct affect on the performance output of the subject.
The fifth area, age and ability provided some evidence for a linear relationship.

Section Three examined research methodology used in Social Facilitation research. All studies reviewed contained some form of statistical analysis. Research design was primarily true experimental with very little carry over to a naturalistic learning environment. Many of the tasks studied were non-academic and used apparatus readily available outside of the experimental setting. Theories evolved from statistical analysis of the research works, experimental notes, observations or research associates and subject interviews.

Two methods of subject selection and codification evolved. The first involved the use of pre-experimental data, including test scores and skill records from previous skill performances. The second method was more closely aligned with behavioral research in that it used baseline data to group subjects.

The major differences between previous works and the present study are:

1) A classroom setting based on a commercial venture where students pay to attend.

2) A quasi-experimental design constrained by the nature of the program.

3) And, the use of qualitative data as a check for external and internal validity.
CHAPTER THREE

METHODS

This chapter outlines the methods to be used to test whether or not coaction within homogeneous and heterogeneous groups really makes a difference in the rate of group learning.

Historically, the coaction paradigm of Social Facilitation theory was tested using a true experimental design with little or no feedback on possible sources of contamination. The present study is different because it will be done using a quasi experimental methodology in a natural classroom setting. The study will also employ qualitative analysis to check the internal and external validity of the statistical results.

Subjects

Gymnastic students participating in the Family Recreation and Instructional program during the Winter Term of 1983 will make up the experimental population for the study. A letter will be sent to the parents one week before the beginning of the study. The document will include a brief description of the study, a parents consent form and a parents questionnaire. (Appendix 1) All materials must be returned on the first day of class to be included in the study.

Group assignment will be done by draw after the skill levels are assessed using a pretest. (Appendix 1) Students falling within the upper 33 percent of the range will be considered highly skilled. Students falling in the lower 33 percent will be considered low skilled. All highly skilled subjects will be randomly assigned
to the All Highly Skilled or Mixed Skilled groups. All low skilled subjects will be randomly assigned to the All Low Skilled or Mixed Skill level groups.

Treatment will be confined to the first hour of classes and control conditions will be confined to the second hour of classes. This is done to avoid contamination of the intervention. Treatment will be established by random assignment (draw).

Duncans' Multiple range test for variable prescore will be used to assess group equality after random assignment to treatment and control groups.

Setting

The setting of the study is the varsity gymnastics gymnasium at The Ohio State University (Figure 1). Instruction and record keeping will be held concurrently with the Family Recreation and Instructional Program. Students from four to six and thirteen to sixteen years of age will also receive instruction during the intervention periods but at no time be permitted in the experimental areas (Figure 2).

Experimental groups will be rotated clockwise for each intervention period to avoid contamination by constant exposure to the parents area. Instructors will be rotated counter clockwise before each intervention to avoid instructor bias toward a particular student or group. The rotations will be done once a week and maintained for the treatment and control groups.
Parents area

Area 1
- Uneven Bars
- Balance Beams
  - High & Low
- Single Low Bar
- Line Tumbling

Non-Experimental Groups

Area 2 Area 3
- Tumbling, Tumbling
- Standard Floor
- Exercise Area

Experimental Groups

Vaulting

Area 6 Area 5
- Tumbling
- Tumbling
- Standard Floor
- Exercise Spring Floor

Experimental Groups

Area 4
- Rings
- Horse
- Parallel Bars
- High & Low Equipment
- Vaulting

Non-Experimental Groups

Storage Low Bar

Varsity Gymnastics Gymnasium: Experimental Area

Figure 1
Pre-Test - Post-Test Area

Note: Groups moved clockwise. Instructors moved counter clockwise.

Figure 2
Experimental Design

The following randomized control-group Pretest - Post Test design will be adapted for this study. Unlike the traditional design the randomization will occur after the pretest in order to assign skill levels.

DIRECT TEACHING METHOD
PRETEST GROUPING INTERVENTION POST TEST (treatment)

REGULAR TEACHING METHOD
PRETEST GROUPING NO INTERVENTION POST TEST (Control)

Figure 3: Experimental Design

The treatment group will receive instruction on ten preset gymnastic skills (Figure 4). Participation will be controlled by requiring that each student be given two attempts at each skill. The instructor will then record the students progress before moving on to the next student. Progress codes will conform to the same codes used by the raters. Progress scores will be recorded by the primary investigator one hour after the instructors leave the testing site.

The control group will receive instruction from a list of 16 gymnastic skills that overlap the treatment skills (Figure 5). Instructors will be permitted to choose the skills that they feel are appropriate for their group and to set the order of presentation. Supervision will be maintained to ensure compliance to the skill sheet. Skill attempts by each student will not be controlled and record keeping is not required. The primary investigator will keep a
record of Instructor compliance and non-compliance to the traditional skill progression sheet. This recording process will not be done in the presence of students or instructors.

Experimental methodology is based on methods outlined by Debold B. Van Dalen in *Understanding Educational Research: An Introduction* (1979, 247-252). His outline includes:

1. Select subjects from a population by random methods, if possible.
2. Assign subjects to groups by random methods.
3. Test the subjects on the dependent variable.
4. Keep all conditions the same for the groups except for exposing the experimental subjects - but not the controls - to the independent variable for a stipulated time.
5. Test the subjects on the dependent variable.
6. Find the difference between the pretest and post test scores and the mean differences for each group.
7. Compare the mean difference to determine whether the application of the treatment has caused a change in the experimental group's scores as compared with the control group's scores.
8. Apply an appropriate statistical procedure to ascertain whether the difference in the scores is sufficiently great to be a statistically significant difference or whether it is only a chance occurrence.
Due to the quasi experimental design of the study, Van Dalens' outline will be adapted in the following ways:

1. Subjects will be selected from a population of gymnasts. It must be accepted that some natural selection will occur due to the nature of the skills involved.

2. The dependent variable will be measured before the groups are assigned by random methods.

3. Statistical analysis will include: Duncans Multiple range test for variable prescore, this is used to check for group equality after the pre test. A two way analysis of covariance will automatically check for differences between pre and post test scores, list mean differences between each group and determine if a statistically significant difference exists. Finally, a t test for independent samples will be run on each sub group to determine if a statistical difference exists between homogeneous groups and heterogeneous groups.

Observational/Instructional Instrument

The observation/instructional instrument developed for this study is based on expert opinion. It has been pretested and adjusted to meet time constraints and the needs of young gymnasts in the initial stages of learning (Figure 4).

The quality point system requires an inter rater reliability of 85% before actual experimentation.
<table>
<thead>
<tr>
<th>Subject Number</th>
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<table>
<thead>
<tr>
<th>Skill</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Roll</td>
<td></td>
</tr>
<tr>
<td>Back Roll</td>
<td></td>
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<tr>
<td>Cartwheel</td>
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<tr>
<td>Roundoff</td>
<td></td>
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<tr>
<td>Headstand</td>
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<tr>
<td>Backbend</td>
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<tr>
<td>Back Extension Roll</td>
<td></td>
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<tr>
<td>Scale</td>
<td></td>
</tr>
<tr>
<td>Handstand Forward Roll</td>
<td></td>
</tr>
<tr>
<td>Jump Full Turn</td>
<td></td>
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</tbody>
</table>

**Codes**

0 - Balk - A refusal to perform the requested skill.
1 - A skill attempt totally dependent upon a spotter for safety and/or completion.
2 - A skill attempt partially dependent upon a spotter for safety and/or completion.
3 - A skill attempt independent of a spotter that is mechanically incorrect.
4 - A skill attempt independent of a spotter that is mechanically correct.

A confidence spot for a mechanically correct spot should be recorded as a four.

Figure 4
Level II* 

Boys and Girls Tumbling

Skill Progression Sheet

Instructions: During the tumbling section of the program warm the students up using skills or combinations of skills the students have already mastered. Next teach new skills based on the progressions presented here.

Forward Roll
Jump Full turn
Back Roll
Scale
Cartwheel
Headstand
Handstand
Backbend
Roundoff
handstand Forward Roll
Back Extension Roll
Headspring
Handspring
Limbre
Front Walkover
Back Walkover

If a student was reported to be too advanced for this skill progression they were moved to a Level III group. Three girls were moved to Level III after the pretest due to professional gymnastic training.

*Adapted from Coll Gymnastics Program, Westerville, Ohio, 1981.

Figure 5: Control Skills
The degree of reliability will be obtained by the use of rater training. Each rater will participate in two training sessions of two hours each. Sessions will be held during the seventh and eighth week of the Autumn term program.

Rater training will consist of skill definitions, demonstrations, use of the coding sheet, and a discussion of each skill. Particular attention will be paid to each person's perception of the skills so that everyone agrees on coding (Figure 7).

Observers will be paid for their participation in training and rating sessions. To assure validity observers will be asked to disqualify themselves from the study if they are related or have a personal relationship with any member of the study (i.e. instructors, students, parents or another rater).

A discussion of the coding system will be held prior to the final rating in an effort to minimize observer drift which may occur if any of the raters forget codes between rating sessions.

Reliability

Internal validity between raters will be established by the use of percentage inter rater reliability. "Interobserver agreement measures are usually reported as percentage or agreement among two or more independent observers: (Cooper 1974, 34).

For this study the behaviors recorded will be calculated into a percentage of agreement using the formula:

\[
\frac{\text{agreements}}{\text{agreements} + \text{disagreements}} \times 100 = \text{percentage of agreement}
\]
A minimal agreement percentage of eighty-five percent will insure that raters are seeing the same behavior and rating the behavior equally. This percentage must be met before the experimental period.

Several other procedures are employed to increase the probability of reliable and valid data:

1. Pretest reliability checks - observers must rate two practice groups achieving 85% agreement before collecting data for the study.
2. Rater discussions - raters will meet for a formal discussion of the coding system before the post test. This procedure should eliminate observer drift by reminding each rater of agreements on each skill code.
3. Rater rotation - raters will be rotated clockwise after the pretest to avoid possible bias.
4. Post test reliability checks - reliability percentages will be determined for each group and each testing session. This will be done to check for bias toward one group or skill level.

Experimental Schedule

The experimental schedule for the six week period will be run in the following manner (1 lesson per Sunday):

<table>
<thead>
<tr>
<th></th>
<th>Treatment</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Week:</td>
<td>Pretest and assignment to groups</td>
<td></td>
</tr>
<tr>
<td>Second Week:</td>
<td>Treatment*</td>
<td>**Control program</td>
</tr>
<tr>
<td>Third Week:</td>
<td>Treatment</td>
<td>Control program</td>
</tr>
<tr>
<td>Fourth Week:</td>
<td>Treatment</td>
<td>Control program</td>
</tr>
<tr>
<td>Fifth Week:</td>
<td>Treatment</td>
<td>Control program</td>
</tr>
<tr>
<td>Sixth Week:</td>
<td>Post Test both</td>
<td></td>
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</table>

*Ten skills - same order for each intervention - two attempts by each subject. Instructor records progress in front of the group.
**Sixteen skills - no given order required - attempts determined by instructor. No record keeping required.**

Note: Intervention skills do overlap the skills listed in the traditional program.

Instructors have been preconditioned to 'try something new' by the request of the program director (also the principle investigator). The only difference between the intervention program and the traditional program will be in the employment period. (Four weeks versus seven). Instructors will not be present for the Pretest or the Post Test. Traditional program substitute instructors will be employed for that part of the program. This is done to avoid assigning any particular importance to the treatment.

**Testing Method**

Testing method will be held constant for treatment and control groups. Substitute instructors will be pretrained to use the following procedures:

**Skill Presentation:** Each instructor will demonstrate the skill twice for the group. The ten intervention skills will be used to determine the skill level of the treatment and control subjects.

**Instructions:** "This is a forward roll. I would like everyone to try two forward rolls. If you would like a spot I will be glad to help you when it is your turn."

**Event Recording:** Raters record the highest score they would give for each attempt. Observation continues until all skills are covered and each student receives two changes to perform each skill.
Substitutes are asked not to discuss their part in the program with regular program instructors.

Teaching Method-Treatment

Teaching method will be held constant for the treatment group. Regular instructors will be assigned to a group on a lesson basis. Before the program begins instructors are to be briefed on the new coding system and asked to try it during the first hour using the following procedures:

Demonstrate - show the skill.
Instruct: (Example) This is a forward roll. I would like everyone to try two forward rolls. If you would like a spot, I will be glad to help you when it is your turn.

Record - record the student's best attempt according to the codes on the recording sheet.

Repeat - until all ten skills are presented, then move on to the apparatus.

After the program briefly note any behavioral problems. Include your suggestions to improve this teaching method.

Instructors will also be told that other Family Recreation and Instructional staff will be conducting a student survey toward the end of each hour. At sometime during the 4 week intervention phase each student will be interviewed.

Teaching Method-Control

Instructors will be permitted to teach using the traditional
method during the second hour. Each instructor will be assigned a group, given the skill progression sheet and reminded of instructions each day.

Instructors are permitted to teach using their own style of teaching within the limits of the skill progression sheet. The program director will use a spot check to insure that guidelines are being followed.

Instructors do not keep progress notes but they are asked to note behavioral problems and suggestions for program improvement at the end of the instructional period.

Survey staff will interview each student during the intervention period of the study.

**Student Interview**

The student interview and parents questionnaire will be used to probe areas of internal and external invalidity that might contaminate the statistical results.

The student interview will be short, asking four basic questions:

1. Why do you like gymnastics?
2. How did you find out about the FRIP program?
3. Do you think the other children in your group are better at gymnastics than you?
4. Do you think the stunts you are learning are too hard or too easy?

Student Interviewers must attend a pretraining session prior to the experimental period. They will be paid for their participation.
In the study. During the training phase interviewers will be instructed to:

1. Interview only during the apparatus and parents in section of the lesson.
2. Write responses after the child has returned to the group.
3. Show interest but do not lead the child. Let the student answer in their own way with their own thoughts.
4. Relax - try not to be formal. Work for a conversational style that makes the child comfortable.
5. Interview-record. Never interview more than one student before recording.
6. Record in the students words - be as accurate as possible.
7. Note the number of minutes that were used to interview the child. That time should not exceed 5 minutes.

The parents questionnaire is also short, asking five basic questions:

1. What type of gymnastic experience has your child had in the past?
2. Does your child play at gymnastics at home?
3. Why did you enroll your child in the FRIP program?
4. At which level would you rate your child's ability?
   a - better than the other children
   b - same as the other children
   c - less than the other children
5. Why do you feel your child is interested in gymnastics?
   (Parents or siblings that are gymnasts, peer interest, TV coverage, etc.)
Quantitative Analysis

Pre-experimental analysis will include:

1. Rank ordering the pretest scores before random assignment to experimental groups.
2. Developing inter-rater reliability percentages before the experimental period.

Post-experimental analysis will include:

1. Use of Duncan's Multiple range test to check for treatment and control group equality after the pre test.
2. A two-way analysis of covariance will check for differences between the treatment and the control group.
3. A t test for independent samples will check for differences between sub groups (All High, All Low, Mixed High, Mixed Low and Medium) in both the treatment and control conditions.

Qualitative Analysis

A qualitative analysis will be done to determine if scores were internally valid and to define external validity for the purpose of limiting generalization. Traditionally, a Pretest-Post Test Control Group design avoids weakness through the use of a true experimental setting. The present study will be done with a quasi experimental design in a natural classroom setting. This indicates the need for a close examination of all internal and external sources of invalidity as proposed by Campbell and Stanley (1963, p. 8).

Internal validity concerns question whether or not the experimental treatments made a difference or if extraneous factors confounded the effect of the experiment.
There are eight relevant areas of internal invalidity, these include: history, maturation, testing, instrumentation, statistical regression, differential selection, experimental mortality and selection-maturation interaction (Campbell, 1963, p. 5).

History, asks if any other event in the subject's life could have affected the statistical results. The present study will attempt to measure extraneous factors including play habits, outside lessons, and significant others from home or school.

Maturation is thought not to affect validity as time spent in the treatment and control conditions is six weeks.

Testing will be controlled by keeping test conditions and instrumentation constant for the treatment and the control groups.

Instrumentation will be controlled by administering the pretest and post test in exactly the same manner.

Statistical regression is not a contaminant as the subjects will not be selected on the basis of extreme scores. Students considered extreme due to previous training or poor motor control will be assigned to non-experimental groups after the pre-test.

Experimental mortality will be reported as a percentage score drawn from attendance records.

Selection - Interaction will be checked using information from registration materials.

External validity asks "to what population, setting, treatment variables, and measurement variables can the study be generalized?" (Campbell, 1963, p. 5). According to Campbell and Stanley (1963) the question is never completely answerable.
To get as close as possible to the answer for this study, the following variables will be studied.

First, the reactive effect of testing. This can be done by comparing the pre test and post test of the control group.

Second, the interaction effects of selection biases and the experimental variable. This question asks if subjects were especially chosen for the study in a way that would give an advantage to those subjects over the unpretested universe. This may occur in the present work due to natural selection factors that affect the type of person that would enjoy gymnastic training. That might include those with flexibility, strength, good physical conditioning and a positive attitude toward gymnastics.

Third, the reactive effects of experimental arrangements. This area questions if the technology of the experiment would hinder or stop the effect from occurring in a non-experimental setting. It is possible that the reactive effects of the experimental arrangement might produce the same results in a non-experimental setting if behavioral factors could be controlled. It may not be possible to measure this factor.

And fourth, multiple-treatment interference. This factor will be measured by taking a percentage analysis of those receiving outside lessons during the treatment period.

Analysis-Theoretical

The analysis of results will conclude with agreement or disagreement of the theoretical findings presented in the literature.
review. Particular attention will be given to the Coaction paradigm of Social Facilitation Theory and Learned Drive Theory.

Summary

This chapter outlines the methods suggested for this study. Subjects are gymnastic students participating in the Family Recreation and Instructional Program at The Ohio State University. The setting is the Varsity Gymnastics Gymnasium. A randomized control group pretest - post test design will be adapted by pretesting before randomly assigning subjects to experimental groups. The treatment group will receive instruction on ten gymnastic skills. Participation is strictly controlled by an instructor. Records are kept of each skill attempt and each student is given two chances on every skill.

The control group will receive instruction from a list of sixteen skills that overlap the treatment skills. Instructors will be permitted to choose the skills, skill order, number of attempts and teach using their own personal style. No record keeping is required. Instructors are asked to comment on behavioral problems and suggest improvements at the end of each treatment and control session.

The naturalistic setting forces several changes in the traditional experimental methods. First, the subjects will be selected from a population of gymnastic students. Second, grouping requires that the students be randomly assigned after skill level assessment (pretest). The treatment and control groups will have
four sub groups each. (All highly skilled, all low skilled, Mixed-highly and Low skilled, and Medium skilled). Each level represents the upper-middle and lower 33.3% of the pre test range.

The observational-instructional instrument developed for this study has two main concerns. First, skill progressions that fit the needs of the subjects being tested. Second, a quality point system that can be easily understood and used in a field setting. Reliability was set at eighty-five percent to insure that raters are rating behavior equally. All raters are required to reach this level before coding the experimental skills. Several others procedures are employed to increase reliability and validity. Those procedures include pretest reliability checks, rater discussions, rater rotation, and post test reliability checks.

The experimental schedule consists of one session for pretesting and group assignment, four sessions of Intervention or regular instruction, and one session for post testing. The testing method will be held constant for all groups. Substitute instructors will run the pre test and post test sessions. Regular instructors will administer the intervention and teach the regular classes.

The student interviews and parents questionnaires will be combined with registration materials, instructor notes, and primary investigator notes to check for contaminants that might affect the statistical results.

Statistical analysis includes pre-experimental statistics to check group equality after the pre test and rater reliability. Post
experimental statistics include a two way analysis of covariance and t test for independent samples.

The results will also be checked by a percentage analysis of internal and external validity factors.

The analysis will conclude with agreement or disagreement of the theoretical findings presented in the literature review.
CHAPTER FOUR

RESULTS

This chapter includes the results of the study as presented through the use of a five-way analysis. First, a qualitative analysis of the statistical results is given. Second, answers are given to the problem statements and study hypotheses from Chapter One. Third, agreements and disagreements with the theories presented in Chapter Two will be presented based on the statistical results. Fourth, a qualitative analysis of internal validity factors that might have contaminated the statistical results are presented. And finally, external validity factors are examined in order to set the limits of generalization.

Quantitative Analysis

The quantitative analysis examines two evaluative forces affecting groups. First the composition of the group. And second, the teaching methods employed in the treatment and control conditions. This was done to determine if highly skilled coactors or the instructor had the greatest perceived potential to evaluate.

Group Composition

In order to study group composition skill groups were assigned on the basis of pretest scores. Once the subjects had been determined to be Highly, Medium or Low Skilled they were randomly assigned to experimental groups. Duncan's Multiple Range test was
used to determine equality of treatment and control groups. Prescore
means of 29.6 for the treatment group and 29.3 for the control group
assured group equivalency. This balance was also due in part to the
elimination of high and low extreme scores from the sample before
setting the range for random assignment. Normally, a control group
may not be this evenly matched with the treatment group. However,
this correlation did make it easier to compare the effects of group
composition versus teaching method.

Treatment Method

A two-way analysis of covariance was used to compare grouping
and teaching method. (Figure 6)

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>SUMS &amp; PARTIAL Sums of Squares</th>
<th>df</th>
<th>MEAN SQUARE</th>
<th>F</th>
<th>LEVEL OF SIGNIFICANTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
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<td>38</td>
<td>--</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>METHOD</td>
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<td>28.5898</td>
<td>11.00</td>
<td>0.0025 Signif.</td>
</tr>
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<td>GROUP</td>
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<td>0.24</td>
<td>0.09</td>
<td>0.9839 Not Sig</td>
</tr>
<tr>
<td>METHOD BY GROUP</td>
<td>11.6347</td>
<td>4</td>
<td>2.9</td>
<td>1.12</td>
<td>0.3672 Not Sig</td>
</tr>
<tr>
<td>PRESCORE</td>
<td>84.8380</td>
<td>1</td>
<td>84.8380</td>
<td>32.65</td>
<td>0.0001</td>
</tr>
<tr>
<td>ERROR</td>
<td>72.7484</td>
<td>28</td>
<td>2.5982</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

Figure 6: POST TEST SCORES

Post Test analysis methodology was set up in the following way.

Teaching (METHOD) was measured by comparing Pretest and Post means (0.0025).
GROUP equivalency was measured by comparing Pretest group means (0.9839).

METHOD BY GROUP composition was measured by comparing group post test means (0.3672).

PRESCORE was measured by comparing means after the prescore (0.0001).

The two way analysis of covariance indicates that grouping was non-significant (p < .3672). This means that only 63 times out of 100 will group composition have an impact on the rate of group learning.

The two-way analysis of covariance also indicated that teaching method was significant (p < .0025). This means that 99 times out of 100 teaching method as prescribed in this study, will have an impact on the rate of group learning.

Problem Statements

The results of the quantitative analysis indicate the answers to the two problem statements in Chapter One. The first statement asked: Would low skilled students in the initial stages of learning coact non-verbally in a positive or negative way with (A) Highly skilled students, and (B) other students of equal ability?

When teaching method is considered through the use of two way analysis of covariance low skilled students in the initial stages of learning coact in a positive way with highly skilled students and students of equal ability (p < .0025).

When the All low skilled treatment and control group means are compared with the Mixed Low Skilled Treatment and Control group means
using a t test, results indicate that grouping alone was not
significant. The t test Table is presented in Table 1.

The difference between the post test means of Groups 1 and 2
represent the standard error of the difference (t test).

Table 1

T TEST TABLE
Independent Samples

<table>
<thead>
<tr>
<th>GROUP 1</th>
<th>GROUP 2</th>
<th>df</th>
<th>Alpha level</th>
<th>t</th>
<th>Table score</th>
</tr>
</thead>
<tbody>
<tr>
<td>All High and Low: Treatment and Control</td>
<td>All Mixed- Treatment and Control</td>
<td>38</td>
<td>0.10</td>
<td>-0.49</td>
<td>1.69</td>
</tr>
<tr>
<td>All Low: Treatment and Control</td>
<td>Mixed Low: Treatment and Control</td>
<td>16</td>
<td>0.10</td>
<td>1.62</td>
<td>1.75</td>
</tr>
</tbody>
</table>
The two t scores reflect combined group means of the High and Low skilled subjects. This measure was also taken after the Post test and indicates that performance was not dependent on grouping.

The second problem statement asked: Would highly skilled students in the Initial stages of learning coact in a non-verbal way with (A) other highly skilled students and (B) low skilled students?

When teaching method or instructor evaluative potential is considered through the use of a two way analysis of covariance, Highly Skilled Students in the Initial stages of learning coact in a positive way with other highly skilled students and low skilled students (p < .0025), particularly in the treatment condition.

When the All Highly Skilled Treatment and Control group means are compared with the Mixed Highly Skilled Treatment and Control group means the t test indicates that grouping alone is not significant (p < 1.69).

In addition to t test findings the analysis of covariance also indicated that grouping was not significant (p < 0.3672).

The two-way analysis of covariance and t test findings are also important because they indicate the direction of the three study hypotheses.

Hypothesis One states: When the heterogeneous groups are compared with the homogeneous groups there is a significant difference between performance scores. This statement is false. When a t test was performed the difference between means was found to be non-significant (p < 1.69). Therefore, there appears to be no evaluative influence among peers in the Initial stages of learning.
Hypothesis Two states: When control and treatment groups are compared there is a significant difference between performance scores. This statement is true. When a two way analysis of covariance was performed the treatment group was found to produce significantly higher performance scores \((p < 0.0025)\). The control group was not significant \((p < 0.3672)\).

Hypothesis 3 states: When low skilled students in homogeneous groups are compared with low skilled students in heterogeneous groups there is a significant difference. This statement is false. When a \(t\) test performed the difference between means was found to be non-significant \((p < 1.75)\).

Theoretical Analysis

The literature review outlines Zajonc's Social Facilitation Theory, Cottrell's Learned Drive Theory and the perceived power to evaluate area studied by Meumann 1904, Bergum and Lehr 1963, and Carment and Latchford 1970. The coaction paradigm of Social Facilitation Theory and the perceived power to evaluate areas concur with the results of the present study.

Social Facilitation Theory

The coaction paradigm of Social Facilitation theory states that drive (effort) will occur in the mere presence of others. Robert Zajonc the father of modern Social Facilitation Theory states if drive or motive to perform is increased the enhancement of the dominant response will occur.
In the present work, drive was increased by repeated stimulation of the treatment group. This stimulation included regular instruction, demonstrations, and opportunity to perform. When control and treatment groups were compared, the treatment was found to effect learning to a greater extent than group composition (0.0025).

Drive effort was stimulated by the presence of others but not to a significant degree when teaching method was unstructured (p < 0.3672).

The present work agrees with Social Facilitation Theory for two reasons: First, it shows that a low level of effort will occur in the mere presence of others. Second, it provides evidence that increased drive will increase performance.

**Learned Drive Theory**

Learned Drive theory states that the mere presence of others is not sufficient to increase drive level. According to N.B. Cottrell, the subject must learn which person(s); the coactors, instructor or investigator have the power to control positive or negative outcomes. It appears that the students found the instructor to be the most powerful influence but it is difficult to state conclusively that Learned Drive Theory concurs with the results of this study. Had the instructors used a reward system as part of the intervention, agreement with Learned Drive Theory could be claimed.

**Perceived Power to Evaluate**

The perceived power to evaluate area is much like Learned Drive
Theory in that the subject must identify the most powerful influence on the group. The difference is that reward is not considered. In learned drive theory the subject learns to respond to the person providing intrinsic and extrinsic rewards. The perceived power to evaluate theorists believe the subjects response is controlled by the rank of those who have the power or perceived power to evaluate each skill.

In the control condition effort was minimal because neither the instructor or the group were perceived to be highly powerful. In the treatment group effort was higher because the subject found the instructor to be a very powerful evaluative force. Each time the student performed, the instructor evaluated performance and noted it on a clipboard (Figure 7.)

<table>
<thead>
<tr>
<th>TREATMENT</th>
<th>CONTROL</th>
</tr>
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<tbody>
<tr>
<td>Instruct</td>
<td>Teach using the prescribed list</td>
</tr>
<tr>
<td>Demonstrate</td>
<td>Order uncontrolled</td>
</tr>
<tr>
<td>Provide Opportunity</td>
<td>Opportunity uncontrolled</td>
</tr>
<tr>
<td>Rate Skills in front of the group</td>
<td>No rating system</td>
</tr>
</tbody>
</table>

Figure 7: Forces Affecting Subject Perceptions**

**The chart shows the differences in the forces that affected the subjects perception of the instructors' power to evaluate.

The perceived power to evaluate area is thought to be the strongest theoretical area to agree with the results of the study.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Controlled by Design</th>
<th>Partial Control by Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>87 88 95 94 89</td>
<td>88 87 89 93 89</td>
</tr>
<tr>
<td>Post test</td>
<td>93 89 95 90 95</td>
<td>91 90 84 95 88</td>
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<td>Statistical regression</td>
<td>Controlled by Design</td>
<td></td>
</tr>
<tr>
<td>Differential selection</td>
<td>Controlled by Design</td>
<td></td>
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<tr>
<td>Testing</td>
<td>Partial control by design</td>
<td></td>
</tr>
<tr>
<td>Selection-maturation</td>
<td>see significant others - school</td>
<td></td>
</tr>
<tr>
<td>History</td>
<td>6/0 5/5 4/2 3/2 2/2</td>
<td>5/4 3/1 5/5 3/2 5/2</td>
</tr>
<tr>
<td>Possible/actual</td>
<td>Play habits</td>
<td></td>
</tr>
<tr>
<td>Significant own, home</td>
<td>6/0 5/5 4/2 3/2 2/1</td>
<td>5/2 3/1 5/5 3/2 5/2</td>
</tr>
<tr>
<td>Significant own, school</td>
<td>6/0 5/5 4/2 3/2 2/2</td>
<td>5/2 3/1 5/5 3/2 5/2</td>
</tr>
<tr>
<td>Outside lessons</td>
<td>6/0 5/5 4/2 3/1 2/0</td>
<td>5/3 5/5 5/4 3/2 5/2</td>
</tr>
<tr>
<td>Cumulative x - history</td>
<td>43% 83% 63% 67% 63%</td>
<td>70% 42% 83% 79% 59%</td>
</tr>
<tr>
<td>Experimental mortality</td>
<td>Partial control by design</td>
<td></td>
</tr>
<tr>
<td>Attendance</td>
<td>36/1 18/0 24/0 18/0 12/1</td>
<td>30/1 18/0 30/2 18/0 30/3</td>
</tr>
</tbody>
</table>

Figure 7: Internal Validity Table

**Factor Definitions, see Figure 8**
Factors controlled by the experimental design are defined to set the limit of each term. Factors that are tabulated are defined to set the limit of each figure.

1. MATURATION - The physical or developmental growth of the subject during the time of the study.

2. INSTRUMENTATION - The controlled use of the observational/Instructional Instrument.

3. RATER AVERAGES - Pretest and Post Test - Stated in percentage Inner-rater reliability and analyzed by groups and sub groups.

4. STATISTICAL REGRESSION - The movement of positive and negative prescores toward the mean on the post score. Control by eliminating extreme scores before random assignment.

5. DIFFERENTIAL SELECTION - Occurs when one or more groups have an advantage due to more experienced subjects. Control through statistical analysis of groups after the pretest and random assignment.

6. TESTING - A. Keeping the test conditions constant for all test subjects.

   B. Subjects were asked during the student interview portion of the study if the stunts they were learning were difficult. Results are reported as the percent of the group that thought the stunts were difficult.

7. SELECTION - MATURATION - Reported by calculating the percent of schoolmates and classmates directly involved with each subgroup.

8. HISTORY - Events occurring in the subject's life that could influence the statistical results.

   A - Play Habits - The figures indicate the number of subjects in the group and the number reported to regularly play at gymnastics at home during the school week.

   B - Significant Others - Home - The figures indicate the number of students in the group and the number of students reported to have at least one family member that could have increased the students' skill level during the experimental period.

Figure 8: Factor Definitions
Figure 8 (continued)

C - Significant Others - School - The figures indicate the number of students in the group and the number of students reported to have at least one schoolmate or classmate directly associated with the experiment.

D - Outside Lessons - The figures indicate the number of students in the group and the number reported to have taken at least one form of community or private gymnastic lesson during the 1982-83 school year.

9. EXPERIMENTAL MORTALITY - The number of students dropping out of the experiment before the post test. In this study all drops were finished by the first intervention.

10. ATTENDANCE - Reported in class opportunities/versus absences and converted to a percentage of total absences for each subgroup.
Qualitative Analysis - Internal

The Family Recreation and Instructional Program accepts participants up until the first class of each term. This made pre-experimental sample screening impossible to control. For this reason the study includes an examination of internal validity factors which include: history, testing, instrumentation, statistical regression, differential selection, mortality and selection-maturation interaction.

The results of the internal validity examination are shown in Table 2. Codes for the internal validity table are given in Figure 8.

Maturation, while not completely controllable, was thought not to affect statistical results because the study was held over a short period of time.

Overall historical advantages appeared evenly shared between the treatment and control groups. Interestingly, the control group had a slight (5%) 'significant other' advantage over the treatment group. This means the control group had more parents, siblings, classmates and schoolmates directly involved in gymnastics who could have influenced the rate of learning. This interaction did not exist and their scores remained lower than the treatment group.

Testing was controlled by keeping the conditions constant for both groups. Subjects were also asked during the interviews if they thought the skills were difficult. Thirty-eight percent of the treatment group (8 of 21) and fifty percent of the control group (9 of 18) thought that the stunts were difficult. The perception of the
control group could have been affected by the teaching style they
received or the activities selected for their group. If so, this
condition was caused by the treatment or lack of treatment and does
not contaminate the findings.

Instrumentation as controlled by keeping test conditions
constant for treatment and control groups. Inter-rater reliability
did not appear biased toward any group or subgroup.

Statistical regression was controlled by elimination of positive
scores before random assignment.

Differential selection was noted in the statistical analysis.
The groups were equivalent after random assignment.

Experimental mortality did not affect the study as all drops
were completed before the intervention period. Absenteeism did not
affect the study as the treatment subjects were absent 4% of the time
and the controls were absent 4.6%.

Selection-maturation Interaction as noted by percentage analysis
of schoolmates and classmates directly involved in the program. As
noted in the history discussion there appears to be an equal
influence of selection-maturation interaction between groups.

The findings of the internal validity analysis indicate that the
statistical results are valid.

Qualitative Analysis-External

The external validity analysis is given to set the rate of
generalization for this study. The results of this examination are
shown in Table 3.
The analysis of external validity indicates that the statistical results can be generalized only to the groups similar to the study group. The treatment variable (The Observational-Instructional Instrument) can be generalized to the untested universe but may not result in as great a gain for that population for the following reasons:

First, the subjects of this study were associated with The Ohio State University, which may have made them more receptive to a strict teaching methodology. Second, a certain amount of natural selection had to be expected in the Family Recreation and Instructional Program student body. The subjects drawn to the program had excellent

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>CONTROL</th>
</tr>
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<tbody>
<tr>
<td>REACTIVE EFFECT OF TESTING</td>
<td>Possible contamination to generalization.</td>
</tr>
<tr>
<td>INTERACTION OF SELECTION BIAS</td>
<td>Possible contamination to generalization.</td>
</tr>
<tr>
<td>REACTIVE EFFECTS OF EXPERIMENTAL ARRANGEMENTS</td>
<td>Possible carry over of Instrumentation.</td>
</tr>
<tr>
<td>MULTIPLE-TREATMENT INTERFERENCE</td>
<td>Possible contamination to generalization.</td>
</tr>
</tbody>
</table>

**Limits of Generalization**
flexibility and a level of fitness that would not be the norm for an average physical education class.

And third, even though outside lessons did not affect the results of this study they may have the effect of a positive skew on the statistical distribution of a regular physical education class.

Summary

This chapter includes an examination of six experimental factors. These factors include: the statistical results, the problem statements and hypotheses, the theories presented in the literature review and an analysis of internal and external validity factors.

The statistical results indicated group equality after the pretest and random assignment to groups. A two way analysis of covariance showed that teaching method was the strongest force affecting group performance rates. Grouping was found to be non-significant. T tests on the skill level sub groups concur with the two way analysis of covariance.

One theory and one area of study strongly agree with the results of the study. The coaction paradigm of Social Facilitation Theory indicates that drive (effort) will occur in the mere presence of others and that drive to perform will directly affect performance output. The increased stimulation level of the treatment is thought to have increased drive with the result of increased performance scores.
The perceived power to evaluate area indicates that the subject must identify the most powerful influence on the group. The present work provided a powerful influence in the form of the instructor(s) of the treatment groups. Each instructor is easily perceived as evaluative as they constantly keep records of subject performance as they taught the group. Treatment group scores are significantly higher than control group scores.

Study design is thought to control five of the internal validity factors: maturation, statistical regression, differential selection and instrumentation. Overall historical advantages appeared evenly shared between the treatment and control groups. Testing was controlled by keeping conditions constant and by asking subjects during student interviews if they thought the skills were difficult. Inter-rater reliability did not appear biased toward any group or subgroup.

Experimental mortality did not affect the study as all drops were completed before the treatment period. Selection-maturation was evenly spread between the groups.

The findings of the internal validity analysis indicate that the statistical results are valid.

The external validity analysis indicates that the overall study can be generalized to the study population and may decrease in power when used in a traditional physical education class.
Summary

Educational research had produced evidence that many factors influence learning. The Social Facilitation Theory paradigm of coaction suggested that learning might be affected by group composition.

The purpose of the study was to test whether or not coaction within homogeneous and heterogeneous skill groups affected the rate of learning in a gymnastic setting. The review of literature identified two major theories and one study area that directly affect the coaction response within a group.

Social Facilitation Theory (1968) contains the coaction paradigm that occurs in the presence of others engaged in the same activities as the experimental subjects. It was concluded that others were necessary to provide behavioral cues which elicit appropriate and inappropriate responses.

Learned Drive Theory (1968) states that the mere presence of others is not sufficient to increase drive level. An evaluative potential must exist if performance rates are to increase in a positive manner. It was concluded that the impact of this theory could not be assessed because a reward system was not included in the design. The Perceived Power to evaluate area (Meumann 1904, Bergum and Lehr 1963, and Carment and Latchford 1970) states the subject will identify the most powerful person(s) affecting the group. The more powerful the person the more effort is increased during
performance. This area is thought to be the strongest theoretical area to agree with the results of the study.

There were three differences between previous works and the present study.

First, a classroom setting based on a commercial venture was used for the study.

Second, the design was contrained by the quasi-experimental nature of the study.

And third, the use of qualitative data was used as a check for internal and external validity.

The major challenge of the study was to find a way in which to focus on coaction within a naturalistic setting without distracting subjects to the point of affecting performance scores. Historically, coaction had been viewed in a true experimental setting. In the present work reactivity was contained by adopting two experimental controls:

First, a control group pretest-post test design was modified to study subjects drawn from fifty gymnastics students between the ages of 7 and 12. These students were the offspring of faculty, students and staff that had registered for the Recreation and Instructional Program (FRIP) of The Ohio State University during the 1983 Winter Term.

Second, a ten item observational-instructional Instrument was developed and tested during the 1981-82 school year. Inter-rater reliability was set at a minimum of 85%.
Random assignments were made after the pretest. Drawings were made from three groups according to skill scores. A highly skilled gymnast was defined as a student in the upper 33% of the pretest, while a low skilled gymnast fell in the lower 33% of the range. The middle 33% were also included in the study. Students judged as extremes in either skill direction were assigned to a non-experimental group. Further assignment to groups was done by random assignment. The treatment group was also chosen by random assignment.

Quantitative results indicated group equality after the pretest. A two-way analysis of covariance indicated that teaching method was more important to performance rate than group structure. The t tests performed on the sub groups concur with this finding.

A two way analysis of covariance indicated that low and highly skilled students coact in a positive way when opportunity to perform (teaching method) remained constant.

A qualitative analysis of parent questionnaires, student interviews, instructor notes and investigator notes indicated the results were statistically valid. Generalization was limited to the groups studied.

Conclusions

Conclusion #1: Teaching method can strongly affect performance levels by controlling the direction of coaction.

Robert Zajonc was correct when he stated that the mere presence of others will cause coaction. However, coaction in itself is not
enough to control the direction of learning. A student may respond to others by emitting unwanted or incomplete responses as well as an occasional correct response. The key to controlling the direction of coaction is a constant monitoring system. This system allows the instructor to constantly evaluate and readjust learning goals for each student.

Concurrently, the student becomes increasingly aware of the evaluative potential of the instructor and will increase effort to perform in the prescribed manner.

The concept of evaluative potential was discussed in the Literature Review as a force that controls subject reaction to an investigator or instructor. The results for the treatment group in this study tend to support this finding. Meumann and others were correct, coaction could not only be controlled it could be increased if the subject perceived the instructor to be potentially evaluative.

Conclusion #2: Teaching method must include the following if the direction of coaction is to be controlled.

A) Specific Instructions
B) Demonstration
C) An opportunity to perform
D) A visual monitoring system that alerts the student of the instructor's potential to evaluate.

Zajonc (1966) concluded that others were necessary to provide behavioral cues in a learning situation. In this study it was recognized that the instructor had the potential to provide key behavioral cues through a careful teaching methodology. The scores
of the control group indicate that these behavioral cues were divided
between the instructor and the students in each group. No matter the
skill grouping, controls did not increase their skill level. This
indicates that the instructor was not the central force in the
learning situation.

The controls may have found the members of the respective groups
more evaluative than their instructor. This seems possible as the
instructor did not have to provide an equal opportunity to perform or
keep progress notes in front of the class.

If the students found the instructor non-evaluative they could
have paid more attention to their classmates, which would have
decreased their emission of the correct responses.

Conclusion #3: Group composition did not influence learning
when teaching method was not held constant.

No matter the skill level composition of the group, controls did
not increase performance rates significantly. This indicates that
other forces were affecting the groups more than their skill level
composition.

Conclusion #4: Group composition did not influence learning
when teaching method was held constant.

No matter the skill level composition of the group, treatment
subjects did increase performance levels. This indicates that
treatment (teaching method) was more influential than group
composition on the direction of coaction.
Recommendations

Recommendation #1: The discussion/lecture portion of the lesson should:
A) Tell the student exactly what the instructor wants them to do.
B) Tell the student exactly how to do the skill.
C) Tell the student how many times to try the skill.

Recommendation #2: Every discussion should include a demonstration by either the instructor or by an excellent role model.

Recommendation #3: Progress notes should be kept in front of the class. This tells the students that they are accountable to the instructor and that evaluation is constant.

Recommendation #4: To remain effective the list of required skills should constantly be upgraded by the instructor.

Recommendation #5: The list of skills used for the study was not meant to be used over a long period of time. It is suggested that baselines be established for each student at the beginning of each term.

Recommendation #6: Due to the behavioral nature of the study these results indicate that the teacher ought to first be concerned with their teaching style.

It is felt that these recommendations will control the direction of coaction no matter the skill composition of the group.

Recommendations for Further Study: If the reader would like to set up this study, several changes are suggested.

First, the instrument should be changed to meet the skill level needs of your subjects.

Second, it may be helpful to study the reactions of the instructors as they move from treatment to control group. This study
did not evaluate the instructors in either group. Had an evaluation occurred, the process of coaction may have taken on a completely different quality.

Third, reactivity to raters could be reduced through the use of audio-visual equipment. Especially if that equipment were set up in a blind. This technique would have decreased the number of raters and reduced experimental costs.
BIBLIOGRAPHY


**EVENT RECORDING SHEET**

<table>
<thead>
<tr>
<th>Skills</th>
<th>Points</th>
</tr>
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<tbody>
<tr>
<td>Forward Roll</td>
<td></td>
</tr>
<tr>
<td>Arabesque into forward roll</td>
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</tr>
<tr>
<td>Straddle forward roll</td>
<td></td>
</tr>
<tr>
<td>Back roll</td>
<td></td>
</tr>
<tr>
<td>Cartwheel</td>
<td></td>
</tr>
<tr>
<td>Donkey kick</td>
<td></td>
</tr>
<tr>
<td>Round Off</td>
<td></td>
</tr>
<tr>
<td>Headstand</td>
<td></td>
</tr>
<tr>
<td>Headspring</td>
<td></td>
</tr>
<tr>
<td>Back bend</td>
<td></td>
</tr>
<tr>
<td>Back extension roll</td>
<td></td>
</tr>
<tr>
<td>Forward handstand back bend</td>
<td></td>
</tr>
<tr>
<td>Handstand forward roll</td>
<td></td>
</tr>
<tr>
<td>Back walkover</td>
<td></td>
</tr>
<tr>
<td>Side ariel</td>
<td></td>
</tr>
</tbody>
</table>

Total Score: __________  Percentile: __________

Group Assignment: ______________________
Observer number: __________  Date: __________

**Pretested Winter Term 1982. Found to be too long and too difficult.**

*Skill progression based upon *Gymnastics for Women*, 1977 and on expert advice from Dr. James Sweeney, Gymnastic Program Director, The Ohio State University.*
PROTOCOL TITLE: The Effects of Coaction on the Skill Development of Low Skilled and High Skilled Gymnastics Students.

It has been observed by the investigator and others in various teaching situations that children who are less skilled in gymnastics are more negatively influenced in the initial stages of learning by highly skilled coactors. Social facilitation theory, the area of social psychology that contains coaction research, lacks direct evidence to support this observation but does suggest that coaction has negative and positive influences on performance. It is suggested that a detailed and systematic study of the coaction effect on performers of different ability levels would bring a new dimension to coaction research and provide evidence to support grouping strategies during the different stages of learning.

Qualitative and quantitative data will be used in the procedures of the research. Data will be gathered through the use of a parent questionnaire, student interview and a pretest, intervention, post test control group design.

Conditions: Experimental groups-Low level students, high level students and a mixed group of low and high level students.

Intervention: 10 gymnastics skills will be taught in the same order after a group warm up. Each child will be given two chances (with or without a spotter) on each skill.

Measures: Each child will be rated on skill performance before and after the intervention by a team of two raters.

Questionnaire: attached
Student Interview: attached
Event Recording Sheet: attached

Subjects will not encounter the possibility of either psychological, social, physical or legal risk.

Stress will not be involved in the study.

Subjects will not be deceived or misled in any way.

There will not be any probing for information which an individual might consider to be personal or sensitive.

Subjects will not be presented with materials which they might consider to be offensive, threatening or degrading.

Each subject will participate in the study for thirty minutes each week.
Subje cts in this study will be children ages 7 to 12, registered for
the Family Recreation and Instructional Program (sponsored by OSU
Intramural Sports). Subjects will be contacted by mail during the
registration period.

Subjects will be offered two groups in which to participate.
Experimental and non-experimental. No inducements will be offered.

It is important to the nature of the study that the procedures used
to run the program during the past two years not be changed for the
study. Thus maintaining a naturalistic teaching environment.
Therefore, prior information is unnecessary.

The standard Human Subjects Consent Form will be used. Completion is
required during the registration process. (attached)

Whether or not a subject participated in the experiment will not be
made part of any permanent record available to a supervisor, teacher
or employer.

Confidentiality of the data will be maintained by the use of a locked
file cabinet, subject numbers and destruction of data at the completion
of the study.

There are no risks other than normal risks in the study.

No data from files or archival data will be used in the study.
Dear Parents:

This winter, as part of my dissertation, students in the Gymnastic Program will be participating in a study designed to determine the best grouping procedure for children ages 7 to 12.

As a parent, you play a particularly important role in the study. First, your permission is necessary before we can keep data on your child’s progress. Second, we need your input concerning your child’s gymnastic experience and play habits. This means your answers on the parents questionnaire are vital. And third, you can help us beat “old man winter”, by making a special effort to bring your child each Sunday.

As Director of the F.R.I.P. Gymnastics Program, I am particularly concerned that the quality of our program remains high. Your child’s participation will help us to upgrade our standards and increase our understanding of the conditions that promote learning in a gymnastic setting.

Should you desire any additional information about the study, please feel free to contact me at my home (457-7197) or to talk with me during the program.

Many thanks for your response.

Sincerely,

Johannah Casey
F.R.I.P. Gymnastics Director
CONSENT FOR PARTICIPATION
SOCIAL AND BEHAVIORAL RESEARCH

I consent to participating in (or my child's participation in) a study entitled: The Effects of Coaction on the Skill Development Levels of Lowly Skilled and Highly Skilled Gymnastic Students.

Johannah Casey, Investigator has explained the purpose of the study and procedures to be followed. Possible benefits of the study have been described and have alternative procedures, if such procedures are available and applicable.

I acknowledge that I have had the opportunity to obtain additional information regarding the study and that any questions I have raised have been answered to my full satisfaction. Further, I understand that I am (my child is) free to withdraw consent at any time and to discontinue participation in the study without prejudice to me (my child). The information obtained from me (my child) will remain confidential and anonymous unless I specifically agree otherwise.

Finally, I acknowledge that I have read and fully understand the consent form. I have signed it freely and voluntarily and understand a copy is available upon request.

Date: ________________ Signed: ________________
(Participant)

(Investigator) (Person Authorized to Consent for Participant)

Please note: If you do not wish to sign this consent form your child will be assigned to a non-experimental group. All groups considered non-experimental will be taught using the same techniques that have been used during the last two years of the program.
PARENTS QUESTIONNAIRE

Parents Name_______________________________________ ._____________________________________

Child’s Name ________________________________________

Age of Child______________

1-What type of gymnastic experiences has your child had in the past?
(F.R.I.P., Public Recreation lessons, private lessons, Public School classes in gymnastics, Pre-school gymnastics, Private School classes in gymnastics, etc.)

2-Does your child 'play' at gymnastics at home?

3-Why did you enroll your child in the F.R.I.P. program?

4-At which level would you rate your child's ability?
   a-better than the other children in the F.R.I.P. gymnastics program.
   b-same as the other children in the F.R.I.P. gymnastics program.
   c-less than the other children in the F.R.I.P. gymnastics program.

5-Why do you feel your child is interested in gymnastics? (natural ability and interest, peer interest, parents interest, TV coverage, etc.)

Please fill out one questionnaire for each child enrolled in the program.
APPENDIX II
# Inter-Rater Agreements on Individual Skills

## Forward Roll

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Refusal to perform or absence</td>
</tr>
<tr>
<td>1</td>
<td>Instructor positions head and body parts</td>
</tr>
<tr>
<td>2</td>
<td>Instructor reminds student of body position</td>
</tr>
<tr>
<td>3</td>
<td>Student touches head and/or fails to stand</td>
</tr>
<tr>
<td>4</td>
<td>Complete</td>
</tr>
</tbody>
</table>

## Pack Roll

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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</tr>
<tr>
<td>1</td>
<td>Instructor positions body parts and spots</td>
</tr>
<tr>
<td>2</td>
<td>Instructor reminds student of body position-light spot</td>
</tr>
<tr>
<td>3</td>
<td>Student rolls without the use of hands and/or fails to stand</td>
</tr>
<tr>
<td>4</td>
<td>Complete</td>
</tr>
</tbody>
</table>

## Cartwheel

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Refusal to perform or absence</td>
</tr>
<tr>
<td>1</td>
<td>Instructor positions body and lifts at waist</td>
</tr>
<tr>
<td>2</td>
<td>Instructor reminds student of body position-light spot</td>
</tr>
<tr>
<td>3</td>
<td>Student safe but lacks control</td>
</tr>
<tr>
<td>4</td>
<td>Complete</td>
</tr>
</tbody>
</table>

## Roundoff

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Refusal to perform or absence</td>
</tr>
<tr>
<td>1</td>
<td>Instructor positions hands and walks through approach steps</td>
</tr>
<tr>
<td>2</td>
<td>Instructor reminds the student of body position and/or approach</td>
</tr>
<tr>
<td>3</td>
<td>Student uses cartwheel step out</td>
</tr>
<tr>
<td>4</td>
<td>Complete-Student lands on both feet</td>
</tr>
</tbody>
</table>

## Headstand

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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</tr>
<tr>
<td>1</td>
<td>Instructor positions body parts and provides support</td>
</tr>
<tr>
<td>2</td>
<td>Instructor reminds the student of body part positions-light spot</td>
</tr>
<tr>
<td>3</td>
<td>Student achieves position but wobbles</td>
</tr>
<tr>
<td>4</td>
<td>Student achieves position-no wobble</td>
</tr>
</tbody>
</table>

## Backbend

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>Refusal to perform or absence</td>
</tr>
<tr>
<td>1</td>
<td>Bridge up or instructor lift and body placement</td>
</tr>
<tr>
<td>2</td>
<td>Bridge up with spot</td>
</tr>
<tr>
<td>3</td>
<td>Backbend or bridge with no help to stand-obvious lack of full control</td>
</tr>
<tr>
<td>4</td>
<td>Backbend or bridge with no help to stand-complete control</td>
</tr>
</tbody>
</table>

## Back Extension Roll

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>Refusal to perform or absence</td>
</tr>
<tr>
<td>1</td>
<td>Heavy lifting spot</td>
</tr>
<tr>
<td>2</td>
<td>Light spot</td>
</tr>
</tbody>
</table>
Inter-rater Agreements on Individual Skills (cont'd)

3 - Horizontal kick-no stand
4 - Vertical kick with stand

SCALE
0 - Refusal to perform or absence
1 - NA**
2 - NA**
3 - Poor body position - wobble
4 - Stretched body position - still

HANDSTAND
FORWARD ROLL
0 - Refusal to perform or absence
1 - Heavy spot with verbal instructions to tuck head
2 - Light spot with verbal instructions to tuck head
3 - No spot-Short handstand into sloppy roll
4 - No spot-Controlled handstand into controlled roll with stand

JUMP FULL
TURN
0 - Refusal to perform or absence
1 - NA**
2 - NA**
3 - Unable to control body in air and/or lack of complete stop
4 - Body control in air and a complete stop

**NA-Not applicable No spot required during the initial stages of learning.
<table>
<thead>
<tr>
<th>Skill</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
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<tbody>
<tr>
<td>Thundersh Roll</td>
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<tr>
<td>Back Roll</td>
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</tr>
<tr>
<td>Cartwheel</td>
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<tr>
<td>Roundoff</td>
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</tr>
<tr>
<td>Headstand</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back Spring-From Standing Position</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back Extension Roll</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Arabé-Qué - 6 Count</td>
<td></td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Handstand Forward Roll</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Scores**

0 - Balk A total refusal to perform. Or an absence from the classroom.

1 - Skill attempt dependent upon a spotter for safety. (Child totally out of control or unable to move alone.)

2 - Skill attempt dependent on a spotter for completion but not for safety. (gentle spot)

3 - Skill attempt independent of a spotter but mechanically incorrect. (sloppy)

4 - Skill attempt independent of a spotter—mechanically correct (smooth and even).
### Treatment

#### Range

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>CODE</th>
<th>SCORE</th>
<th>GROUP</th>
</tr>
</thead>
<tbody>
<tr>
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<td>H1</td>
<td>37</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>H2</td>
<td>36.6</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>H3</td>
<td>36.3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>H4</td>
<td>36.3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>H5</td>
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<td>1</td>
</tr>
<tr>
<td></td>
<td>H7</td>
<td>34</td>
<td>1</td>
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<tr>
<td></td>
<td>H8</td>
<td>33.6</td>
<td>1</td>
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<td></td>
<td>H9</td>
<td>33</td>
<td>1</td>
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<td></td>
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<td>-</td>
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<tr>
<td></td>
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<td>4</td>
</tr>
<tr>
<td></td>
<td>M2</td>
<td>30.3</td>
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<td>M3</td>
<td>30.2</td>
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<tr>
<td></td>
<td>M4</td>
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<td>4</td>
</tr>
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<td>M5</td>
<td>29</td>
<td>4</td>
</tr>
<tr>
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<td>26.3</td>
<td>-</td>
</tr>
<tr>
<td></td>
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<td>L5</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>L9</td>
<td>20.5</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Randomization of each range

- **Group One**: All High
  - HI dropped
  - H2
  - H3
  - H4
  - H10
  - H5
  - H6
  - H7
  - L6 dropped

- **Group Two**: All Low
  - L1
  - L2
  - L3
  - L4
  - L5
  - L6
  - L7
  - L8
  - L9

#### Selection Range

- **All High Skilled**: 31.61 - 37.11
- **All Medium Skilled**: 26.10 - 31.60
- **All Low Skilled**: 20.50 - 26.00

### Notes

- 29.68 Pop. Mean
- 5.09 SD
- 16.5 range
- R divided by 3 -'s SR

- Randomization of each range
- Group One: HI dropped
- Group Two: L6 dropped
- Group Three: Mixed: H & L
- Group Four: Medium
## CONTROL

### Range and Grouping Sheet

<table>
<thead>
<tr>
<th>SUBJECT CODE</th>
<th>SCORE</th>
<th>GROUP</th>
</tr>
</thead>
<tbody>
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<td>39</td>
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<tr>
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<tr>
<td>H4</td>
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<td>2</td>
</tr>
<tr>
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</tr>
<tr>
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<tr>
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</tr>
<tr>
<td>L13</td>
<td>20.7</td>
<td>2</td>
</tr>
</tbody>
</table>

M = 28.90  
SD = 5.61  
Range = 18.3  
R divided by 3 = 's SR  

### Selection Range

| All High       | 32.92 - 39.02 All High Skilled |
| All Low        | 26.81 - 32.91 Medium           |
| Mixed: H & L   | 20.70 - 26.80 All Low Skilled  |

### Randomization of each Range

<table>
<thead>
<tr>
<th>Group One</th>
<th>Group Two</th>
<th>Group Three</th>
<th>Group Four</th>
</tr>
</thead>
<tbody>
<tr>
<td>All High</td>
<td>All Low</td>
<td>Mixed: H &amp; L</td>
<td>Medium</td>
</tr>
<tr>
<td>H5</td>
<td>L12</td>
<td>H8</td>
<td>M1</td>
</tr>
<tr>
<td>H1</td>
<td>L13</td>
<td>H2</td>
<td>M2 dropped</td>
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<tr>
<td>H3 dropped</td>
<td>L2</td>
<td>H6</td>
<td>M3</td>
</tr>
<tr>
<td>H7</td>
<td>L5</td>
<td>L1</td>
<td></td>
</tr>
<tr>
<td>H4</td>
<td>L8</td>
<td>L7</td>
<td></td>
</tr>
<tr>
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### Progress and Attendance Chart

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<th>S.</th>
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<th>C</th>
<th>Subject Code</th>
<th>RR</th>
<th>Water Reliability</th>
<th>I - 1 Interventions</th>
<th>Pretest</th>
<th>Post test</th>
</tr>
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<tbody>
<tr>
<td>2</td>
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<td></td>
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<td>4</td>
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<tr>
<td>5</td>
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<td>6</td>
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<td>11</td>
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</table>

**TREATMENT GROUP**
### Progress and Attendance Chart

<table>
<thead>
<tr>
<th>C</th>
<th>E1</th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>E5</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>58</td>
<td>78</td>
<td>89</td>
<td>100</td>
<td>111</td>
</tr>
<tr>
<td>B</td>
<td>38</td>
<td>57</td>
<td>66</td>
<td>77</td>
<td>88</td>
</tr>
<tr>
<td>C</td>
<td>33</td>
<td>45</td>
<td>56</td>
<td>67</td>
<td>78</td>
</tr>
</tbody>
</table>

- **C**: Subject Code
- **E1**: Present
- **E2**: Absent
- **E3**: Rating
- **E4**: Class Meetings
- **E5**: Post-test

*Drop and Non-Exp.*

|  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
| L1 | L2 | L3 | L4 | L5 | L6 | L7 | L8 | L9 | L10 | L11 | L12 |
| 91 | 80 | 100 | 90 | 80 | 70 | 60 | 50 | 40 | 30 | 20 | 10 |

*CONTROL GROUP*
<table>
<thead>
<tr>
<th>Level I</th>
<th>Level II</th>
<th>Level III</th>
<th>Level IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-6 yr. olds</td>
<td>7-12 yr. olds</td>
<td>7-12 13-16 upper skill level</td>
<td>advanced</td>
</tr>
</tbody>
</table>

Area(s) 5-6) 5 minute Group Stretching and Cardiovascular Warm-Up - Class Announcements

<table>
<thead>
<tr>
<th>Educational Gymnastics (Area 1)</th>
<th>Intervention Tumbling (Areas 2-3-5-6)</th>
<th>Vaulting Apparatus (Area 4)</th>
<th>Apparatus Vaulting (Area 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>—---15 to 20 Minutes---</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Swing Activities (Areas 1-4)</th>
<th>Apparatus (Area 1)</th>
<th>Tumbling (Areas 2-3)</th>
<th>Tumbling (Areas 5-6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>—---15 to 20 Minutes---</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
STUDENT INTERVIEWS

(Answers to be recorded in a research diary after each interview.)

1. Why do you like gymnastics?

2. How did you find out about this gymnastics program?

3. Do you think the other children in your group are good gymnasts? As good as you are?

4. Do you think the stunts you are learning are too hard or too easy? Which are too hard? Which are too easy?
SCHOOLS
1. Wilson Hill
2. Indianola
3. Stevenson
4. Universal Being
5. Olde Sawmill
6. Salders
7. Indian Run
8. Indian Springs
9. Monroe
10. Linden Park
11. Olentangy Elementary
12. Greensview
13. Dominican
14. Christ the King
15. Dublin
16. Winter Set
17. Berrington Elementary
18. Huber Road Elementary
19. Gladstone
20. Avalon
Country (Students Citizenship)
1. United States 85%
2. Germany 5%
3. Saudi Arabia 5%
4. Africa 2.5%
5. Australia 2.5%

Parents Working Status
1. Faculty 35.9%
2. Graduate 38.5%
3. General Staff 23%
4. Undergraduate 2.6%

+Prior experience in the FRIP program
- No prior experience in the FRIP program
<table>
<thead>
<tr>
<th>SKILLS</th>
<th>PRETEST</th>
<th>INTERVENTION</th>
<th>POST TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Roll</td>
<td>4 4 4</td>
<td>4 4 4 4</td>
<td>4 4 4</td>
</tr>
<tr>
<td>Back Roll</td>
<td>4 4 4</td>
<td>4 3 4 3</td>
<td>3 3 4</td>
</tr>
<tr>
<td>Cartwheel</td>
<td>4 4 4</td>
<td>4 4 3 4</td>
<td>4 4 4</td>
</tr>
<tr>
<td>Roundoff</td>
<td>3 3 3</td>
<td>3 4 3 4</td>
<td>4 4 4</td>
</tr>
<tr>
<td>Headstand (Standing)</td>
<td>3 4 4</td>
<td>3 4 3 4</td>
<td>4 4 4</td>
</tr>
<tr>
<td>Back Bend (Standing)</td>
<td>4 4 4</td>
<td>2 2 3 2</td>
<td>3 3 4</td>
</tr>
<tr>
<td>Back Extension Roll</td>
<td>2 2 2</td>
<td>3 3 3 3</td>
<td>3 3 3</td>
</tr>
<tr>
<td>Scale - 3 count</td>
<td>4 4 4</td>
<td>3 3 3 3</td>
<td>3 3 3</td>
</tr>
<tr>
<td>Handstand Forward Rl.</td>
<td>3 3 3</td>
<td>3 3 4 4</td>
<td>4 4 4</td>
</tr>
<tr>
<td>Jump full turn - acrop</td>
<td>3 3 3</td>
<td>3 3 4 4</td>
<td>4 4 4</td>
</tr>
</tbody>
</table>

**HISTORY:**
- Plays N 3x2
- Outside Lessons: Y
- Siblings
- Parent Gymnasts: S F
- Origin of Interests: P (M B S Other Student)

**TESTING:**
- Stunts difficult: Y

**INSTRUMENTATION AND REGRESSION:**
- Absences Q
- Ability perceived by student: H L L No Basis
- Sick weeks: 1 2 3 4
- Behavioral problem weeks: 1 2 3 4
- Instructor Problems: 1 2 3 4
- Student understanding: 1

**SELECTION:**
- Range score: 34
- Group No. 1
- H: 2
- Mortality: Drop out: Y

**INTERACTION OF SELECTION AND MATURATION:**
- School Attended: 
  - 5th grade 1
  - 6th grade 0
- No. of classmates: 0
- Schoolmates: 0
- Outside lessons: Y
- Family Gymnasts: F M B S Student Other

**INTERACTION OF TESTING AND I:**
- Brothers / Sisters in program
- Interaction of Selection and I:
- Outside lessons: Y
- Multiple I Interference:
- Outside lessons: Y
SKILLS PRETEST

<table>
<thead>
<tr>
<th>SKILLS</th>
<th>PRETEST</th>
<th>INTERVENTION</th>
<th>POST TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Roll</td>
<td>3 3 3</td>
<td>3 3 4 4</td>
<td>3 3 4</td>
</tr>
<tr>
<td>Back Roll</td>
<td>3 3 3</td>
<td>4 3 4 4</td>
<td>4 4 4</td>
</tr>
<tr>
<td>Cartwheel</td>
<td>3 4 4</td>
<td>4 4 3 3</td>
<td>4 4 4</td>
</tr>
<tr>
<td>Roundoff</td>
<td>4 4 4</td>
<td>3 4 3 3</td>
<td>3 3 4</td>
</tr>
<tr>
<td>Headstand</td>
<td>3 3 3</td>
<td>4 3 3 3</td>
<td>4 4 4</td>
</tr>
<tr>
<td>Back Bend (Standing)</td>
<td>4 4 4</td>
<td>4 4 3 3</td>
<td>4 4 4</td>
</tr>
<tr>
<td>Sack Extension Roll</td>
<td>3 3 3</td>
<td>4 3 3 3</td>
<td>4 4 4</td>
</tr>
<tr>
<td>Scale - 1 count</td>
<td>4 4 4</td>
<td>4 4 4 4</td>
<td>4 4 4</td>
</tr>
<tr>
<td>Handstand Forward Rl.</td>
<td>3 3 3</td>
<td>3 3 3 3</td>
<td>3 3 3</td>
</tr>
<tr>
<td>Jump full turn - stop</td>
<td>3 3 3</td>
<td>4 3 3 4</td>
<td>4 4 4</td>
</tr>
</tbody>
</table>

Subject Code: 1

Group: 2

Instructor No.: 90

SELECTION

Interaction of Selection and Maturation:
School Attended: 4 10 yr school 0
Grades: 1-6

No. of classmates: 2 Home school: 90
Outsiders: 0

Outside lessons: 3
Family Gymnastics: FH B Student Other

Interaction of Testing and X:
Brothers: 2 Sisters in program
Interaction of Selection and X:
Outside lessons: 3
Multiple X Interferences:
Outside lessons: 3

86.6 %
### SKILLS PRETEST 1

<table>
<thead>
<tr>
<th>SKILLS</th>
<th>PRETEST</th>
<th>INTERVENTION</th>
<th>POST TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Roll</td>
<td>4 4 4</td>
<td>3 4</td>
<td>4 4 4</td>
</tr>
<tr>
<td>Back Roll</td>
<td>3 3 3</td>
<td>3 3</td>
<td>3 4 3</td>
</tr>
<tr>
<td>Cartwheel</td>
<td>3 3 3</td>
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<td>3 3 3</td>
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<tr>
<td>Roundoff</td>
<td>3 3 3</td>
<td>3 3</td>
<td>3 3 3</td>
</tr>
<tr>
<td>Headstand</td>
<td>2 2 2</td>
<td>2 2</td>
<td>2 2 2</td>
</tr>
<tr>
<td>Back Bend (Standing)</td>
<td>2 2 2</td>
<td>1 2</td>
<td>2 2 2</td>
</tr>
<tr>
<td>Back Extension Roll</td>
<td>1 / /</td>
<td>2 / /</td>
<td>1 / /</td>
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<tr>
<td>Scale - 1 count</td>
<td>2 2 2</td>
<td>3 2</td>
<td>1 2 2</td>
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<tr>
<td>Handstand Forward Rl.</td>
<td>1 / /</td>
<td>3 1</td>
<td>2 2 2</td>
</tr>
<tr>
<td>Jump full turn - stop</td>
<td>1 / 2</td>
<td>3 0</td>
<td>2 2 2</td>
</tr>
</tbody>
</table>

**HISTORY:**

- **Play:** M (H, L)
- **Outside Lessons:** N, M, A, S, L
- **Brothers:** ____________
- **Sisters:** ____________
- **Parent Gymnasts:** M (P) __
- **Origin of Interest:** P (H) __ B (Other Student) __

**TESTING:**

- **Stunts difficult:** ____________

**INSTRUMENTATION AND REGRESSION:**

- **Absences:** ____________
- **Ability perceived by parents:** H __ L __ No Basis __
- **Sick weeks:** ____________
- **Behavioral problem weeks:** 1 2 3 __
- **Instructor Problems:** 1 2 3 __
- **Student understanding:** ____________

**SELECTION:**

- **Range score:** ________ 24
- **Group No.:** ________
- **Sr.:** ________
- **Mortality:**
- **Drop out:** Y __

**Interaction of Selection and Maturation:**

- **School Attended:** 1 ____________
- **Grade:** ________
- **No. of classmates:** ________
- **Schoolmates:** ________
- **Outside lessons:** ________
- **Family Gymnasts:** N, M, A

**Interaction of Testing and I:**

- **Brothers:** ____________
- **Sisters in program:** ________
- **Outside lessons:** ________
- **Multiple X Interference:** ________

** reliabilities:** ________ 100%
<table>
<thead>
<tr>
<th>SKILLS</th>
<th>PRETEST</th>
<th>INTERVENTION</th>
<th>POST TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Roll</td>
<td>3 3 3</td>
<td>4 3 3 5</td>
<td>3 3 3</td>
</tr>
<tr>
<td>Back Roll</td>
<td>2 2 2</td>
<td>3 2 2 2</td>
<td>2 2 2</td>
</tr>
<tr>
<td>Cartwheel</td>
<td>3 3 3</td>
<td>4 4 4 4</td>
<td>3 3 3</td>
</tr>
<tr>
<td>Roundoff</td>
<td>3 3 3</td>
<td>4 3 3 3</td>
<td>3 3 3</td>
</tr>
<tr>
<td>Headstand</td>
<td>2 2 2</td>
<td>2 2 3 2</td>
<td>2 2 3</td>
</tr>
<tr>
<td>Headstand (Standing)</td>
<td>1 2 4</td>
<td>2 4 2 4</td>
<td>2 2 2</td>
</tr>
<tr>
<td>Back Extension Roll</td>
<td>2 2 2</td>
<td>3 3 3 3</td>
<td>2 2 3</td>
</tr>
<tr>
<td>Scale - 1 count</td>
<td>3 4 3</td>
<td>4 3 3 3</td>
<td>4 4 4</td>
</tr>
<tr>
<td>Handstand Forward Rl.</td>
<td>2 2 2</td>
<td>3 3 3 3</td>
<td>3 3 3</td>
</tr>
<tr>
<td>Jump full turn - stop</td>
<td>3 3 3</td>
<td>3 3 3 3</td>
<td>3 3 3</td>
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<table>
<thead>
<tr>
<th>L2</th>
<th>1 y 2</th>
<th>1 y 3</th>
<th>2 y 1</th>
<th>1 y 2</th>
<th>1 y 3</th>
<th>2 y 3</th>
<th>4</th>
<th>6</th>
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</thead>
</table>

Subject Code: 2
Group: 2

Subject Code:

Group:

Instructor No.

Reliability

HISTORY:

TESTING:

INSTRUMENTATION AND REGRESSION:

INSTRUMENTATION AND REGRESSION:

INSTRUMENTATION AND REGRESSION:

INSTRUMENTATION AND REGRESSION:

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<td>Jump full turn - stop</td>
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</table>

**HISTORY:**

Play: 0 N. 0
Outside Lessons: 0 N. Public Rec.
Brothers: _______
Sisters: _______
Parent Gymnast: M F 2
Origin of Interest: F (N) B S Other Student

**TESTING:**

Stunts difficult: Y

**INSTRUMENTATION AND REGRESSION:**

Absences: 0

Ability perceived by student: H O L No Basis

Ability perceived by parents: H O L No Basis

Sick weeks: 1 2 3 4

Behavioral problem weeks: 1 2 3 4

Instructor Problems: 1 2 3 4

Student understanding: 0 0

**SELECTION:**

Range score: 26 27

Group No. 2

Mortality: 0

Drop out: Y

Interaction of Selection and Maturation:

School Attended: 2 2 2 2 2 2 2 2 2 2

Grade: 2

No. of classmates: 0

Outsider: 0

Family Gymnast: F M B S Student Other

Interaction of Testing and Is:

Brothers / Sisters in program:

Interaction of Selection and Is:

Outside lessons: 0 N

Multiple I Interference:

Outside lessons: 0 N
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<td>3 3 3 3 3 3 3</td>
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**HISTORY:**
- Play: Y 0
- Outside Lessons: Y 0
- Brothers: 1
- Sisters: 1
- Parent Gymnasts: M F
- Origin of Interest: P (H) B S Other Student

**TESTING:**
- Stunts difficult: Y 0

**INSTRUMENTATION AND REGRESSION:**
- Absences: 6 0
- Ability perceived by student: H 6 L No Basis
- Ability perceived by parents: H 6 L No Basis
- Sick weeks: 1 2 3 4
- Behavioral problem weeks: 1 2 3 4
- Instructor Problems: 1 2 3 4
- Student understanding: 0

**SELECTION:**
- Range score: 20.5 23.3
- Group No.: 1 2
- Hr. 1 2 3
- Mortality:
- Drop out: Y 0

**Interaction of Selection and Maturation:**
- School Attended: 1
- No. of Classmates: 6 2 7 1 2
- Outside Lessons: Y 0
- Family Gymnasts: F M S S Other Student

**Interaction of Testing and X:**
- Brothers: 1 / Sisters in program
- Interaction of Selection and X:
- Outside lessons: Y 0
- Multiple X Interference:
- Outside lessons: Y 0
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</table>

Subject Code: 2

L3

Group: 2

1 x 2 100
1 x 1 60
2 x 1 60

Instructor No.

X Reliability

93.3%

HISTORY:
Play: Y
Outside Lessons: Y
Brothers: 1
Sisters: 1
Parent Gymnastics: M F
Origin of Interest: Y

TESTING:

STUNTS DIFFICULT: Y

INSTRUMENTATION AND REGRESSION:

Absences & Absences perceived by student: 1 S L No Basis
Ability perceived by parents: 1 S L No Basis
Sick weeks: 1 2 3 4

Behavioral problems: 1 2 3 4

Instructor Problems: 1 2 3 4

Student understanding: Y

SELECTION:

Range score: 25.3

Group No.: 2

Mortality:

Drop out: Y

Interaction of Selection and Maturation:

School Attended: 1

Schoolmates: 2

Outside Lessons: Y

Multiple X Interference:

Interaction of Testing and X:

Brothers: 1 1 Sisters in program

Interaction of Selection and X:

Outside Lessons: Y

Multiple X Interference:

Outside Lessons: Y
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<td><strong>H2</strong></td>
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**HISTORY:**

- Play: @ N
- Outside Lessons: @ N. Pub Rec
- Sisters
- Parent Gymnasts: N F O
- Origin of Interest: F (H) B S Other Student

**TESTING:**
- Stunts difficult: Y(@)

**INSTRUMENTATION AND REGRESSION:**
- Abnormalities: @ 0
- Ability perceived by student: H S I No Basis
- Ability perceived by parents: H S I No Basis
- Sickness: 1 2 3 4
- Behavioral problems: 1 2 3 4
- Instructor Problems: 1 2 3 4
- Student understanding: @

**SELECTION:**
- Range scores: 36 6 37
- Group No.: 3
- Instructor No.: 2

**Mortality:**
- Drop out: Y(@)

**Interaction of Selection and Maturation:**
- School attended: 1 0
- Special needs: @
- Grade: 2
- No. of classmates: 6
- Schoolmates: 1
- Outside Lessons: @
- Family Gymnasts: F H B S
- Student Other

**Interaction of Testing and I:**
- Brothers / Sisters in program
- Interaction of Selection and I:
- Outside Lessons: @
- Multiple X Interference:
- Outside Lessons: @

Subject Code: 3

Group: 3

Reliability: 92% H 74%
### SKILLS

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</table>

### HISTORY:

- **Play:** YM
- **Outside Lessons:** Y
- **Sisters:** 1
- **Parent Gymnasts:** M P
- **Origin of Interest:** P (M) B S Other Student

### TESTING:

- **Stunts difficult:** M

### INSTRUMENTATION AND REGRESSION:

- **Absences:** 1
- **Ability perceived by student:** M L No Basis
- **Ability perceived by parents:** M L No Basis
- **Behavioral problem weeks:** 1 2 3 4
- **Instructor Problems:** 1 2 3 4
- **Student understanding:** B

### SELECTION:

- **Range score:** 36.3 36
- **Instructor No.:** 3
- **No. of classmates:** 1

### MORTALITY:

- **Drop outs:** Y

### Interaction of Selection and Maturation:

- **School Attended:** YM
- **No. of sisters:** 1

### Interaction of Testing and X:

- **Brothers:** YM
- **Outside Lessons:** Y
- **Multiple X Interference:** Y

### Notes:

- Subject Code: 3
- Group: 1
- Instructor No.: 1
- X Reliability: 96.67%
## SKILLS PRETEST

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<td>4 4 4</td>
<td>4 4 4 4 4</td>
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### HISTORY:

- **Play:** F
- **Outside Lessons:** M, A, B, S, L, S
- **Brothers:** 1
- **Sisters:** 3
- **Parent Gymnastics:** M, F
- **Origin of Interest:** P, F, B, S, Other Student

### TESTING:

- **Stunts difficult:** Y

### INSTRUMENTATION AND REGRESSION:

- **Absences:** 6
- **Ability perceived by student:** H, F, L, No Basis
- **Ability perceived by parents:** H, F, L, No Basis
- **Sick weeks:** 1234
- **Behavioral problems weeks:** 1234
- **Instructor Problems:** 1234
- **Student understandings:** F, M

### SELECTION:

- **Range score:** 336 - 35
- **Group No.:** 3
- **No.:** 2

### Mortality:

- **Drop outs:** Y

### Interaction of Selection and Maturity:

- **School Attended:** 7
- **Grades:** 4
- **No. of classmates:** 0
- **Outside lessons:** F, M, S, Student Other
- **Family Gymnastics:** F, M, S, Student Other

### Interaction of Testing and M:

- **Brothers:** 1
- **Sisters in program:**
- **Outside lessons:** F, M
- **Multiple X Interferences:**
- **Outside lessons:** F, M
### SKILLS PRETEST

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<td>3 3 3</td>
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### HISTORY

- **Play:** Y
  - **Outside Lessons:** Y
  - **Brothers:** __________
  - **Sisters:** ________
  - **Parent Gymnasts:** H P
  - **Origin of Interest:** P (W) B S Other Student

### TESTING

- **Stunts difficult:** ______

### INSTRUMENTATION AND REGRESSION

- **Abstinence:**
  - Ability perceived by student: H S (C) No Basis
  - Ability perceived by parents: H S (C) No Basis
  - Sick weeks: 1 2 3 4
  - Behavioral problem weeks: 1 2 3 4
  - Instructor Problems: 1 2 3 4
  - Student understanding: (C) 3

### SELECTION

- **Range score:** 20.6 __________
  - **Group No.:** 3
  - **HR:** ______

### MORTALITY

- **Drop outs:** Y

### RELIABILITY

- **Instructor No.:**
  - __________
  - **No. of classmates:** 6
  - **Outside lessons:** Y
  - **Family Gymnasts:** P H B S Student Other

- **Interaction of Selection and Maturation:**
  - **School Attended:** H
  - **Goals:** O
  - **Grade:** 2
  - **No. of classmates:** 6
  - **Outside lessons:** Y

- **Interaction of Testing and X:**
  - **Brothers / Sisters in program:**
  - **Interaction of Selection and X:**
  - **Outside lessons:** Y
  - **Multiple X Interference:**
  - **Outside lessons:** Y

- **Subject Code:** 3
- **Group:** ________
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**SKILLS PRETEST**

**I**

**Forward Roll**

**y V y**

**Back Roll**

**2 2 2**

**Cartwheel**

**3 3 3**

**Roundoff**

**2 2 2**

**Headstand**

**3 3 3**

**Sack Extension Roll**

**2 2 2**

**Scale - 1 count**

**3 3 3**

**Handstand Forward Rl.**

**2 2 2**

**Jump full turn - step**

**3 3 3**

**L5**

**Subject Code:**

| 3 |

**Group:**

| 3 |

**IX Reliability:**

| 73.3 |

**HISTORY:**

**PLAY:**

- Outside Lessons: Y (8)
- Brothers: 1
- Sisters: 1
- Origin of Interest: F (8) B 3 Other Student

**TESTING:**

- Stunts difficult: <M>
- Ability perceived by students: H O L No Basis
- Ability perceived by parents: H O L No Basis
- Sick weeks: 1 2 3 4
- Behavioral problem weeks: 1 2 3 4
- Instructor Problems: 1 2 3 4
- Student understanding: <M>

**SELECTION:**

<table>
<thead>
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<th>Range score: 24 3 20</th>
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**Mortality:**

- Drop out: Y (8)

**Interaction of Selection and Maturatation:**

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<tbody>
<tr>
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<tr>
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<tr>
<td>siblings</td>
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<tr>
<td>Outside lessons: Y (8)</td>
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<td>Family Gymnas: F X (8) Student Other</td>
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**Interaction of Testing and X:**

- Brothers: 1
- Sisters in program:
- Interaction of Selection and X:
- Outside lessons: Y (8)
- Multiple X Interference:
- Outside lessons: Y (8)
# SKILLS PRETEST

<table>
<thead>
<tr>
<th>SKILLS</th>
<th>PRETEST</th>
<th>INTERVENTION</th>
<th>POST TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Roll</td>
<td>3 3 3</td>
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<tr>
<td>Back Roll</td>
<td>3 3 3</td>
<td>3 3 3 3</td>
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<tr>
<td>Cartwheel</td>
<td>3 3 3</td>
<td>3 3 3 3 3</td>
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</tr>
<tr>
<td>Roundoff</td>
<td>2 2 2</td>
<td>3 2 3 2 2</td>
<td>2 2 3</td>
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<tr>
<td>Headstand</td>
<td>3 3 3</td>
<td>3 2 4 2 4</td>
<td>4 4 4 4</td>
</tr>
<tr>
<td>Back Bend (Standing)</td>
<td>2 2 2</td>
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<tr>
<td>Back Extension Pull</td>
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<td>3 3 2</td>
<td>4 3 3 3 3</td>
<td>3 3 3</td>
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<tr>
<td>Handstand Forward H1.</td>
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<tr>
<td>Jump full turn - stop</td>
<td>3 3 3</td>
<td>4 3 3 3 3</td>
<td>3 3 3</td>
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</table>

**HISTORY:**
- Plays: Y (4)
- Outside Lessons: Y (6)
- Brothers
- Sisters
- Parents Gymnasts: H Ξ (3)
- Origin of Interest: P (4) Ξ B 3 Other Student

**TESTING:**
- Stunts difficult: Ξ (4)

**INSTRUMENTATION AND REGRESSION:**
- Absences: " " (4)
- Ability perceived by student: H Ξ L No Basis
- Ability perceived by parents: H Ξ L No Basis
- Sick weeks: 1 2 3 4
- Behavioral problems: 1 2 3 4
- Instructor Problems: 1 2 3 4
- Student understanding: Ξ (4)

**SELECTION:**
- Group No. 8
- Standardized Test: 25 3 4 5

**MOTIVATION:**
- Drop out: Y (4)

**Interaction of Selection and Maturation:**
- School Attended: 7 "superior" (3)
- Grade: 1
- No. of classmates: 10
- Schoolmates: 1
- Outside lessons: Y (4)
- Family Gymnasts: P H B S Student Other

**Interaction of Testing and I:**
- Brothers: S 4 Sisters in program

**Multiple I Interference:**
- Outside lessons: Y (4)
- Outside Lessons: Y (4)
<table>
<thead>
<tr>
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<th>INTERVENTION</th>
<th>POST TEST</th>
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<td>2 2 3</td>
</tr>
<tr>
<td>Jump full turn - stop</td>
<td>4 4 4</td>
<td>4 4 4</td>
<td>3 3 3</td>
</tr>
</tbody>
</table>

Subject Code: 4
Group: 29

HISTORY:
Play: Y
Outside Lessons: Y
Brothers: 1
Sisters: 1
Parent Gymnasts: M F
Origin of Interest: P (M) B S Other Student

TESTING:
Stunts difficult: Y

INSTRUMENTATION AND REGRESSION:
Ablessness: 3
Ability perceived by student: H L No Basis
Ability perceived by parents: H L No Basis
Sick weeks: 1 2 3
Behavioral problem weeks: 1 2 3 4
Instructor Problems: 1 2 3 4
Student understanding: N

SELECTION:
Range score: 3
Group No.: 7

Mortality:
Drop outs: Y

Interaction of Selection and Maturation:
School Attended: N
Grades: 4
No. of classmates: 4

Interaction of Testing and X:
Outside Lessons: Y
Family Gymnasts: F H B S Student Other

Interaction of Selection and X:
Outside Lessons: Y
Multiple X Interference:
Outside Lessons: Y

86.6%
### SKILLS

<table>
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<tr>
<th></th>
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<th>INTERVENTION</th>
<th>POST TEST</th>
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<tr>
<td>Sack Extension Poll</td>
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<td>1 1 1</td>
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<td>Scale - 3 count</td>
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<td>4 4 4</td>
</tr>
<tr>
<td>Handstand Forward Roll</td>
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<tr>
<td>Jump full turn - stop</td>
<td>4 4 4</td>
<td>3 3 3</td>
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</tr>
</tbody>
</table>

### HISTORY

- **Play:** Yes
- **Outside Lessons:** No
- **Brothers:** 2
- **Sisters:** No
- **Parent Gymnasts:** Male
- **Origin of Interest:** Parent

### TESTING

- **Stunts difficult:** Yes

## INSTRUMENTATION AND REGRESSION

- **Absences:** 2
- **Ability perceived by student:** Male
- **Ability perceived by parents:** Female
- **School weeks:** 1 2 3 4
- **Behavioral problems weeks:** 1 2 3 4
- **Instructor Problems:** 1 2 3 4
- **Student understanding:** Yes

### SELECTION

- **Range score:** 3.6 3.1
- **Group No.:** 1
- **Mr.:** 2
- **Drop outs:** Yes

### M 2

- **Subject Code:** 4
- **Group:** 2

### Statistics

- **% Reliability:** 96.6%
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<th>POST TEST</th>
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<td>1 1 1 1</td>
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<tr>
<td>Scale - 3 count</td>
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<td>Handstand Forward Rl.</td>
<td>2 3 3</td>
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<tr>
<td>Jump full turn - stop</td>
<td>3 3 3</td>
<td>4 3 3 3</td>
<td>3 3 3</td>
</tr>
</tbody>
</table>

HISTORY:

Play: Y N C - L
Outside Lessons: Y N
Brothers: _
Sisters: _
Parent Gymnasium: M F P _
Origin of Interest: F (N) _
Other Student

TESTING:
Stunts difficult: Y _

INSTRUMENTATION AND REGRESSION:
Absence & O
Ability perceived by student: H P L No Basis
Ability perceived by parents: H P L No Basis
Behavioral problem weeks: 1 2 3 4
Instructor Problems: 1 2 3 4
Student understanding: _

SELECTION:
Range Score: 30 3 30
Group No. 4
Br. 0 2

Mortality:
Drop out: _

Interaction of Selection and Maturation:
School Attended: 3 _
Grades: _
No. of Classmates: 
Instructor:
Outside Lessons: Y N

Interaction of Testing and X:
Brothers: _

Multiple X Interference:
Outside Lessons: Y N
## SKILLS Pretest | Intervention | Post Test
--- | --- | ---
Forward Roll | 4 4 4 | 4 4 4 | 4 4 4
Back Roll | 3 3 3 | 3 3 4 | 3 3 4
Cartwheel | 4 4 4 | 4 4 4 | 4 4 4
Roundoff | 3 3 3 | 3 3 3 | 3 3 3
Headstand | 3 3 3 | 3 3 2 | 3 3 3
Back Bend (Standing) | 2 2 3 | 3 2 4 | 3 3 4
Sack Extension Roll | 1 1 1 | 1 2 1 | 1 1 1
Scale - 1 count | 4 4 4 | 4 4 4 | 3 3 4
Handstand Forward Roll | 4 4 4 | 4 4 4 | 4 4 4

### HISTORY:
- **Play:** Y
- **Outside Lessons:** Y
- **Sisters:**
- **Parent Gymnasts:** M F
- **Origin of Interest:** P (M) B Other Student

#### TESTING:
- **Skills Difficult:** ON

#### INSTRUMENTATION AND REGRESSION:
- **Absences:** 2
- **Ability Perceived by Students:** H (L) No Basis
- **Behavioral Problem weeks:** 1 2 3 4
- **Instructor Problems:** 1 2 3 4
- **Student Understanding:** ON

#### SELECTION:
- **Range Score:** 30 - 30.6
- **Group No.:** 4

#### MORTALITY:
- **Drop out:** Y

### INTERACTION OF SELECTION AND NATURALIZATION:
- **School Attended:** 12 yrs old female
- **No. of classmates:** 0
- **Outside Lessons:** F

### FAMILY GYMNASTS:
- **Brothers / Sisters in program:**

---

Subject Code: 1 1 1 1

**Score:** 31 31 33 32

**K Reliability:** 94.4

**PC. 4%**

---

### INTERACTION OF TESTING AND XI:
- **Brothers / Sisters in program:**
- **Multiple XI Interference:**
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<th>PRETEST</th>
<th>INTERVENTION</th>
<th>POST TEST</th>
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<tr>
<td>Jump full turn - stop</td>
<td>3 3 3</td>
<td>3 3 3</td>
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</tbody>
</table>

**HISTORY:**

**Play:** Y ↔
**Outside Lessons:** Y ↔
**Brothers:**
**Sisters:** 1
**Parent Gyms:** M, F ↔
**Origin of Interest:** P (W) B (Other Student)

**TESTING:**
**Stunts difficult:** O

**INSTRUMENTATION AND REGRESSION:**
**Absences:** 1
**Ability perceived by student:** H ↔ L (No Basis)
**Ability perceived by parents:** H ↔ L (No Basis)
**Sick weeks:** 1, 2, 3 (O)
**Behavioral problem weeks:** 1, 2, 3 (O)
**Instructor Problems:** 1, 2, 3 (O)
**Student understanding:** O

**SELECTION:**
**Range score:** 29 34
**Group No.:**
**No. of classmates:** 6
**Schoolmates:** 7
**Outside lessons:** Y (O)
**Family Gyms:** F (O) M (X) Student Other

**Interactions of Selection and Nurturing:**
**School Attended:** 2 (O) 3 (O) 4 (O)
**Grade:** 5
**Outside Lessons:** Y (O)
**Multiple X Interferences:**
**Outside Lessons:** Y (O)

**M5**
**Subject Code:**
**Group:** 4

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<th>1 v 2</th>
<th>1 v 1</th>
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**Instructor No.:**

90

**X² Reliability:** 85 %
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<tr>
<td>Jump full turn - stop</td>
<td>3</td>
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</tbody>
</table>

**HISTORY:**
- Plays: Y
- Outside Lessons: Y
- Brothers: 3
- Sisters: 1
- Parent Gymnasts: H P
- Origin of Interest: F (H) B (Other Student)

**TESTING:**
- Stunts difficult: 4 N

**INSTRUMENTATION AND REGRESSION:**
- Absences: 4
- Ability perceived by student: H O L (No Basis)
- Ability perceived by parents: H O L (No Basis)
- Sick weeks: 1 2 3 4
- Behavioral problems: 1 2 3 4
- Instructor Problems: 1 2 3 4
- Student understanding: 4 N

**SELECTION:**
- Range score: 35
- Group No.: 35
- Instructor No.: 32.6
- Mortality: 35
- Drop out: Y

**INTERACTION OF SELECTION AND MATURATION:**
- School Attended: 13
- Grade: 7
- No. of classmates: 6
- Schoolmates: 6
- Outside Lessons: Y
- Family Gymnasts: H B (Other Student)
- Interaction of Testing and X:
  - Brokers: 1
  - Sisters in program: 3
- Interaction of Selection and X:
  - Outside Lessons: Y
  - Multiple X Interference: 2

**GROUP:**
- Subject Code: 1
- Group: 1

**RELIABILITY:**
- 93.3%
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<th>POST TEST</th>
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<td>4 4 4</td>
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</tbody>
</table>

Subject Code: 1
Group: 1

HISTORY:

Play: Y N S K P W K
Outside Lessons: O N Universal
Brothers: O N Public School
Sisters: O N Public School
Parent Gymnasts: M F O Other Student
Sisters and Gymnast

TESTING:

Stunts difficult: Y O

INSTRUMENTATION AND REGRESSION:

Absences: O O
Ability perceived by students: O S L No Basis
Ability perceived by parents: O S L No Basis
Sick weeks: 1 2 3 4
Behavioral problem weeks: 1 2 3 4
Instructor Problems: 1 2 3 4
Student understanding: O H

SELECTION:

Range scores: 39 39
Group No. 1
Hr. 1

Mortality:

Drop out: Y O

Interaction of Selection and Maturation:

School Attended: O N Public School
Grade: 7
No. of classmates: O
Schoolmates: O
Outside lessons: Y O
Family Gymnasts: P H B O Student Other

Interaction of Testing and Y N O O O O
Outside Lessons: 1 1 1 1 1 1
Multiple X Interference:
Outside Lessons: O N

X2 Reliability

108 72
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</table>

**HISTORY:**

- **Play:** Y
- **Outside Lessons:** Y
- **Brothers:** _
- **Sisters:** _
- **Parent Gymnasts:** H F
- **Origin of Interest:** P H B S Other Student

**TESTING:**

- **Stunts difficult:** _
- **Abilities perceived by student:** H S No Basis
- **Abilities perceived by parent:** H S No Basis
- **Sick weeks:** 1 2 3
- **Behavioral problem weeks:** 1 2 3 4
- **Instructor Problems:** 1 2 3 4
- **Student understanding:** _

**INSTRUMENTATION AND REGRESSION:**

- **Absences:** #
- **Ability perceived by student:** H S No Basis
- **Ability perceived by parents:** H S No Basis
- **Weeks:** 1 2 3
- **Behavioral problem weeks:** 1 2 3 4
- **Instructor Problems:** 1 2 3 4
- **Student understanding:** _

**SELECTION:**

- **Range score:** 33 33 30 33
- **Group No.:** 1
- **Hr.:** 1

**Mortality:**

- **Drop outs:** Y

**Interaction of Selection and Maturation:**

- **School Attended:** 14
- **Family Gymnasts:** P H B S Other

**Interaction of Testing and X:**

- **Brothers:** _
- **Sisters in program:** _

**Multiple X Interference:**

- **Outside Lessons:** Y

**Outstanding comments:**

- **Subject Code:** 1
- **Group:** 1
- **Instructor No.:** 90
- **% Reliability:** 96.6%
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<th>POST TEST</th>
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<td>Jump full turn - stop</td>
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HISTORY:

Play: OH
Outside Lessons: O H P R E K
Brothers: 1
Sisters: 1
Parent Gymnasts: H P
Origin of Interest: P (H P) O Other Student

TESTING:
Shunts difficult: T O

INSTRUMENTATION AND REGRESSION:
Absences: 4 4
Handicap by student: H P L No Basis
Handicap by parent: H O L No Basis
Sick weeks: 1 2 3 4
Behavioral problem weeks: 1 2 3 4
Instructor Problems: 1 2 3 4
Student understanding: N

SELECTION:

Range score: 26.3

Subject Code: 1
Group: 1

Instructor No.: 1234

Instructor No. Reliability: 96.4%
### SKILLS PRETEST

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**Subject Code:** 1 1 2

**Group:** 2

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### HISTORY:

**Playing:**

- 7 ao K
- Outside Lessons: Y
d

**Brothers:**

**Sisters:**

**Parent Gymnast:** F P

**Origin of Interest:** P (H) B S Other Student

### TESTING:

**Sucks difficult:**

**INSTRUMENTATION AND REGRESSION:**

- Absences 1 1
- Ability perceived by student: H S [No Basis
- Ability perceived by parents: H S [No Basis
- Sick weeks: 1 2 3 4
- Behavioral problem weeks: 1 2 3 4
- Instructor Problems: 1 2 3 4
- Student understanding: O

### SELECTION:

- Range score: 20.7
- Group No.: 4
- Br. 1 2

**Mortality:**

- Drop out: Y

---

**Interaction of Selection and Naturation:**

- School Attended: 2
- 7 yr. - 1st Grade
- Grades: 2
- No. of classmates: 3
- Schoolmates: 3
- Outside lessons: Y
- Family Gymnast: F H B S Student Other

**Interaction of Testing and Xi:**

- Brothers / Sisters in program
- Outside lessons and Xi:
- Outside lessons: Y

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**Multiple X Interference:**

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**HISTORY:**
- Play: *K* 2p = K
- Outside Lessons: Y O
- Brothers
- Sisters
- Parent Gymnasts: M F O
- Origin of Interest: F (M F) B S Other Student

**TESTING:**
- Stunts difficult: Y O

**INSTRUMENTATION AND REGRESSION:**
- Absences & O
- Ability perceived by student: H O L No Basis
- Ability perceived by parents: H O L No Basis
- Sick weeks: 1 2 3 4
- Behavioral problems: 1 2 3 4
- Instructor Problems: 1 2 3 4
- Student understanding: O O

**SELECTION:**
- Range score: 20 3 2 2
- Group No. 2
- Br. 1 O
- Mortality:
- Dropout: Y O

**Interaction of Selection and Maturity:**
- School attended: 1/6 1/6 1/6 1/6 1/6 1/6 1/6
- Grade: 2
- No. of classmates: 2 2
- Schoolmates: O
- Outside lessons: Y O
- Family Gymnasts: F N B S Student Other

**Interaction of Testing and X:**
- Brothers / Sisters in program
- Interaction of Selection and X:
- Outside lessons: Y O
- Multiple X Interference:
- Outside lessons: Y O
### Skills

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### Post Test Information

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### Drop out Information

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<tr>
<td>Jump full turn - stop</td>
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Subject Code: L 5

Group: 2

Instructor No.: 1 2 3

No. of Classmates: 0

Outsides lessons: Yes

Interaction of Selection and Maturation:

Interaction of Testing and X:

INTERVENTION AND REGRESSION:

HISTORY:

Play: Y N

Outside Lessons: Yes

Brothers:

Sisters:

Parent Gymnasts:

Origin of Interest:

TESTING:

Stunts difficult: Y N

Instrumentation and Regression:

Ability perceived by students:

Ability perceived by parents:

Sick weeks:

Behavioral problem weeks:

Instructor Problems:

Student understanding:

SELECT:

Range score:

Group No.: 2

Br. 1 (C)

Mortality:

Drop out: Y N

Interaction of Selection and Maturation:

School Attended:

Grade:

No. of Classmates:

Outsides lessons:

Family Gymnasts:

Interaction of Testing and X:

Brothers:

Sisters:

Interaction of Selection and X:

Outside lessons:

Multiple X Interference:

Outside lessons:
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<td>3 3 3</td>
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HISTORY:

Play: Y
Outside Lessons: Y
Brothers: __________
Sisters: __________
Parent Gymnasts: M F
Origin of Interest: F H B S Other Student

TESTING:
Stunts difficult: □□□

INSTRUMENTATION AND REGRESSION:
Absences: □□□
Ability perceived by student: H □□□ L No Basis
Ability perceived by parents: H□□□ L No Basis
Mentally: 1 2 3 4
Behavioral problem weeks: 1 2 3 4
Instructor Problems: 1 2 3 4
Student understanding: □□□

SELECTION:
Range score: 24.4
Group No. __

Reliability:
Drop out: Y

Interaction of Selection and Maturation:
School attended: □□□
Grade: □□□
No. of classmates: □□□

Interaction of Testing and Instr:
Brothers / Sisters in program:
Outside lessons: Y
Multiple testing: □□□

Reliability:
P: □□□

Subject Code: 2

Group:

Reliability:

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<td>Sisters: 1 in program,</td>
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### SKILLS PRETEST

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<th>INTERVENTION</th>
<th>POST TEST</th>
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<tr>
<td>Jump full turn - stop</td>
<td>4 4 4</td>
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</table>

### HISTORY:

**Plays:** 1
- **Outside Lessons:** Y □
- **Brothers:** 1 □
- **Sisters:** 1 □
- **Parent Gymnastics:** H P □
- **Origin of Interest:** P (H P) □
- **Other Student** □

**TESTING:**
- **Difficulties:** Y □

**INSTRUMENTATION AND REGRESSION:**
- **Absence:** □
- **Ability perceived by student:** H □ L No Basis
- **Ability perceived by parents:** H □ L No Basis
- **Sick weeks:** 1 2 3 4
- **Behavioral problem weeks:** 1 2 3 4
- **Instructor Problems:** 1 2 3 4
- **Student understanding:**□

**SELECTION:**
- **Range score:** 33 33 □
- **Group No.:** 3 □
- **Hr.:** 1 □
- **Mortality:** □
- **Drop out:** Y □

**Subject Code:**
- **Group:** 3 □

**Instructor No.:**
- **Reliability:** 100 □

**Subjects:**
- **Selection and Nature:**
- **School Attended:** 2 □
- **Age:** □
- **No. of classmates:** 3 □
- **Family Gymnastics:** □
- **Outside Lessons:** □
- **Interactions of Selection and X:**
- **Outside Lessons:** □
- **Multiple X Interferences:**
- **Outside Lessons:** □

---

**Group:** □

**Instructor No.:** 100 □

**Reliability:** 100 □

**Subjects:**
- **Selection and Nature:**
- **School Attended:** □
- **Age:** □
- **No. of classmates:** 3 □
- **Family Gymnastics:** □
- **Outside Lessons:** □
- **Interactions of Selection and X:**
- **Outside Lessons:** □
- **Multiple X Interferences:**
- **Outside Lessons:** □
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</tbody>
</table>

HISTORY:
- Play: O N S
- Outside Lessons: Y O
- Other Student
- Parent Gymnastics: M P O
- Instructor Problems: 1 2 3 4
- Student understanding: O N

INSTRUMENTATION AND REGRESSION:
- Absences: O
- Ability perceived by student: O S L No Basis
- Ability perceived by parents: O S L No Basis
- Sick weeks: 1 2 3 4
- Behavioral problem weeks: 1 2 3 4
- Group No.: 3
- Student understanding: O N

SELECTION:
- Range score: 38 37
- Group No.: 3
- Instructor No.: 3

INSTRUCTOR RELIABILITY

Interaction of Selection and Maturation:
- School Attended: Z 4 yr old female
- Grade: 3
- No. of Classmates: 3
- Schoolmates: 3
- Outside lessons: Y O
- Family Gymnastics: F M B S Student Other

Interaction of Testing and X:
- Brothers [ ] [ ] Sisters in program
- Interaction of Selection and X:
- Outside lessons: Y O
- Multiple X Interference: 1 2 3 4

Subject Code: 1 2 1 0 0

Group: 3

Instructor No.: 3 4 1 2

Interaction of Selection and Maturation:
1 2 1 0 0
1 2 1 0 0
2 2 1 0 0

Interaction of Testing and X:
1 2 1 0 0
1 2 1 0 0
2 2 1 0 0

100%
## SKILLS PRETEST

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### HISTORY:
-_play:
- Outside Lessons: S H, Physical Education.
- Parents:
  - Brothers: S
  - Sisters: S
  - Parent Gymnastics: H
  - Origin of Interest: P
- Other Student:
  - Testing:
    - Stunts difficult: S N
  - Instrumentation and Regression:
    - Absence: S
    - Ability perceived by student: H S L No Basis
    - Ability perceived by parents: H S L No Basis
    - Sick weeks: 1 2 3 4
    - Behavioral problems weeks: 1 2 3 4
    - Instructor Problems: 1 2 3 4
    - Student understanding: S N
- Selection:
  - Range score: 34.6 __ 34 __
  - Group No.: 3
  - Mr. 1 2
  - Mortality:
    - Drop out: S
  - Interaction of Selection and Maturation:
    - School attended:
      - 2 - Year old girls
    - Grade: 4
    - No. of classmates: S
      - Schoolmates: S
    - Outside lessons: O
      - Outside lessons: O
      - Student Other
    - Family Gymnastics: P H B S
    - Interaction of Testing and X:
      - Brothers: S
      - Sisters: S
      - Interference: S
      - Outside lessons: O
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<tr>
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<td>3 3 3</td>
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</table>

**HISTORY:**

- **Play:**
  - Brother(s): 1
  - Sisters: 1
- **Origin of Interest:**
  - Parent Gymnasts: 1 P 0 8 8 9 1 1
  - S Other Student

**TESTING:**

- Stunts difficult: 10

**INSTRUMENTATION AND REGRESSION:**

- Absences: 1
- Ability perceived by student: H 0 L No Basis
- Ability perceived by parents: H 0 L No Basis
- Sick weeks: 1 2 3 4
- Behavioral problem weeks: 1 2 3 4
- Instructor Problems: 1 2 3 4
- Student understanding: 10

**SELECTION:**

- Group No.: 24 3 23 3
- Nr. 1 (2)

- Mortality:
  - Drop outs: 10

**INTERCEPTION AND REGRESSION:**

- Interaction of Selection and Maturity:
  - School Attended: 2 For 10 nento 0
  - Grade: 2
  - No. of classmates: 3
  - Student: 2
  - Outside lessons: 1 0 0 8
  - Family Gymnastics: F 0 3 S Student Other

- Interaction of Testing and X:
  - Brothers: 1
  - Sisters in program: 1
  - Interaction of Selection and X:
  - Outside lessons: 1 0 0
  - Multiple X Interference:
  - Outside lessons: 1 0 0

**Z Reliability:**

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**PP. S Z.**
### SKILLS PRETEST

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</table>

### INTERVENTION

- **115**
- **3**
- **17**

### POST TEST

- **1**
- **2**
- **4**

### HISTORY:

- **Play:** Yes
- **Selection:** Yes
- **Testing:** Yes
- **Instrumentation and Regression:** Yes
- **Absences:** No
- **Ability perceived by students:** Yes
- **Behavioral problems:** Yes
- **Sick weeks:** Yes
- **Instructor Problems:** Yes
- **Student understanding:** Yes

### SELECTION:

- **Group No.:** 3
- **Number of siblings:** 3
- **Number of classmates:** 2

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### NOTES:

- **X Reliability:** 84.97%
## SKILLS

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</table>

**HISTORY:**

- Family: Parents; H 48 F. 3.4.
- Student: S.
- Origin of Interests: P (H F) B.
- Other: Brothers; S.
- Parents; M.
- Subject Code: i.
- Instructor No: 34.
- Subject: 1.
- Reliability: 95%
- Subject Code: i.
- Group: 3.
- Instructor No: 34.
- Reliability: 95%
## SKILLS PRETEST 1

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### HISTORY:

- Play: \( M \) \( Z \) \( d \) \( w \) \( K \)
- Outside Lessons: \( T \) \( O \)
- Brothers: ___
- Sisters: ___
- Parent Gymnastics: \( X \) \( P \) \( R \) \( F \) \( a \)
- Origin of Interest: \( P \) \( M \) \( B \) \( S \) Other Student

### TESTING:

- Stunts difficult: \( Y \) \( O \)

### INSTRUMENTATION AND REGRESSION:

- Ability perceived by student: \( H \) \( O \) \( L \) No Basis
- Ability perceived by parents: \( H \) \( O \) \( L \) No Basis
- Sick weeks: 1 2 3 4
- Behavioral problem weeks: 1 2 3 4
- Instructor Problems: 1 2 3 4
- Student understanding: \( X \) \( N \)

### SELECTION:

- Range score: 31 31
- Group No.: ___
- Mortality: Drop outs: \( Y \) \( O \)

### Interaction of Selection and Maturity:

- School Attended: 19 9 yr old Grade 4
- Grades: ___
- No. of classmates: ___
- Mortality: Drop outs: \( Y \) \( O \)

### Interaction of Testing and Xi:

- Brothers: ___
- Sisters in program: ___
- Interaction of Selection and Xi:
- Outside Lessons: \( Y \) \( O \)
- Multiple Xi Interferences:
- Outside Lessons: \( Y \) \( O \)

### Median:

- Subject Code: 4
- Group: ___

### Median Repeatability:

- 94.4%
### SKILLS PRETEST

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### HISTORY:

**Play:** o P ick K
- Outside Lessons: Y(1)
- Brothers: ___
- Sisters: ___
- Parent Gymnast: M P
- Origin of Interest: P (M P) B S Other Student

**Testing:**
- Stunts difficult: Y(1)

**Instrumentation and Regression:**
- Absences: 0
- Ability perceived by student: H 6 L No Basis
- Ability perceived by parents: H(6) L No Basis
- Sick weeks: 1 2 3
- Behavioral problem weeks: 1 2 3 4
- Instructor Problems: 1 2 3 4
- Student understanding: O(8)

**Selection:**
- Range scores: 29-30
- Group No.: 4
- Mortality: Drop out: Y(1)

**Interaction of Selection and Nature:**
- School attended: To 9 year old class O
- Grade: 3
- No. of classmates: O
- Outside lessons: Y(1)
- Outside lessons: Y(1)
- Family Gymnast: M P B S Student Other

**Interaction of Testing and X:**
- Brothers / Sisters in program.
- Interaction of Selection and X:
- Outside lessons: Y(1)
- Multiple X Interference:
- Outside lessons: Y(1)
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<tr>
<td>Back Bend (Standing)</td>
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HISTORY:

Play: 6 N 2
Brothers: 1
Sisters: 0
Parent Gymnasts: H F
Origin of Interest: O N P O Other Student

TESTING:
Stunts difficult: Y O

INSTRUMENTATION AND REGRESSION:
Absences: 2
Ability perceived by student: H O L No Basis
Ability perceived by parents: H S L No Basis
Sick weeks: 1 O 3 O
Behavioral problem weeks: 1 2 3 4
Instructor Problems: 1 2 3 4
Student understanding: O H

SELECTION:
Range score: 34 O 3 37
Group No. 01
Br. 02
Mortality: Drop outs Y O

Interaction of Selection and Maturation:
School Attended: 1 (3 school) females O
Grade: 3
No. of classmates: 0
Schoolmates: 1
Outside lessons: O N
Family Gymnasts: O H O Student Other

Interaction of Testing and X:
Brothers: 1 / 1. Sisters in program.
Interaction of Selection and X:
Outside lessons: O N
Multiple X Interference:
Outside lessons: O N

94.4 x Reliability
90

88.3%
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<thead>
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<td>4 4 3</td>
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<tr>
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Subject Code: 1
Group: 1

HISTORY:

PLAYS: O N 2A.C.J.
Brothers 4
Sisters 4
Parent Gymnastics: M 1 2
Origin of Interests: F 1 2 3
Other Student: 4

TESTING:
Stunts difficult: Y 1

INSTRUMENTATION AND REGRESSION:
Abnormality perceived by student: 4 1 3 4
Abnormality perceived by parents: 4 1 3 4
Sick weeks: 1 2 3 4
Behavioral problem weeks: 1 2 3 4
Instructor Problems: 1 2 3 4
Student understanding: O N

SELECTION:
Range score: 32.4 33
Group No.: 1

H 10

Subject Code:
2

Interaction of Selection and Maturation:
School Attended: 2 3 4 5
Grade: 3
No. of classmates: 0
schoolmates: 7

Interaction of Testing and X:
Brothers 1 2 3 4 5
Sisters in program.

Interaction of Selection and X:
Outside lessons: O N
Multiple X Interference:
Outside lessons: O N
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<th>INTERVENTION</th>
<th>POST TEST</th>
</tr>
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Subject Code: 1

Group: 1

Instructor No.: 50

\( \text{X} \) Reliability: 3.3%
APPENDIX IV
# QUANTITATIVE RESULTS

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### Results - 2

#### Group Three Mixed TREATMENT

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#### Group Three Mixed CONTROL

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#### Group Four Middle TREATMENT

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#### Group Four Middle CONTROL

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### Results

#### Comparison of all low Skilled

**TREATMENT**

(In all low group)

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(In mixed ability group)

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<td>L4</td>
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#### Comparison of all low skilled

**CONTROL**

(In all low group)

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(In mixed ability group)

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Results

Comparison of all highly skilled
(In all High group)

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</tr>
<tr>
<td>H7</td>
<td>34</td>
<td>37.6</td>
</tr>
</tbody>
</table>

(In mixed ability group)

| H2           | 36.6    | 37        |
| H3           | 36.3    | 36        |
| H8           | 33.6    | 35        |

Comparison of all highly skilled
(In all high group)

<table>
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<tr>
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<td>34</td>
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(In mixed ability group)

<p>| H8           | 33      | 33        |
| H2           | 38      | 37        |
| H6           | 34.6    | 34        |</p>
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**Report Statistics**

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NOTE: THE JOB CASEY47 HAS BEEN RUN UNDER RELEASE 82.3 OF SAS AT OHIO STATE UNIVERSITY.

NOTE: CPU: VERSION = 08 SERIAL = 07C206 MODEL = 0470.

NOTE: SAS OPTIONS SPECIFIED ARE:

SORT=4

DATAONE;

INPUT SUBJ $ 1-3 METHOD $ 5 METHOD $ 5 GROUP $ 7 PRESCORE 9-12 POSSCORE 14-17;

NOTEDATA SET WORK.ONE HAS 39 OBSERVATIONS AND 5 VARIABLES. 407 OBS/TRK.

NOTE: THE DATA STATEMENT USED 0.06 SECONDS AND 272K.

PROC PRINT;

NOTE: THE PROCEDURE PRINT USED 0.10 SECONDS AND 272K AND PRINTED PAGE 1.

PROC GLM;

CLASS METHOD GROUP;

MODEL PRESCORE POSSCORE=METHOD GROUP METHOD*GROUP PRESCORE/SOLUTION;

MEANS METHOD GROUP METHOD*GROUP/DUNCAN;

LSMEANS METHOD GROUP/STDERR PDIFF;

NOTE: THE PROCEDURE GLM USED 0.29 SECONDS AND 306K AND PRINTED PAGES 2 TO 11.

NOTE: SAS USED 306K MEMORY.

NOTE: SAS INSTITUTE INC.

SAS CIRCLE
PO BOX 8000
CARY, N.C. 27511-6000
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SAS:
GENERAL LINEAR MODELS PROCEDURE
CLASS LEVEL INFORMATION

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NUMBER OF OBSERVATIONS IN DATA SET = 39
### General Linear Models Procedure

**Source of Variation**

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<th>DF</th>
<th>Sum of Squares</th>
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**Parameter Estimates**

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**Notes:**
- The fit matrix has been printed as a table, and a generalized inverse was used to solve the normal equations.
- The model is linear, and the model fits well (R-Square = 1.000000).
- The standard error of estimate is 0.0000, indicating a good fit.

---

**SAS**

1347 Thursday, March 19, 1984
### General Linear Models Procedure

**Dependent Variable:** PUSSCORE

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<th>MEAN SQUARE</th>
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**Method**

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**Parameter**

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**Note:** The design matrix has been uncrossed and a generalized inverse has been used to solve the normal equations. The values of the parameter estimates are only one of many possible solutions to the normal equations. Estimates followed by a letter *b* are BLUE for the parameter, indicating that the bias in the estimator may be relatively small in some linear combination of parameters. For all tests, the statistic is that of the biased estimator and the F value tests.
**GENERAL LINEAR MODELS PROCEDURE**

**DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: PRESCORE**

**NOTE:** THIS TEST CONTROLS TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE.

| ALPHA=0.05 | DF=28 | MSE=0 |

**WARNING:** CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES=15.3046

**MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.**

**DUNCAN GROUPING**

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<td>C</td>
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**SAS GENERAL LINEAR MODELS PROCEDURE**

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: PRESCORE
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE.

**ALPHA=0.05 DF=28 MSE=9**

**WARNING: CELL SIZES ARE NOT EQUAL.**
**HARMONIC MEAN OF CELL SIZES=7.37234**

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

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**Duncan's Multiple Range Test**

For variable: POSSCORE

**Note:** This test controls the Type I comparisonwise error rate, **not** the experimentwise error rate.

**ALPHA=0.05**  DF=20  MSE=2.59E16

**Warning:** Cell sizes are not equal.

Harmonic mean of cell sizes=7.3723

Means with the same letter are not significantly different.

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### GENERAL LINEAR MODELS PROCEDURE

**DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: POSSCORE**

**NOTE:** THIS TEST CONTROLS THE TYPE I COMPARISON ERROR RATE.

**ALPHA = 0.05**  
**DF = 25**  
**MSE = 2.59616**  
**WARNING:** CELL SIZES ARE NOT EQUAL.

**HARMONIC MEAN OF CELL SIZES = 1.37234**  
**MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.**

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### SAS
GENERAL LINEAR MODELS PROCEDURE

#### MEANS

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NOTE: TO ENSURE OVERALL PROTECTION LEVEL, MULTIPLE PROBABILITIES ASSOCIATED WITH PRE-PLANNED COMPARISONS SHOULD BE USED.