The Development of a Motor Creativity Test Using Fluency and Flexibility Measures.

by

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ABSTRACT

Guilford identified four main factors of creativity: fluency, flexibility, originality and elaboration. Dodds (1978) recommended the use of both Guilford's factors and behavioral definitions of movement elements to observe and assess motor creativity. Creative dance programs aim at providing students with a large vocabulary of movements (fluency) and facilitating manipulation of movement elements to produce a variety of responses (flexibility). Most previous research in motor creativity focussed on fluency and originality factors and resulting measuring tools were tedious, time consuming and of little use for teachers.

The purpose of this study was to develop and validate an instrument to assess creativity in the context of dance. Twenty four grade two students were selected. Five movement elements and two creativity factors were defined by four experts in the field of dance, to establish content validity. Responses to two movement tasks were videotaped and scored on their fluency and flexibility by three observers. The Pearson Product-Moment correlation was used to compare the results of the Motor Fluency Flexibility Test (MFFT) and O'Neil's Refined Movement Analysis Category System (RMACS). Results showed no relationship between the two tests. Based on this study, it was concluded the two tests were not measuring the same variables.

RESUME

Le but de cette étude est de développer et valider un instrument de mesure de la créativité pour la danse. Quatre principaux facteurs de la créativité ont été identifiés par Guilford. Dodds (1978) recommande l'utilisation de ces facteurs avec un choix d'actions motrices bien définies pour l'observation et l'évaluation de la créativité motrice. Les programmes de danse créative visent à procurer aux élèves un large éventail de mouvements (affluence d'idées) et à encourager les diverses utilisations de chaque élément du mouvement (flexibilité d'idées). Jusqu'à présent, l'affluence d'idées et l'originalité constituaient les objets de la plupart des recherches dans le domaine de la créativité motrice. En raison de leur complexité et du temps nécessaire à leur administration et compilation, les instruments de mesure qui en ont résulté se sont avérés peu pratiqués pour l'enseignant.

Vingt-quatre élèves de deuxième année scolaire furent sélectionnés pour cette étude. Deux facteurs de créativité et cinq éléments de mouvement ont été choisis et définis par quatre experts dans le domaine de la danse, établissant ainsi la validité de contenu. Les réponses motrices à deux problèmes ont été filmées sur vidéo pour être ensuite évaluées par trois juges quant à leur affluence d'idées et flexibilité. Les résultats du "Motor

Fluency-Flexibility Test" (MFFT) ont aussi été comparés aux résultats du "O'Neil's Refined Movement Analysis Category System" (RMACS). Selon la corrélation "Pearson Product-Moment", aucune relation n'existe entre les deux tests. Les résultats de cette étude indiquent que les deux tests ne mesurent pas les mêmes variables.

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CHAPTER I

INTRODUCTION

Creativity has received increased attention in the last twenty years as business leaders, psychologists and educators have elucidated its importance in society. Creativity research is needed to assist teachers in identifying creative potential, in measuring students' progress towards instructional objectives, in designing of programs and in providing future guidance for individual students (Bauernfeind, 1963; Beveridge, 1973; Brennan, 1976; Gowan, 1977; Jackson-Glass, 1982; Johnson, 1977; O'Neil, 1982; Philipp, 1969; Steel, 1975; Tanwar, 1977; Torrance, 1976; Wall, 1971).

With a growing interest in the field of movement, many researchers have investigated the relationships between motor creativity and existing tests of creativity, IQ and physical performance. Generally, results indicate that motor creativity is specific and that it does not relate to verbal or figural creativity, motor ability or intelligence (Beveridge, 1973; Dodds, 1978; Jackson-Glass, 1982; Johnson, 1978; O'Neil, 1982; Roseman, 1984; Wall, 1971; Wyrick, 1968).

Various problems are related to the identification and measurement of creative abilities. For example, Petrosko (1978) pointed out that: "It is well not to lose sight of the elusive nature of the construct being measured... The

challenge of measuring creativity is the paradox of trying to build a standard way of capturing a nonstandard behavioral product" (pp.118-119). Also the lack of a general widely accepted theory has led researchers to utilize various approaches to the measurement of creativity (McCormack, 1975; Poole, 1979; Singh, 1978; Tanwar, 1977).

Guilford (1959), one of the pioneers in creativity testing, provided some light with his factor analytic work. Guilford identified four main factors contributing to creativity: fluency, flexibility, originality, and elaboration. Based on these four factors, Guilford (1959) and Torrance (1966) developed verbal and figural creativity test batteries. The literature provides evidence for the multi-dimensionality of creativity; it is therefore recommended to use a variety of tasks and measures to study creativity (Brennan, 1976; Steel, 1975; Torrance, 1965).

Each of Guilford's factors may easily be applied to movement creativity, since movement responses lend themselves to open observation in ways that cognitive responses do not (Brennan, 1976; Dodds, 1978; Glover, 1974; O'Neil, 1982; Steel, 1975). According to Dodds (1978), these factors are observable as "They represent classes of actual behavior that can be seen, heard or counted" (p.266) and thus result in a quantitative measure of motor creativity.

The field of dance appears to be an ideal medium for creativity. Hawkins (1964) stated:

> The fundamental ingredient in dance is the impulse to create. The urge to sense, discover, and relate tends to culminate in the creative act (as cited in Steel 1975, p.37).

Creative dance programs often utilize adaptations of Laban's movement analysis as a theoretical framework. Rudolf Laban developed and described a movement analysis applicable to educational dance in which movement elements were classified under four main movement concepts: 1) the instrument of expression, or the body; 2) how the body moves, or the effort; 3) where the body moves, or the space; 4) the relationship of body parts or individuals (Laban, 1960, 1975; North, 1964, 1971; O'Neil, 1982; Preston-Dunlop, 1963; Russell, 1975; Stanley, 1969).

Laban's approach to movement has not generally been juxtaposed to Guilford creativity factors. Creativity tests in dance should reflect curriculum content and therefore might benefit by including Laban's basic movement concepts. O'Neil's Refined Movement Analysis, as a test of motor creativity, provided a major contribution by using Laban's movement elements in the realm of motor creativity in dance.

Many tests of motor creativity have proved to be reliable and valid, and thus useful for research purposes. However most remain impractical for teachers' use. In the area of dance, Glover (1974), Steel (1975) and Brennan (1976) investigated motor creativity measures but reported scoring inconsistencies and the need for further refinement and simplification of scoring procedures. Interesting movement problems have been developed, but the scoring procedures are tedious and time consuming (Beveridge, 1973; Wyrick, 1968). Even O'Neil's Refined Movement Analysis Category System (1982) in which twenty-six subjects were involved, required twenty-four hours for the training and the observation sessions.

It is important that the measuring instrument control subjective judgment. Teachers often have biases and preconceived ideas of who or what is creative (Bauernfeind, 1963; Brennan, 1976; Poole, 1979; Stalker, 1981; Steel, 1975; Torrance 1981). Objective evaluation is not possible when dealing with an instrument based solely on observations unless some specific criteria have been well defined and predetermined. As Dodds (1978) argued:

> With precise, agreed-upon definitions for movement responses as guidelines, two or more observers can easily attend to the same parameters of a movement

> sample, while without such an agreement they could easily observe different dimensions of that same performance (pp.266-267).

Thus, an objective test of motor creativity including Laban's movement elements, with behaviourally defined criteria would be of great value to the field of dance. To date, only O'Neil created such a test.

O'Neil (1982) selected six movement elements: "range" (element within the body concept), "time", "flow" (elements of effort), "level","'direction" (elements of space), and "relationship" of body parts. O'Neil's results indicated that five of her behavioral definitions for movement elements were substantiated, but that the one for 'flow' was not.

O'Neil's test might be improved in a number of ways. For example, since young children are usually not very familiar with the element of "relationship" (with individuals), it could be eliminated. Wall (1971) explained: "Socially, at this stage, the child is egocentric and therefore the main relationship exists between the child and the teacher" (p.21). The elements 'body parts' and 'body actions' could replace O'Neil's element 'range' for the body concept, since they are more readily observed. The element of 'flow', being difficult to define for observation purposes could therefore be ignored.

Thus, the movement elements 'body actions', 'body parts', 'time', 'level' and 'direction' could be readily observable and representative of the 'body', 'effort' and 'space' concepts; three important concepts of the dance curriculum.

In summary, there is a need for a test of motor creativity in the context of dance so that teachers might evaluate the effectiveness of their program. Such a test should reflect the curricula which in the area of dance frequently stems from Laban's movement analysis. Furthermore, the test must be objective and practical for teachers' use.

Statement of the problem

The purpose of the study was to develop and validate a test of motor creativity for dance using fluency and flexibility measures and five movement elements: body actions, body parts, time, level and direction.

Hypotheses

The Motor Fluency-Flexibility Test (MFFT) would represent a valid, reliable and objective means of assessing motor creativity.

Assumptions

It was assumed that the children have been appropriately exposed to the concepts of the selected movement elements and therefore understood and were able to utilize the movement concepts in their creative expression.

Delimitations

The study was delimited to randomly selected subjects from second grade classes in a middle class suburban school in Montreal, Quebec. The study was also delimited to subjects who had been exposed to Laban's movement concepts.

Limitations

1) A stress factor related to performing "in solo" might have affected the results of this study. However, the imitative effects of a group situation would have been more severe.

2) The performance of the children in the presence of the camera and the technician might not have been typical. However, the presence of the camera on previous occasions during the dance classes should have greatly reduced this effect.

Definitions

Creativity involves mainly divergent thinking or "the generation of information from given information where the emphasis is upon variety and quantity of output" (Guilford, 1967).

Motor creativity is the combination of perceptions, with particular emphasis on the kinesthetic perception, into new and fresh motor patterns (Wyrick, 1968). It is operationally defined in this study as the composite score of motor fluency and motor flexibility.

Motor fluency is the total number of movements produced. Motor flexibility is the number of different categories into which movement responses fall. The categories to be used in classifying responses are elements of the movement concepts: body actions, body parts, time, level, direction. Motor Fluency-Flexibility Test (MFFT) is the instrument designed in this study to assist teachers in observing and assessing creative abilities in dance.

Movement problems are the verbal problems used as stimuli to evoke motor responses (Beveridge, 1973).

Movement elements describe the specific use of the body, effort, space, and relation to self, others and objects. In the present study they represent categories within each movement concept: body actions, body parts, time, level and direction.

Body Actions involve locomotor, non-locomotor motion and stillness. The main categories of actions are: jump, turn, travel, pause, gesture and stopping. Sub-categories are included in the Appendix.

Body Parts are either 1) leading; 2) supporting; 3) in contact. In this study, only supporting body parts are identified.

Time refers to body time in movement. Elements are: 1) increase of speed; 2) decrease of speed; 3) maintaining of speed.

Level is the relationship of the body to space in the vertical plane. Elements are: 1) high (head is in its normal area or higher, the extremities reach the highest plane; 2) medium (most of the body moves in the area limited by the shoulders and knees when the body is upright); and 3) low (most of the body moves in the area located below the knees when the individual is upright). Direction is the relationship of the body to space in the horizontal plane. Elements are: 1) forward (leading with the front of the body); 2) sideways (leading with the right or left side); 3) diagonal (diagonally forward or backward), and 4) backward (leading with the back of the body).

CHAPTER II

REVIEW OF THE LITERATURE

The purpose of this study was to develop and validate the Motor Fluency-Flexibility Test (MFFT) designed by the investigator. The information presented in this chapter is discussed under the following headings: 1) need to define and measure creativity; 2) Guilford's Structure-of-Intellect; 3) factors influencing creativity; 4) the multi-dimensional aspect of creativity; 5) research in motor creativity; 6) motor creativity testing; 7) the measurement issue; and 8) summary of the review of literature.

Need to define and measure creativity

Creativity has now become a major priority in education (Barron, 1973; Maslow, 1959; O'Neil, 1982; Steel, 1975). For more than thirty years, there has been increasing interest in creativity research with the underlying assumption that creative potential lies within each individual (Berman, 1983; Guilford, 1959; Jackson-Glass, 1982; Maslow, 1959; Steel, 1975; Taylor, 1962). Despite the fact that the field has gained some recognition, much remains to be done to better understand creative thinking abilities. Indeed while valuable studies have attempted to elucidate the multi-dimensional aspects of the subject many controversies remain.

Philipp (1969) stressed the importance of testing for creativity: "The identification of creative potential within the individual child is the first step toward support and encouragement of creative development" (p.163). Beyond the identification of creative individuals, Torrance (1976) also determined five uses of creativity tests:

> 1: To obtain a more complex understanding of the human mind and personality, and their functioning.
> 2. As a possible basis for individualizing instruction.
> 3. As a part of the process of guiding mental growth, as an indicator of mental health status, and as a source of clues for remedial or psychotherapeutic programs.
> 4. As a means of assessing the differential effects of various kinds of experimental programs, new curricular arrangements or materials, organizational arrangements, teaching procedures, and the like.
> 5. As indicators of growth potential and future guidance needs (p.137).

Although justification to measure creativity seems evident, the question of what to measure is still unanswered. Rhodes (1961) suggested that the profusion of definitions available are not mutually exclusive, but

overlap and intertwine. Torrance (1966) described creative thinking as "What takes place in the process of sensing difficulties, problems, gaps in information, missing elements; making guesses or formulating hypotheses about these deficiencies; testing these guesses and possibly revising them; and finally, in communicating the results" (p.6). Rogers (1978) described three inner conditions of constructive creativity: an openness to experience, an internal locus of evaluation, and an ability to toy with elements and concepts. Taylor (1962) defined creativity as an ability to sense ambiguities, to form and test hunches, to foresee consequences and infer causes, and evaluate.

Torrance (1966) also clearly pointed out the need to define creativity when he said: " Any measuring instrument should be evaluated in terms of the definition of the phenomena it is designed to assess and its results should be interpreted in terms of this definition" (p.6). Almost unanimously authors and researchers agree on the lack of a widely accepted definition of creativity and of valid criteria for its measurement. For many reasons, such as identifying the multiple aspects of creativity, it is urged that a battery of measures or tools be developed (Mishra, 1977).

Guilford's Structure-of-Intellect

Only in the last few decades, has research in education begun to look at creativity as an entity separate from intelligence. Much of the early work on creativity came in the fifties from psychologists such as Thurstone and Guilford who investigated the components of intelligence and later applied a similar theoretical orientation to creativity (Roseman, 1984).

Guilford (1959), one of the pioneers in creativity testing, provided a theoretical framework for the study of creativity. The Structure-of-Intellect as outlined by Guilford (1959) contains three types of categories:

1) Contents - the set of stimuli acted upon including figural (auditory, visual and kinesthetic), symbolic, semantic and behavioral areas.

2) Operations - the use of the contents, information or action taken upon the stimuli (cognition, memory, convergent thinking, divergent thinking and evaluation).

3) Products - the result created by the action which could be classified into: a) units, b) classes, c) relations, d) systems, e) transformations, f) implications (p.8).

Guilford's distinction between convergent and divergent thinking made a great impact on creativity

research. In his model of human intellectual abilities, he described five operations: cognition, memory or retention, convergent thinking, divergent thinking and evaluation. Convergent thinking involves deduction and the drawing of fully determined conclusions from given information. It calls for conventional, stereotyped ideas. Taylor (1962) compared this ability to recognizing a correct answer on a multiple choice task. In contrast, divergent thinking involves thinking in different directions as one searches for a variety of possible solutions. According to Guilford (1967), creativity primarily involves divergent thinking or "the generation of information from given information where the emphasis is upon variety and quantity of output" (p.213).

Guilford (1959) identified four principal parameters of divergent thinking: fluency, the flow of ideas or the quantity of ideas produced; flexibility, the readiness to change direction or modify information or the variety of ideas produced; originality, the production of unusual and novel ideas and, elaboration, the production of a variety of implications and the addition of detail. Although transformation abilities which primarily lie outside the divergent production category also appear to contribute to creative thinking, a significant aspect of creativity is accounted for in terms of operations of divergent

production. Therefore, Guilford devoted most of his work to the area of divergent thinking.

Researchers have viewed the process of creative thinking and divergent thinking as part of the cognitive domain. Much confusion remains however as to the extent of the relationship between divergent thinking and creativity. The terms have been used interchangeably in the literature. Further research beyond the scope of the present study is needed to help distinguish between them more precisely.

Many researchers have investigated the possible relationship between creativity and various measures of general intelligence. The results suggest that a minimum IQ is necessary to engage in creative activities, however, beyond that minimum, creativity has little to do with IQ (Anderson, 1959; Asthana, 1977; Getzels & Jackson, 1978; Guilford, 1968; Jackson-Glass, 1982; Rawat & Argawal, 1977; Roseman, 1984; Roweton, 1970; Steel, 1975; Taylor, 1962; Torrance, 1962; Vernon, 1978). Since intelligence tests emphasize convergent abilities, one should not expect to find much correlation between divergent production test scores and IQ (Guilford, 1967). Numerous studies have demonstrated that creativity scores and IQ are not highly related and that measures of general intelligence fail to predict creativity (Asthana, 1977; Taylor, 1962; Vernon, 1978).

Factors influencing creativity

Although the cognitive aspect of creativity have received most of the attention, it seems that the affective aspect also plays a major role. (Guilford, 1968, 1977; Steel, 1975; Torrance, 1963). In addition to cognition, personality characteristics, motivation and environmental conditions also influence creativity. The environment may act as a facilitator or a restrictor of creativity. An open, non-critical and positive environment appears to be most favorable (Anderson, 1959; Deltour, 1977). It fosters creativity to the extent that it tolerates deviation from the traditional and permits freedom.

Numerous studies offer strong support for the view that creative thinking processes can be enhanced through direct intervention (Feldman, 1980; Roseman, 1984; Torrance, 1973). Practicing divergent production skills such as problem-solving has the best chance of stimulating creative development (Guilford, 1959; Steel, 1975). Torrance (1976) reviewed the results of 142 studies which attempted to teach creativity with a variety of methods and found that 72 percent had been successful. Education may therefore promote creativity. The extent to which it can be motivated and developed is dependent upon the opportunities each individual is given for expression and discovery.

Busse and Mansfield (1980), questioned much of Torrance's research arguing that most of divergent thinking tests are probably influenced by factors such as persistence and an understanding of the kinds of answers that are expected. Indeed, an increased familiarity with a test may alter the results of a post test and perhaps explain the improvements in creativity. According to Lewis (1974): "Consistency of performance on divergent thinking tests is affected by familiarity with the test, the kind of response expected and the conditions of administration" (p.153).

The emotional, physical, motivational and mental health factors affect creative functioning and development, and may alter test results. Nevertheless, Gowan (1967) stressed the urgent need to recognize creative talents and to provide an educational environments which facilitate the development and growth of creative potential.

The multi-dimensional aspect of creativity

Since creativity seems multi-dimensional, it is usually recommended that a variety of tasks and measures be used to study it (Brennan, 1976; Steel, 1975; Torrance, 1965). Belcher and Rubovits (1977) studied the interrelationships among ten different creativity tests. The study demonstrated that;

> Single tests of creativity are inadequate to explore the construct. Tests that purport to assess this concept are at best, partial views of this complex behavior...Care should be taken when creativity tests are used for decision-making purposes (p.220).

In addition, Torrance (1966) recommended that scores be studied in relation to one another, since a single score may be misleading if not viewed in relation to the other scores.

In an attempt to measure the many aspects of creativity, Torrance refined several of Guilford's tests. Steel (1975) claimed that:

> While Guilford based his evaluation of creativity on evidence from correlations of test scores of the degree of trait manifestation, Torrance based differences in creative abilities as differences in human potential, not as traits common to all (p.18).

Over a period of about ten years, Torrance and his associates have developed several batteries of tests for use in all cultures and from kindergarten through graduate school (Biondi & Parnes, 1976). "The Torrance Tests of Creative Thinking" (TTCT) include verbal and figural forms based on a person's divergent production ability in fluency, flexibility, originality and elaboration (Torrance, 1966). Since Torrance believed in the multi-

dimensionality of creativity and in the fact that no one method could successfully assess creative potential in all its aspects, he also developed the "Thinking Creatively in Action and Movement" test (TCAM), to assess motor creativity.

The Thinking Creatively in Action and Movement test (TCAM) was designed for use with three to eight year old children. Torrance believed that preschool children expressed thought through the kinesthetic modality more than the other modalities. The test includes four sets of activities: 1) How many ways? 2) Can you move like? 3) What other ways? 4) What might it be? The test involves demonstrating various ways of running and walking, pretending to act like various animals or people, showing various ways of putting paper cups in a wastebasket and finding different things one can do with paper cups. Both verbal and motor responses are accepted. Torrance considered that the use of the TCAM to be more advantageous for children with undeveloped verbal and drawing skills to exhibit their creative thinking potential rather than using the figural and verbal forms of the TTCT.

Research in motor creativity

With the growing interest in the field of movement, many researchers have investigated the relationships between motor creativity and existing tests of creativity

and physical performance. Their results seem to indicate that motor creativity is quite specific and that is does not relate to verbal or figural creativity, or motor ability (Beveridge, 1973; Jackson-Glass, 1982; O'Neil, 1982; Roseman, 1984; Wall, 1971; Wyrick, 1968).

Various issues surround motor creativity. Particularly prominent have been studies 1) addressing the multi-dimensionality of motor creativity, 2) exploring the relationship between motor creativity and verbal or figural creativity and 3) investigating the relationship between motor creativity and motor skills.

The multi-dimensionality of creativity was highlighted in Steel's (1975) study of the relationship of three creativity assessment measures as applied to a first grade class in a creative dance situation. The creativity measures involved the Torrance Tests of Creative Thinking (TTCT) (Figural Form B), a checklist developed from the literature as a measure of personality; and four movement problems in creative dance taken from the curriculum. The movement problems were presented as follows:

1) Make a shape with your weight on three body parts
2) Using a rope, make one strong and one weak shape
3) Interpretation of an icy/hot floor
4) Rhythmic and dynamic interpretation of musical sounds (pp.42-44).

The study was implemented by initiating a creative dance program in a first grade class. Subjects attended each other's performance while five judges evaluated them in a class situation on a four point scale. Four points were allotted for the use of unusual position and body parts; three points for the use of unusual position or body parts; two points for a correct response without anything unusual or for showing a clear distinction between elements of the problem ; one point for attempting a solution that was inappropriate; and no response was a zero.

Steel found a significant relationship among the three assessment measures. The movement problems correlated best with a composite TTCT score rather than individual sub-tests. Movement problem No.4 correlated highest with the TTCT. In general, the movement problems and the Torrance sub-tests did not measure identical aspects of creativity. Results of the TTCT indicated that elaboration was the sub-test most highly related to the entire Torrance test.

Steel also found that the teacher, while using the checklists, rated the children very differently than the judges. The TTCT scores and the judges' ratings were in closer agreement than the teacher's ratings. Steel concluded that creativity as a generalized trait was best measured by a variety of tasks and measures.

Studies by Baas (1973) and Philipp (1969) support the suggestion that motor creativity is not related to verbal creativity. For example, Baas (1973) investigated the relationship between motor creativity and verbal creativity in graduate students of dance and related arts. The Wyrick Test of Motor Creativity and the Torrance Tests of Creative Thinking (Verbal Form A) were selected for the measurement of motor and verbal creativity. The investigator concluded that motor creativity and verbal creativity were not highly related among the subjects tested.

In contrast, Withers (1960) demonstrated that significant correlations between dancers' scores on the movement tasks and their scores on Guilford's verbal creativity tests existed. Based on Guilford's factors of creativity; fluency, flexibility, originality and elaboration, Withers (1960) attempted to isolate factors in motor creativity. The movement tasks included:

1) Compose a short dance composition based on Haiku poetry

2) Compose a two minute movement phrase of dance

3) Compose a two minute improvisation performed in response to a previously viewed film strip (p.27-29).

Four judges were selected to rate the creative performances with a nine point scale for each of seven criteria of

creativity: 1) overall creativity, 2) sensitivity to the problem, 3) originality, 4) conceptual unity, 5) penetration, 6) appropriateness and 7) technique. Withers compared the performance task ratings and results from Guilford's written tests or modified versions.

She concluded that it was possible to measure the creative ability of dancers using written tests of verbal creativity, and that professional dancers and dance educators could agree when evaluating creative ability.

A third area which has attracted some research is the relationship between motor creativity and motor skills. Johnson (1978) investigated the relationship between motor creativity and motor performance, age and sex of young children. Johnson used the Wyrick Test of Motor Creativity and a motor performance test battery. Although she found no relationship between motor creativity and age and sex, she concluded that children who score well on measures of motor performance also score well on measures of motor creativity.

Philipp (1969) also investigated the relationship between motor creativity and selected motor skills, height, weight, and intelligence. The Wyrick Motor Creativity Test and the Torrance Test of Creative Thinking were administered to sixty-five fourth grade students. Her results indicated that there was no relationship between

motor creativity and performance on selected motor skills or between the various aspects of creativity. Similar results were obtained by Stroup & Pielstick (1965) and Wyrick (1966).

Many authors suggest the lack of a relationship between motor creativity and motor ability (Jackson-Glass, 1982; Philipp, 1969; Stroup & Pielstick, 1965; Wyrick, 1966). However one needs to develop a repertoire of previously acquired movement skills in order to express oneself freely and creatively (Brow & Gaynor, 1967; Dodds, 1978; Jackson-Glass, 1982; Withers, 1960). It seems that a repertoire of basic skills may influence creative production. In their "Action Theory" of creativity, Brown and Gaynor (1967) maintained that a vocabulary of movements was necessary for successful creative production. They also stated that:

> The greater the amount of physical skill the creative individual has, however, the greater will be his potential to vary and improvise in these skills. With his greater skill, the creative athlete has more sources from which to choose for invention, improvisation, and experimentation (p.160).

Therefore it appears that a repertoire of movement is necessary, but that beyond a basic vocabulary of movement there is not an equivalent increase in motor creativity.

The development of creativity measures also led researchers to investigate motor creativity with disabled children. In a study with preschool mentally retarded children on a novel piece of play apparatus, the Lind Climber, Rowe (1977) concluded that mildly mentally retarded preschool children are more like their normal peers in motor creativity than unlike them.

Jackson-Glass (1982) compared the motor creativity of a group of physically disabled and non-disabled children on two measures of motor creativity. She also compared the two measures of creativity. Twenty-nine physically disabled and non-disabled children of elementary school age served as subjects in her study. They were divided into three groups: physically disabled non-walkers (10), physically disabled walkers (7), and non-disabled (12). Each subject was videotaped while responding to a Creative Movement Problem which required the student to create a movement sequence using three basic movements: a clap, a body turn and a movement in a forward direction. The videotaped sequences were analyzed by a panel of four experts and assigned a motor creativity score out of 20. A modified version of the Torrance Test of Thinking Creatively in Action and Movement was also administered to each subject to obtain scores of motor fluency, motor originality, and a composite score of motor creativity.

Jackson-Glass found a moderate relationship (r = .44) between the Torrance Test and the Creative Movement Problem and no significant difference among the three groups on the Torrance Test. She concluded that the Torrance Test of Thinking Creatively in Action and Movement is not a valid measure of motor creativity with physically disabled children and that elementary school aged physically disabled children are not significantly different from their non-disabled peers in motor creativity.

In conclusion, she recommended that the scoring procedure for the Creative Movement Problem be more clearly delineated to define explicitly the behaviours to be observed by the experts, and that more extensive and more precise training for the panel of experts be required. She also suggested that more care be exercised when selecting measuring instruments for motor creativity, and that combinations of instruments utilized to measure motor creativity come from similar theoretical backgrounds. The moderate relationship between the Torrance Test and the Creative Movement Problem might indicate that the instruments were not measuring the same creative abilities. Indeed the instruments emanated from different theoretical backgrounds and thus the data would not be expected to be highly congruent.

This latter point was supported by Berman's (1983) study on divergent thinking with emotionally disturbed adolescents and by Roseman's (1984) study on the effects of a creative movement program on the divergent thinking abilities of mildly retarded adolescents. The two authors found that different tests often yield different scores for divergent thinking and thus were not highly related, presumably because they tap different areas of creativity.

Motor creativity testing

Wyrick (1968) developed a test of motor creativity for college women. Her test purported to differentiate individuals in producing both varied and unique motor responses in problem solving tasks of a motor nature. Based upon Guilford's factor analytic framework, Wyrick's test consisted of test items assessing two divergent production factors: fluency and originality. Although motor creativity may be operationally defined as the ability to produce both varied and unique motor responses to a stimulus, objective assessment of motor creativity still represented considerable difficulties.

Four test items were devised for each of four motivators: rubber balls, parallel lines, a red hoop, and a low balance beam. The judges descriptively recorded the responses of each subject. Methods of scoring, such as summing the number of responses (fluency), computing

frequency of occurrence (originality), and combining the fluency and originality scores to determine a measure of motor creativity were investigated. Originality was determined by the frequency of a response: responses occurring only once within the total sample for each day were given two points, responses occurring twice were given one point; and responses occurring three or more times received no points.

Wyrick found a high correlation between motor fluency and motor originality, and thus concluded that subjects who were original were also very productive and fluent. Wyrick operationally defined motor creativity as the ability to produce many varied motor responses to a given stimulus, in conjunction with the ability to produce original motor responses. Nevertheless, scoring difficulties, test objectivity, and the technicalities of administration rendered her tests unsuitable for classroom use.

Beveridge (1973) developed a test to measure the fluency and originality factors of motor creativity. The purpose of her study was to investigate the relationships among motor creativity (fluency and originality), movement satisfaction, and the utilization of specified movement factors. Nine movement factors were analyzed: the effort factors of force, flow and time; the space factors of

level, direction and range; and the body factors of support, relationship and shapes.

Forty-five second grade children were videotaped individually while producing solutions to four different movement problems which required the utilization of one or more of the following manipulative objects: a ball, a hoop and a bench. Tanner's movement satisfaction scale was also administered to the students.

No significant correlations were found between movement satisfaction and either the fluency or the originality factor of motor creativity. However, the two factors of motor creativity, fluency and originality, showed a very high degree of association. Some differences were found in how the high and low motor creativity groups utilized the movement factors. No differences were found for the other groups. Using the operational definition of motor creativity as the ability to produce many varied and unique responses to a given stimulus, Beveridge's test proved to be both reliable and valid.

Administration of the test, and the analysis of the data proved to be very tedious and time consuming. For this reason, and because of the high correlation found between the fluency and originality factors ($r = .96$), Beveridge recommended the elimination of the originality factor to simplify scoring procedures. She also suggested that only

one problem (problem three) be used, as it was found to be the most representative of the four problems when correlated to the total fluency (r = .86) and originality (r = .87) scores.

Beveridge concluded that some relationship seems to exist between motor creativity and the way children characteristically use their bodies with respect to space, time and energy. She also postulated that a movement analysis could serve independently as an assessment of motor creativity. As noted Laban's movement analysis could be used for such a purpose.

Brennan (1976) developed a test to assess creative ability in dance. She also investigated the relationship between creative ability in dance, field independence-dependence and attributes of creativity. Nineteen test items were administered to sixty-one university female dance majors who volunteered to serve as subjects for the investigation. Brennan hypothesized that field independence would be related to creativity, since personality characteristics of field independent individuals were similar to those believed to be possessed by creative individuals.

Two methods were used to assess creative ability in dance. In the first method, six faculty experts in dance rated the subjects on the criteria of fluency, originality

and flexibility. In the second method, Guilford's theoretical Structure-of-Intellect construct was used to develop three movement performance measures; the Positions Test, the Composition Test, and the Improvisation Test. Brennan included three additional criteria in his motor tests: unusualness, appropriateness and transformation.

Three judges were trained to use a seven point scale to rate videotaped responses of the Composition Test with regard to originality and flexibility, and the Improvisation Test on originality. To determine a fluency criterion score, the number of responses given by each subject on the Positions Test were totaled.

Evidence of the content validity of the three measures was provided by the description of the process involved in developing the tests. Interrater objectivity was low, indicating that the experts had different interpretations of the criteria. Brennan suggested that with further refinement of the measures and specific training, the agreement among judges could be greatly increased.

No meaningful relationship was found among the three constructs pertinent to the study, creative ability in dance, field independence-dependence and creative attributes. Two of the movement performance tests, the Composition Test and the Improvisation Test, have potential as valid and reliable measures of dance creativity provided

the test instructions and the evaluation procedures are refined for future use. The two methods of evaluating creative ability in dance, experts' ratings and movement performance tests, tended to identify the same individuals as more or less creative, but were not meaningfully related to creative attributes as determined by the four Guilford tests. Brennan emphasized the need to develop reliable, valid and easily administered and evaluated tests of motor creativity. He encouraged continued efforts to more specifically define and objectify the criteria of creative movement.

Due to the lack of relationship among various measures of creativity and the importance of relating the field of content to the test items, Glover (1974) and O'Neil (1982) developed motor creativity measures in the context of dance.

Glover (1974) developed and validated a measure of motor creativity for college women. Based upon the theoretical construct of the Torrance Test of Creative Thinking, Figural Form, twelve movement tasks were developed, from which three were selected as valid for a motor creativity test (Move to Sounds, See and Move, and Hoops and Lines).

A scoring system was devised to enable three judges to evaluate the videotaped subjects' performances on five

variables: fluency, originality, flexibility, elaboration and motor creativity. Until Glover's work, motor creativity tests had measured fluency and originality only. Glover defined flexibility as the variety of responses representing different strategies and approaches used to solve the problem. Flexibility described the different kinds of actions which the subject employed in the movement responses. Actions were classified into twelve locomotor sub-categories, twenty-three non-locomotor sub-categories and fifteen manipulative sub-categories. Elaboration was defined by the details of movement and included the use of body parts, floor space, changes in level and changes in tempo. Motor creativity was the combined score of fluency, originality, flexibility and elaboration.

The intra-judge and inter-judge agreement results indicated that the judges were consistent in evaluating all dimensions except originality. Correlation coefficients among the variables in the three movement tasks indicated that originality, flexibility and elaboration had the highest relationships with the motor creativity variable. In spite of some scoring inconsistencies, demonstrated by the low objectivity correlation coefficients, results indicated that originality was more strongly related to motor creativity than the other factors. Although the test was found to be a valid tool for measuring the motor

creativity of college women, Glover concluded that the scoring procedures needed further refinement in order to be an objective and reliable system for evaluating motor creativity.

O'Neil (1982) developed and validated a new measure, the Refined Movement Analysis Category System (RMACS), to assess motor creativity and to investigate the relationship between RMACS scores and scores on the Beveridge Motor Creativity Test (BMCT). The RMACS was also used to identify creative movement components within the movement elements.

O'Neil's RMACS was designed to obtain scores on motor creativity in the context of dance. Therefore the movement tasks were developed to resemble the content that would appear in an educational dance lesson. A systematic category system was developed to study the characteristic movement elements of grade two children. The movement elements selected for RMACS included: a) efforts elements (time and flow) b) space elements (level and direction) c) body element (range) and d) relationship element (relationship).

O'Neil measured the occurrence (fluency) of uncommon responses. A panel of four judges verified behavioural definitions which identified unusual and usual components within the movement elements and established reliability of the RMACS.

Twenty-six grade two subjects responded to five problem solving tasks while being videotaped. The movement tasks were presented in the following order:

> Problem 1) "Moving in the room, show different ways you can use your body".
>
> Problem 2) "Moving in the room, show as many different directions as you can".
>
> Problem 3) "There is a space between the floor and the ceiling. With your body show different ways of using the space".
>
> Problem 4) "Put a body part in the hoop. Can you think of another body part and put it in the hoop? Good Now try to show different body parts that you could put in the hoop".
>
> Problem 5) "Here is a ball and a hoop. Show something that you can do with a ball and a hoop. Good Now show different things that you can do with the ball and the hoop" (p.37).

Problems one and two were designed to gather data on the movement elements direction, time and flow. Problems three and four were constructed to gather data on the movement elements level, range and relationship. The first four problems were used to provide data for the RMACS, while problem five was used as an independent measure of the Beveridge Motor Creativity Test (BMCT).

O'Neil found a significant relationship between scores on the RMACS and scores on the BMCT. Therefore the RMACS was found to be a valid measure of motor creativity. It was found that the RMACS' behavioral definitions of the movement elements of direction, range, relationship, time, and level were substantiated and flow was not. O'Neil defined the flow element as the link or transition between movements. Laban's concept of flow differed considerably; as part of the 'effort' concept, flow is defined as either bound or free (Laban, 1960, 1975; Laban & Lawrence, 1947; North, 1964, 1971; Preston-Dunlop, 1963; Russell, 1975).

The scoring procedure of the RMACS involved forming a ratio of the number of uncommon movement responses to the total number of responses. The ratio multiplied by 100 yielded the creative percentage. Despite this, the researcher conceded that the RMACS procedure was time consuming and that the use of the total test might be impractical for teachers' use.

The contribution of each movement element (time, flow, level, direction, range and relationship) to the total creativity score was determined and enabled O'Neil to provide movement profiles for each individual child that could be used to design future curriculum. The elements of direction and a combination of direction and flow were identified as possible predictors of motor creativity.

O'Neil recommended observing only direction and flow, instead of all six movement elements, as an abbreviated method of identifying the creative child in dance. Two of the five RMACS problems (No.1 and No.2) including the elements direction and flow could therefore be selected for use in a modified version of the RMACS.

The measurement issues

Various issues are related to the measurement of motor creativity. Some of these include 1) the use of Guilford's factors, 2) the inclusion of content related material, 3) the test objectivity and 4) the selection of criteria to establish validity.

Each of Guilford's factors of divergent thinking may easily be applied to movement, since movement responses lend themselves to open observation in ways that cognitive responses do not (Beveridge, 1973; Dodds, 1978; O'Neil, 1982; Wyrick, 1968). According to Dodds (1978), these factors are observable as "They represent classes of actual behavior that can be seen, heard or counted", and thus result in a quantitative measure of motor creativity (p.266). Dodds suggested the use of behavioral definitions of movement elements for each of Guilford's factors of divergent thinking: fluency, flexibility, originality and elaboration. She also defined the factors for observation and measurement:

> 1) Movement fluency can be operationalized as the total number of movements produced per unit of time; 2) Movement flexibility is the number of different categories or classes of movement produced per time unit;
>
> 3) Movement originality is the production of totally novel responses. Originality may be referenced to only a single individual or to a whole population; 4) Movement elaboration is the production of variations on a theme of a single movement response, and may be dualized into product and process phases (pp.265-266).

She recommended the use of Laban's analysis of movement to determine basic movement elements. With precise agreed-upon definitions for movement responses as guidelines, observers could easily attend to the same parameters of a movement sample. Without such agreement they could easily observe different dimensions of the same performance.

Laban's Movement Analysis provides a framework of movement elements related to the dance curriculum. In 1928, Rudolf Laban, developed and described a movement analysis applicable to educational dance in which movement elements were classified under four main movement concepts: 1) the instrument of expression, or the body; 2) how the body moves, or the effort; 3) where the body moves, or the

space; 4) the relationship of body parts or individuals (Laban, 1960, 1975; North, 1964, 1971; O'Neil, 1982; Preston-Dunlop, 1963; Russell, 1975; Stanley, 1969).

Laban's Sixteen Basic Movement Themes were based on the individual's physical, intellectual, emotional and social development (Preston-Dunlop, 1963). Each theme explained a particular aspect of movement. Laban (1960) labeled movement as either expressive or objective. Objective movement was functional and enabled one to operate purposely and efficiently in the environment. Expressive movement was artistic and involved self-expression and communication of an idea. Laban's analysis of movement, as presented in Table 1, enables the observation of the quantitative and qualitative aspects of movement in terms of the concepts: body, effort, space and relationship.

Creative dance programs present in the school curriculum often utilize adaptations of Laban's movement analysis as a theoretical framework and are designed to provide a base for physical, emotional, and aesthetic development (Steel, 1975). This approach lends itself to evaluation by simple observation. Movement becomes an educational experience when both quantity and quality of movement are developed. According to Ramirez (1980): "The guidance of movement experiences first centers on securing

a variety of response... The child's performance must then be assessed in terms of suitability and quality" (p.30).

Table 1

LABAN'S MOVEMENT CONCEPTS AND ELEMENTS

The BODY is the instrument of expression	- body actions - body parts - body symmetry /asymmetry - body flow - body shape
EFFORT is how the body moves	- weight (strong/light) - time (slow/fast) - space (direct/flexible) - flow (bound/free)
SPACE is where the body moves	- extensions - levels - directions - pathways
RELATIONSHIP	- of body parts - of individuals - of groups

The standard procedure for evaluating motor creativity has been by a panel of judges (Steel, 1975). Until now, most research in creative movement has been based on subjective judgments of "qualified" observers. In most cases, evaluations based on observations often included many flaws as the judges seemed to use different criteria

for measurement (Brennan, 1976; Glover, 1974; O'Neil, 1982; Steel, 1975).

There are two approaches for evaluating motor creativity. The first argues that an overall qualitative appraisal can be as discriminative as judging multiple criteria (Wall, 1971; Withers, 1960). The second approach involves a training procedure which will ensure that the raters base their judgment on common specific criteria, for example, using a rating scale. Torrance (1966) emphasized the importance of familiarity with the rationale of the test tasks and the concepts of fluency, flexibility, originality and elaboration.

Brennan (1976), Jackson-Glass (1982), O'Neil (1982), Torrance (1966) and many others suggested training judges so that they are objective and consistent in their assessment of movement performance measures. The judgment itself must be an informed one, and should be left to specialists in the field (Adkins, 1974; Bauernfeind, 1963; Cangelosi, 1982.)

According to Feldman (1980), the criteria for evaluation of creative works is inextricably entwined with the field of effort in which the work is produced. A more valid approach to the measurement of creativity is to devise a test that will utilize in the testing situation the content area, tools and materials of the area of

interest (O'Neil, 1982; Steel, 1975; Wyrick, 1968). Therefore a test should be content related. In addition, if one wishes to assess students' creative progress, evaluate programs and provide future guidance for the development of divergent thinking, the test should be tied to the curriculum.

It seems that teachers of creative dance or any other field have biases and preconceived notions of who or what is creative (Poole, 1979; Stalker, 1981; Steel, 1975; Torrance, 1981). Stalker (1981) considered that teacher's evaluation of creativity have many flaws, deriving in part, from teacher subjectivity and insufficient knowledge about the behaviours of creative individuals. Poole (1979) maintained that creativity is such an inclusive term that it easily leads to confusion, especially for a teacher who may feel that it expresses an ideal (and perhaps a false one) of "freedom" as opposed to "discipline" or "training".

As previously mentioned, movement creativity is uniquely open to observation; but it is important to define clearly, in behavioural terms, the creative factors to be evaluated (Brennan, 1976; Hagerty & Dick, 1971; Dodds, 1978). Bennett-Doppelt and Madans (1976) suggested that the creativity rating of an act depends on both the frame of reference of the rater and the content of an act to be rated. Every individual (judges included) comes with a

specific background and a personal set of values, and is likely to have his/her own views on creativity. Wall (1971) and Shapiro (1978) insisted that a number of ratings are necessary to eliminate subjective biases. It seems that the pooled judgment of several observers can yield a more valid score than that given from a single rater.

Guilford (cited in Withers, 1960) stated five common errors often arising in rating or judging performance:

1) Error of leniency; a tendency to rate all individuals whom they know above the average in certain traits

2) Error of central tendency; an hesitation to give extreme judgments, a tendency to displace individuals in the direction of the mean

3) Halo effect; a tendency to force the rating of any trait in the general direction of the general impression of the individuals rated

4) Logical error; a tendency to give similar ratings in traits that seem logically related in the minds of the raters

5) Tendency to rate persons of the opposite sex lower (p.31).

The problem of finding suitable criteria against which a test can be validated lies in the "how to" identify the creative person, or the creative product (Davis, 1975;

Guilford, 1971; Khatena, 1976; Shapiro, 1978; Singh, 1978; Stalker, 1981; Taylor & Ellison, 1978; Torrance, 1966). The problem is quite a critical one as Shapiro (1978) pointed out:

> Without establishing objective criteria, all endeavours at devising predictors, investigating personality and cognitive characteristics and venturing hypotheses about the creative process, are of questionable value (p. 257).

Shapiro also listed four types of bias often unwittingly introduced into criterion: 1) Criterion deficiency; the omission of important elements, 2) Criterion contamination; the introduction of extraneous elements, 3) Criterion scale unit bias; the inequality of the scale units, 4) Criterion distortion; the improper weighting in combining criterion elements.

The validation of a test is closely related to the degree of specificity of the test items and the conceptual definition of creativity used in the development of the test. The problems of establishing suitable criteria and the difficulty of finding a definition that will include the multidimensional aspect of creativity have been mentioned previously. It is therefore no surprise that the validation of motor creativity tests is a problem (Meeker,

1978; p. 57). Ebel (1961) argued that all tests cannot be validated:

> ...So long as what a test is suppose to measure is conceived to be an ideal quantity, unmeasurable directly and hence undefinable operationally, it is small wonder that we have trouble validating our tests. Only if we are willing to accept some actual test, or other actual method of obtaining criterion measures, as a basic (if somewhat arbitrary) operational definition of the thing we wish to measure, and only if we have some other test or measurement procedure that we wish to check against this standard, do we find the concept of test validity useful. Further, if the test we propose to use provides in itself the best available operational definition, the concept of validity does not apply. A basic definition needs to be clearly meaningful, but it does not need to be, and indeed it cannot be validated... The interpretability of a test score depends on its meaningfulness. We would suggest that meaningfulness replace validity in the usual lists of major desirable characteristics of a measuring instrument... (p.643-645).

In the development of their motor creativity measures, Beveridge (1973), Brennan (1976), and Wyrick (1968) used

Ebel's principle of operationally defining the measurement criteria to validate their tests.

Summary

An overview of the research on the creative process and its measurement revealed that the literature fails to provide a widely accepted definition of creativity. The basic assumption that creative potential lies within every individual is accepted. Creativity seems to have two dimensions, cognitive and affective The influence of environmental and motivational conditions are also of prime concern in the educational context.

Many researchers have investigated the relationships between motor creativity and existing tests of creativity, IQ and physical performance. Results indicate that motor creativity is quite specific and is not highly related to verbal and figural creativity, nor to intelligence and motor ability.

Guilford's factors of fluency, flexibility, originality and elaboration have been recognized as the most appropriate factors for evaluating motor creativity. Fluency measures have been widely used in motor creativity research and have been operationally defined in the literature. Fluency is usually defined as the total number of different responses produced, and represents the quantity of ideas (Anderson, 1959; Dodds, 1978; Guilford,

1968; Wyrick, 1968). It is easily observable and agreed upon. Incongruities remain in the definitions and scoring procedures of originality, flexibility and elaboration measures. Originality has been defined as the production of unique or novel responses (Anderson, 1959; Dodds, 1978; Guilford, 1968; Wyrick, 1968). Withers (1960) commented: "Often originality is confused with creativity. Originality does not necessarily indicate creativity if other factors are not present" (p.38). Flexibility has been defined as the number of different categories or classes of responses produced. It represents the variety of ideas (Anderson, 1959; Dodds, 1978; Guilford, 1968). It seems however that different classifications of movement have been used, often unrelated to the field of content. Finally, elaboration has been defined as the generation of variations on a theme of a single response. It represents the production of a variety of implications and details (Anderson, 1959; Dodds, 1978; Guilford, 1968).

Only Glover (1974) and Steel (1975) included all four measures measures in their tests: that is, fluency, flexibility, originality and elaboration. Brennan (1976) included measures of fluency, flexibility, and originality. All three reported that their scoring procedures needed further refinement. Others, like Beveridge and Wyrick included measures of fluency and originality. In most cases

fluency was utilized as a sole measure to tap motor creativity.

Fluency and flexibility appear to be of prime importance in the context of dance. Creative dance programs aim at providing students with a large vocabulary of movements, thus developing fluency, and facilitating the manipulation of movement elements to produce a variety of responses, i.e. developing flexibility. The literature suggests the use of specific movement elements in conjunction with Guilford's creativity factors. Laban's movement analysis provides specific movement elements for observation and instruction purposes. Movement exploration and creative dance programs provide children with experiences known to promote creativity. Valid and reliable motor creativity tests would be of particular benefit to dance educators in order to assess and develop the creative behaviour of their students.

In studying motor creativity, few instruments have been constructed to measure creative ability in dance. Glover (1974), Steel (1975), Brennan (1976) and O'Neil (1982) have attempted to develop practical motor creativity measures in the context of dance. There is agreement on the need for practical, reliable and valid instruments to measure motor creativity. The reported scoring inconsistencies, such as the lack of agreement among

observers, the need for further refinement and simplification of the scoring procedures indicate the difficulties involved in obtaining objectivity concerning the creative aspect of movement (Beveridge, 1973; Brennan, 1976; Glover, 1974; Jackson-Glass, 1982; O'Neil, 1982; Steel, 1975; Wyrick, 1968). For these reasons, most existing tests of motor creativity have been considered impractical for teachers' use.

Various problems are related to the identification and measurement of creative abilities. The lack of a general accepted theory has led researchers to utilize various approaches to the measurement of creativity. It would seem that what is being measured in creativity tests vary from test to test (McCormack, 1975; Poole, 1979). Tanwar (1977) presented the problems of measurement of creativity as follows:

> The problem of theoretical rationale and definition arises out of the attempt of the psychometrist to operationalize a universe of intangibles which by its very nature defies complete scrutiny; the problem of dimensionality arises from the unresolved issues of the relationship between what is being measured by tests of creative thinking and other more traditional intellectual measures, the problem of validity hinges upon sampling of appropriate stimuli from stimuli

> universe not fully definable and inherently discrepant theoretical framework, and the determination of suitable criteria; the problem of reliability impinges upon the operation of extraneous variables in the context of sociological and psycho-physiological dynamics of subjects relative to test administration and conditions, scoring procedures and scores, internal consistency of instruments and repeated testing (p.59).

The present research is directed to the development of a motor creativity test using fluency and flexibility measures, a test that is closely related to the content of dance programs. It is hoped that this device could be used by teachers to help determine progress and future instructional strategies.

CHAPTER III

METHODOLOGY

The purpose of this study was to develop and validate a test of motor creativity in the context of dance, using fluency and flexibility measures and five movement elements: body actions, body parts, time, level and direction. In this chapter, the methodology will be discussed under the following sections: 1) test construction, 2) subjects, 3) pilot study, 4) procedures and 5) treatment of data.

Test construction

The construction of a test requires several steps including the following: 1) reviewing the relevant theoretical literature; 2) selecting the criteria; 3) selecting the test items; 4) establishing measuring procedures; 5) selecting the subjects; 6) standardizing the directions; 7) testing reliability and objectivity of test items; 8) validating the test (Dvorak, 1967; Lewis & Mussen, 1969; Safrit, 1981). The construction of the Movement Fluency-Flexibility Test (MFFT) involved the aforementioned steps:

1) Review of literature

The literature on creativity, motor creativity and test construction was reviewed and reported in chapter two.

2) Selecting the criteria

Five movement elements, a) body actions, b) body

parts, c) time, d) level, and e) direction, were selected and behaviourally defined. These movement elements were selected as they represent the movement concepts 'body', 'effort' and 'space' being taught in the dance curriculum (Laban, 1960, 1975; North 1964, 1971; O'Neil, 1982; Preston-Dunlop, 1963; Russell, 1975; Stanley, 1969). They were also selected for their convenience of observation after discussion with four experts in the field of educational dance.

The creativity factors, fluency and flexibility, were selected and defined in behavioral terms after consultation with four experts in the field of educational dance and were formally defined in chapter one. Their affinity with dance program objectives: a) to produce a large number of ideas [fluency], and b) to change and manipulate a variety of movement elements [flexibility], was the determinant for their inclusion. Originality and elaboration were not included because of the difficulty to define and objectify these factors. Taylor (1979) noted:

> In constructing an observation instrument it is important to select a limited range of behaviours and to define behavioural categories as clearly as possible to make the raters' judgments as easy to determine as possible during coding (p.470).

3) Selecting the test items

Movement problem tasks were designed to resemble the content that would appear in an educational dance program. They were developed such that they would elicit fluency and flexibility.

Interviews with four experts in the field of educational dance were conducted to assist in the selection and definition of movement elements, and in the design of the movement problems. Agreement was reached with all four experts. The following movement tasks provided data for the MFFT:

Problem No.1) Look at the pattern on the blackboard. a) Can you dance the pattern? b) Can you do it differently? c) Can you think of another way?

Problem No.2 a) Can you build a sequence using the four movements: jump, turn, travel and stop? b) Can you do it differently? c) Can you think of another way?

The subjects were familiar with the type of problems but were never introduced to the pattern of problem No.1 nor to the group of four movements of problem No.2. Figure 1 illustrates the pattern used in problem No.1. In order to avoid the pattern of problem No.1 being interpreted as a dance motive, a similar problem was presented in class prior to the study where a rope was tossed in the air and

the pattern it created on the ground upon landing became the pattern used.

Figure 1

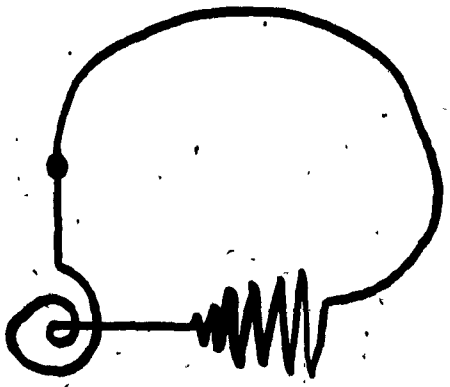

Figure 1. Illustration of the pattern presented in problem No.1 of the MFFT.

4) Establishing measuring procedures

The MFFT was administered to all subjects to obtain scores on fluency, flexibility and motor creativity. The test was comprised of two problems designed to sample the creative thinking abilities of fluency and flexibility in the context of dance. An observation grid was devised by the investigator and two of the experts (see Appendix D). Measurement procedures for assessing each subject's motor fluency and flexibility on the five movement elements were

determined on the basis of previous studies and discussion with experts in the field of dance.

The fluency measure included the total number of motor responses given in the all task solutions (Beveridge, 1973; Brennan, 1976; Dodds, 1978; O'Neil, 1982; Wyrick, 1968). For example, jumping forward, turning low, running backward and then forward with an increasing speed would have given four fluency points for four different movement responses (see Appendix E).

Flexibility is an ability to look at things in different ways, an ability to discard one frame of reference for another, to change approaches spontaneously. It involves a change in mental set to produce a diversity of expressed ideas from a relatively unstructured situation. The ability to 'shift' one's thinking is the criterion by which flexibility is judged. The score is the number of times the class of uses is changed. (Asthana, 1977; Lewis, 1974). Therefore changes in the use of each movement element were considered. The flexibility measure in the present study included the number of different categories into which reponses occurred. For example, varying the time element from increasing to maintaining the speed or changing the level element from high to low constituted a flexible response. In the example given for fluency in the preceding page, the sequence of four

movements would have been given five flexibility points: two points for two changes in body actions, none for changes in body parts, one point for varying the time, one point for using another level and one point for using another direction (see Appendix E). As one can see on the observation grid (Appendix D) only a maximun of two points for changes in both time and level and a maximun of three points for direction are possible but the numerous possibilities of changes in the uses of body parts and body actions make these two movement elements especially important in determining the flexibility score.

The motor creativity score for each problem was a composite attained by averaging the fluency and the flexibility standardized scores (Z-fluency + Z-flexibility)/2. Converted scores, such as percentiles, standard or t-scores were recommended by Petrosko (1978) and Torrance (1966) to facilitate the interpretation of results. Conversion of scores was a necessary procedure in order to combine fluency and flexibility scores. The composite MFFT motor creativity score was achieved by averaging the motor creativity scores of the two problems.

5) Selecting the subjects

The selection of subjects is described in the next section.

6) Standardizing the directions

The investigator's behaviour followed O'Neil's (1982) guidelines (see Appendix B) and the problem tasks were presented as in step No.3. Further standardization is reflected in the procedural section of this chapter.

7) Testing reliability and objectivity of test items

A pilot study was conducted to prepare a video for the training of observers and to establish inter-rater agreement in scoring. Brennan (1976), Jackson-Glass (1982), O'Neil (1982) and Torrance (1966) highlighted the need to train judges to be objective and consistent in their assessment of motor creativity measures. Two sessions to train the observers in using the Motor Fluency-Flexibility Test (MFFT) and the Refined Movement Analysis Category System (RMACS) scoring procedures preceded the actual study. The RMACS was used as a criterion score to establish the validity of the MFFT. The training sessions for the two tests lasted seven hours and were designed to familiarize the observers with the rationale of the tests, the concepts of fluency and flexibility, the definitions of the selected movement elements and the utilization of the observation grids (see Appendix D and E). Discussion followed observation of a videotape which involved grade three students performing movement tasks within a dance class. Three observers, including the investigator, used the MFFT

while the RMACS involved two different observers. At the completion of the observers' training session, inter-rater agreement was established with data from the pilot study and then further assessed in the actual study.

Figure 2

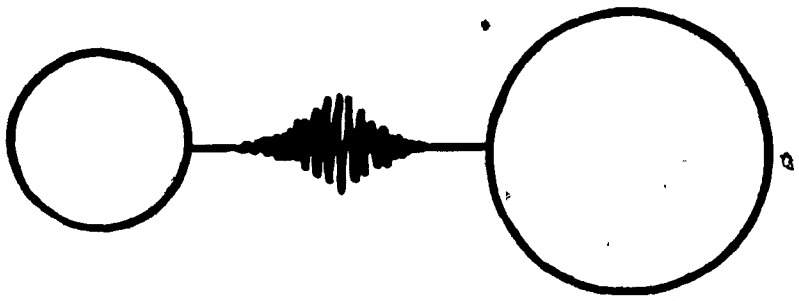

Figure 2. Illustration of the pattern presented in the test of equivalent form.

Reliability was determined by correlating the test scores with those of a test of equivalent form (Gronlund, 1968). A version of problem No. 1 using a different pattern (see Figure 2) was administered two weeks following the first testing session to verify stability and consistency of test results. The use of an equivalent form as a retest was appropriate in order to avoid familiarity with the test (Hagerty & Dick, 1971; Wyrick, 1968). A

retest identical to the original test would not have been realistic since the children could have rehearsed solutions for the problems and might not have been motivated to create new solutions. An equivalent form to problem No.2 was not used due to the difficulty in replicating identical content.

8) Validating the test

Meeker (1978) noted that: "Since creativity tends to be subjective and problematic, this has made the problem of validation very difficult, though not insurmountable". (p.57) The idea of content validation is that one or more persons, presumably well qualified in the field, endorse the operational definitions of the behaviours to be observed and their relationship to the test items and the test objectives (Adkins, 1974; Ebel, 1961, 1979; Guilford, 1971). In this study, content validation was established by "professional judgment". Four experts in the field of educational dance were consulted and as noted agreed on the selection and definitions of the creativity factors: fluency, flexibility, and the movement elements: body actions, body parts, time, level and direction; and on the design of the movement problems. Criterion-related validity was also assessed in the present study. Specifically, the results of the MFFT were compared with the scores on the RMACS (O'Neil, 1982).

O'Neil's RMACS (1982) was selected for this study because it was designed to obtain scores on motor creativity in the context of dance. Also, since the MFFT and the RMACS have similar theoretical designs, the data acquired with these tools should be comparable (Glover, 1974; Jackson-Glass, 1982; O'Neil, 1982). Both tests utilize movement elements from Laban's analysis. In addition, the RMACS is considered a valid means to identify motor creativity in dance, although it is time consuming and impractical for teacher's use.

O'Neil recommended the observation of the two movement elements, direction and flow, instead of the six she used as an abbreviated method of identifying the creative child in dance. The RMACS was originally designed to provide information on the child's utilization of the movement elements range, time, flow, level, direction and relationship. This information could later be used in planning future instructional strategies. Although the abbreviated form would allow for the recognition of creative individuals, the information it would generate would be insufficient for teachers to provide future instructional guidance. The RMACS problems No.1 and No.2 included the elements direction and flow and were therefore selected as a modified version of the RMACS. The RMACS movement tasks were presented as follows:

Problem No.1) "Moving in the room, show different ways you can use your body". The problem is considered an 'open' problem with little restriction. It is used specifically to gather data on direction, time and flow.

Problem No.2) "Moving in the room, show as many different directions as you can". The problem is more specific and therefore is more restrictive. It allows the observers to consciously gather data on direction as well as time and flow. (O'Neil, 1982, p.37).

O'Neil selected movement elements which were found in a study by Beveridge (1973) to discriminate between high and low motor fluency groups. Specifically, high creative children were found to produce more unusual ways of using their body than low creative children. Each movement elements was divided into components. Direction was composed of four components: forward, sideways, diagonal and backward. Flow was composed of three components: smooth, pause and jerky. Some of the components of each movement elements were considered commonplace responses and some were considered unusual. The usual and unusual classifications were defined by a panel of experts. The scoring procedure of the RMACS involved forming a ratio of the number of uncommon movement responses to the total

number of responses. The ratio multiplied by 100 resulted in the creative percentage.

Subjects

Two second grade classes were selected for the study from a middle class English suburban public school in the greater Montreal area. Twenty-four subjects (10 males and 14 females) were randomly selected and thus comprised the sample. Grade two students were recommended as a target population because they exhibit a spontaneous and uninhibited nature in life to a greater extent than older subjects (Beveridge, 1973; O'Neil, 1982; Torrance, 1981). The students were also chosen because 1) they are more familiar with the vocabulary and concepts of the dance program than younger subjects, 2) the group had some experience in problem-solving situations, and 3) they had been exposed to a creative dance program in their physical education classes since kindergarten. A letter, requesting parental authorization for the child to participate in the study was sent home (see Appendix A).

Pilot study

A pilot study was conducted to establish inter-rater agreement. A correlation $r = .9$ between raters' scores was necessary prior to the collecting of data. More training would have been provided if the criteria had not been met. The Pearson Product-Moment correlation was used to

determine inter-observer agreement for the MFFT pilot study. Correlations ranging from .97 to .98 (p .05), indicated a strong agreement among observers.

The pilot study also determined the amount of time needed for the subjects to respond to the movement task and the amount of videotaping necessary for the collection of data. The literature reports some controversy about the amount of time that should be allotted for task responses. Guilford (1971) suggested to control the working time during testing, while Adkins (1974), McCormack (1975), Singh (1978), Steel (1975) and Torrance (1981), Wallack and Kogan (1978), considered that a time limit restrains and reduces the creative output. In this study time limit was not a major consideration. For testing convenience, a maximum length of time of five minutes per solution was established to provide sufficient opportunity for completion of motor tasks and also limit some subjects from performing indefinitely (Jackson-Glass, 1982; O'Neil, 1982; Withers, 1960).

Procedures

Baas (1973), Johnson (1977) and Rowe (1977) recommended the use of videotape to record responses on motor creativity tests. The testing location was in a gymnasium of 16 by 15 metres; the filming area was marked by a circle measuring 8 metres in diameter. The testing

sessions were held out of class time in groups of four subjects. Each subject was filmed individually, while the other three waited in another room. The four tasks, two from the MFFT and two from the RMACS, were presented to the children by the investigator in random order. Consistency of the tester's behavior (see Appendix B) and of the instructions as noted previously, contributed to the objectivity of the test.

A brief warm-up of two minutes preceded the problem tasks. The warm-up served two major functions: to remind the child of the dance concepts and to help set a comfortable, playful, unthreatening atmosphere (see Appendix C)

Each problem was presented and the children were allowed to practice before each response was recorded. A maximum of three minutes was considered sufficient time to allow the children to think about their solution. A maximum response time of five minutes was allotted for each solution, as was determined in the pilot study.

According to Brown and Gaynor (1967), creativity requires calmness, and McCormack (1975) and Torrance (1966) considered some measures of creativity to be very susceptible to motivational effects. Serious consideration was given to the possibility of added stress on the subjects because they had to perform individually. However,

the possible detrimental effects of group performance, such as distractions and copying behaviors, were deemed to be more severe by all four experts consulted. Furthermore, since the children were familiar with the investigator the stress factor should have been minimal.

Children need a repertoire of skills previously acquired to express themselves more freely (Brown & Gaynor, 1967; Dodds, 1978; Withers, 1960). Exposure to, and understanding of the vocabulary and movement concepts is essential for children to display creative behavior in dance (Glover, 1974; Jackson-Glass, 1982; O'Neil, 1982; Steel, 1975). For the subjects of the present study, creative dance was an integral part of the school physical education program (20 percent), thus there was no need to organize such a program. Special attention, though, was given during eight lessons of thirty minutes each, in the month prior to the testing, to provide further experience and review the concepts of the body elements: body actions, body parts, time, level, direction and flow.

While the researcher and a videotape technician were testing, there was no interruption. The videotapes were half inch VHS cassettes. The data were collected on a color Panasonic videotape recorder (No.NV-8410, half inch VHS) with a Panasonic camera (No.0433VM010). The tapes were edited to include the movement responses only, not the

instructions nor the warm-up session. Also, the editing permitted the rearrangement of the order of the problems to allow scoring of the two MFFT problems and of the two RMACS problems separately.

The subjects were retested two weeks following the first testing session to establish the reliability of the MFFT. Problem No.1 of the MFFT with a different pattern was used as an equivalent form of the test.

Treatment of data

The data compiled from the MFFT and the RMACS were analyzed by an AMDAHL 5850 computer at McGill University. The Statistical Package for the Social Sciences (SPSSX) was used (Norusis, 1983). The Pearson Product-Moment correlation was used to demonstrate interrater agreement and reliability of the test. Conversion of scores to standard scores (Z scores) was necessary for comparison of test scores and for determining a total creativity score in combining the fluency and flexibility scores. To establish validity of the test, the MFFT scores were correlated with the RMACS scores of motor creativity using the Pearson Product-Moment method.

CHAPTER IV

RESULTS

The results of the statistical treatment of the data are presented in this chapter. The purpose of the study was to develop and validate the Motor-Fluency-Flexibility Test (MFFT) designed by the investigator. Data were collected on twenty-four grade two students using the MFFT and the the Refined Movement Analysis Category System (RMACS) designed by O'Neil (1982). An equivalent form of the MFFT was also administered two weeks following the original testing. Thus all students were tested using five problem-solving movement tasks; the two MFFT problems, the two RMACS problems and an equivalent form MFFT problem. Responses to the movement problems were videotaped for analysis by observers. The information in this chapter is presented under the following headings: 1) inter-observer agreement; 2) reliability of the MFFT; 3) the MFFT Motor Creativity Test; 4) the RMACS Motor Creativity Test; 5) the relationship between the MFFT and the RMACS; 6) summary of the results.

Inter-observer agreement

Inter-observer agreement for the MFFT problem tasks was determined using the Pearson Product-Moment correlation. The correlations were all significant ($p < .05$) and ranged from .88 to .92, indicating strong agreement among the judges. The inter-judge correlations are

presented in Table 3. The judges' means for the MFFT and its equivalent form are presented in Table 2.

Table 2
Mean scores for each judge on the MFFT and the equivalent form

Judge	1	2	3
MFFT	10.7	9.4	10.9
Equivalent form	11.1	9.5	11.1

Inter-observer agreement for the test of equivalent form was higher than for the MFFT. The correlation between rater 1 and rater 2 was .91, the correlation between rater 2 and rater 3 was .92 and the correlation between rater 1 and rater 3 was .93 (p .05).

Table 3
Pearson Product-Moment correlations for the inter-rater agreement of the MFFT

Judge	1	2	3
1		.88 *	.92 *
2			.89 *
3			

* p .05

Responses to the movement tasks were videotaped for analysis by three judges. The three judges viewed the tapes independently and awarded a fluency score and a flexibility score to each subject for each problem. The raw scores

assigned by the judges can be found in Table 11 of Appendix F.

Reliability of the MFFT

The reliability of the MFFT was determined by comparing the scores from the original test with those from an equivalent form (see Table 12 of Appendix F). The Pearson Product-Moment correlation was used to determine the relationship between the MFFT, each of its problems and its equivalent form. As shown in Table 5, a moderate but significant relationship (.57) was found between the MFFT and its equivalent form ($p < .05$). Problem No.1 related the highest to the equivalent form ($r = .64$), probably due to the similarity of the problems. Table 4 shows the descriptive statistics for each MFFT problem.

Table 4
Descriptive statistics for the creative movement problems

Section	Mean	Standard Deviation	Standard Error	Range Min.	Range Max.
Problem No.1	11.9	4.5	0.64	5	22
Problem No.2	8.7	4.4	0.63	2	21
Equivalent	10.6	4.4	0.64	0	18

The MFFT motor creativity test

The MFFT was administered to all subjects to obtain scores on fluency, flexibility and thus motor creativity.

The test was comprised of two problems designed to sample the creative thinking abilities of fluency and flexibility in the context of dance.

Table 5
Pearson Product-Moment correlations between MFFT problems

	MFFT No.1	MFFT No.2	MFFT No.1&2
MFFT Equivalent	.64 *	.30 *	.57 *
MFFT No.1		.40 *	.83 *
MFFT No.2			.84 *

* p .05

The motor fluency score was a count of the total number of different responses offered on each problem of the MFFT. The means of motor fluency for problem No.1, problem No.2 and problems Nos. 1 and 2 combined were 10.8 , 8.1 and 9.4 respectively. The motor flexibility score was computed from the number of different categories utilized in each of the two problems of the MFFT, as outlined in chapter three. The means of motor flexibility were calculated for problem No.1, problem No.2 and problems Nos.1 and 2 combined and were 13.1 , 9.3 and 11.2 respectively. The motor creativity score was a composite attained by averaging the fluency and the flexibility standardized scores (Z) from each movement problem. Conversion of scores was a necessary procedure in order to

combine and compare fluency and flexibility scores. The fluency, flexibility and composite scores are presented in Table 14 of Appendix F. The descriptive statistics for motor fluency, motor flexibility and motor creativity can be found in Table 6. The fluency and flexibility means on each problem are presented in Table 7.

Table 6
Descriptive statistics for the MFFT factors

Variable	Mean	Standard Deviation	Range Minimum	Range Maximum
Motor Fluency	9.4	4.2	3	20
Motor Flexibility	11.2	5.0	2	22
Motor Creativity *	0	.98	-1.68	1.85

* standardized scores

Table 7
Fluency and flexibility means on each problem

Problem	Fluency	Flexibility
No. 1	10.8	13.1
No. 2	8.1	9.3
Equivalent	9.3	11.8

The Pearson product-moment correlation coefficient was used to calculate the relationship between creativity factors. The correlation between the fluency scores and the

flexibility scores was r = .91 (p .05), indicating that the two factors were highly related.

RMACS motor creativity test

A modified version of the RMACS was also administered to all subjects to obtain a motor creativity score. The test was comprised of two problems designed to sample creative thinking abilities on the movement elements: direction and flow. The motor creativity score was an average of the percentage scores obtained on direction and flow. The percentages were drawn from the number of uncommon responses over the total number of responses. Descriptive statistics of the two RAMCS problems and their movement elements were calculated and are presented in Tables 8 and 9.

Table 8
Descriptive statistics for the RMACS problems

Variable	Mean	Standard Deviation	Range Minimun	Maximum
Problem #1	61.1	30.3	0	100
Problem #2	75.1	26.5	0	100
Problem #1&2	68.1	24.0	0	100

Raw scores and means of the 2 judges on the RMACS problems for each subjects are presented in Table 13 of Appendix F.

Table 9
Descriptive statistics for the
RMACS movement elements

Variable	Mean	Standard Deviation	Range Minimum	Range Maximum
Direction	49.3	24.2	0	100
Flow	89.0	15.6	35	100
Total Creativity	68.1	18.0	0	100

Inter-observer agreement for the RMACS was established by the Pearson Product-Moment correlation ($r = .82$; $p < .05$).

Relationship between the MFFT and the RMACS

The Pearson Product-Moment correlation coefficient was used to calculate the relationship between the MFFT and the RMACS. The correlation between the students' scores on the MFFT and the students' scores on the RMACS was not significant at the .05 level ($r = -.14$), indicating no relationship between the two instruments.

Table 10
Pearson Product-Moment correlations
between MFFT and RMACS problems

	MFFT No.1	MFFT No.2	MFFT Nos.1&2
RMACS No.3	-.12	-.35	-.28
RMACS No.4	-.09	.14	.03
RMACS Nos.3&4	-.13	-.09	-.14

Table 10 shows the correlation coefficients between the MFFT problems and the RMACS problems.

Summary of the results

Motor creativity data were collected for each subject using the MFFT and the RMACS. Responses were videotaped for analysis by two observers for each RMACS problem and by three observers for each MFFT problem. The MFFT produced motor fluency and motor flexibility scores which were standardized and combined (averaged) to yield a single motor creativity score per subject for each problem. Results on the two problems were then averaged to yield final scores on the MFFT.

The Pearson Product-Moment correlation was used to determine the relationship between the MFFT and the RMACS. The results of the analysis failed to show that a significant relationship ($p < .05$) between the two instruments existed ($r = -.14$). The results of this study indicate no relationship between the MFFT and the RMACS. Problem #1 of the MFFT correlated significantly with the equivalent form indicating a moderate relationship. Fluency and flexibility were highly related ($r = .91$, $p < .05$). Neither fluency nor flexibility was highly related to the RMACS.

CHAPTER V

DISCUSSION

The purpose of this study was to develop and validate the Motor Fluency-Flexibility Test (MFFT) designed by the investigator. Data were collected using the MFFT and the Refined Movement Analysis Category System (RMACS) developed by O'Neil (1982) in order to determine the relationship between the two instruments. The information in this chapter is subdivided into the following sections: 1) inter-rater agreement; 2) Reliability of the MFFT problem No.1; 3) the relationship between the MFFT problems; 4) the relationship between fluency and flexibility; 5) the administration of the MFFT; 6) the relationship between the MFFT and the RMACS; 7) summary.

Inter-rater agreement

The inter-rater agreement of the MFFT indicated that the three judges were indeed attending to the same parameters (r's ranging from .88 to .92). The operational definitions and the training of observers were therefore considered to have been adequate. The MFFT clearly defined the behaviours to be observed and scored. The judges understood and agreed on fluent and flexible responses, and on how the use of Laban's movement elements contributed to fluency and flexibility. The inter-observer agreement correlation was also high for the test of equivalent form (r's ranging from .91 to .93, p .05).

Inter-observer agreement of the RMACS was lower than the MFFT. However, Guilford (1954) cited .50 as an acceptable level of inter-judge agreement and thus the .82 which resulted from the RMACS was deemed adequate.

Reliability of the MFFT problem No. 1

The significant correlation ($r = .64$ at $p .05$) indicated that problem No. 1 of the MFFT was moderately related to its equivalent form. A number of reasons could account for this result. As noted in chapter two, emotional, physical, motivational, and mental health factors affect creative functioning (Guilford, 1968, 1977; Steel, 1975; Torrance, 1963). These factors could also affect reliability. Although the task selected for the equivalent form included content similar to problem No. 1, the two tasks might have been differentially stimulating. The measuring instruments are not necessarily unreliable or lacking in usefulness. In some circumstances, it may be unreasonable to expect high reliability for example, an individual's motivation to do a creative task might vary over time. (Dodds, 1978; Lewis, 1974; Torrance, 1966). Torrance (1967) reported that motivational factors are more critical in creative testing than in personality, intelligence and achievement testing. Also, studies of test-retest reliabilities have indicated that reliabilities are higher for adults and older children

than for younger children (Petrosko,1978; Torrance, 1967). The literature suggests .5 as an acceptable coefficient of reliability (Ebel, 1979; Torrance, 1967). The reliability of problem No.1 was therefore deemed adequate.

The relationship between the MFFT problems

Each problem represents a different stimulus to which children react differently. The correlation between problem No.1 and problem No.2 of the MFFT showed a moderate relationship ($r = .42$ at $p .05$). While the subjects were prompted to give three solutions to each problem task, some subjects offered five and six solutions to a task and one subject did not respond to task No.2. Therefore it seems that some children respond differentially to various stimuli. For example, 56% of the subjects scored higher on problem No.1 than on the equivalent problem, 15% scored the same and 29% scored lower; 60% scored higher on problem No.1 than on problem No.2, 17% scored the same and 23% scored lower; while 42% scored higher on problem No.2 than on the equivalent problem, 6% scored the same and 52% scored lower. In general, therefore, subjects scored higher on problem No.1 than on either problem No.2 or the equivalent problem. It seems that problem No.2 was a more restrictive task. It is possible that the movement situation offered in problem No.1 was more stimulating to

some children than others and the reverse could also be true.

The relationship between fluency and flexibility

The results demonstrated that fluency and flexibility were highly related to each other (r = .91). Therefore, within the limitations proposed by this investigation, measuring one or the other factor of creativity would seem to be sufficient to determine creative abilities in dance. Others studies have recommended the use of the sole measure of fluency to tap motor creativity (Beveridge, 1973; Wyrick, 1968). While Guilford identified four different factors of creativity (fluency, flexibility, originality and elaboration), the movement literature suggests that these factors may often be related (Beveridge, 1973; Glover, 1974; Wyrick, 1968). Fluency is a necessary condition to flexibility and the two creative thinking abilities have often been highly related; thus the use of both fluency and flexibility might not be important to tap motor creativity in dance.

The administration of the MFFT

Training of the observers for the MFFT required seven hours. With a prepared instructional package, the amount of time necessary to train observers might be reduced considerably. The scoring itself was not laborious nor time consuming as it required ten minutes for a trained observer

to record a subject's response on each problem. With the use of the scoresheet, Laban's movement analysis was easily understood and utilized. At a glance, the teacher could see to what extent children utilized each movement element, as well as how fluent and flexible they were in the use of each movement element. Charts could also be constructed showing individual fluency and flexibility profiles relative to the group means.

The relationship between the MFFT and the RMACS

Results of the statistical analysis revealed that no relationship existed between the MFFT and the modified version of the RMACS. There are two possible explanations for this finding. One is that the two tests utilized different movement elements. Another explanation is that the scoring procedures differed considerably.

The selection of different movement elements in the MFFT and the modified version of the RMACS might account for the lack of relationship between the two instruments. O'Neil recommended the short version of the RMACS which included the elements of flow and direction only, while the MFFT included the elements of body actions, body parts, time, level and direction. In her study, O'Neil's element of flow was not substantiated and was therefore not selected for the MFFT. It appears that O'Neil considered 'flow' as the link or transition between movements. Flow,

within Laban's 'effort' concept refers to changes in the quality of tension in the movement and is usually considered to be either bound or free (Beveridge, 1973; Laban, 1960, 1975; Laban & Lawrence, 1947; North, 1964, 1971; Preston-Dunlop, 1963; Russell, 1975).

The movement elements selected for use in the MFFT were not all-inclusive but representative of the concepts of body, effort and space. The inclusion of relationship elements and more effort elements, such as weight (strong/light), space (direct/flexible) and flow (bound/free) would have better accounted for the creative expression in dance. In fact, the more movement elements included in the rating scale the more completely and truly the instrument might identify creative thinking abilities in dance. However some of these elements are not easily observable and since one of the main purposes of this study was to design an instrument that teachers could use, the choice of movement elements from Laban's analysis was restricted for practical purposes to only five: body actions, body parts, time, level and direction. Thus the MFFT included the observation of five movement elements while the RMACS modified version included only two. A larger number of observations improves the reliability of a test (Ebel, 1980; Hagerty & Dick, 1971; Safrit, 1981). And as Lyman (1978) mentioned: "Test reliability is very

important to the test user, for it is necessary for good validity" (p.32). The validity of the original version of the RMACS was substantiated, but the validity of the short version has not been verified.

Scoring procedures also differed between the MFFT and the RMACS. While the MFFT and the RMACS appear to have similar frameworks, both utilizing movement elements inspired from Laban's analysis, the differences in the definitions of what was measured might account for the lack of relationship. In fact, the MFFT creativity factors, fluency and flexibility differ considerably from the RMACS creative score which consisted of the frequency of uncommon responses within each movement element. It may therefore be difficult to identify relationship among creativity tests because they may in fact be measuring different creative thinking abilities.

Although no relationship was observed with the RMACS, the possibility that the MFFT is a valid measure of fluency and flexibility can be advanced. This study and others (Beveridge, 1973; Brennan, 1976; Jackson-Glass, 1982; Steel, 1975 have found negligible or low relationships between a newly proposed test of motor creativity and selected criteria. If creativity is multidimensional (Brennan, 1976; Steel, 1975; Torrance, 1965), this is not particularly surprising. Possibly the most productive way

to establish validity is to follow Ebel's suggestion (1980) of operationally defining the measurement criteria (Beveridge, 1976; Brennan, 1976; Wyrick, 1968). According to Ebel (1980):

> The kind of validity that measures possess as a result of being derived from unambiguous, operational definition of the characteristic being measured is direct primary validity. It is fundamental to all other kinds of validity, and there is no substitute for it. It is validity by definition, and is related to but not identical with the other types of validity (p.231).

Summary

Results indicated that the MFFT had high inter-rater agreement and that the reliability of problem No.1 was deemed adequate. Fluency and flexibility were highly related, therefore the use of both fluency and flexibility measures might not be necessary to tap motor creativity in dance. The administration of the MFFT does not require much time and training and could therefore be a useful tool for teachers. Results of this study revealed no relationship between the MFFT and the RMACS indicating that the two instruments are not measuring the same variables.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The purpose of the study was to develop and validate a test of motor creativity for dance using fluency and flexibility measures and five movement elements: body actions, body parts, time, level and direction. This chapter is divided into the following sections: 1) summary of methodology; 2) summary of results; 3) conclusions; 4) implications; 5) recommendations for further study.

Summary of methodology

The development of the Motor Fluency-Flexibility Test (MFFT) involved selecting and operationally defining the creativity factors, fluency and flexibility, and the movement elements, body actions, body parts, time, level and direction with a panel of four experts in the field of dance, thus establishing content validity. The investigation involved twenty-four grade two students. Motor creativity data were collected for each subject using the MFFT and the Refined Movement Analysis Category System (RMACS). Each subject's response was videotaped for analysis by two observers for each RMACS problem and by three observers for each MFFT problem. Inter-judge agreement was verified by Pearson Product-Moment correlations. The reliability of the test was established using a test of equivalent form. Criterion-related validity

was verified by comparing the results of the MFFT and O'Neil's RMACS.

Summary of the Results

Inter-observer agreement of the MFFT indicated that the three judges were indeed attending to the same parameters (r's ranging from .88 to .92, p .05). The inter-observer agreement correlation was also high for the test of equivalent form (r's ranging from .91 to .93, p .05). Fluency and flexibility were highly related (r =.91, p .05). The MFFT produced motor fluency and motor flexibility scores which were standardized and combined to yield a single motor creativity score per subject for each problem. Results on the two problems were then averaged to yield final scores on the MFFT. Problem #1 of the MFFT correlated the highest with the equivalent form (r = .64 at p .05). Correlation between problem #1 and problem #2 of the MFFT showed a significant relationship (r = .42 at p .05). The Pearson Product-Moment correlation was used to determine the relationship between the MFFT and the RMACS. The result of the analysis failed to demonstrate a significant relationship between the two instruments. Neither fluency nor flexibility of the MFFT was highly related to the RMACS.

Conclusions

The results of the statistical analysis revealed that no relationship existed between the MFFT and the RMACS. Within the limitations of the present study and assuming that the RMACS is a valid test of motor creativity, the hypothesis stating that the MFFT would represent a valid, reliable and objective means of assessing motor creativity was rejected. However, considering the multi-dimensionality of creativity, the possibility of the MFFT as being a valid measure of fluency and flexibility is justifiable according to Ebel (1980). The MFFT includes clear operational definitions of the factors fluency and flexibility to be measured. This was supported by the high interjudge agreement correlation. Since no relationship was observed with the RMACS, it appears that the two tests are measuring different variables. The MFFT could represent a unique tool to identify the presence of the creative thinking abilities, fluency and flexibility in dance. Also, the MFFT included the observation of five movement elements while the RMACS modified version included only two. Only one movement element (direction) was common to both tests. For these reasons, no significant relationship could be established with another instrument. Further studies are needed to validate the MFFT.

Implications

Since the results indicated high inter-observer agreement, the MFFT proved to be an objective test of motor fluency and flexibility in dance. Fluency and flexibility are of prime interest to the dance educator since dance programs aim at providing students with a large vocabulary of movements (fluency) and at facilitating the manipulation of movement elements to produce a variety of responses (flexibility). Thus the MFFT can be used as an independent measure of fluency and flexibility.

Fluency and flexibility were highly related to each other. Therefore, measuring one or the other factor of creativity in order to save time would be sufficient to determine the presence of creative abilities in dance.

The problem task used as an equivalent form of problem No. 1 might not have been really equivalent. Since the subjects' scores on the two movement tasks were moderately related, it is possible that one movement situation was more stimulating to some children than the other. Therefore the selection of problem tasks seems important and a large number of observations is preferable.

The instrument appears to be a good tool to improve teachers's observation skills and could easily be used in teacher training. It could also be a valuable tool in teaching Laban's analysis of movement. The scoring

procedure for creative movement should be applicable to various movement problems utilizing Laban's movement elements. The instrument offers opportunities of using the full range of movement elements or only a portion of them. Other movement element could be added to the rating scale. At a glance, the teacher can see to what extent each child utilized each movement element, as well as how fluent and flexible he/she was in the use of the elements. From such information the teacher could develop future instructional strategies. Charts could also be constructed showing individual fluency and flexibility profiles relative to the group means.

The MFFT testing procedures and its scoring system are simple and unequivocal, and therefore would not require a great deal of training for the teacher. With a prepared instructional package, the amount of time necessary to train observers can be reduced considerably. The scoring itself was not laborious nor time consuming as it required ten minutes to a trained observer to record and score a subject's response on each problem.

Recommendations for further study

From the results of the present investigation, the author recommends that research in the following areas would be productive:

(1) Replication studies should be done to determine the criterion-validity or construct-validity of the MFFT.
(2) A study investigating intra-observer reliability could determine the scoring consistency of each rater.
(3) Future studies are needed to determine how present motor creativity measures can be adapted to special populations (physically and/or mentally handicapped).
(4) The Generalizability Theory to determine reliabilities and sources of error could be used in a study involving the MFFT.
(5) Once adequate validity and reliability of the MFFT is established, it could be used to determine program efficacy.
(6) The relative weight of fluency and flexibility in the equation for motor creativity should be investigated.
(7) Answers are needed for questions such as: What is originality? What is elaboration? How can they be operationally defined for observation purposes in the context of dance?
(8) Studies should investigate whether originality criteria should be the same for children and adults.
(9) Studies should be done on the screening for potential creative capacity at an earlier age.

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APPENDIX A

Letters of permission

January 28th, 1985

Dear Parents,

For the completion of a Master's degree in Physical Education at McGill University, I would like to conduct a study on motor creativity with twenty-four grade two students. The purpose of the study is to develop a test to assess children's creativity in motor tasks. The test will also be useful in designing programs and instructional strategies that could stimulate creativity. Research and evaluation are necessary procedures to upgrade the quality of education.

To this end, your child _____ has been randomly selected as one of the twenty-four subjects for the study. The study will take place at Seigniory school, out of class time, during two lunch hours between March 5th and March 22nd 1985. The children will be requested to respond to two movement tasks, presented in the familiar way of their physical education classes, while being videotaped. Upon your consent to your child's participation in the study, you will be notified as to the precise dates he/she will be staying at school for the lunch period. I will be conducting the study myself with the help of a

technician for the videotaping. The children will be given the opportunity to see their performance. The videotapes are strictly for professional use and all participants will be kept anonymous. This research project has received permission and support from the Lakeshore School Board and McGill University.

Please fill out the form below and return it to school as soon as possible. If you have any questions about the study, feel free to call me at school (695-3921).

Your cooperation is greatly appreciated,

Ginette Gingras
Physical Education

I give permission for my child _____ to participate in the motor creativity study.

_____ _____
Date Signature

I do not grant permission for my child to be included in the study.

_____ _____
Date Signature

Mr. Owen Buckingham
Principal of Seigniory School
150 Seigniory Ave
Pointe-Claire
Quebec
H9R 4R5

January 25th, 1985

Dear Sir,

For the completion of a Master's degree in Physical Education at McGill University, I would like to conduct a study on motor creativity with twenty-four grade two students from Seigniory school, during the lunch hours of the first three weeks of March 1985.

The purpose of the study is to develop and validate a test to assess creativity of children in dance. The children will be requested to respond to two movement tasks while being videotaped. Grade two students were chosen as a target population because they understand the basic movement concepts and the vocabulary used in a dance program, and because this age group tends to be spontaneous and uninhibited.

Permission from the parents of the selected subjects will also be requested. I would appreciate your approval and support.

Thank you for your consideration,

cc. Mr. John Killingbeck

APPENDIX B

Summary of suggestions for investigator behavior

For a consistent, concise controlled investigator behavior during the study:

a) In the introduction omit reference to "being nervous".

b) In the warm-up utilize the phrase "let's move together for a while" and slowly wean the student to a state of showing something of his own.

c) In the warm-up introduce body actions, body parts, time, level, direction and flow (see O'Neil's definition of flow in chapter one and two).

d) In the instruction and wording of problems remove the use of "I" as this sets up a situation where the child is trying to please the researcher.

e) Lead the problems through a slow progression: " Can you do one way, can you do it differently, can you find another way".

f) Make a list of non-judgmental verbal reinforcements that could be utilized, e.g. "interesting", isn't that different".

g) The researcher should be consistent in use of his own body level and distance from the participant.

h) The researcher should be consistent in utilizing encouragement and reinforcement statements while the student is responding (O'Neil, 1982).

APPENDIX C

Warm-up procedures

The warm-up preceding the problem tasks served two major functions: first, to remind the child of the dance concepts introduced in class and second, to help set a comfortable, playful and unthreatening atmosphere. The researcher first suggested some running with the child. Then, they walked anywhere in the gymnasium without following one another. Physical boundaries were mentioned as well as suggestions made to use the whole area. The researcher asked the student what other directions could be used. If only verbal answers were given, the subjects was then asked to demonstrate. As the child changed direction, so did the researcher, copying the child's movement. The researcher would initiate a movement if the child was omitting an element. At first, the researcher participated with the subject and then gradually withdrew from the activity so that by the end of the warm-up the child was using his/her own responses. Attempts were made to draw all possibilities of responses from the child. The same procedure was used for the concepts of body actions, body parts, time and level. The subject was considered ready for the experiment when he/she was illustrating a clear understanding of the concepts which would be used in the movement problems.

APPENDIX D

RECORDING THE OBSERVATIONS

1) Note the subject's number and the task number

2) For each task, observe and mark one solution at a time (the use of a videotape distance control might be useful)

3) Mark on the same scoresheet all solutions as follows:

   solution 1 in blue

   solution 2 in red

   solution 3 in green

   solution 4 in black (if necessary)

4) Observe the first solution entirely then mark from memory with a pencil (if necessary) the body actions and their order, then the body parts supporting (or leading, if there is gesture), the time factor, the level and finally the direction. Repeat the observation and correct with a color marker.

To determine the type of action

Body actions involve locomotor, non-locomotor motion and stillness. The main categories of actions are: jump, turn, travel, pause, gesture and stepping. Sub-categories are:

a) travelling actions : walk, run, skip, gallop, slide, crawl...

b) jumping actions : hop, bounce, leap...

c) turning actions : twirl, spin, rotate, pivot, roll...

d) pause actions : stop, balance...

e) gesture : swing, sway, circle, push, pull, lift, lower, kick, thrust, grasp, fling, shake, vibrate, part, rise, sink, invert, open, close, twist, fall, arch, curl...
f) stepping actions: lying, sitting, kneeling, standing... Stepping involves a weight transfer.

When there is a combination of actions the observer notes the movement as she/he perceive the intent. For example, in jumping forward, the intent is travelling; in jumping on the spot, the intent is jumping. In all cases, the most important is to be consistent.

If stepping is required for the next movement, as in getting up to run, the stepping does not count. Pause, gesture and stepping are considered when they are perceived as intentional or deliberate actions part of the sequence.

Note the difference between turning and moving forward following a circular pattern. A turning action involves a turn of at least 180 degrees.

To determine the body parts Body parts are either 1) leading; 2) supporting; 3) in contact. In this study, only supporting body parts are identified. Body parts supporting were considered for all jumping, turning, travelling, stopping and stepping actions; body parts leading were considered for gesture.

To determine time

Time refers to body time in movement. Elements are: 1) increase of speed; 2) decrease of speed; 3) maintaining of speed.

To determine level

Level is the relationship of the body to space in the vertical plane. Levels are viewed from a reference point of base of support (head, shoulders, knees, feet). Elements are: 1) high (head is in its normal area or higher, the extremities reach the highest plane); 2) medium (most of the body moves in the area limited by the shoulders and knees when the body is upright); and 3) low (most of the body moves in the area located below the knees when the individual is upright).

To determine direction

Direction is the relationship of the body in space in the horizontal plane. Elements are: 1) forward (leading with the front of the body); 2) sideways (leading with the right or left side); 3) diagonal (diagonally forward or backward), and 4) backward (leading with the back of the body).

Codes and abbreviations

Abbreviations are made with the first and last letter of the word. Codes were decided by the group of observers. Again, consistency in the marking is stressed so that the investigator could read all observation sheets.

ACTIONS	BODY PARTS	TIME
WALK -- WK	HEAD -- ^	INCREASING SPEED -- I
SKIP -- SP	SHOULDER -- SH	DECREASING SPEED -- D
HOP -- HP	ELBOW -- E	MAINTAINING SPEED -- M
LEAP -- LP	HAND -- H	LEVEL
SLIDE -- SE	CHEST -- C	HIGH -- H
CRAWL -- CL	BACK -- B	MEDIUM -- M
PIVOT -- PT	SIDE -- SI	LOW -- L
	GLUTEUS -- G	DIRECTION
	KNEE -- K	FORWARD -- F
	FOOT -- F	SIDEWAYS -- S
		DIAGONAL -- D
		BACKWARD -- B

(Plural, as in using two feet was notated with a set of quotation marks after the code: F")

MFFT OBSERVATION SHEET

Subject No._____ Task No._____

BODY ACTIONS	#	BODY PARTS	TIME			LEVEL			DIRECTION			
			I	D	M	H	M	L	F	S	D	B
jump												
turn												
travel												
pause												
gesture												
stepping												

FLUENCY SCORE:_____ FLEXIBILITY SCORE:_____

Observer: _____

Figure 3

Example:

The subject is skipping, then pivots on one foot and falls to the floor. After getting down on the knees, the subject pulls the body forward with the hands a few times, then stops curled on the floor.

Observations:

Actions	No.	B.Parts	Time	Level	Direction
Jump	-	-	-	-	-
Turn	2	foot	maintain	high	-
Travel/skip	1	feet	M	H	forward
slide	4	hands-knees	M	low	F
Pause	5	H-K	-	L	-
Gesture	-	-	-	-	-
'Stepping'	3	feet to knees	decrease	medium	-

(In this case, curling is not considered as a gesture because it is the position of the body after stopping the previous action).

APPENDIX E

SCORING FLUENCY AND FLEXIBILITY

1) Motor fluency is the total number of movements produced. The fluency score is the total number of different responses for the problem task. For example running forward, backward and skipping forward would give three points.

2) Motor flexibility is the number of different categories into which movement responses fall. The categories to be used in classifying responses are elements of the movement concepts: body actions, body parts, time, level, direction. The flexibility score is the total number of changes in categories. For example running forward, backward and skipping forward would give two points; one for changing direction and one for changing action. Note that a point is not given for changing direction again to forward or backward; direction has four possibilities and can allow a maximum of three points. Time and level have each three possibilities and can allow a maximum of two points. Note that body parts, their combinations and body actions have a large number of possibilities and would allow up to that number minus one number of points. For the flexibility score, consider changes

a) in the body action: such as run, walk, skip, slide, turn....

b) in the use of body parts: feet, hands, feet and hands, one foot and hands....

c) in time: increasing, decreasing and maintaining speed

d) in level: high, medium and low

e) in direction : forward, sideways, diagonally, backward

MFFT SCORE SHEET

TASK #________

Ss #	FLUENCY			FLEXIBILITY		
	Rater #1	Rater #2	Rater #3	Rater #1	Rater #2	Rater #3

Figure 4

APPENDIX F

Table 11
Raw scores from the MFFT

Subject #		rater 1 flu	rater 1 flex	rater 2 flu	rater 2 flex	rater 3 flu	rater 3 flex	mean flu	mean flex
1	a	7	9	4	5	6	7	6	7
	b	6	6	7	7	8	7	7	7
2	a	8	12	5	8	9	16	7	12
	b	3	4	3	5	3	6	3	5
3	a	11	14	8	13	9	11	9	13
	b	3	3	2	1	4	2	3	2
4	a	11	10	6	8	8	8	8	9
	b	8	9	6	9	10	9	8	9
5	a	7	10	5	10	6	10	6	10
	b	6	7	7	7	6	6	6	7
6	a	13	18	11	13	13	14	12	15
	b	11	11	9	11	11	10	10	11
7	a	9	9	6	6	6	7	7	7
	b	8	11	9	13	10	11	9	12
8	a	10	8	5	7	11	14	9	10
	b	5	5	5	5	5	5	5	5
9	a	13	15	11	14	14	18	13	16
	b	4	3	4	3	6	4	5	3
10	a	22	16	14	15	23	18	20	16
	b	16	18	18	19	18	21	17	19
11	a	15	15	12	15	14	15	14	15
	b	15	21	12	16	15	20	14	19
12	a	11	16	12	12	11	16	11	15

12	b	9	7	7	8	9	9	8	8
13	a	9	14	7	12	12	16	9	14
	b	10	13	12	17	14	15	12	15
14	a	10	12	10	13	10	12	10	12
	b	6	5	5	5	6	6	6	5
15	a	9	13	8	12	10	15	9	13
	b	6	9	6	7	5	8	6	8
16	a	6	9	3	5	6	9	5	8
	b	5	5	4	6	7	7	5	6
17	a	7	9	5	6	5	4	6	6
	b	5	6	6	7	6	7	6	7
18	a	13	13	9	9	13	12	12	11
	b	8	10	7	12	12	12	9	11
19	a	20	22	16	14	19	20	18	19
	b	13	11	9	10	8	10	10	10
20	a	17	20	16	23	16	22	16	22
	b	5	6	3	3	4	5	4	5
21	a	17	16	14	17	17	18	16	17
	b	7	8	10	10	9	10	9	9
22	a	14	20	18	21	17	16	16	19
	b	11	12	8	7	12	10	10	10
23	a	6	10	4	7	6	11	5	9
	b	8	9	6	10	7	11	7	10
24	a	16	20	13	18	14	18	14	19
	b	18	23	14	18	17	23	16	21

Note: abbreviations 'flu' and 'flex' are used for fluency and flexibility; a refers to problem No.1, b to No.2.

Table 12

Raw scores from the test of equivalent form

Subject	rater 1		rater 2		rater 3		mean	
	flu	flex	flu	flex	flu	flex	flu	flex
1	7	8	5	6	7	6	6	7
2	0	0	0	0	0	0	0	0
3	11	11	6	7	11	11	9	10
4	5	7	3	6	4	7	4	7
5	13	14	11	11	11	15	12	13
6	11	11	6	7	9	9	9	9
7	8	9	5	8	7	8	7	8
8	14	15	11	14	16	17	14	15
9	11	11	7	11	10	14	9	12
10	12	16	10	15	11	14	11	15
11	14	17	11	18	11	18	12	18
12	9	10	7	8	9	10	8	9
13	9	15	7	12	9	17	8	15
14	11	12	11	12	9	14	10	13
15	11	14	9	12	10	13	10	13
16	10	13	7	10	11	13	9	12
17	7	11	7	11	7	11	7	11
18	4	3	4	7	7	7	5	6
19	18	21	15	15	20	19	16	18
20	16	19	13	17	15	18	15	18
21	12	15	12	16	13	16	12	16
22	11	16	11	17	15	18	12	17
23	4	7	3	7	4	7	4	7
24	12	16	13	14	12	14	12	15

Table 13
Raw sores from the RMACS

Subject #		rater 1 dir	rater 1 flo	rater 2 dir	rater 2 flo	mean dir	mean flo
1	a	67	100	67	80	67	90
	b	80	100	67	100	73	100
2	a	0	100	0	100	0	100
	b	0	0	0	0	0	0
3	a	63	71	63	71	63	71
	b	50	100	50	100	50	100
4	a	67	83	83	80	75	82
	b	50	100	40	100	45	100
5	a	29	57	44	75	36	66
	b	67	100	75	100	71	100
6	a	35	100	50	100	43	100
	b	20	80	40	100	30	90
7	a	50	100	60	100	55	100
	b	50	100	67	100	58	100
8	a	57	86	50	100	54	93
	b	100	100	63	100	81	100
9	a	60	100	46	18	53	59
	b	50	100	50	100	50	100
10	a	29	86	43	17	36	51
	b	75	100	67	100	71	100
11	a	0	50	40	20	20	35
	b	50	67	50	80	50	73
12	a	20	100	33	100	27	100
	b	75	100	75	67	75	83

13	a	20	100	14	100	17	100
	b	100	100	100	100	100	100
14	a	33	100	14	100	24	100
	b	71	100	50	100	61	100
15	a	60	100	50	71	55	86
	b	33	100	33	100	33	100
16	a	40	60	25	100	33	80
	b	50	100	50	100	50	100
17	a	22	78	30	56	26	67
	b	80	100	100	100	90	100
18	a	67	100	75	67	71	83
	b	80	100	75	57	78	79
19	a	71	67	63	100	67	83
	b	60	60	60	50	60	55
20	a	64	100	58	100	61	100
	b	67	100	58	91	62	96
21	a	0	71	0	100	0	86
	b	64	100	56	100	60	100
22	a	22	88	10	100	16	94
	b	75	100	67	88	71	94
23	a	17	100	14	67	15	83
	b	75	100	66	100	71	100
24	a	13	100	18	90	15	95
	b	40	100	50	100	45	100

Note: the abbreviations 'dir' and 'flo' are used for direction and flow; 'a' refers to problem No.1; 'b' refers to problem No.2.

Table 14
Fluency, flexibility,
composite MFFT score and RMACS scores

Subjects	#	fluency	flexibility	MFFT	RMACS
1	a	6	7	-.83	79
	b	7	7	-.71	87
2	a	7	12	-.21	50
	b	3	5	-1.38	0
3	a	9	13	.13	67
	b	3	2	-1.68	75
4	a	8	9	-.39	79
	b	8	9	-.39	73
5	a	6	10	-.53	51
	b	6	7	-.83	86
6	a	12	15	.68	72
	b	10	11	.05	60
7	a	7	7	-.71	78
	b	9	12	.03	79
8	a	9	10	-.17	74
	b	5	5	-1.15	91
9	a	13	16	.90	56
	b	5	3	-1.35	75
10	a	20	16	1.73	44
	b	17	19	1.67	86
11	a	14	15	.92	28
	b	14	19	1.32	62
12	a	11	15	.56	64

12	b	8	8	-.49	79
13	a	9	14	.23	59
	b	12	15	.68	100
14	a	10	12	.15	62
	b	6	5	-1.03	81
15	a	9	13	.13	71
	b	6	8	-.73	67
16	a	5	8	-.85	57
	b	5	6	-1.05	75
17	a	6	6	-.93	47
	b	6	7	-.83	95
18	a	12	11	.28	77
	b	9	11	-.07	79
19	a	18	19	1.79	75
	b	10	10	-.05	58
20	a	16	22	1.86	81
	b	4	5	-1.26	79
21	a	16	17	1.36	43
	b	9	9	-.27	80
22	a	16	19	1.56	55
	b	10	10	-.05	83
23	a	5	9	-.75	49
	b	7	10	-.41	86
24	a	14	19	1.32	55
	b	16	21	1.76	73

Note: a refers to problem No.1, b to No.2. MFFT scores are standardized scores; the RMACS scores are percentages.