DIVERGENT THINKING AND SCHMIDT'S SCHEMA THEORY AS A FUNCTION OF PROBLEM SOLVING METHODOLOGY IN PHYSICAL EDUCATION

by

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ABSTRACT

The purpose of this study was to explore the relationship between divergent thinking and Schmidt's schema theory of motor learning in a population of first year University physical education students.

Problem solving teaching methodology was used as the intervention program in this study and the main sources of data were the Torrance Tests of Creative Thinking and tests of Schmidt's schema theory designed by the researcher. Descriptive data were used to explain the intervention program.

A mixed model analysis of variance was used to compare the pre-test and post-test performance on Torrance Tests of Creative Thinking (TTCT), and the Pearson product-moment correlation technique was used to compare the results of the TTCT post-test and the Schmidt test.

Results showed minimal differences attributable to the intervention and no relationship between the two tests. Analysis of the descriptive data suggests several limitations to the intervention program and some suggestions for further research are offered.

RESUMÉ

Le but de cette était d'évaluer la relation entre le raisonnement divergent et la théorie d'apprentissage moteur de Schmidt "Schmidt's Schema Theory of Motor Learning" chez un groupe d'étudiants débutant des études de 1er cycle en éducation physique. Les données expérimentales ont été recueillies à l'aide d'une intervention d'enseignement basée sur une technique de solution de problèmes et les résultats des tests de Torrance (Torrance Tests of Creative Thinking) (TTCT) et de test développés par l'investigateur pour évaluer la théorie de Schmidt. Des mesures descriptives ont été utilisées pour expliquer les résultats de cette intervention.

Une "mixed model analysis of variance" a été effectuée afin de comparer les scores obtenus sur les pré-tests et post-tests de TTCT. Une technique de corrélation de Pearson a été utilisée pour comparer les résultats obtenus sur le post-test de TTCT et le test de Schmidt.

Les résultats n'ont pas démontré de différences significatives suite à l'intervention et n'ont pu mettre en évidence une relation entre les deux tests. L'analyse des données descriptives suggère qu'il existe plusieurs limitations inhérents au programme d'intervention utilisé. Certaines suggestions relatives aux recherches ultérieures sont proposées.

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CHAPTER I : INTRODUCTION

This thesis will examine divergent thinking in relationship to movement, specifically the theories of divergent thinking posited by Guilford (1950) and amplified by Torrance (1962) and Schmidt's (1975) Schema Theory of motor learning. Much of the literature in the area of divergent thinking gives insight into the cognitive processes evidenced in written or verbal form. In a movement context, research in motor creativity suggests that divergent thinking is observable in the variety and novelty or uniqueness of the movement pattern(s) produced (Wyrick, 1968; Dodds, 1978). In order to explain an individual's ability to produce a novel or unique movement pattern, a link must be drawn between the cognitive and physical processes. Schema Theory of motor learning gives evidence that novel movement production is possible because a vocabulary of movement patterns is stored in the memory. A generalized program, comprising such parameters as speed, force, spatial relationships and movement size, is retained which allows for appropriate selection to be made in a novel situation (Schmidt in Kelso & Scott, 1982).

Schema Theory resolved the memory storage problem inherent in previous motor learning theory which implied that a nearly infinite capacity in memory would be necessary if each and every moment had a separate program (Schmidt,

1977). The constructs of divergent and convergent thinking posited by Guilford (1968) bear a strong resemblance to Open- and Closed-Loop Theories of motor learning and much of the discussion of rote learning versus creative learning in cognitive psychology is similar to that of specificity versus variability in motor learning.

From an exploration of the literature on divergent thinking and schema motor learning, it would appear that a juxtaposition exists which forms a strong basis from which to examine and evaluate divergent thinking in a movement context. There are several common constructs underlying the two fields of study:

1. Both refer to novelty production, in divergent thinking. This is measured as original thought expressed verbally or in written form, whereas Schema Theory deals with the ability to produce novel movement.

2. Both are based on the extent and variability of previous experience. Divergent thinking theory suggests that the individual is re-expressing previous experiences and that the skills of divergent production "pertain to searching in one's memory for appropriate information to meet the needs of the moment" (Guilford, 1968, p. 191).

Schema Theory predicts that the more varied the movement experiences, the stronger the schema (Schmidt, 1975). This

suggests that by experiencing many different movements an individual develops a better understanding of movement patterns and consequently is likely to become a more proficient mover in a novel situation.

Both theories suggest the importance of creating a learning environment which will encourage a variety of experiences and that an inquiry or problem solving teaching approach best serves this purpose. In an inquiry or problem solving methodology, the students are guided and encouraged to find a variety of responses to an initial question or task by their own efforts (Stones, 1966). In this methodology there is an implicit connection drawn between cognitive and physical functions. By employing this methodology in physical education, the teacher encourages students to use their creative and organizational talents to the fullest (Dougherty and Bonnano, 1979). Historically, the use of a discovery or problem solving approach in physical education has been associated with movement education programs (Jewett and Bain, 1979). The underlying assumptions of this approach to the learning of movement skills are threefold:

1. That the varied complex movements done throughout life are based on an assemblage of many movement patterns developed early in life.

2. That the interplay of cognitive and physical learning will enhance the meaning and purpose in the development of

movement skills.

3. That exposure to, and practice of, a wide variety of movement experiences will be effective in developing facility for learning new skills (Locke, 1969).

Physical education parallels education in general, in having a traditional emphasis on the acquisition of pre-determined specific skills which can be objectively measured and evaluated. Traditionally, physical education programs have focused on movement experiences that are functional, with little regard for the kinesthetic and aesthetic perspectives of movement. Many product oriented programs, both past and present, have an emphasis on rote-learning, with drills to be copied and commands to be obeyed, central to the teaching style (Logsdon, 1984).

Movement education programs, by comparison, stress the attitudes and cognitive abilities necessary for the acquisition and performance of new skills beyond school years (Locke, 1970). In this teaching method the focus is shared between product and process, on the basis of their capacity to stimulate thought processes in the development of movement products. This seems to parallel the trend of educators and educational psychologists who believe that "growth does not happen in many cases because it has been permanently stunted or warped by traditional schooling" (Farnham-Diggory, 1972, p. xxxiii).

Both the concept of creativity and the proponents of creative learning are a significant part of this educational trend. J.P. Guilford is generally credited with initiating the serious investigation of creative behaviour in the 1940's, as he sought to elaborate on his theory of intelligence. He suggested that "when educational philosophy adopts education's responsibility for developing problem-solving powers in its students, it also adopts responsibility for developing creativity" (Guilford, 1964). This view is supported by the literature on creativity in education and problem solving methodology (Guilford, 1959, 1964; Torrance, 1970; DeBono, 1976; Logsdon, 1984; Jewett and Bain, 1985).

The literature does not seem to have consensus on the definition of the term creativity. Some definitions are formulated in terms of a product (invention and discovery, for example), others in terms of a process, a kind of person, or a set of conditions. The concept of divergent thinking is posited in literature on creativity as being a key determinant of the creative process (Guilford, 1959; Torrance, 1970; DeBono, 1976). Divergent thinking has become fairly widely accepted as meaning the ability to produce multiple unique responses to a single stimulus. Through test development and the use of factor analytic techniques, Guilford identified different intellectual

abilities and prepared his structure of intellect model to categorize and interrelate them. The ability to produce numerous alternative responses to a problem, instead of a predetermined solution, Guilford terms 'divergent thinking'. Guilford contrasts this with convergent thinking which he suggests involves the usual and expected response and implies a rigidity of thought. Rigidity of thought he describes as a "resistance to change of a single belief or set of habits, when the situation clearly demands it" (Guilford, 1959).

Study of divergent thinking is based on the supposition that thinking is a skill that can be learned rather than merely the application of innate intelligence (DeBono, 1976, p. 45). In his structure of intellect model Guilford suggests four skills involved in divergent thinking: (1) Fluency or the number of responses, (2) Flexibility or the variety of responses, (3) Originality or the novelty of responses, and (4) Elaboration or the detailed development of the responses (Guilford, 1959).

Although there are problems inherent in measuring creative thinking, the concept of divergent thinking does present an instrument with which to examine and evaluate certain dimensions of the creative process. In a divergent thinking context the quality of reasoning is measured by evaluating

the decisions, judgments and actions that a subject delivers in response to a task. In this study the Torrance Tests of Creative Thinking or TTCT (Torrance, 1966), will be employed. The Torrance tests are well known and widely used in creativity research circles. In these tests an attempt is made to assess the products of the test activities in terms of Guilford's divergent thinking factors (fluency, flexibility, originality, and elaboration) (Torrance, 1966, p. 9).

In an exploration of the psychomotor aspect of creativity in movement, it seems important to discover whether divergent thinking skills effect an individual's ability to produce a creative movement pattern. Schmidt's Schema Theory of motor learning, developed in 1975, was influenced by cognitive psychology and shows a focus on the underlying mental or neural events that produce movements, rather than on the performance of motor tasks (Schmidt, 1982). The theory suggests the development of a schema in memory from previous movement experiences from which an individual selects in order to perform a novel task. A key prediction of Schmidt's Schema Theory being that the more varied the previous movement experiences, the more likely that the individual will be successful in performing in a novel situation.

Hypotheses

This thesis will examine two areas of study: divergent thinking and Schmidt's Schema Theory of motor learning. It will seek to examine if divergent thinking is related to the ability to respond to a novel movement task. Specifically, it aims to test the following hypotheses:

1. That subjects exposed to a problem solving approach in rhythmic activities will show greater improvement in divergent thinking on Torrance Test of Creative Thinking than those who were not.

2. That subjects exposed to a problem solving approach in rhythmic activities will show greater ability to respond to a novel movement task than those who have not.

3. That subjects who score highly on TTCT will also score highly on a novel movement task.

In order to test these hypotheses an intervention program of problem solving teaching methodology will be used. This selection is supported by the literature on divergent thinking, creative learning and schema motor learning, in which consensus is found that problem solving methodology is the most likely educational style to be successful in producing the desired outcomes.

Rationale

Researchers and practitioners alike have long been interested in the phenomenon of creativity and most of the work has focused on the cognitive components. Movement educators and proponents of creative movement postulate thinking as an intrinsic part of moving and believe in developing a versatile and varied repertoire of movements. Yet there is a paucity of literature which might help to explain or give a basis for this philosophic position which interrelates cognitive and motor processes. It is anticipated that the present investigation will shed light on divergent thinking skills in a movement context.

In the next chapter the literature on divergent thinking and schema motor learning will be explored. The aim will be to investigate this literature in order to arrive at a better understanding of the cognitive and physical processes in movement.

CHAPTER II : REVIEW OF LITERATURE

An examination of the literature on divergent thinking and schema theory is necessary in order to present the theoretical framework of the present study. This thesis will seek to examine whether divergent thinking is related to the ability to respond to a novel movement task. Literature on creativity will be explored in an attempt to uncover the meaning and implications of divergent thinking as well as an examination of motor creativity which may give some enlightenment in the area of novelty of movement production. Comparison will be made between relevant literature on motor learning and creative learning theories, in an attempt to show a relationship that might substantiate the value of creative movement programs.

Creativity

Creativity has had only a passing interest for many physical educators. There seems to have been little attempt to define the role of creativity in physical education (Brown and Gaynor, 1967). Many physical educators have only related creativity to knowledge about physical education, such as in creating new strategies and tactics in games, which may reflect the creativity of the teacher but does not necessarily demand divergent thinking of the students and does not appear to produce creativity in movement. For movement to be creative the performer must have freedom to explore and experiment (Poole, 1979).

Modern Educational Dance, as defined by Laban (1948) and Movement Education appear to bring to the physical education curriculum a movement domain which has a more central focus on creativity and the development of creative potential (Poole, 1979; Logsdon, 1984). Modern Education Dance is more commonly referred to as Creative Dance in North American literature. Creativity is such an inclusive, generic term that it easily leads to confusion in its interpretation and meaning. In education, for example, it has often been interpreted to mean a lack of structure or discipline. Defined in such terms it cannot be acceptable as a meaningful educational process to be encouraged (Poole, 1979).

There appears to be no commonly agreed upon definition of creativity. However there is general consensus that creativity involves the combination within the individual's consciousness of previously unrelated experiences to form a new pattern, a new whole (DeBono, 1967; Guilford, 1967; Poole, 1979). Four distinctly unique phenomena emerge in the study of creativity; each is studied independently, yet as interdependent parts of the whole. The four parts are: 1) the creative person, 2) the mental processes operative in creating ideas, 3) the relationship between the person and the environment, and 4) the creative product, which is usually an idea expressed in language or craft form

(Brennan, 1980; Rhodes, 1961; Torrance, 1966). It is the synthesis of these four interdependent parts that has enabled scholars and researchers to develop some clarity within the field of creativity.

The term 'person' as used in creativity studies encompasses information about personality, intellect, traits, habits, attitudes, self-concept, and behaviours (Rhodes, 1961). Prior to 1950 most investigators tried to understand the hereditary determinants of creative performance rather than to distinguish the mental operations involved (Guilford, 1967). At this time the thinking was "that the problem of creativeness is the problem of the creative person (rather than of the creative products, creative behaviours, etc.)" (Maslow, 1971, p. 70). Torrance (1962) compiled evidence on all the personality characteristics that have been demonstrated to correlate with creativeness and this list overlaps with characteristics used by Maslow to describe self-actualizing people, with Rogers' 'fully functioning person', with Jung's 'individuating person' and with Fromm's 'autonomous person' (Maslow, 1971). All of these correlations strongly imply that the creative person is somewhat special.

Guilford's studies indicate that people who stand out (from their fellows) as creative thinkers are characterized by

sensitivity to problems, fluency of ideas, mental flexibility, divergent thinking and ability to redefine familiar objects and concepts (Rhodes, 1961). In general it is agreed that the creative person is willing to be different, that he may conform or not of his own free will (Starkweather, 1976). It is this willingness to be different together with the freedom of expression and uniqueness of the ideas of the creative child, that is often considered antithetical to the conformity deemed necessary to learn subject matter (Meeker, 1978). Further, relationships have been established between a sense of humour and creativity. Also, a tendency for their behaviour to be more unpredictable than for others often makes the presence of creative children in a group upsetting (Meeker, 1967; Parnes, 1978).

J.P. Guilford, often named the father of the trait approach to creativity (Feldman, 1980), developed a general theory of intelligence and its components known as "structure of intellect". This theory forecasts many distinguishable abilities which could be especially relevant for creative performance (Guilford, 1967, p. 269). It was this model that became the cornerstone for researchers facing the practical necessity of demonstrating substantial independence of creativity from Intelligence Quotient (Rhodes, 1961; Feldman, 1980). The predictive value of IQ

measures had been found to be poor in situations requiring the production of new ideas (Feldman, 1980). Guilford (1967) found a substantial correlation between creativity and IQ among subjects with low ranges of IQ, but among those in the upper ranges there was practically no correlation. He concluded that IQ appears to set an upper limit on creative potential and that an average or higher IQ may be a necessary, but insufficient, precondition for high creativity.

In his structure of intellect model, Guilford (1959) hypothesized five major groups of intellectual abilities which were: cognition, memory, convergent thinking, divergent thinking, and evaluation. Guilford proposed that the abilities that are most relevant to creative thinking are divergent production and transformation. "Divergent production abilities pertain to generation of ideas, as in solving a problem, where variety is important", and "transformation abilities which pertain to revising what one experiences or knows, thereby producing new forms and patterns" (Guilford, 1967). It is this distinction between convergent and divergent thinking abilities that has had great impact on creativity research. Convergent thinking, which is defined as the usual and expected response and leads to a pre-determined best answer, is the kind of thinking on which traditional tests of learning and

attainment are based (DeBono, 1970; Stones, 1966). Divergent thinking, or lateral thinking as DeBono terms this process, involves a restructuring and provocation of new and different ideas. If the purpose of learning and thinking is to collect information and to make the best possible use of it, then both convergent and divergent thinking are necessary and complementary. Convergent or vertical thinking is concerned with the collection of information, and divergent or lateral thinking is concerned with making the best use of it; thus, divergent thinking enhances the effectiveness of convergent thinking (DeBono, 1970).

Divergent Thinking

For a better understanding of divergent thinking and its relationship to creativity, it is useful to examine the factors involved. Guilford (1959) identified four principal factors of divergent thinking which are: fluency, flexibility, originality, and elaboration. Fluency is a quantitative aspect of thought production; flexibility is an indicator of lack of rigidity in thinking. Rigidity of thinking is explained as "a resistance to change of a single belief or set of habits, when a situation clearly demands it" (Galanter, 1967, p.56). Hence flexibility, shown in the production of a variety of different responses, can be viewed as the opposite end of a thought continuum from rigidity. Guilford's third factor, originality, is defined

as the unusualness or uniqueness of response, that is, the ability to produce ideas that are not obvious. The final factor, elaboration, suggests the ability to elaborate or extend a basic idea with the addition of details or implications. Although these factors of divergent thinking are not considered synonymous with creativity (Guilford, 1967), they do form the basis from which many creativity tests are constructed.

A general flexibility of mind is necessary for creative thinking, and readiness to be flexible is a general characteristic of the ability labelled transformation by Guilford. The variety of transformation abilities depends on the kind of information and the media with which the creator deals (Guilford, 1967, 1968). The overall process of creative thinking involves an understanding of the mental operations that function to influence creative production. Guilford (1971) suggests that there are three phases involved in this process: perceiving problems, which is a matter of understanding their implications; analyzing the problem, which may involve understanding cognitive systems; and an evaluation phase, which serves to guide and channel creative thinking. The mental operation in fluency of divergent thinking, for example, is largely the retrieval of information from the memory store, which comes under the historical concept of recall of learned information. This

implies an importance of skills in recalling information as well as indicating the importance of a good stock of information in memory storage. Flexibility suggests the ability to recognize and to decide whether the generated information is adequate or should be modified or changed. This process is likely to call for evaluation-operations such as the sensing of errors, shortcomings or inconsistencies that will keep the thinker on the right track (Guilford, 1968).

A schematic view of learning suggests operations which appear to be analogous with creative production. Schematic processes involve the integration of past adaptations to the environment into complex patterns of responses. These complex patterns of responses will be applicable to a greater variety of situations than single responses. The extent of the versatility of the schema and its application to different situations depends on the variety of experiences on which it is built (Stones, 1966). Piagetian views on the schematic nature of mental and motor operations are of interest in this context because they suggest the assimilation of stimuli to the schema. D.P. Ausubel (1963) posits a model which relates schemas and concepts more clearly. He suggests that meaningful learning is learning which can be related to and assimilated into existing cognitive structures. He suggests that new learning is not

simply tagged on to previously learned concepts but is fitted into a hierarchical structure (Ausubel, 1963).

Experience is built from the interaction between the person and the environment and as Rhodes (1961) states, "environmental factors at all times in life form a psychological press that may be either constructive or destructive to creativity" (Rhodes, 1961, p. 306). This clearly indicates that teachers can construct experiences in any curricular area, such that children have more opportunity to develop creative thinking (Poole, 1979).

> If, as literature on child development tells us, children are innately curious and imaginative, then it seems the predispositions for leading children to creative behaviour already exists and the teacher's role becomes one of setting up interactions which will stimulate these predispositions further. (Poole, 1979, p. 11)

If this statement is true it is perhaps curious that the question of whether creativity can be taught or learned is raised. This may be answered in part by making a distinction between creative teaching and teaching creativity. Creative teaching implies the use of a kind of methodology that will encourage creative production and the development of students' creative potentialities (Torrance, 1970). Teaching creativity suggests a course content of specific skills of creativity.

A prolific scholar in the field is Dr. Edward DeBono, the founder and director of the Cognitive Research Trust (CORT) in Cambridge, England. He has developed what is now the largest curriculum program in the world for the direct teaching of thinking in schools. DeBono's belief that lateral thinking skills (his term for the concept of divergent thinking skills) can be learned, practised, and used is such that he suggests specific curricular time should be set for teaching these skills, rather than "trying to gently introduce the principles in the course of teaching some other subject" (DeBono, 1970, p. 17). The CORT thinking program that has been developed by DeBono is gaining tremendous popularity and success in both education and business fields throughout the world. The impact of this innovative concept has given considerable credence to the thesis that "creativity is not a special gift which some people have and others never acquire" (DeBono, 1985). Rather, creativity is treated within the CORT program as a part of thinking processes that can be learned, practised, and applied deliberately.

Motor Creativity

As with the theories of divergent thinking, the learning program deals largely with verbal communication; few researchers have elaborated theories of divergent thinking in the realm of movement. In motor creativity studies the

focus has been usually on the product or the teaching methodology rather than on the operative divergent thinking processes. Modest attempts have been made to develop tests of motor creativity, largely in recognition of the need to assess the effectiveness of programs such as movement education and educational dance.

Wyrick (1968), defining motor creativity as "the ability to produce both varied and unique motor responses to a stimulus" (Wyrick, 1968, p. 756), used the written tests of Guilford and Torrance as guidelines and applied the components of divergent thinking to the psychomotor domain in her tests of motor creativity. Wyrick tested for motor fluency, which was simply scored by counting the number of responses generated, and for motor originality which was based on the frequency of occurrence of responses within a sample. Interestingly Wyrick selected items for this test which she felt were objective and "free of the connotations of dance" (Wyrick, 1968, p. 757), employing, for example, activities using balls, hoops and balance beam. Non-dance activities were selected in Wyrick's test in order to overcome difficulties in objective evaluation of creative products; yet the selection was made to allow for both number and uniqueness of responses in problem solving motor tasks (Wyrick, 1968).

Later studies (Baas, 1973; Philipp, 1969) used Wyrick's motor creativity test together with Torrance Tests of Creative Thinking (TTCT) to examine a relationship between divergent thinking verbally and motor creativity in fourth grade boys and girls (Philipp, 1969) and in university women (Baas, 1969). In both these studies a lack of relationship between verbal and motor creativity was, in part, attributed to the objective nature or lack of expressive potential within the selected battery of motor skills in Wyrick's test.

A development came with Dodds' (1978) proposed model for analyzing creativity in movement by clarifying Guilford's four factors of divergent thinking in movement terms and positing Laban's (1948) descriptive analysis of movement as a tool to identify the movement responses. This model appears to be more useful in examining movement responses in a dance context and has been used by several recent researchers (Gingras, 1985; Jackson, 1982; O'Neil, 1982; Roseman, 1984;) whose concern is more directly with dance movement.

Dancing involves phrases or sequential patterns of movement rather than single actions (Poole, 1979). Laban's descriptive analysis of movement allows for the continuous flow of movement to be viewed and described in terms of the

use of the body (the instrument of movement), where the movement occurs (space), how the movement is performed (time or dynamics, size, weight or force, and flow), and in what relationship to others or to the environment the movement occurs. All these movement elements are observable and trained evaluators can score movement sequences for fluency, flexibility, originality, and elaboration on Guilford's divergent thinking model.

There appears to be a very limited amount of literature which deals with the mental operations in creative movement production. Gomez and Carriere (1979) give some insight in their presentation of an information-processing view of movement production in dance. A link is drawn with schema learning by their suggestion that there are mental plans governing a motor act which are operative motor schemes, and that the learning of a dance technique involves accessing these motor schemes for the necessary movement vocabulary. The operative motor schemes are largely established by the identification of appropriate sources of kinesthetic feedback rather than only the external form of the movement. "Relating kinesthetic forms to intention helps identify retrieval cues to construct and recall how and why movements were executed" (Gomez & Carriere, 1979, p. 228).

The development of kinesthetic awareness is fundamental to the clarity of movement in dance and the question of how some individuals appear to have a better kinesthetic sense than others remains largely unanswered. Reeve and Mainor (1983) shed some light on the mental operations that function in performance demanding kinesthetic spatial information. In support of the notion that certain movement parameters are integrated and stored in memory, they investigated the encoding characteristics of spatial information to determine whether visual or kinesthetic systems are at work. In a series of experiments the researchers examined endpoint location, movement direction, and length to determine the influence of movement context on the encoding of kinesthetic spatial information. Their findings suggested evidence that kinesthetic information is used in the replication of certain movements that are devoid of visual feedback and that errors will occur in recoding kinesthetic information due to visual information at recall (Reeve, Mainor, 1983). This gives some support to the notion that specific sensory information is not necessary for accurate reproduction of movements which have been encoded in memory kinesthetically. Thus the accurate replication of the dancers' movements are a function of a strong kinesthetic schema, and a good 'kinesthetic sense' is developed from repeated practice of movement without reliance upon visual feedback.

An examination of some motor learning literature follows in an attempt to find some viable theoretical link between divergent thinking processes and psychomotor behaviour.

Motor Learning and Schmidt's Schema Theory

Motor Learning and Control is an area of study emerging from the separate but parallel fields of Motor Behaviour and Neurophysiology, in an attempt to give understanding of how movements are learned. Motor learning and control focuses on the acquisition of skilled movement as a result of practice and the neural physical and behavioural aspects of movement. Since the early seventies there have been changes in this field of study with a shift from the strict stimulus-response orientation towards a cognitive information-processing approach. This was influenced by cognitive psychology and saw a transition from a focus on the performance of movement tasks to a focus on the underlying mental or neural events that support or produce movements (Schmidt, 1982).

Understanding how movement information is coded and stored, how actions are represented in memory, and how information is processed about errors so that learning occurs are integral parts of the cognitive aspect of motor learning and control (Schmidt, 1982). The role of errors and error correction is fundamental in motor learning (Adams, 1976).

Two processes are theorized: one is a closed-loop mechanism which involves the processing of feedback against a reference of correctness, the other is an open-loop system which involves no such feedback analysis and error regulation. The open-loop system suggests that each action in a sequence is triggered by the response-produced feedback from the immediately previous action (Adams, 1976). Closed-loop mechanism appears to give an explanation of the learning of slow movements whereas open-loop seems better able to explain rapid movements -- actions in which there is not sufficient time for a reference of correctness to be made (Schmidt, 1982).

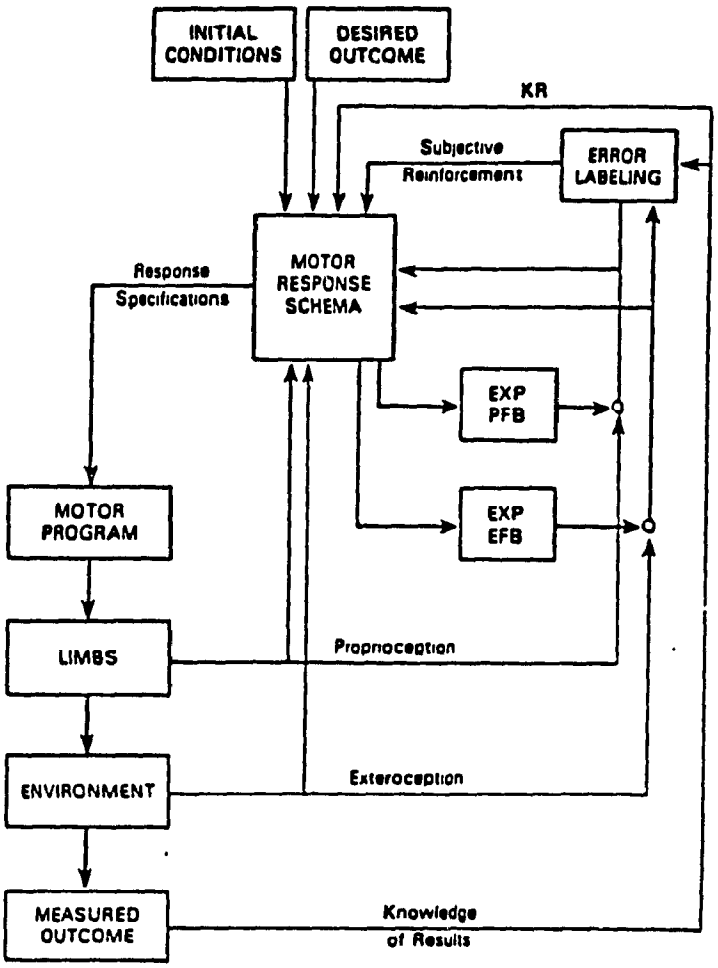
Schmidt formulated his Schema Theory of Motor Learning in 1975 in an attempt to explain both rapid and slow movement. It is a hybrid theory, borrowing heavily from closed-loop theory posited by Adams in 1971, yet with a strong open-loop dependency. Adams' (1971) closed-loop theory does not deal with either the novelty problem or the storage problem "because it assumes that for every movement there is a reference of correctness against which response-produced feedback is compared during the response" (Schmidt, 1976, p.45). Half a century ago Bartlett (1932) first popularized the notion of schema by suggesting that the general characteristics about movement must be organized to meet specific environmental demands as well as the goal of the

performer (Marteniuk, 1976). Bartlett also discussed the issue of novelty, suggesting that movements are rarely absolutely new as they depend on past learning but are never exactly a repetition of something old, as any particular movement will be slightly different from all previous ones (Schmidt, 1982).

These ideas remained dormant and undeveloped for several decades, but it was this kind of thinking that led to the notion that the motor program should be considered as generalized. The idea that "a motor program for a particular kind of action is stored in memory and that a unique pattern of activity will result if the program is executed" (Schmidt, 1982, p. 303) is central to Schmidt's schema theory which evolved in 1975. In order to activate the program, certain parameters must be supplied which define exactly how the motor program is to be executed on that particular occasion. Schmidt postulates two states of memory involved: recall memory which is responsible for the production of movement, and recognition memory which is responsible for response evaluation. Thus the theory assumes the presence of the schemata as different states of memory, developed from four different sources of information: "... the recall schema being the relationship among response specifications, actual outcomes and initial conditions and the recognition schema being the relationship

among sensory consequences, actual outcomes, and initial conditions" (Schmidt, 1976, p. 47). The entire system can perhaps be visualized more clearly by means of the flow diagram in Figure 1.

Figure 1



Flow diagram (Figure 1): showing critical elements in a movement performance from the point of view of schema theory (EXPPFB = expected proprioceptive feedback, EXPEFB = expected exteroceptive feedback). (from Schmidt, 1982, p. 598).

Thus after practising a series of movements of similar type an individual is able to form recall and recognition schemata by abstracting information about the initial conditions, response specifications, sensory consequences and the actual outcome of the response which facilitates performance on subsequent transfer to a novel task of the same type (Newell & Shapiro, 1976).

There have been many studies designed to examine these two schemata (Kelso, 1978; McCracken & Stelmach , 1977; Newell & Chew, 1974; Wallace and McGhee,1979; Williams, 1978), and evidence for the recognition schema is quite strong, though support for the recall schema is somewhat lacking. However all conclude that the variability of practice results in greater success in novel movement production, thus supporting one of schema theory's key predictions.

Skills learning is an ongoing process which is probably not ever completed, and there is strong evidence to suggest that the strongest contribution to schema formation occurs in childhood (Kerr & Booth, 1978; Moxley, 1979; Schmidt, 1975; Schmidt, 1982). An individual more actively extracts parameters of speed, force and spatial relationships for the schema during the initial phases of learning movement, and this occurs more frequently in childhood when more new movement experiences are encountered. Adults tend to have

established fixed rules from previous experiences and tend to have a rigidity of thinking about movement (Gerson & Thomas, 1977). More active schema strengthening may occur when adults face new movement learning experiences, for example, when learning to ski or to type.

Schmidt (1982) suggests that learners pass through various phases when acquiring a skill, a cognitive phase in which concern is on discovering what to do, an associative phase in which the concern is with perfecting the movement patterns, and an autonomous phase in which attentional requirements of the response appear to be reduced or even eliminated as the performer becomes "automatic" in making his/her responses. These phases parallel the three processing stages posited by Powell, Katzko & Royce (1978) in their Multifactor Systems Theory in which stage one is the stage of task evaluation and task decomposition; stage two is that of establishing the global relations among the specific components and comparing the performance requirements of the task with the performance capabilities of the individual; and stage three is a sequence of motor commands concerned with the selection and channelling of output messages. It is suggested that the extraction of information for the schema formation occurs largely in stages one and two and that stage three is a function of the schema so formed (Powell, Katzko & Royce, 1978).

Sensory involvement in influencing movement learning is suggested in Multifactor Systems Theory (Powell, Katzko & Royce, 1978) and further elaborated in studies of individual differences in motor learning (Kearsley & Royce, 1977; Powell, Katzko & Royce, 1978; Royce, 1973). This literature gives important detail about the processing of certain parameters that would be used in forming the schema. Sensory modalities of audition, vision and kinesthetics (Kearsley & Royce, 1977) are perhaps the most central to the present study as they are involved in spatial and temporal processing of movement to a rhythmic stimulus. Tapping fingers to music is one of the tests designed for the present study, and the following diagram (Figure 2) illustrates the sequence of sensory processing involved; it shows an interaction between the auditory and kinesthetic modalities.

Figure 2

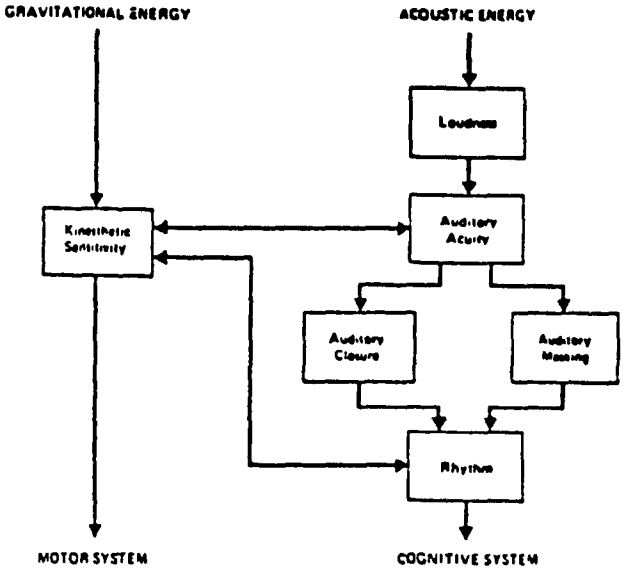


Figure 2: The functional sequence of sensory processing involved in the task of tapping fingers to music (from Kearsley & Royce, 1977, p. 1312)

This illustrates that "... the kinesthetic sensitivity dimension (accommodating finger tapping) interacts with the auditory acuity dimension (reflecting the relationship between sensation of finger position and the presence of an auditory pattern) and the rhythm dimension (indicating the relationship between finger movements and the temporal pattern of auditory sensation)" (Kearsley & Royce, 1977, p. 1312). This finger tapping pattern will be discussed in a later chapter as it is the basis for the design of one test of Schmidt's Schema Theory used in this study.

It is the connections drawn between cognitive and motor processes in movement production that encouraged this researcher to examine the areas of divergent thinking in a movement context. The similarities between Schmidt's Schema Theory and theories of divergent thinking seemed to lend support to both movement education and creative or expressive movement programs. In the next chapter the intervention program to be used in this study will be defined and discussed.

CHAPTER III : THE INTERVENTION PROGRAM

The aim of the present study is to examine divergent thinking in relationship to movement. Review of the literature on divergent thinking, creative learning and schema motor learning reveals consensus that problem solving methodology is the most likely to prove successful in producing the desired outcomes (Locke, 1969; Rink, 1985; Stones, 1966; Torrance, 1962). Therefore in this study the subjects will be physical education students enrolled in a course of rhythmic activities, with problem solving teaching methodology as the intervention. In this chapter a theoretical basis for this selection will be presented.

Problem Solving Methodology

To gain an understanding of problem solving as a learning process, it is necessary to explore literature in the areas of Cognitive Psychology and Curriculum and Methodology. An examination of this literature does not reveal a rigorous definition of what is meant by Problem Solving, but there is consensus on one criterion: "Problem solving is high on the dimension of discovery of -- as opposed to being told or shown -- the correct response. This distinguishes problem solving from conditioning and rote-learning where there is a minimum of response discovery" (Schulz, 1965, p. 625). The terms 'discovery', 'inquiry' and 'exploration' are frequently used in a problem solving context and there is

general agreement that the process of problem solving is explained as dissonance to inquiry to discovery (Mosston, 1981). The challenge for the teacher is to clarify this process for the learners, and to guide them through it to meaningful results. In so doing the teacher becomes the learning consultant for the students, helping them to develop a pattern of procedures which allows them to manipulate content and direct themselves toward a desired learning goal or objective (Bibens, 1980).

The teacher must present the problem or task such that the students can identify the dissonance and clearly understand exactly what they are trying to discover (Kagan, 1971, p. 102). DeBono (1970) suggests that problems may be open ended (that is, there may be many possible solutions) or closed (in which there is a definite answer), but there must always be a clear desired outcome. Without clarity of desired outcome, problem solving can fall into a vague and much criticized process of trial and error (Torrance, 1970). In movement, a lack of clear definition of the problem's parameters or performance objectives may result in mediocre, rather than quality performance (Jewett & Bain, 1985).

The challenge for the teacher is first to present the problem clearly and then to guide the students in the inquiry process. It is assumed that successful inquiry

process (described in the literature both as exploration and invention) will result, for the learner, in the identification of the elements or concepts within the problem (Bibens, 1980). Several authors identify this as the information processing phase of problem solving. It involves the retrieval of information from memory (exploration) and often a reorganization of that information (invention) for the present needs (Bibens, 1980; Guilford, 1968; Kagan, 1971; Newell, Simon and Shaw, 1965). This process implies that there first must be a good stock of relevant information in memory and that the teacher must teach for multiple applications of basic concepts (Kagan, 1971). The teacher must encourage the learners in the inquiry process to explore all possibilities and help them break through rigid associations that may be obstacles to the generation of new ideas (Kagan, 1971). Great sensitivity is needed on the part of the teacher to the readiness and experiences of the group and individuals, within the group, in order for this learning process to be successful (Mosston, 1981).

Inquiry strongly suggests that the learner becomes his own teacher (Bibens, 1980). Initially there is often a state of uncertainty for some individuals in this process, and the teacher must be aware that the fear of making a mistake may cause some to withdraw from the task, or to be inhibited

about offering a response. These fears can be reduced by an encouraging teacher (Kagan, 1971). "Steering and guiding student's thinking so that he achieves the respect of others may be one of the greatest contributions a teacher can make to a student's individual development of confidence and motivation" (Bibens, 1980, p. 90).

The discovery phase of the problem solving process is concerned with the result or the outcome of the inquiry phase. The teacher is challenged to help the learners evaluate their results. The students must match the criteria of the problem with the outcome and make decisions on the appropriateness and value of the results. For some individuals whom Kagan (1971) calls 'reflective', this is an ongoing process; "they mentally analyze their ideas and censor many possible solutions before they report or act upon them" (Kagan, 1971, p. 126). Others, whom he calls 'impulsive', accept their first idea with minimal consideration of its appropriateness or quality (Kagan, 1971, p. 126). The teacher must adopt tactics of diplomacy and sincerity during the evaluation phase that will encourage a balance of reflective and impulsive attitudes and behaviours in the students. The level and extent of critical evaluation that can be given by the teacher or demanded of the learners, depends upon the age and experience of the learners and the academic environment (Bibens, 1980).

Physical Education Students

There appear to be few studies on creativity or problem solving learning using university level populations, and even fewer using physical education students. The subjects in the present study will be first year physical education students registered in a rhythmic activities course (434-202B) at McGill University. These students will be in their first or second semester at university, are both men and women, and this will be their first course in dance or rhythmics in the physical education program.

Physical education students generally come from a sports background, often with a strong concentration in only one sport. They are products of school physical education programs in which the dominant value orientation has been skill mastery. There are few school curricula oriented primarily toward self-actualization, learning process, or ecological validity.

Although many school physical educators, facing recent challenges of accountability, have attempted to implement more individualized or humanistic curricula, there is still a tendency for the subject matter to be the main focus of the program (Jewett and Bain, 1985). The subject matter has tended to have an emphasis on competitive team sports. Descriptive data (Hodge, Boucher & Lepore, 1984) indicate

that a very small percentage (approximately 10%) of physical education students (at McGill University) have any extensive background experience in dance, music, creative movement or a problem solving approach to learning.

Further data (Hodge, Dumont, 1984) indicate that anxiety, caused by fear of making a mistake and fear of social criticism, was a predominant state of mind of physical education students when initially exposed to a problem-solving learning environment. These findings support the literature which suggests that creative learning is best started at an early age. As we grow older learned conformity in thinking becomes evident. Rules about a phenomenon become practised and fixed, and this tends to force rejection of insightful solutions which are a major factor in creativity (Kagan, 1971; Torrance, 1970). Descriptive data (Hodge & Dumont, 1984), collected from physical education students after exposure to a learning experience of a problem solving nature, indicate that positive attitudes develop largely because of the non-threatening, non-competitive environment within the class. Fear of failure appeared to dissipate and willingness to take chances in trying new or unusual ideas occurred mainly because of the teachers' positive attitude and encouragement.

Over the years, professional preparation programs in physical education, such as the Bachelor of Education in Physical Education at McGill University, have been modified to reflect more closely the content and intent of the Provincial school curriculum guides. The Quebec School Curriculum Guide for physical education (1984) presents a humanistic concept of physical education within which the child needs to be

> "provided with situations that allow him to be active, to make mistakes without having to worry about them, and to experiment with different situations in various ways" (Ministère de l'Education, 1984, p. 9)

Teacher education programs have been modified to reflect these principles as well as to encourage instructional innovation in future physical educators. Emphasis has been shifted from the traditional competitive sports oriented content and rigid authoritarian teaching style to a broader program content which includes creative movement and dance courses, with an accompanying spectrum of teaching methodology encompassing problem solving and discovery approaches.

Students currently entering the program (at McGill) are still largely products of traditional school programs, having had little experience of this kind of creative content or methodology. It seems appropriate to discover

whether exposure in their professional preparation program is in any degree effective in causing change in their thinking. The present study is made in an attempt to find if there are any changes in divergent thinking skills in physical education students as a result of taking a rhythmic activities course. Specifically, it aims to test the following hypotheses:

1. That subjects exposed to a problem solving approach in rhythmic activities will show greater improvement in divergent thinking on Torrance Test of Creative Thinking (TTCT) than those who were not

2. That subjects exposed to a problem solving approach in rhythmic activities will show greater ability to respond to a novel movement task than those who have not and

3. That subjects who score highly on TTCT will also score highly on a novel movement task.

The Intervention Program

The rhythmic activities course is designed to introduce students to basic music concepts and rhythm in movement and dance so that they gain some understanding of the value of rhythmic activities in the school physical education curriculum (see Appendix A for the course outline). A very simplistic structure of musical notation is introduced, such that students with limited or no musical theory background

can understand and identify whole, half, quarter, and eighth notes and different musical time signatures. This is illustrated in Figure 3.

Figure 3

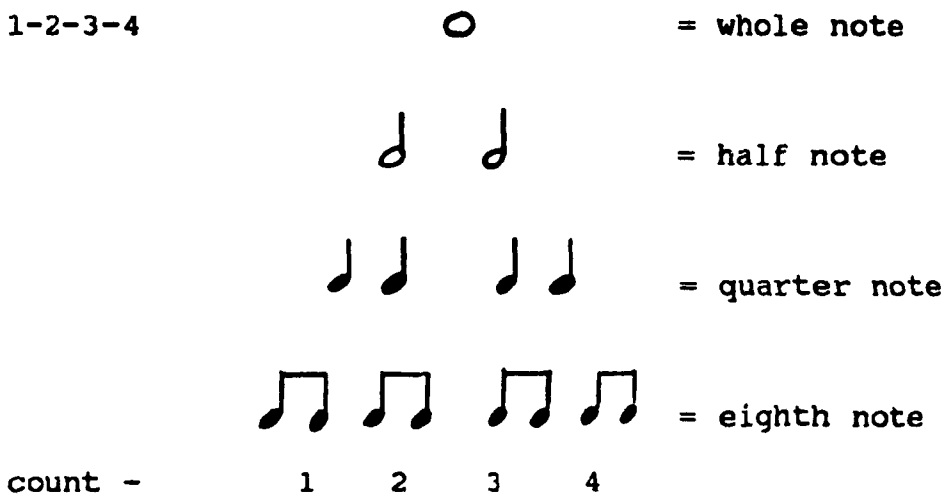


Figure 3: Music Notation

Simple movement activities, such as stepping, stamping, clapping and gesturing, are presented to illustrate the rhythmic patterns that can be developed from this basic structure. A variety of familiar, yet unusual movement sources is used to encourage multiple connections to be seen between movement and rhythm. For example, simple patterns of steps, claps and/or gestures are developed using whole, half, quarter and eighth note values as the stimulus for the timing and amplitude of the movements. Then a novel movement source is suggested, such as a tennis game, a

traffic scene or bathtime ritual, and the students are given, or challenged to find, appropriate actions from within the new scenario. They must select and perform the new actions with a conscious awareness of note value, rhythm and movement-amplitude.

The movement patterns and phrases that are developed will illustrate the relationship between the music note value and movement size and speed. The students are encouraged to search all dimensions of the scenario to select their actions. For example, if a tennis game is the movement source they would include the umpires, spectators, ballboys, action of the ball as well as the actual tennis strokes and game action in the search for action ideas. Hence the task might render something like a whole note, large action as a tennis serve; a half note value displayed as a ground stroke or a ballboy kneeling; a quarter note value might be seen in a volley-like action or the umpire head turning; and the eighth notes might be illustrated in shuffle "ready" steps or preparatory stylistic bouncing of the ball prior to service, or a ballboy's sprint to collect a ball.

This work is usually done in small groups. Decisions are made for the final composition such as whether all the group will perform the phrases in unison or canon, or whether the performance will be a simulation sequence or whether the

actions will be orchestrated simultaneously. Always the underlying (quarter beat) pulse must be maintained. Students may choose to do this vocally or by using an action sound, or in some compositions a percussion instrument or prop might be used.

Progressions demanding more diverse thought connections are made by selecting less familiar and more abstract stimuli for movement such as clocks, visual art, cityscape, nature or words. In addition, more complex rhythmic patterns including syncopation, canon form and irregular timing and phrases are introduced thus heightening the students' awareness both of the different movement possibilities and of the extent of the musical or rhythmic potential.

The dance material used in the course is drawn from folk, social, jazz and popular novelty dance. Polka, waltz, cha cha, charleston, rock and roll and other styles are introduced with an emphasis on mastering the rhythmic coordination of steps and floor patterns demanded in each style. Once the basic steps are mastered and the rhythmic phrasing of the music is known, the students are given, or challenged to create, their own variations. For example by using different combinations of steps or designing new floor patterns or new partner or group relationships or adding new gestures within the musical structure of the original dance,

they can create their own dance. They are encouraged to maintain the style of the dance, and hence an implicit awareness of both musical and movement idiosyncracies of the dance is learned.

The first two or three classes of the course are taught in an imitative style with the teacher selecting, choreographing and modelling all the movements for the students to copy. This methodology is familiar to the students as it is used most frequently in the learning of games skills, and it is used here to establish a degree of comfort and confidence for the students in this less familiar movement area. For the same reason the work is designed initially for the whole class to move as individuals in unison; only when confidence and security builds does the teacher encourage or challenge the students to make decisions about the content and shift to partner or small group work.

For the present study the subjects will be divided alphabetically into experimental or control group. The researcher's objective is to manipulate the teaching methodology such that the experimental group is encouraged to learn through problem solving (inquiry/discovery) process, whereas the control group is taught only by imitation. The experimental group will be challenged

constantly throughout the course to select their own variations of the material, whereas the control group will work only on ideas selected and presented by the teacher. This is illustrated in the following example.

In a lesson using the 'Bird Dance' (a current popular novelty dance), both groups will be taught the standard version of the steps and gestures. The actions and musical phrases will be explained and rehearsed. The experimental group will then be challenged to experiment and find alternative movement patterns, drawn from their repertoire of movement, to fit the same musical phrases: thus designing their own new dance to the original music. The control group will be given a second variation of the dance comprising actions selected and presented by the teacher. This example illustrates that the control group experiences the variation of movement possible to one piece of music, without the experience of exploring and selecting their own solutions in the inquiry process. Other examples of manipulations that are made in the teaching process to ensure problem solving only for the experimental group can be found in lesson plans which are included in Appendix B.

The verbal behaviour employed by the teacher will be a distinguishing difference between the two groups. A conscious effort will be made to encourage divergent

production in the experimental group. This will be demonstrated by the language used in the design and presentation of the problems for example:

> "Using the same four phrases of music, let's see if you and your partner can change the steps to include at least two turns, one change of level."

As work is in progress the teacher will give encouraging, corrective and prescriptive feedback, for example, statements such as:

> "Make sure that your phrases are accurate; select steps that allow you to lead in and out of your turns easily; your change of level may be quick or slow, but be sure it is smooth and clearly shows the music phrase intended."

As the work takes shape frequent reinforcing and accepting verbal behaviours will be used for example:

> "You two have an interesting design - I like your choice of turns" or "Those jumps really make that phrase of music clear, well done - now work on a definite finish" or "I like your changes in relationship they really emphasize the musical phrases well."

Most of these comments and feedback are made to individuals but usually publicly, since this then serves the dual purpose of helping the specific individuals yet also giving further ideas for others in the environment.

The objectives for using a problem solving methodology (adapted from Mosston, 1981, p. 230) with the experimental group are:

1. to tap the cognitive capacities of the learners in discovering multiple solutions to given problems;

2. to develop insight into the musical-movement structure of rhythmic activities and discover potential possible variations within the structure;

3. to reach the level of affective security which 'permits' the learner to go beyond accepted or conventional responses;

4. to develop ability to verify and evaluate solutions produced.

All these objectives are sound and concur with the literature suggesting that they should lead to the enhancing of the students' divergent thinking skills.

In the following chapter the research design for this study will be described and explained.

CHAPTER IV: RESEARCH DESIGN

The purpose of the present study was to examine an interrelationship between divergent thinking skills and motor learning for novel movement production. While the literature in these areas has many common bases of reference, there is little evidence of any comparisons being drawn between them. A principal aim of this study was to test and compare divergent thinking skills and ability in novel movement production.

Subjects

This research was conducted among Physical Education undergraduate students enrolled in a rhythmic activities course at McGill University. The subjects who participated in the study were in their first or second semester at university and Rhythmic Activities was their first required course in dance or rhythm in the Physical Education Teacher Certification program. The subjects were randomly assigned, by alphabetical class grouping, either into experimental group, which comprised two classes, or the control group which was one class. The subjects were informed that they were participants in a research study and their cooperation in taking the pre- and post-tests was invited. They were informed that individual or group results from this research would be available to them upon request. Ten percent of the final grade of the course was designated for participation

in the research tests, on the basis that approximately ten percent of the total course time was devoted to the testing.

Instrumentation

The data used for analysis in this study were obtained from two different sources; one being tests of divergent thinking the other tests of Schmidt's Schema Motor Learning Theory.

Torrance Tests of Creative Thinking (TTCT)

The verbal forms of TTCT were selected to examine the divergent thinking of the subjects. The test comprises two booklets (Pre-Test Booklet A and Post-Test Booklet B) which examine divergent thinking through a variety of written test activities. The verbal tests are claimed to be appropriate for use in fourth grade through graduate school (Torrance, 1974). A copy of each test booklet is included in Appendices C and D.

Torrance makes a deliberate attempt to construct test activities that are models of the creative process. Each involves different kinds of thinking and makes use of what is known about the creative process, the qualities of creative products and creative personalities. "An attempt, however, is made to assess products that result from the administration of these test activities in terms of Guilford's divergent thinking factors (fluency, flexibility,

originality and elaboration)" (Torrance, 1966, p. 9). Fluency is defined as, and measured by, the number of different responses given for each question. It is simply the number of responses less any duplications or irrelevant responses.

Flexibility is determined by the variability of responses given. Different answers are grouped in 'General Flexibility Categories' and listed in the TTCT manual; a subject's flexibility score is obtained by the number of categories accumulated in their answers. An example is included in Appendix E.

Originality is judged by comparing the subjects' response with the TTCT scoring manuals' list of most statistically frequent responses. Responses which show creative strength, that is, "require intellectual energy beyond what is learned, practiced and habitual and result in responses that are away from the obvious and common place" (Torrance, 1974, p. 14), but do not appear on the list, are considered more original and are, consequently, scored higher on the originality scale. (An example from the scoring manual is included in Appendix E.)

Verbal Elaboration is measured by counting the number of additional details used to spell out or elaborate the answer

over and above what is necessary to communicate the basic idea or concept. Some difficulties have been experienced in obtaining inter-scorer reliability with elaboration scores (Torrance, 1974), and in the present study it was decided not to score the tests for elaboration.

The tests in the present study were scored by 'untrained scorers' with the use of the scoring manual. Since the mean Pearson product-moment coefficients between scoring of trained and untrained scorers for verbal tests are fluency .99, flexibility .98, originality .76 (Torrance, 1974), it was felt that untrained scorers could be selected with confidence. An analysis of data yielded from scoring experiments by Torrance and colleagues (1966) results in evidence of high inter- and intra-scorer reliability and high test re-test reliability of the tests.

Despite limitations in establishing any overall measure of validity, largely due to a lack of solid definition of creative behaviour, the TTCT are the most widely used and the most fully developed tests for measuring divergent thinking skills available at the present time.

Tests of Schmidt's Schema Theory of Motor Learning

The second source of data in the present study was tests designed by the researcher to measure novel movement

production in rhythmic activities.

Schmidt's schema theory of motor learning predicts that the more varied the practice of movements the more likely an individual will be able to respond successfully to a novel task (Schmidt, 1975). Most of the literature in this area, describes studies designed to test this prediction in a laboratory setting, using specific motor skills such as target shooting (Kerr & Booth, 1978; Moxley, 1979), or linear tracking tasks (Newell & Shapiro, 1976).

In the present study two tests directly relating to the work covered by the subjects within the rhythmic activities course were designed. For the purpose of clarity in designing these tests, "novelty" was defined in two ways, the first being novelty of the rhythmic stimulus and the second being novelty of movement response to a rhythmic stimulus. The reason for this was that rhythm and movement response to rhythm are introduced within the rhythmic activities course and therefore both were seen as independent measures of novel production.

Test one: Response to Novel Rhythm. In this test subjects were requested to listen to a new piece of music and to clap or tap back the rhythm of the time signature. The rationale for this being that subjects who have

practiced clapping back to a variety of music during the course, will, according to Schmidt's prediction, have greater success in responding to the novel music. Subjects were scored for accuracy of response. This test was designed and used previously (Hodge, Boucher & Lepore, 1984) in a pilot study on Rhythmic Aptitude of Physical Education Students.

Test Two: Novelty of Movement Response. In this test a novel rhythmic stimulus was presented and subjects were asked to respond with any movements that they liked. A video tape recording of a hand clenching and unclenching in a clear rhythmic pattern was used. This visual rhythmic stimulus was designed and used successfully, with similar population, in a pilot study (Hodge, Boucher & Lepore, 1984). Subjects were asked to move to this rhythmic stimulus in any way that they liked, with mild encouragement from the tester to think of interesting ways. Subjects were scored for rhythmic accuracy and for novelty of movement response. Novelty of the movement response was measured in a way similar to the TTCT originality scoring; the novelty score being a comparison between the response given and an inventory of all the responses, with a weighting given for each response according to frequency of occurrence.

Although no validity measures have been developed for this

test, confidence is strong in its reliability to indicate a subjects' ability to draw from previous variable practice experience in the rhythmic activities course and that it does evaluate performance in a novel situation. The scoring for rhythmic accuracy and originality are separated in order to limit possible discrepancy against subjects with poor rhythmic aptitude. In this way originality of movement response may be scored even when the response is rhythmically inaccurate.

Design

The subjects were designated by class group either to the experimental condition of problem solving learning or to the control condition of traditional imitative learning in their rhythmic activities course. The problem solving learning intervention was monitored in two ways: 1) random classes in both experimental and control conditions, were video taped and the tapes were viewed and assessed by an expert methods teacher at McGill University, 2) lesson plans were written and instructor's verbal behaviour planned with guidance from the same expert. The researcher served as the teacher for all subjects in the rhythmic activities course.

To test the hypothesis that subjects in the experimental group would show greater improvement on TTCT scores (as a result of the intervention program) than the control group,

a mixed model ANOVA consisting of two factors was used. The between subjects factor was groups (experimental vs control) and the within subject factor was time (pre-test vs post-test).

The second hypothesis was that subjects in the experimental group would score more highly than the control group subjects on the Schmidt tests of novel movement production. A t-test was used to compare results of both groups on the Schmidt tests.

The Pearson product-moment correlation procedure was used to test the third hypothesis, that there would be a positive relationship between TTCT post-test and Schmidt test scores.

Procedure

The test period for this research lasted for the duration of the rhythmic activities course, January through April, 1985. All the classes met for one hour, twice each week in the dance studio at McGill University. The pre-test (Booklet A) of TTCT was administered by the researcher to each group during the eighth class hour. This allowed time for the class populations to settle and for the teacher to develop a friendly rapport with the students. The course material up to this point was presented for all classes in an imitative style of teaching. All the test administration

instructions, specified in the booklet, were followed, with the exception that all the ten minute activities were reduced to eight minutes, due to class time restraints. The post-test (Booklet B) of TTCT was administered by the researcher in the final class hour of the course, with the same time adjustments made as in the Pre Test.

The Schmidt tests were administered by two trained assistants. These assistants were third year physical education students who had worked previously with the researcher on the design, execution and evaluation of pilot studies (Hodge, Boucher & Lepore, 1984). Both assistants worked with the researcher in rehearsing and refining the testing and scoring procedures for the present study by pilot runs with other subjects prior to the experimental period. The Schmidt tests were administered to the subjects individually during the final week of the course. Both tests were administered on the same occasion with subjects individually and randomly assigned the order in which the tests were taken.

Lesson Plan Log

A complete log of detailed lesson plans was maintained by the researcher primarily in compliance with literature on effective teaching (Dougherty and Bonanno, 1979; Logsdon, 1984; Rink, 1985; Siedentop, 1983). "The lesson plan is a

guide for the process of instruction for a single lesson and is based on unit objectives" (Rink, 1985, p. 149). It was felt by the researcher that since the unit objectives for the present study were critical, detailed lesson plans were essential. In order that the methodology of the intervention program remain consistent, clear preparation for the distinct progressions and teacher interaction that was to occur was necessary. This process was monitored by a methodology expert in the Department of Physical Education at McGill University.

Journal

An anecdotal journal was kept by the researcher throughout the course. This enabled the researcher to make informal notes after each class to indicate particular success or failure in the maintenance of the experimental set. Also indicated in the journal were the feelings and any emotional changes of the researcher, as well as any extraordinary group emotions that affected the teaching or class responses. Jourard (1968) has suggested that within the realm of psychological research, self-disclosure can provide important insights into one's own personal development. This researcher felt that by keeping a journal it was possible to trace whether the methodologies used for the experimental and control group were maintained.

In the following chapter the statistical treatment of the data will be presented and the results will be analyzed. The descriptive data and intervention program will be reviewed in order to more fully explain the results from the empirical data.

CHAPTER V: Results and Discussion

The statistical treatment of the data and results are presented in this chapter. The primary purpose of the study was to investigate the relationship between divergent thinking skills, as defined and measured by Torrance Tests of Creative Thinking (TTCT) and motor learning for novel movement production, as defined by Schmidt (1975) and measured by tests designed by this researcher. It was hypothesized that subjects exposed to an intervention treatment of problem solving teaching methodology would show greater improvement in divergent thinking skills than those who were not. This was measured by pre- and post-tests of TTCT on two groups, the experimental group which was exposed to the intervention and the control group which was not. A second hypothesis of this study was that subjects exposed to the problem solving intervention would perform more successfully on a test of novel movement production than those who were not. This was measured by tests designed by this researcher which are called Schmidt tests hereafter. A third hypothesis was that there would be a positive relationship between the TTCT (post-test) and the Schmidt tests with regards to performance of subjects.

The first section of this chapter will be devoted to the statistical analysis and interpretation of the data from the Torrance Tests of Creative Thinking and the Schmidt tests.

In the second section an interpretation of the relationship between TTCT and Schmidt will be discussed. Descriptive data, including journalistic evidence and analysis of video tapes and lesson plans, will be presented to clarify the treatment used as intervention. These will be discussed in the third section to more fully explain the results obtained from the empirical data.

Measures of Divergent Thinking

Verbal Forms A and B (Thinking Creatively with Words) of the Torrance Tests of Creative Thinking (TTCT), were used respectively as pre- and post-test measures with both the experimental and control groups. The tests are in the form of booklets comprising seven activities, each activity poses a question requiring a series of written answers. Each answer is scored, using a directions manual and scoring guide, for three kinds of creative thinking abilities (fluency, flexibility and originality). These scores can be combined to give a composite creative thinking score. The responses are scored to measure creative strength. Creative strength is defined by Torrance as requiring "intellectual energy beyond what is learned, practised and habitual and results in responses that are away from the obvious and common place" (Torrance, 1974, p. 14)

The subjects were assigned alphabetically to either the experimental or control group. It was therefore assumed that there would be no differences between the groups on scores measured by TTCT verbal form A (pre), before implementing the intervention program. The intervention program in this study was problem solving teaching methodology given over a three month period for two single hours per week in a course of rhythmic activities. This treatment was given only to the experimental group. The control group was taught for the same period in an imitative teaching style.

It was anticipated that the TTCT post-test scores for fluency, flexibility and originality would be higher for both experimental and control groups. However it was anticipated that this improvement would be greater for the experimental group (receiving the intervention treatment), than for the control group.

The means and standard deviations for both groups in pre- and post-tests for fluency, flexibility and originality are presented in Table 1.

Observation of Table 1 indicates that there were differences between the groups, particularly for fluency scores, before the intervention program was implemented. Both experimental

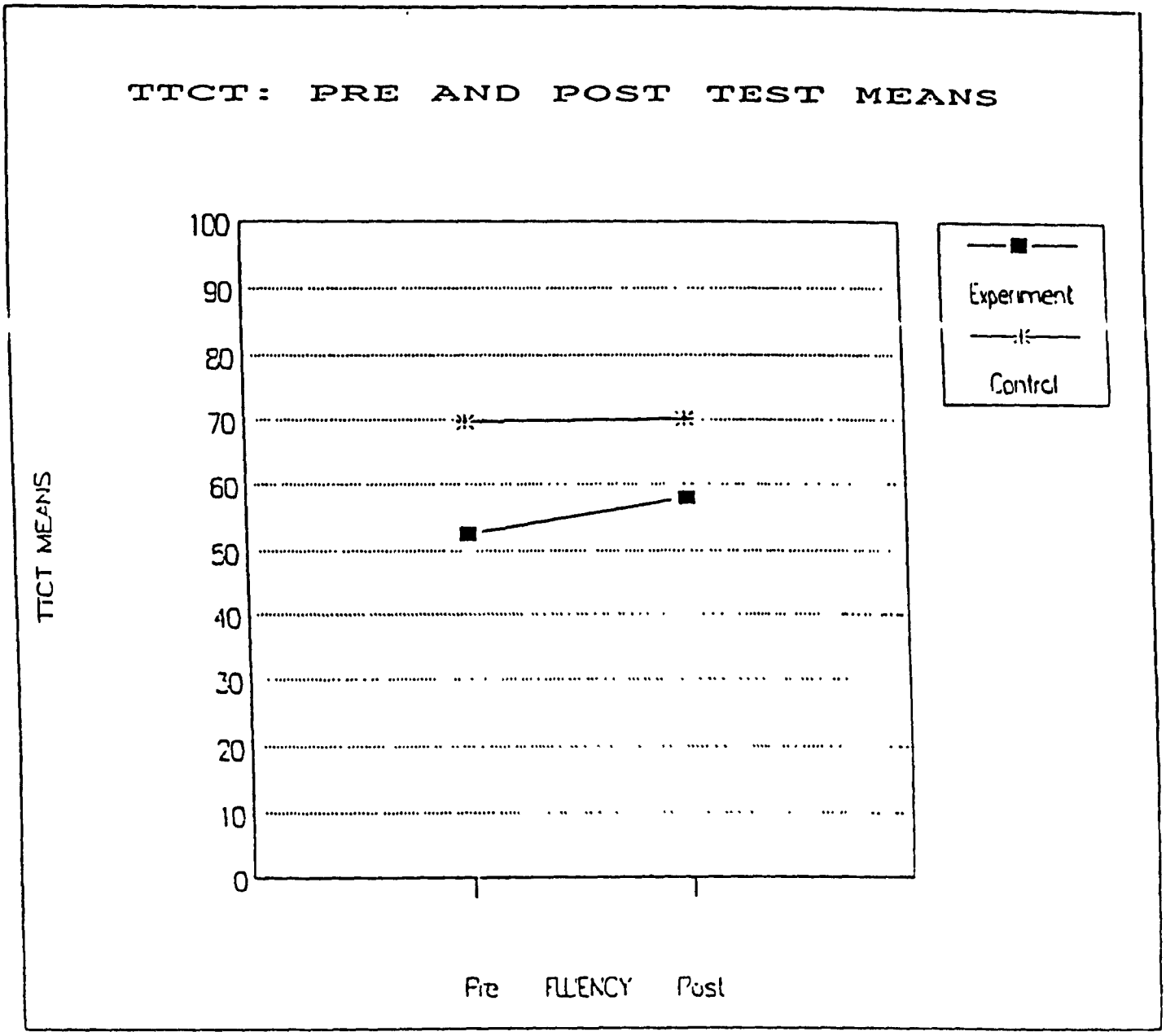
and control groups showed an increase in scores for all variables (fluency, flexibility and originality) between the pre- and post-tests. The control group had slightly higher scores for all three variables both in pre- and post-tests. It can also be noted that the greatest difference for both groups between pre- and post-scores was for originality. These data are displayed in Figures 4, 5, and 6.

TABLE 1

TORRANCE TESTS OF CREATIVE THINKING, PRE- AND POST-TEST MEANS

		FLUENCY		FLEXIBILITY		ORIGINALITY	
		PRE	POST	PRE	POST	PRE	POST
EXPER (n=22)	$\bar{x}$	52.5	58.0	28.2	31.8	34.4	51.4
	SD	(11.4)	(18.8)	(5.9)	(7.2)	(12.6)	(17.8)
CONTROL (n=13)	$\bar{x}$	69.7	70.1	32.4	33.6	34.8	52.0
	SD	(21.9)	(25.0)	(7.3)	(6.4)	(18.0)	(18.5)

It is curious, yet inexplicable, that there were differences between the groups prior to the intervention program. An examination of the subjects in each group sheds little light on this finding. The control group comprised seven males and six females aged 20-22 years ($\bar{x}$ = 20.7 years) with family names beginning with letters C to L. The experimental group had a slightly higher proportion of males to females (males = 15, females = 7) and a slightly wider age range (18-25 years, $\bar{x}$ = 20.4 years), with family names beginning with letters L through W. None of these observations, according to the literature, contravene the statistical randomness of the group composition.


TTCT: PRE AND POST TEST MEANS
TTCT MEANS
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Experiment
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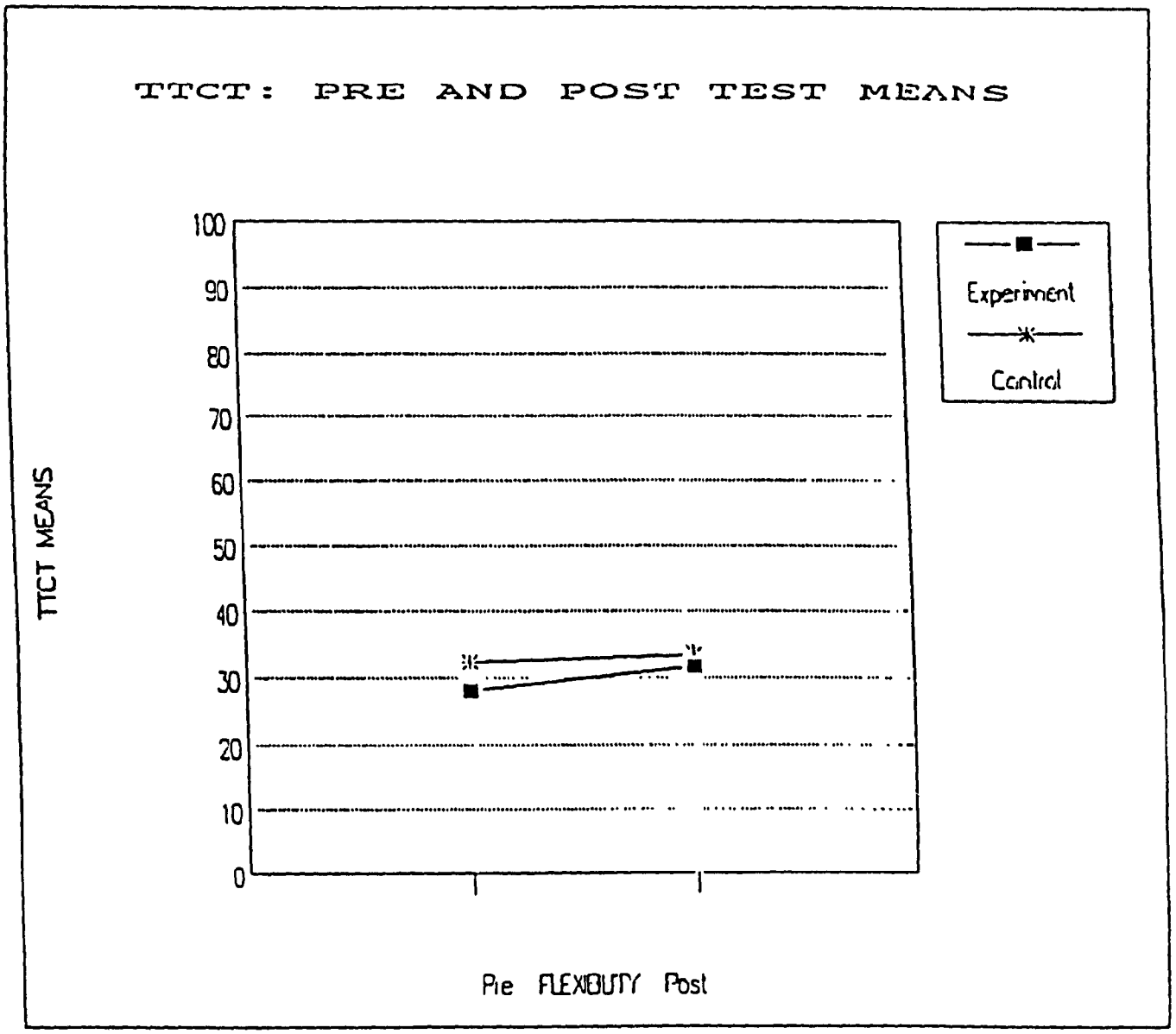
Pre
FLUENCY
Post

Figure 4


TTCT: PRE AND POST TEST MEANS
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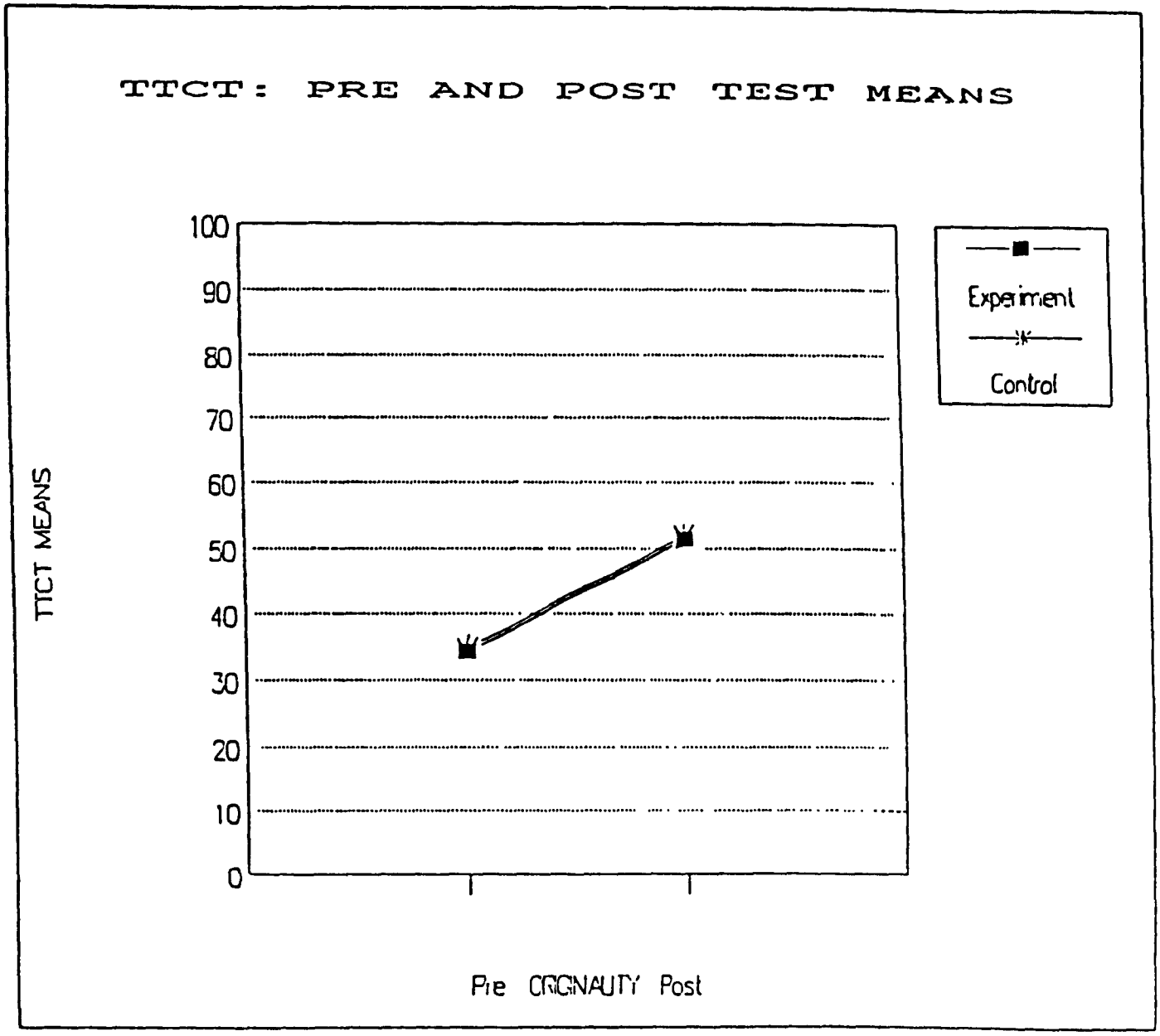
Experiment
Control
Pre FLEXIBILITY Post

Figure 5


TTCT: PRE AND POST TEST MEANS
TTCT MEANS
100
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Experiment
Control
Pre ORIGINALITY Post

Figure 6

TTCT ANOVA

To find out whether any differences between experimental and control groups or within groups over pre- and post-tests of TTCT were statistically significant, a mixed model analysis of variance procedure was used to analyze the three variables (fluency, flexibility and originality).

The first analysed was the variable fluency which measures the number of responses produced. A summary of the ANOVA results for the variable fluency is presented in Table 2.

TABLE 2

SUMMARY ANOVA OF TORRANCE TESTS OF CREATIVE THINKING FOR FLUENCY

SOURCE OF VARIABILITY	DF	MS	F	P
BETWEEN SUBJECTS GROUP	1	3500.2	5.7	.022
ERROR	33	611.5	-	-
WITHIN SUBJECTS PRE-POST	1	145.9	1.5	.227
PRE-POST*GROUP	1	110.8	1.2	.291
ERROR	33	96.1	-	-

Observation of this table shows that for the variable fluency there are differences found between the experimental and control groups when the scores are statistically collapsed over the time variable ($p = .02$).

The control group scores are higher than the experimental group (control $\bar{x}$=69.9, experimental $\bar{x}$=55.2). However, no differences were found in the time factor, ie. between pre-test and post-test performance; nor were there any interactions. This indicates that the experimental group did not display, as a result of the intervention program, any greater improvement than the control group.

The second variable analysed was flexibility. The score for flexibility represents the subject's ability to produce a variety of kinds of responses, showing shifts from one approach to another or the use of a variety of strategies in arriving at the response. It is assumed that a subject with low flexibility score will have a tendency to stick to a narrow range of responses. Such a performance might be a result of a rigid pattern of thinking or a narrow range of experiences (Torrance, 1966, p. 73). Since the intervention program was designed to encourage a non-rigid pattern of thinking and to provide a wide range of experiences, it was anticipated that there would be improvement on scores for flexibility in the experimental group after treatment.

A summary of the ANOVA for the variable flexibility is presented in Table 3.

TABLE 3

SUMMARY ANOVA OF TORRANCE TESTS OF CREATIVE THINKING FOR FLEXIBILITY

SOURCE OF VARIABILITY	df	MS	F	P
BETWEEN SUBJECTS GROUP	1	149.3	2.3	.14
ERROR	33	65.5	-	-
WITHIN SUBJECTS PRE-POST	1	95.0	3.9	.06
PRE-POST*GROUP	1	22.8	.9	.34
ERROR	33	24.2	-	-

Observation of this table shows that differences for the within subjects source of variance between pre- and post-tests were marginally significant ($p = .06$). Otherwise no differences were found to be statistically significant for any source of variance in the ANOVA.

The third variable analyzed was originality. The score for originality represents the subjects' ability to produce ideas that are away from the obvious or commonplace. Hence this will indicate a subjects' ability to draw upon intellectual energy and to be less conventional in his/her response (Torrance, 1966, p.73). It was anticipated that these skills would be encouraged by the problem solving methodology used in the intervention program.

A summary of the ANOVA for the variable originality is presented in Table 4.

TABLE 4

SUMMARY ANOVA OF TORRANCE TESTS OF CREATIVE THINKING FOR ORIGINALITY

SOURCE OF VARIABILITY	DF	MS	F	P
BETWEEN SUBJECTS GROUP	1	3.7	0.01	.925
ERROR	33	408.6	-	-
WITHIN SUBJECTS PRE-POST	1	4787.4	35.4	.0001
PRE-POST*GROUP	1	.22	.00	.968
ERROR	33	135.2	-	-

Observation of this table shows that the pre-post main effect at $p < .001$ was significant. This indicates that the increase in scores for all subjects between the pre-test and the post-test on TTCT for originality was significant. A greater difference was expected from the experimental group, rather than for all subjects. That there were differences in both groups indicates that all subjects were affected by the exposure to the rhythmic activities course. The stimulation of the originality factor appears to have been caused more as a result of the experiences with unfamiliar and new course content, than by the teaching process.

In summary the ANOVA treatment of the pre-test and post-test scores on the TTCT show no interaction for fluency, flexibility or originality. This indicates that any differences in scores in either group was not a function of the intervention program as suggested in the hypothesis. In other words, the subjects in the experimental group did not show greater improvement in divergent thinking skills than the subjects in the control group as a result of their exposure to the intervention program.

Schmidt Tests

The second battery of tests used in this study were tests of Schmidt's Schema Theory of motor learning. These tests were designed by this researcher and administered to all subjects after the intervention program. In the first test subjects were scored for accuracy of rhythmic response in a finger tapping to music activity. In the second test subjects were scored for movement response to a rhythmic visual stimulus.

The Schmidt test scores were combined to give one cumulative score (high scorers being those who accumulated high score on rhythmic accuracy test and on the movement response test).

A t-test was used to compare the experimental and control groups on the Schmidt test scores. The results of this analysis are presented in Table 5.

TABLE 5

t-TEST ON SCHMIDT TEST

GROUPS	SCHMIDT				TTCT-POST			
	$\bar{X}$	SD	T	P	$\bar{X}$	SD	T	P
EXPT	13.6	6.3	1.30	>.05	141.2	41.9	.95	>.05
CONTROL	10.9	4.6			155.7	46.2		

It was hypothesized that the subjects in the experimental group would score higher than those in the control group. However it can be seen from Table 5 that when the groups were compared on the Schmidt test the differences failed to reach statistical significance (t (33) = 1.30, p > .05).

It was also anticipated that subjects in the experimental group would score higher than those in the control group on the TTCT post-test. TTCT post-test scores for fluency, flexibility, and originality were combined as one post-test score for creative thinking. A t-test was used to compare the two groups on the TTCT post-test scores. From Table 5 it can be seen that on the TTCT post-test scores the differences were not statistically significant (t (33) = .95, p > .05).

Pearson Product-Moment Correlation

It was hypothesized that high scorers in the Schmidt tests would also be high scorers in the post-tests of Torrance Tests of Creative Thinking.

The relationship between scores on the TTCT post-tests and the Schmidt tests was measured by the Pearson product-moment correlation technique. This was used in order to test the hypothesis that there would be a positive relationship between scores on TTCT post-test and Schmidt test. A correlation coefficient reflects differences in the alignment of the scores of individuals on the two tests.

The Pearson product-moment coefficient for scores on TTCT post test and Schmidt test was low (r = .093) and non-significant ($t(33)$ = .54, p > .05). A correlation of r = .093 indicates less that one percent commonality between scores on the two distributions. This result suggests that different specific skills are being measured in each of the tests and that the relationship is insignificant.

Descriptive Data

Descriptive data, including journalistic evidence and an analysis of video tapes of lessons and lesson plans is presented to explain the intervention program and possible effects on the test results.

This researcher was the teacher for all subjects for the entire three month period of the intervention program. Since this researcher is an experienced teacher whose preferred methodology is the problem solving approach, it was important to monitor the classes closely in order to maintain the specificity of the different teaching styles used in this study. Video tapes were made of several classes with both the experimental and control groups. The tapes were reviewed and discussed by this researcher with Professor Jennifer Wall, an expert in teaching methodology at McGill University (see Appendix F). Particular attention was paid to an examination of the verbal behaviours used by the researcher in presenting the tasks to each class and the kind of feedback and encouragement statements used as subjects were working on the tasks.

It was noted that the classes for the experimental group were clearly and consistently of a problem solving nature, with text book verbal behaviours used to encourage the inquiry/discovery process. It was noted however, that this researcher had more difficulty in maintaining an imitative, non-problem solving methodology for the control group classes. Although the tasks were clearly presented in an imitative manner with specific limitations, there was seen, from the video tapes, a tendency for the teaching to encourage students to make a wider interpretation of their performance than pure imitative methodology would suggest.

Detailed lesson plans were kept by the researcher and reviewed by the same methodology expert, with particular attention paid to the selection and progression of tasks for each group. Examination of the lesson plans reveals a clear intention of the distinctly different methodology approaches for the two groups.

A journal was kept by the researcher which included anecdotal comments following each lesson. These notes reflected the teacher's perception of the strengths and weaknesses of the course material as well as the psychological set of both teacher and class.

In reviewing the journalistic evidence two points became clear that may have affected the impact of the intervention program. Firstly, the teacher indicated times of difficulty in maintaining the purity of imitative methodology for the control group, for example:

"Because of a lack of excitement in the students' response to this task, I gave some suggestions to stimulate variations. This they enjoyed."

Secondly, the teacher reflects a concern for developing a comfortable atmosphere for the students and encouraging a relaxed enjoyment in their learning. To achieve this there

are reports of informal interactions pre- and post-classes with subjects in the control group. It was also noted that there was considerable interaction between students from both groups outside the classroom. In some instances it was learned that students were demonstrating their performances from class in the locker room. Whereas this sharing indicates a rewarding enthusiasm for the activities, it does appear to encourage an uncontrolled expansion of thinking about the tasks and experiences for all subjects.

Much of the evidence from the descriptive data collected suggested that the intervention program was well maintained, but that perhaps the control group treatment of imitative methodology, against which it was measured, was not so well maintained. This may, in part, account for the results showing minimal differences attributable to the intervention.

In the next chapter some conclusions from these results will be drawn and some suggestions for further research will be presented.

CHAPTER VI: SUMMARY & CONCLUSIONS

The purpose of the present study was to examine divergent thinking and Schmidt's Schema Theory of motor learning in order to discover any commonalities or relationship between the two processes. It was hypothesized that there would be a positive relationship between skills of divergent thinking, as defined and measured by Torrance Tests of Creativity, and skills of novel movement production as defined by Schmidt and measured by tests designed by this researcher. The intervention program utilized in this study was problem solving teaching methodology in a physical education context. The literature from both divergent thinking and Schmidt's Schema Theory sources was equivocal in suggesting that this methodology best encouraged success in the production of desired outcomes (Locke, 1969; Rink, 1985; Stones, 1966; Torrance, 1962).

In order to explain an individual's ability to produce a novel or unique movement pattern, a link must be drawn between cognitive and physical processes. Schema Theory of motor learning suggests that novel movement production is possible because a vocabulary of movement patterns is stored in memory. An individual draws an appropriate response in a new situation from this repertoire. Guilford defines the ability to produce numerous alternative responses to a problem, instead of a predetermined solution, as divergent

thinking. In this study an attempt was made to draw parallels between theories of divergent thinking posited by Guilford (1950) and amplified by Torrance (1962) and Schmidt's (1975) Schema Theory of motor learning.

The statistical treatment of the data collected from the tests failed to reveal any significant evidence to support this researcher's hypotheses. Several questions are raised by this evidence, some of which are examined in this summary.

The Subjects

The subjects for this study were undergraduate physical education students in their first or second semester of a three year Bachelor of Education in Physical Education Teacher Certification program. The environment for the intervention was a rhythmic activities course required of all students in the B.Ed. Physical Education program. Evidence from a pilot questionnaire (Hodge, Boucher & Lepore, 1984) on a similar population suggested that this was an unfamiliar situation for most of the subjects since very few had previous experience of dance or creative movement courses. Problem solving methodology was also new to most of these subjects, since traditional physical education learning tends to be in a product-oriented imitative style. As was mentioned in a previous chapter,

this approach may initially give rise to frustration and fear of social criticism for some participants (Bibens, 1980, Hodge and Dumont, 1984). Therefore a gradual introduction of this methodology is recommended in order not to confuse or frighten students (Bibens, 1980, p. 89). Although caution with regard to these problems was taken by the teacher in this intervention program, the short period of the rhythmic activities course (three months of two single hours per week) perhaps did not allow for a sufficiently gradual familiarization with the problem solving approach.

Image and peer pressure appear to be very important factors for first year physical education students. Interaction and enjoyment with their peers often appears to be more important to this population than serious application to the task at hand. The teacher in this situation was well aware of the need to adopt strategies to encourage an ambient environment for the students to feel comfortable with each other and with the material. In this case the experience of the teacher perhaps caused her to overemphasize the problem solving approach to resolve these difficulties, even with the control group. It was seen from the journals kept by the teacher that there was a constant concern for "developing the student as a 'thinker' in his own right and not merely a mirror of what he thinks the teacher wants"

(Bibens, 1980). Bibens (1980) suggests this to be an overriding outcome of good inquiry process. If the development of divergent thinking skills and movement schema theory strengthening were not to be expected in the control group, then these inquiry conditions should not have been encouraged at all.

The following comments from the researcher's journal seem to give evidence that the teacher was not able to distance herself adequately from the problem solving approach.

> The students (control group) were not nearly as enthusiastic about this task as the other group who had made up their own variations. I felt perhaps my selection was not interesting enough and I talked about the value of allowing students to select their own ideas. They were interested in this concept and its impact on motivating High School students learning dance. We had to experiment.
>
> After the difficulties I had remembering the prepared action for the "Tornado" group I found myself explaining the advantages of students designing their own movement patterns and taking ownership of their choreography. This gave rise to a lively discussion of appropriate methodology for this kind of material.

Some of these comments reveal the subjects' interest in the teaching methodology of the course. That all the subjects were in a teacher education program may have caused this heightened awareness of the learning process that they were exposed to in this study. It does seem that a good problem solving intervention was established for the experimental group, but certainly for some of the classes with the

control group a less pure non-problem solving approach was apparent. This appears to have been more evident when the material was of a less structured nature. For example in lessons using words or ideas as the movement stimulus more difficulty was encountered in maintaining the imitative teaching style, than in lessons on folk or novelty dance.

It would appear that the extent of the problem solving that crept into the environment for the control group during the relatively short experimental period may have had a weakening effect on differences found between the groups.

In any future research where teaching methodology is the intervention program, it would probably be better to select two different teachers who are confident and competent in the specific methodology required for each environment. This would prevent the problems encountered in this study of one methodology effecting the other.

The Instrumentation

The tests selected to measure performance in this study were considered sound for the purposes intended. The Torrance Tests of Creative Thinking are the most widely used in research on divergent thinking for populations from kindergarten through graduate school. Statistical significance found only in group differences for fluency

after the intervention program is a reinforcement of this researcher's belief that the intervention program was insufficiently different from the control group treatment.

Although the Schmidt tests designed by the researcher had no empirical validity, it was considered that they did isolate the specific aspects of performance under scrutiny for this study. The first test, finger tapping to music, isolated the subjects' rhythmic aptitude, thus measuring the subjects' recall and recognition schemata for rhythmic response. This should have developed from the variable rhythms practiced during the rhythmic activities course. The second test involved a movement response to a novel rhythm source. This demanded that subjects draw upon schemata developed from the variety of practice with different rhythmic sources throughout the rhythmic activities course. Minimal group differences were found in these tests and it is possible that the tasks selected for the tests may have involved sufficiently simple responses, for which the adult subjects already had well developed schemata. Moxley (1979, p.65) suggests that "... experiments which provide different practice conditions on a task for which a schema already exists cannot reasonably expect to differentially develop the schema for this task."

Another weakness may have been the researcher's attempt to separate rhythmic accuracy and movement performance. This was done because pilot studies had shown that many students who had developed little rhythmic accuracy over the period of the three month course had produced a variety of movement responses. Part of the main focus of the rhythmic activities course was the adaptation of movement to rhythm, so it seemed prudent to this researcher to maintain the two concepts of novel production. This meant that subjects with a high score on finger tapping to music but a low score on movement response, scored overall the same as a subject with a low rhythmic accuracy score and a high movement response score. After scrutiny it appears that this blending of scores might have diluted the effects sought on a test of Schmidt's novelty production theory.

A schema is a broad abstraction of a movement. In tasks which contain only one potential portion of a schema, e.g. positioning, timing, force application, varying one of these portions in isolation may not necessarily produce variation sufficient for schema development (Moxley, 1979). It was assumed that the variability of practice of rhythms throughout the rhythmic activities course would result in more successful response to the tasks in the tests. But it appears that either the subjects already had fixed schemata for these tasks, or that the variability of practice was not

adequate to cause changes to occur, or the subjects were not sufficiently focused on the tasks.

There is some evidence in the literature to suggest that adults may not be the most responsive subjects in tests of schema theory (Moxley, 1979; Schmidt, 1982). "If adult subjects find the tasks boring they may not attend to the information in the task. Hence they may not behave differently in low- and high-variability conditions" (Moxley, 1979, p. 68). It is possible that the physical education students perceived the tasks used in the tests in this study to be less challenging than some of those experienced during the course. Regardless of the learning process that they had been exposed to, the subjects may have been unsure of how to respond sensibly, due to the simplicity of the test.

Powell, Katzko and Royce (1978) cite expressive movement, social interaction and non-verbal communication as illustrations of situations which require the integration of specific affective processes with motor programs. Most of the experiences in the rhythmic activities course were of this type and, as such, were novel to the physical education students. It is possible that the experimental period was not long enough and the subjects had insufficient time to become familiar enough with the situation to show improvement.

Conclusions

Both experimental and control groups showed an increase in scores for all TTCT variables (fluency, flexibility and originality) between the pre- and post-tests. The control groups had slightly higher scores for all three variables both in pre- and post-tests and the greatest difference for both groups between pre- and post-scores was for originality.

To find out whether any differences between experimental and control groups or within groups over pre- and post-tests of TTCT were statistically significant, a mixed model analysis of variance procedure was used to analyze the three variables (fluency, flexibility and originality).

No significant interaction was found for any of the variables. There was significant increase in scores for all subjects between pre- and post-tests. That this occurred for both groups, indicates that all subjects were affected by the exposure to the rhythmic activities course. This suggests that the improvement appears to have been caused more as a result of the experiences with unfamiliar and new course content, rather than by the teaching process.

In summary the ANOVA treatment of the pre-test and post-test scores on the TTCT indicates that any differences in scores

in either group did not reflect as a function of the intervention program as suggested in the hypothesis.

The relationship between scores on the TTCT post-tests and the Schmidt tests was shown by the Pearson product-moment correlation technique. This was used in order to test the hypothesis that there would be a positive relationship between scores on TTCT post-test and Schmidt test.

The Pearson product-moment coefficient for scores on TTCT post-test and Schmidt test of $r = .093$ indicates less than one percent commonality between scores on the two distributions. This result suggests that different specific skills are being measured in each of the tests and that the relationship is insignificant.

Much of the evidence from the descriptive data collected suggested that the intervention program was well maintained, but that perhaps the control group treatment of imitative methodology, against which it was measured, was not so well maintained. This may, in part, account for the results showing minimal differences attributable to the intervention.

Poole (1979) suggests that "Growing old, or even just growing up, could be said to be a gradual loss of

flexibility of both body and mind - and where movement is the medium, it may be too late, too soon." This suggestion supports the notion that abilities necessary for both divergent thinking and schema production need to be developed early in life (Schmidt, 1982). The present study provides some insight on difficulties experienced by an adult population when exposed to the challenge of thinking divergently, particularily in an unfamiliar environment. Therefore it would be interesting to discover if any different outcomes might result from similar work with a younger population.

The present study provides some support for a problem solving approach to learning in physical education. Although the tests showed no statistically significant relationship between processes of divergent thinking and movement schema development, descriptive data from the journals appear to suggest that changes did occur in the subjects' appreciation, enjoyment and understanding of rhythmic activities. Evidence from journals and video tape analysis suggests that subjects shared their experiences outside class time and showed enthusiastic response to problem solving tasks which gives credence to their level of motivation. These findings also support the contention that "physical education using problem solving may enhance movement awareness or the ability to interpret information

about movement. Such awareness may then facilitate skill learning based on a variety of practice" (Kerr & Booth, 1978).

Suggestions for Further Research

For any future search for information about divergent thinking skills and movement schema formation with an adult population, some suggestions are offered as a result of the present study.

Given that the period of problem solving intervention in the present study was found to be too short for much effect to be seen, it would be interesting to discover what the outcomes would be if this program were extended or intensified.

To show more clearly the impact of teaching methodology on divergent thinking skills and movement schema development, an attempt could be made to investigate the effects of having two different expert teachers for the experimental and control groups. This would avoid problems encountered in this study of one methodology creeping into the treatment of both groups.

It would be preferable for a future design of this study that the subjects in the two groups were not able to

interact with each other or to share experiences during the experimental period in order to avoid contagion. This way the subjects in the control group would not have the possibility of learning from the experimental group

Because both divergent thinking skills and movement schema are developed most thoroughly early in life, a study to examine any relationship in these areas might produce interestingly different results with a younger population.

For further study with adult subjects, an improved instrument could be designed to test novel movement production using more challenging tasks. The movement task in the current test was too simplistic, probably because it demanded minimal divergent thinking.

The attempt in this study to show a relationship between divergent thinking skills and movement schema development was not successful from an empirical perspective. However, the descriptive data suggests that the problem solving intervention program is of some benefit to University physical education students. Before any definitive statements can be made about the kind of methodology that should best be used in university physical education classes, further research in this area is needed.

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APPENDIX A

RHYTHMIC ACTIVITIES COURSE OUTLINE

DEPARTMENT OF PHYSICAL EDUCATION - McGILL UNIVERSITY

34-202B RHYTHMIC ACTIVITIES J. Hodge

COURSE OBJECTIVES

To give students the opportunity:

1. to recognize and understand the relationship between dance form and musical form;
2. to work with a variety of equipment and to use various stimuli in developing rhythmic activities;
3. to gain knowledge and skills in fundamental step patterns and formations required in folk and social dance;
4. to select appropriate rhythmic activities and teaching progressions for use with children at different age levels.

COURSE CONTENT

The majority of the sessions will be practical. Theoretical concepts will be covered in seminar discussions and lecture presentations.

Theory topics will include:
1) environmental and sports rhythms
2) hearing and feeling rhythm
3) music and rhythm
4) words and rhythm
5) children, learning, and rhythm
6) planning, rhythmic activities
7) planning demonstrations/presentations

Practical sessions will include:

1. a variety of rhythmic activities using equipment, words, voice and sounds, percussion instruments; music;
2. an introduction to basic step patterns and formations fundamental to folk and other forms of dance;
3. individual and group performances and presentations;
4. peer teaching.

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APPENDIX B

EXAMPLE LESSON PLANS

DEPARTMENT OF PHYSICAL EDUCATION - MCGILL UNIVERSITY
RHYTHMIC ACTIVITIES
434-202B

TITLE: Rhythmic Spelling!

APPROPRIATE AGE LEVEL: Grade 5 and up.

STIMULUS: R-H-Y-T-H-M (or any other word eg. school name)

RHYTHMIC OBJECTIVE(S):
1. Understanding and performing different note values.
2. Practice in keeping own rhythm with a constant pulse.
3. Concentration in rhythmic group work.

EQUIPMENT: Tambour to keep pulse.

ORGANIZATION: Groups of 6 - scattered Or 6 groups - arranged

HOW THE ACTIVITY WORKS:
1. Introduce the letter note values

eg. R = 𝅗𝅥 = half note =2 counts
H = ♩ = 1/4 note =1 count
Y = 𝅝 = whole note =4 counts
T = ♪ = eighth note =1/2 counts (one and)
H = ♩
M = 𝅝 (or 𝅗𝅥.)

2. Allocate a letter to each person or have the groups of 6 allocate one letter per person in their group.
3. Each person create a movement pattern appropriate for their letter and the associated note value [OR T-designate appropriate actions]. Practice movement with vocalizing accompaniment.
4. Learn-practice the "choreography":

4 bars	(16 counts) All do own letter action simultaneously.
1 bar	(4 counts) 'Pause' - all remain absolutely still.
4 bars	as follows: 4/4 𝅗𝅥 ♩ 𝄽 | 𝅝 ♫ ♫ ♩ 𝄽 | 𝅝 || R H 𝄽 | Y T T T T H 𝄽 | M ||
Everybody moving only on their letter (remaining still for the others)	
1 bar	Everyone in unison explosive action saying "Rhythm"

SKILLS TO EMPHASIZE:
1. Ensure that everyone knows the pulse and the rhythmic value of their own letter.
2. Help everyone clarify the action and that the selected movement is appropriate for their note value eg. the whole note actions take 4 beats - not one best action ⌣ 3 bets rest!.
3. T-give the pulse clearly - count the bars (adjust pace of pulse)
4. Repeat practice until absolutely accurate.
5. T- make adjustments in spacing of whole group to make an interesting choreography.

OBJECTIVE

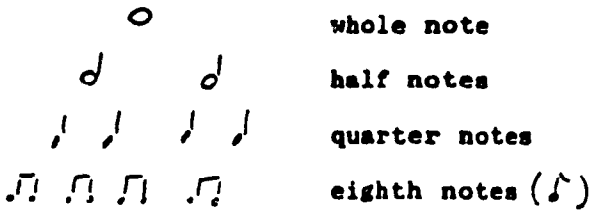
1. To understand simple note values in music.
2. To see potential relationships between movement and music.
3. To produce a short movement sequence in a small group using note value at stimulus.

PRE-REQUISITE

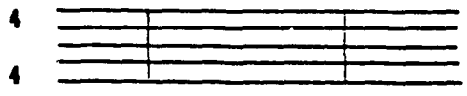
That students are given/have experienced a repertoire of possible body actions that could be used to define a rhythmic pattern, eg. claps, stamps, jumps, steps, gestures, turns and changes of level. That students understand the difference, for example between a quarter beat action and a whole note action.

How the activity works:

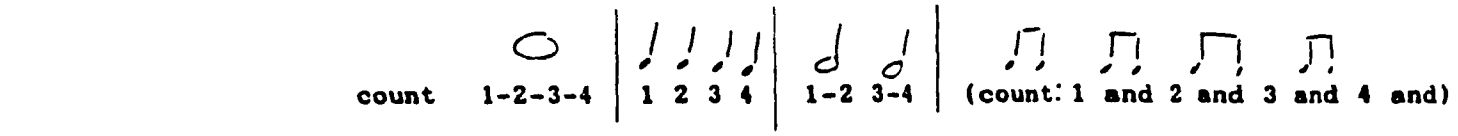
1. Introduce simple music note values:



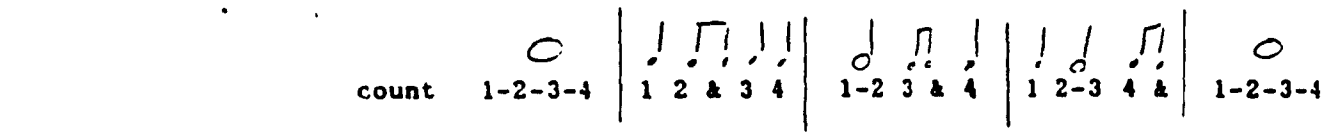
Time signature and stave and bars/measures



2. Explain that each bar under a 4/4 time signature must value 4 (4 x quarter notes). Practice clapping (or stamping, etc.) bars of like note values, eg.



Practice clapping mixed note bars, eg:



3. Select a mixed phrase of about 4 bars. Students in groups of 3-no-more-than-six. Develop a sequence of movements to define the rhythm.

Skills to emphasize as students work:

1. Be sure the actions selected are truly defining the note value, eg. = half note = 2 counts. i.e. needs an action that "lasts" 2 counts and is not a quarter beat = 1 count action plus a one count rest!
2. Encourage students to select a variety of actions in their pattern - to develop movement interest by including turns, rising and/or falling, travelling and stillness.
3. Once the students have planned their movement patterns encourage them to amplify their actions.
4. Have the students practice their performance and then share each groups' with the class. (N.B. each group must establish their own pulse [pace of their quarter beats] or T

Rhythmic Activities
434-202B

TITLE: Rhythmic Spelling! - [Control Group]

DESIGNATED ACTIONS:

R = Butterfly arms forward with body wave

H = Stride jump (with arms)

Y = With lunge to right, full frontal circle with both arms ending with both feet together arms extended wide above head

T = 1/4 beat jogging with arms horizontal bends at elbow, right/left

M = From lower couch position, symmetric rise and swoop forward to open curl

EXPLOSION = Stride jumps with clap overhead

Rhythmic Activities
434=202B

TITLE: Note values - [Control Group]

DESIGNATED ACTIONS FOR MIXED PHRASE

BAR #1 = Large frontal circle with arms extended and large chassé step to side

BAR #2 = Chug forward/clap left and right/chug forward, chug backward

BAR #3 = Medium level 1/2 turn to right/stamp left, stamp right/arms overhead

BAR #4 = Drop to right knee/arms circle down to floor/clap floor, drop onto front

BAR #5 = Slow sideways roll legs extended in air

Rhythmic Activities

Title: Rhythm and the Workplace **App. Age Level**

Stimulus: A variety of "Workplace" (or Environmental Setting or Daily Situations or Sports Activities) Situations

Rhythmic Objective(s): 1) To extract various actions from a specific workplace scene and to define them rhythmically within a group.

Equipment: OR 2) To use a basic rhythm format and find appropriate actions from the workplace to design/choreograph the workplace scenario.

Organization: Groups of 4 - 8 students.

How the Activity Works:

Depending on the experience and musical knowledge of the students:

EITHER:
- present the note formula
- give each group a specific workplace setting
- have them select an appropriate action for each note value
- have them choreograph their scenario

OR:
- give each group a specific workplace scenario
- challenge each group to select appropriate actions and define each action with a specific rhythmic pattern
- have them choreograph their scenario

Skills to Emphasize:

1. Ensure rhythmic accuracy both within selected actions and in the rhythmic cohesion of their choreography.
2. Encourage students to amplify their actions and to refer to their repertoire of potential actions to use.
3. Suggest variations of group relationships possible.
4. Encourage use of vocal or other sounds to help rhythmic accuracy.

DEPARTMENT OF PHYSICAL EDUCATION - MCGILL UNIVERSITY

434-202 RHYTHMIC ACTIVITIES J. HODGE

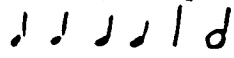
TITLE: PERCUSSION

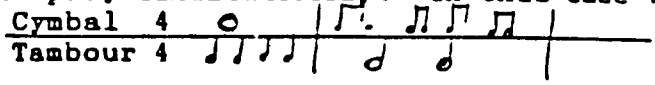
STIMULUS SOURCE: The different sounds that can be drawn from different percussion instruments.

TASK: IN SMALL GROUPS (3-NO-MORE-THAN-5)

a) EXPERIMENT with the sounds of different percussion instruments i) noting how many variations can be drawn from any one instrument; ii) description of the "type" of sound eg. ongoing, sustained, short, repetitive short, strong, light, gentle, explosive, etc. - WRITE THESE DOWN.

b) SELECT one or two instruments for your group (i.e. one that has many variations or two that have different qualities of sounds.) You may have one instrument per person if available or one or two for the group.

c) COMPOSE a rhythmic phrase with the instruments. (Decide on you time signature and your pulse - 1/4 note value!) WRITE your phrase eg. 4/4 

N.B. You may have "Orchestration" i.e. two rhythmic phrases that you wish to play simultaneously! In this case write them as such. e.g. 

d) PRACTICE playing your phrase. (Make your phrase as long as you wish - minimum 4 bars.)

e) CHOREOGRAPH a movement phrase to accompany your "music". (Remember your repertoire of actions, steps, gestures etc.)

SOME NOTES TO HELP:

You must be able to play and move. This may not necessarily mean EVERYONE plays ALL the time, but everyone must play at some time. (If you do not have an instrument each, you build in the exchange or change of instruments into your choreography.)

You may repeat your pattern. (In fact, it is probably a good idea to plan for a repetition). The repetition may have different movement patterns and/or different/changing quality of sound, but the rhythmic phrase remains the same.

Next session, these choreographies will be performed.

Also, prepare a percussion resource sheet to include: 1) list of instruments; 2) quality/ies of sounds; 3) possible movements.

Also, list possible homeade instruments giving the materials used and construction. (Bring one with you if you can!). Describe the sound(s) quality of these.

N.B.: Please take great care in handling our instruments - some of them are rather fragile!

APPENDIX C

TTCT VERBAL BOOKLET A

THINKING CREATIVELY WITH WORDS

By E. Paul Torrance

VERBAL BOOKLET A

NAME _____

AGE _____ SEX _____

SCHOOL _____

GRADE _____

CITY _____

DATE _____

STS®

SCHOLASTIC TESTING SERVICE

Activities 1-3: ASK-AND-GUESS

The first three activities will be based on the drawing below. These activities will give you a chance to see how good you are at asking questions to find out things that you don't know and in making guesses about possible causes and consequences of happenings. Look at the picture. What is happening? What can you tell for sure? What do you need to know to understand what is happening, what caused it to happen and what will be the result?

Activity 1. ASKING. On this page, write out all of the questions you can think of about the picture on the page opposite this one. Ask all of the questions you would need to ask to know for sure what is happening. Do not ask questions which can be answered just by looking at the drawing. You can continue to look back at the drawing as much as you want to.

1. _____
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22. _____
23. _____

GO ON TO NEXT PAGE

Activity 2. GUESSING CAUSES: In the spaces below, list as many *possible* causes as you can of the action shown in the picture on page 2. You may use things that might have happened just before the things that are happening in the picture, or something that happened a long time ago that made these things happen. Make as many guesses as you can. Don't be afraid to guess.

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22. _____
23. _____

GO ON TO NEXT PAGE

Activity 3. GUESSING CONSEQUENCES: In the spaces below, list as many possibilities as you can of what might happen as a result of what is taking place in the picture on page 2. You may use things that might happen right afterwards or things that might happen as a result long afterwards in the future. Make as many guesses as you can. Don't be afraid to guess.

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23. _____
24. _____
25. _____

Activity 4: PRODUCT IMPROVEMENT

In the middle of this page is a sketch of a stuffed toy elephant of the kind you can buy in most dime stores for about one to two dollars. It is about six inches tall and weighs about a half pound. In the spaces on this page and the next one, list the cleverest, most interesting and unusual ways you can think of for changing this toy elephant so that children will have more fun playing with it. Do not worry about how much the change would cost. Think only about what would make it more fun to play with as a toy.

1. _____

2. _____

3. _____

4. _____

5. _____

Activity 5: UNUSUAL USES (Cardboard Boxes)

Most people throw their empty cardboard boxes away, but they have thousands of interesting and unusual uses. In the spaces below and on the next page, list as many of these interesting and unusual uses as you can think of. Do not limit yourself to any one size of box. You may use as many boxes as you like. Do not limit yourself to the uses you have seen or heard about; think about as many possible new uses as you can.

1. _____
2. _____
3. _____
4. _____
5. _____
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9. _____
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23. _____

Activity 6: UNUSUAL QUESTIONS

In this activity, you are to think of as many questions as you can about cardboard boxes. These questions should lead to a variety of different answers and might arouse interest and curiosity in others concerning boxes. Try to think of questions about aspects of cardboard boxes which people do not usually think about.

1. _____
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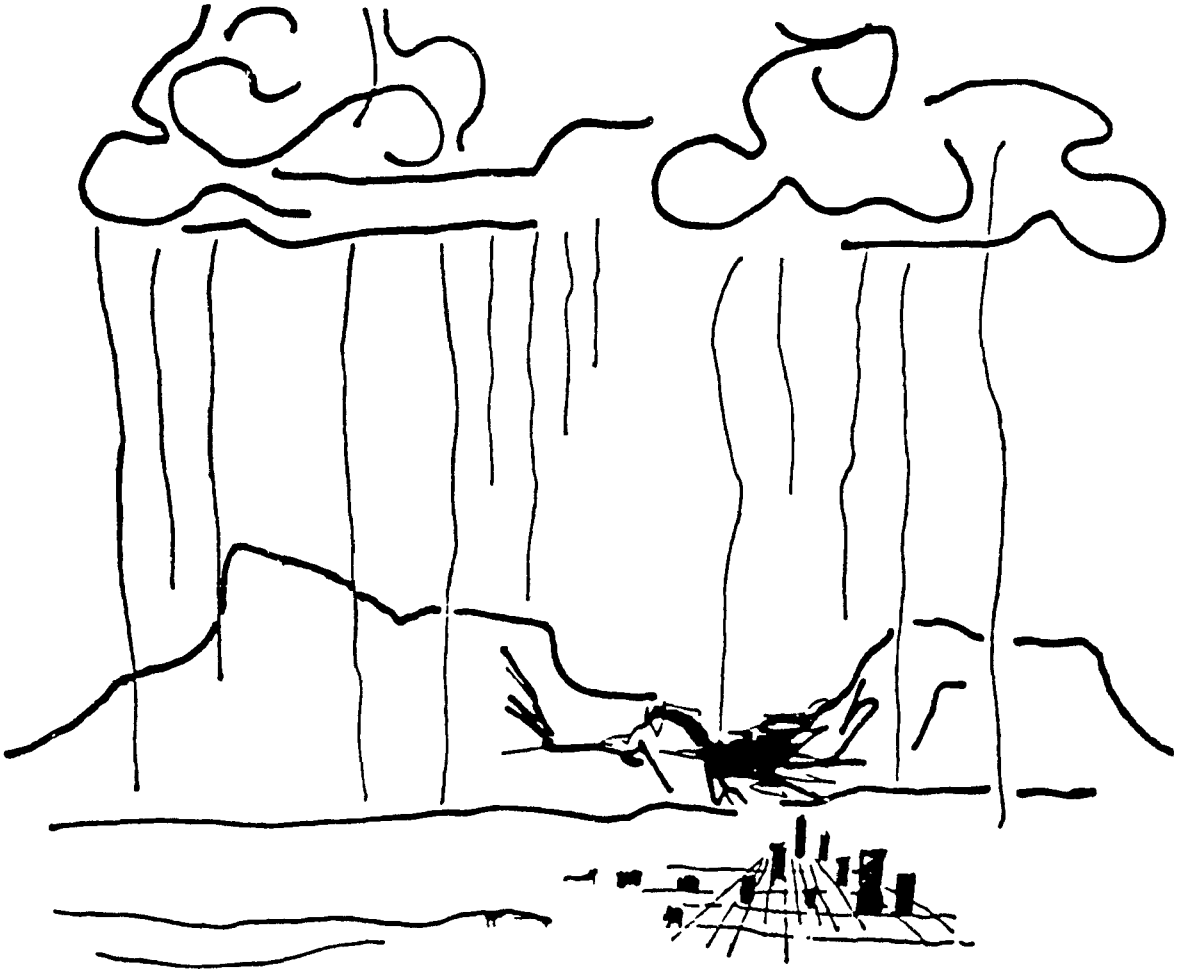
23. _____

Activity 7: JUST SUPPOSE

You will now be given an improbable situation—one that will probably never happen. You will have to *just suppose* that it has happened. This will give you a chance to use your imagination to think out all of the other exciting things that would happen IF this improbable situation were to come true.

In your imagination, *just suppose* that the situation described were to happen. THEN think of all of the other things that would happen because of it. In other words, what would be the consequences? Make as many guesses as you can.

The improbable situation—JUST SUPPOSE *clouds had strings attached to them which hang down to earth.* What would happen? List your ideas and guesses on the next page.



APPENDIX D

TTCT VERBAL BOOKLET B

THINKING CREATIVELY WITH WORDS

By E. Paul Torrance

VERBAL BOOKLET B

NAME _____

AGE _____ SEX _____

SCHOOL _____

GRADE _____

CITY _____

DATE _____

STS®

Activities 1-3: ASK-AND-GUESS

The first three activities will be based on the drawing below. These activities will give you a chance to see how good you are at asking questions to find out things that you don't know and in making guesses about possible causes and consequences of happenings. Look at the picture. What is happening? What can you tell for sure? What do you need to know to understand what is happening, what caused it to happen and what will be the result?

Activity 1. ASKING. On this page, write out all of the questions you can think of about the picture on the page opposite this one. Ask all of the questions you would need to ask to know for sure what is happening. Do not ask questions which can be answered just by looking at the drawing. You can continue to look back at the drawing as much as you want to.

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GO ON TO NEXT PAGE

Activity 2. GUESSING CAUSES: In the spaces below, list as many *possible* causes as you can of the action shown in the picture on page 2. You may use things that might have happened just before the things that are happening in the picture, or something that happened a long time ago that made these things happen. Make as many guesses as you can. Don't be afraid to guess.

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GO ON TO NEXT PAGE

Activity 3. GUESSING CONSEQUENCES: In the spaces below, list as many possibilities as you can of what might happen as a result of what is taking place in the picture on page 2. You may use things that might happen right afterwards or things that might happen as a result long afterwards in the future. Make as many guesses as you can. Don't be afraid to guess.

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Activity 4: PRODUCT IMPROVEMENT

In the middle of this page is a sketch of a stuffed toy monkey of the kind you can buy in most dime stores for about one to two dollars. It is about six inches tall and weighs about six ounces. In the spaces on this page and the next one, list the cleverest, most interesting and unusual ways you can think of for changing this toy monkey so that children will have more fun playing with it. Do not worry about how much the change would cost. Think only about what would make it more fun to play with as a toy.

1. _____

2. _____

3. _____

4. _____

5. _____

Activity 5: UNUSUAL USES (Tin Cans)

Most people throw their tin cans away, but they have thousands of interesting and unusual uses. In the spaces below and on the next page, list as many of these interesting and unusual uses as you can think of. Do not limit yourself to any one size of can. You may use as many cans as you like. Do not limit yourself to the uses you have seen or heard about; think about as many possible new uses as you can.

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Activity 6: UNUSUAL QUESTIONS

In this activity, you are to think of as many questions as you can about tin cans. These questions should lead to a variety of different answers and might arouse interest and curiosity in others concerning tin cans. Try to think of questions about aspects of tin cans which people do not usually think about.

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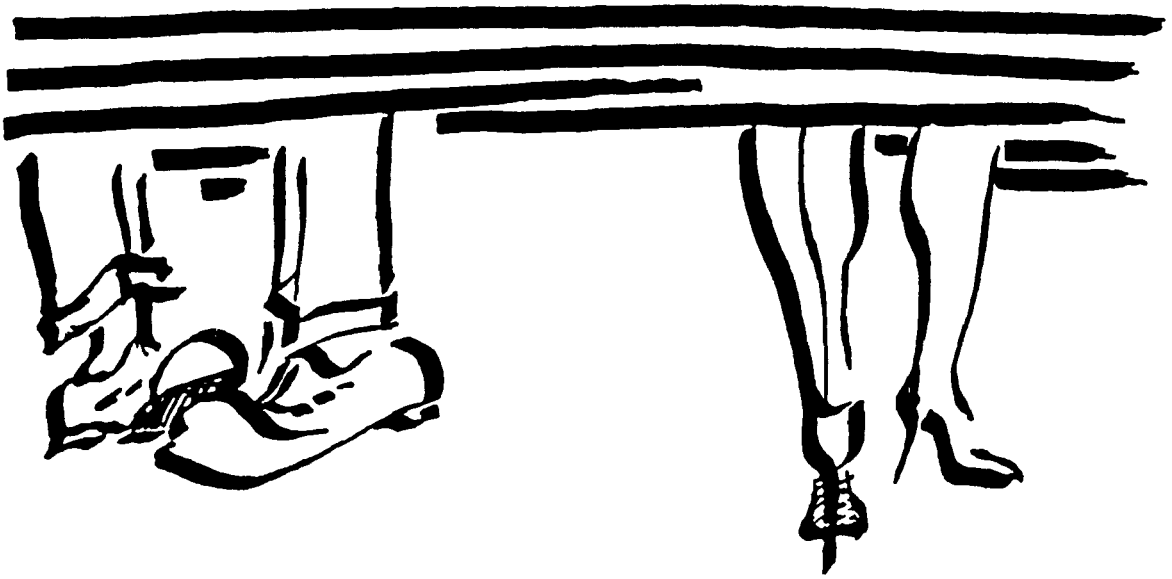
22. _____
23. _____

Activity 7: JUST SUPPOSE

You will now be given an improbable situation – one that will probably never happen. You will have to *just suppose* that it has happened. This will give you a chance to use your imagination to think out all of the other exciting things that would happen IF this improbable situation were to come true.

In your imagination, *just suppose* that the situation described were to happen. THEN think of all of the other things that would happen because of it. In other words, what would be the consequences? Make as many guesses as you can.

The improbable situation – JUST SUPPOSE *a great fog were to fall over the earth and all we could see of people would be their feet.* What would happen? How would this change life on the earth? List your ideas and guesses on the next page.



APPENDIX E

EXAMPLE SCORING INSTRUCTIONS

Step 3 – Scoring Activity 4: PRODUCT IMPROVEMENT

Proceed as in Step 1, remembering that a scoreable response must retain some quality of a toy and "be fun to play with." Record the originality weight and the flexibility category number for each response in the "Orig." and "Cat." boxes under "Activity 4" on the Scoring Worksheet

Fluency

The fluency score is the number of ideas for improving the stuffed toy monkey as a plaything, something that will make it more fun to play with Responses that involve non play uses, making the monkey alive, and the like are considered as irrelevant to the task and are not counted The following responses are examples of irrelevant or unscoreable ideas

1. Make the monkey come alive
2. Make it do homework.
3. Use it as a decoration.
4. Use it as a pincushion.

Flexibility

About twenty three general principles may be used in thinking of new ideas for improving almost any product, process, organization, plan, and the like. The flexibility score is the number of different principles or approaches (categories) used in responding to the task The following categories should be used as a guide

General Flexibility Categories

1. **ADAPTATION:** Change it to a cat, mouse, etc Play uses other than as a toy monkey
2. **ADDITION.** Add a leash, ribbon, squeaker, hat, hat with flowers, collar and license, "wee wee" thing to go to the bathroom, banana, clothing, decoration, etc.
3. **CHANGE COLOR:** All red, all black, brown all over, more like a real monkey in color, red and green polka dots, purple and yellow stripes, different colored eyes, etc
4. **CHANGE SHAPE:** Hold ears up, make rear stick up, change shape of nose, more like a real monkey in shape, neck fatter, ears not too long, tongue inside mouth, tail curlier, etc
5. **COMBINATION:** Put with monkey cage, little monkeys, mommy, master, mate, beg for monkey cage, car for master and monkey, tree or rope to climb, etc
6. **DIVISION** Cut him into parts and make a puzzle of him, make detachable parts, etc
7. **HUMANIZATION.** Give it a mechanical brain, feed it, etc Most of the humanization responses given by children are considered as irrelevant because they do not fit the requirements of the task, i e , making it into a toy which will be fun to play with Examples of irrelevant responses are. make him human, make him say prayers, give it manners, make it do your homework, have it write poems, make him a doctor, make him babysit, etc.

8. **MAGNIFICATION:** Bigger, longer legs, longer tail, ears, body, etc. So big you could sit on it, ride it, etc.
9. **MINIFICATION:** Smaller mouth, smaller ears, shorter ears, baby monkey, midget monkey, dwarf monkey, etc.
10. **MOTION:** Legs so they will bend or move; eyes move, open, close; jump around, sniff, wag tail; wind up toy, touch button and runs by itself; wheels on feet; ears that move; mouth that opens and closes, grins, shows teeth, etc.
11. **MULTIPLICATION:** Litter of monkeys, twins, triplets, etc.
12. **POSITION:** Sit up, stand up, lie down, stand on head, stand up better, etc.
13. **QUALITY OF MATERIAL:** Make it out of rubber, gold, silver, real monkey fur, ears should be strings, flexible material, soft material, etc.
14. **REARRANGEMENT:** Eyes higher in head, ears closer to neck, etc.
15. **REVERSAL:** Make skin or cover reversible and of different kinds of material.
16. **SENSORY APPEAL: AESTHETIC AND EMOTIONAL.** Make him look good, cuter, look happy, etc.
17. **SENSORY APPEAL: EAR.** Barks, makes noise like monkey, sings a song, etc.
18. **SENSORY APPEAL: EYE.** Eyes that light up, glowy nose, fluorescent, etc.
19. **SENSORY APPEAL: SMELL.** Holes in nose, cold nose, sponge nose, smells sweet, filled with catnip, etc.
20. **SENSORY APPEAL: TOUCH.** Softer, fuzzier, fluffy, rough texture, etc.
21. **SIZES:** Several sizes, different sizes of ears that are interchangeable, etc.
22. **SUBSTITUTION:** Collar in place of ribbon, chain in place of ribbon.
23. **SUBTRACTION:** Take off seal or trade mark (if there is one), take bow off, etc.

Originality

The zero and one credit responses are listed alphabetically with both the originality weights (points) and the flexibility categories A few examples of two credit responses have also been included *Other responses showing creative strength and getting away from the obvious and commonplace receive a weight of "2."*

Responses	Orig Weight	Flex Categ.
Animal, change it into another	0	1
Arms, different color	0	3
Arm and hand, make him wiggle and shake his	1	10
Baby monkey, make him have a	1	11
Baby monkey on his back, put	2	5
Banana, give him a	0	2

Step Scoring Activity 6. UNUSUAL QUESTIONS ABOUT TIN CANS

Determine the "divergent power" score of each response as described below Record it in the "Orig " column under "Act 6" on the Scoring Worksheet

Fluency

The fluency score for the Unusual Questions activity is the number of questions asked about tin cans, regardless of the quality of the questions To be counted, however, the question must in some way be concerned with tin cans

Flexibility

No flexibility score will be determined for this activity until the author is able to determine what kind of flexibility is most meaningful

Originality

The originality score for this activity will be what Burkhart has called the "divergent power" score Developmental work in the future may alter this decision, but work already completed indicates that it is a psychologically meaningful score The following basic classification system, modified from one developed by Robert Burkhart,* will be used in scoring responses The system is based on Burkhart's Object Question Test and has been modified from it with permission The scoring weights (modified from Burkhart) for each of the six basic categories are shown below.

ORIGINALITY WEIGHTS FOR ACTIVITY 6. UNUSUAL QUESTIONS

Type of Question	Personal (Self Involving)	Factual Established Knowledge
SIMPLE ANSWER QUESTIONS 1 Yes No 2 One word 3 Quantity or amount 4 Prepositional phrase 5 Either Or	1 point	0 points
COMPLEX ANSWER QUESTIONS 1 Two or more words 2 Sentences 3 Why Because	2 points	0 points
DIVERGENT QUESTIONS 1 Basic alteration of tin cans 2 Projection of self into "New World" 3 Projection of self into object	4 points	4 points

*Burkhart, R C and Gloria Bernheim *Object Question Tests Manual* University Park, Pa Department of Art Education Research, Pennsylvania State University, 1963

Definitions

Questions are considered *"personal"* when they involve the use of "you" and rely upon the personal experience, perception, opinion, attitude, or thought for an answer. This includes questions of "beauty" and other questions that ask for value judgments such as "is it exciting, inspiring, good, etc."

Questions are considered *"factual"* when they rely upon facts for an answer: that is, the response would be based upon reference to an established body of knowledge, encyclopedias, dictionaries, and completed research There is no reliance upon personal opinion or unknown facts

Questions involving a *"basic alteration of the object"* (tin cans) are those that change the object's basic characteristics or relationships to the world by isolating or denying some aspect of it or creating some new aspect or function These questions then ask the subject to deduce what the result would be. (These questions sometimes take the form of asking for new uses of the object)

Questions involving *"projection of self into a new world"* are those that ask the subject to project himself into a "new world" relationship (hypothetical or imaginary), which in reality could not ordinarily be experienced They then ask the subject to relate the facts that would exist in this world (factual) or his perceptions of this world (personal).

Questions involving *"projection of self into an object"* are those that ask one to project himself into the role of an inanimate or animate object. They then ask him to relate what facts would be from this new perspective (factual) or relate his perceptions of this world from this new perspective (personal).

Examples:

1. Factual, Simple Answer Questions (0 points):
   - What are tin cans made of?
   - What color are tin cans?
   - What shape are tin cans usually?
   - Are tin cans made in other countries?
   - How long have tin cans been in use?

2. Factual, Complex Answer Questions (0 points):
   - Why don't people save tin cans?
   - How are tin cans made?
   - Do they have tin cans all over the earth? (It is anticipated that this question cannot be answered with a simple "yes" or "no" very well)
   - How can a tin can be made square?
   - Why are most tin cans round?
   - How was the first tin can made?

3. Factual, Divergent Questions (4 points):
   - Will tin cans be used a hundred years from now?
   - Is it possible to make tin cans that won't rust?
   - How will tin cans be used in the future?
   - How might a marching band sound from the inside of a tin can?

NAME	RHYTHMIC ACCURACY			MOVEMENT RESPONSE																COMMEN
				CLAP				STAMP				BODY PARTS								
	1	2	3	HANDS	BODY	THIGHS	FLOOR	FOOT	ALT. FOOT	HEEL	TOE	HEAD	SHOULDER	ARMS	HANDS	FINGERS	HIPS	KNEES		

APPENDIX F

SYNOPSES OF REVIEWS OF VIDEO TAPES

Synopsis of discussion of video tapes

Date: Feb. 3 Class: Control
Lesson Plan #: 6 Waltz

Introductory Activity: Review of waltz-solo
-structured imitative style

Waltz in pairs: Holding hands moving straight. Waltz in ballroom hold with turns.
-This transition took quite a long time - 20 minutes
-Structured repetitive teaching cues for time and step size, and maintenance of ballroom hold.

Valeta: Students in circle in pairs. Lousy space awareness when waltzing in circle - teaching cues to maintain timing and readiness for new patterns.

Viennese Waltz: Students in pairs circling room CCW. Set patterns to follow = 8 bars turning, 4 bars valeta swing straight.
-Teaching cues largely timing phrases and step size.

- Good imitative style throughout

Date: Feb 16 Class: Experimental
Lesson Plan #: 10 Maori Sticks

Introductory Activity: Review of partner sequences with sticks to various note values.

Maori Stick Patterns: Structural introduction and practice of four basic patterns. Teacher elicits ideas for other possible variations. Teacher establishes a pulse and sets a limit on the phrases. Students design their own sequences. Teacher moves from pair to pair encouraging accuracy of phrases and variations of actions selected. Gives suggestions when needed. Students are very concentrated and well-focused on this task. All show their work.

Group Stick Pattern: Students are given 16 bars to use and to draw on complete vocabulary of stickwork covered to design a group stick dance. There are two or three strong leaders in this group by everyone seems very cooperative and the end result was very interesting. Teacher role - encouraging the completion and accuracy of the students' ideas.

Good problem solving style throughout

Date: March 2 Class: Control
Lesson Plan #: 14 Topic: Words

Introductory Activity: Examination of quarter, half and whole note words. Teacher gave the example and an accompanying action. Class was not very enthusiastic about the selected phrase - teacher will not allow much time for practice before changing the values. I think class was a bit confused.

"I jist kint get it" etc. Groups were challenged to find the 1/4, 1/2 whole note values in their phrases and to match actions accordingly. Teacher gave hints to encourage enthusiasm like "Try a turn somewhere" [P.S. inquiry]. Structure of the final group choreography was clear both rhythmically and activity wise.

Months of the year: Teacher presented the actions of all 12 then challenged each small group to link their designated three. Teacher orchestrated the final choreography. Groups elaborated their designated actions with dramatization of some of the months, eg. "December" added a whole phrase of Jingle Bells with the group as reindeers and "July" added surfing actions which were not included in the teachers' choreography. Teacher was somewhat incoherent in accepting these yet reprimanding the groups for not sticking to the task at hand.

Nonsense Jingle: Actions given by the teacher. Good response on this, your actions helped them memorize the words. No pre-conceived ideas here so no elaboration - pure memory work!

Some problem solving techniques used

Date: March 16 Class: Experimental
Lesson Plan #: 18 Topic: Schmerfs: Weather

Weather: Students in small groups. Teacher outlined the parameters of the task clearly. Each group was given a different weather condition and challenged to select and choreograph appropriate movements. Teacher moved from group to group as work was in progress giving encouragement and helping each group clarify their ideas. Excellent work! All groups shared their performances.

Schmerfs: To the 1st 16 bars of music students listened and checked the pulse of bars. Teacher gave a step pattern for everyone to follow and gave a direction for everyone to travel to get together in small groups. Groups were then challenged to select actions for the next 16 bars - to include turns, jumps change of level 1/8, 1/4, 1/2 whole

note timing. Students took to this idea very quickly and teacher stopped everyone a couple of times to give general comments regarding clarity and amplitude of actions. When everyone was ready teacher directed group from top of music into their own phrase which was repeated twice. Their teacher introduced a canon section and a finale in which everyone picked up on one action that evolved from one of the groups.
Whole choreography was completed with teacher cuing the phrases and encouraging clarity of gestures and timing. Amazingly high quality of work was shown in such a short time - now I can see how you got the demonstration piece for last year! They loved this - but this will certainly be shown in the locker room.

Good problem solving methodology

Date: March 23 Class: Control
Lesson Plan #: 21 Intro. to Sticks and Bird Dance

Introductory Activity: "Pick up the step pattern I am doing." Teacher modelling in front of class. Verbal cues are ok - linking rhythmic pattern plus framework.
When you stopped to talk to those two the class carried on and began to add their own steps and gestures - Your comments to the class when you returned were congratulatory and you pointed out that there were many variations of the vocabulary of steps and gestures that they had learned that could be choreographed for a fun introductory activity.
[Note: This is P.S. behaviour.)

German Clap Dance: Students in circle. Teacher modelling steps and gestures from the centre. Verbal cues to reinforce learning. You made them comfortable by encouraging them to sing the words and by your wild hijinks as you led them.
When they got their sticks you suggested they try the dance pattern using the sticks [P.S. task]. You "recovered" and directed them after that. They tended to pop in their own variations because they felt so comfortable with this [I think some of them had seen the other class in action or they picked up some of those moves from the locker room!].

Bird Dance: Good clear imitative style throughout - They followed well. Perhaps too much implication in your final remarks regarding the use of variations of pre-set dances.

Mixed problem solving and imitative methodology