

The University of Manitoba

The Effect of Montessori Education on the Divergent
Thinking Skill of Kindergarten-Age Students

by

Avi Rose

A Thesis Submitted to the Faculty of Graduate Studies
In Partial Fulfillment of the Requirements
for the degree of
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Winnipeg, Manitoba



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THINKING SKILL OF KINDERGARTEN-AGE STUDENTS

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AVI ROSE

A thesis submitted to the Faculty of Graduate Studies of
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MASTER OF EDUCATION

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ABSTRACT

This study examined the effect of Montessori Preschool education on the divergent thinking skill of kindergarten-age students. The author hypothesized that these students would display below-average ability in this area as a result of exposure to Montessori education. Research was presented which criticized Montessori for its lack of open-ended materials and fantasy play which might suppress divergent thought. Further research was reviewed which indicated a possible link between educational environments and scores on tests of divergent thinking.

Subjects were 31 kindergarten-age students from two Montessori pre-schools. Divergent thought was assessed using The Torrance Test of Creative Thinking-Figural Form "A". Results indicated above average performance on overall scores of the test. However, performance on sub-tests suggested that divergent thought was affected by the Montessori curriculum.

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TABLE OF CONTENTS

<u>Chapter 1</u>	1
INTRODUCTION.....	1
PURPOSE OF THE STUDY	1
IMPORTANCE OF THE STUDY.....	2
OUTLINE OF THE STUDY.....	4
THE MONTESSORI METHOD.....	5
HISTORICAL INFLUENCES	6
MONTESSORI EDUCATIONAL PRACTICE	8
MONTESSORI AND DIVERGENT THINKING- AN OBSERVATION	1 6
HYPOTHESIS	2 0
<u>Chapter 2</u>	2 3
LITERATURE REVIEW	2 3
CONTENTS	2 3
CREATIVITY AND DIVERGENT THINKING- DEFINITION AND TESTING	2 4
INFLUENCE OF EXTERNAL FACTORS ON SCORES OF DIVERGENT THINKING TESTS.....	3 5
SHORT AND LONG-TERM EFFECTS OF PRE-SCHOOL PROGRAMS.....	4 4
MONTESSORI PRE-SCHOOL PROGRAMS AND DIVERGENT THINKING-A CRITICAL REVIEW.....	5 3

Conclusion.....	6 1
<u>Chapter 3</u>	6 4
METHOD	6 4
SUBJECTS (AND SUBJECT MONTESSORI SCHOOLS).....	6 4
PROCEDURE.....	6 9
ANALYSIS	7 8
LIMITATIONS OF THE STUDY	7 8
<u>Chapter 4</u>	8 4
RESULTS OF THE STUDY.....	8 4
TABLE 1.....	8 9
<u>Chapter 5</u>	9 0
DISCUSSION.....	9 0
IMPLICATIONS FOR FURTHER RESEARCH.....	9 7
CONCLUSION.....	9 9
REFERENCES	1 0 3
APPENDIX A	1 3 5
APPENDIX B.....	1 3 6
APPENDIX C.....	1 4 0

THE EFFECT OF MONTESSORI EDUCATION ON THE
DIVERGENT THINKING OF KINDERGARTEN-AGE
STUDENTS

Chapter 1

INTRODUCTION

PURPOSE OF THE STUDY

The purpose of this study is to assess the impact of the Montessori pre-school program on the divergent thinking ability of kindergarten age students enrolled in two such programs. Divergent thinking ability will be measured using the Torrance Test of Creative Thinking -Figural Form "A" (Torrance, 1966, 1974). Scores on the test will be compared with those of a same-age norm reference group provided by the test author.

The Montessori program, which has seen a resurgence of popularity in North America since the 1960's (after briefly enjoying popularity in the 1920's and 30's), is noted for its revolutionary attitude towards the education of young children. It distinguishes itself from other early childhood programs through its use of specialized equipment and

procedures (Orem, 1965). The program stresses the importance of free choice and responsibility for young children (Malloy, 1974). Its main purpose is to provide students with an education that allows for self-discovery and that prepares them for the many complex tasks and duties of adult life (Montessori, 1964).

IMPORTANCE OF THE STUDY

"Divergent thinking", or the ability to think in several unique directions (Gardner, 1988), is closely associated with (and an important aspect of) creative thinking. It is distinguished from "convergent thinking", or the focusing of ideas along a single or limited line of thought. Divergent and creative thinking are considered to be important components in areas such as problem solving skills, artistic expression, and the generation of new theories and thoughts (Guilford, 1959).

It has been shown that external influences such as educational environments affect a child's ability to think divergently (Harrison, 1982; Jaben, 1982a,

1982b, 1983, 1985, 1986a, 1986b, 1986c; Ziv, 1983). Further, it has been demonstrated that the impact of early childhood programs (such as Montessori) can have a lasting effect on the thinking style of graduates as they move into the middle years. (Grotberg, 1983; Jones & Miller, 1979; Miller & Bizzel, 1984; Stallings, 1975). Evidence of this influence can be detected in the thinking styles and behavior of students many years after graduation from pre-school programs. Therefore, it is important to examine the possible effect of the Montessori program on the divergent thinking ability of its students. If the Montessori program does promote divergent thinking ability, then it can be said to be contributing to students' development as creative generators of original thought.

If, however, the program is seen to actually hamper the development of divergent thinking, then its attitudes towards creativity and its means of instruction should be called into question. In either case, the program's contribution to the overall thinking style of the student is important to understand and evaluate because its effects may be

long lasting and may shape the direction of future leaders in many fields.

OUTLINE OF THE STUDY

This study will consist of five central chapters. The first chapter, the introduction to the study, will outline the purpose and organization of the study, along with a statement on the nature of the Montessori method. This will be followed by a description of an extended observation at a Montessori school which led to the formulation of the current research question. The final segment of the first chapter is a statement of hypothesis on the possible outcomes of the research findings.

The second chapter reviews the literature relevant to the research question. This review will discuss issues such as the nature of creativity and divergent thinking, effects of environment and education on divergent thinking ability, long-term effects of preschool programs such as Montessori, and, specific criticism and support of the Montessori attitude towards creativity and divergent thinking.

The third chapter consists of a detailed description of the test subjects and the Montessori environments from which these subjects were chosen. In addition, an outline of the Torrance Tests of Creative Thinking will be provided along with a brief discussion on their validity and use. The last section of the third chapter is devoted to the limitations of the study.

The final two chapters will be devoted to the assessment of the study results. Chapter four will provide an in-depth description of the results in all relevant areas of study. Chapter five will conclude the study with a discussion of the results and the implications of the findings.

THE MONTESSORI METHOD

The current "Montessori" educational system is based on the work of Italian physician Maria Montessori. Despite the fact that many Montessori schools are independently owned and operated with varying adherence to the principles of the founder,

each posses Montessori's basic philosophy and educational outlook.

HISTORICAL INFLUENCES

Montessori lived and worked at the turn of the century and sought to discover a means of educating socially disadvantaged and mentally handicapped children. Though trained as a physician, Montessori soon developed an interest in the treatment and education of mentally handicapped children assigned to the psychiatric wards of her hospital and branded as "unteachable". She began to study the works of several educators in an attempt to devise a program that would assist these children. Among the most influential were the writings of Gaspard Itard and Seguin (Hainstock, 1978).

Itard, a French physician who worked with deaf-mute children believed in the art of observation as an educational tool. He stressed the importance of action-based learning and activation of the senses as part of the educational process. Seguin, a student of Itard, saw the treatment of the mentally handicapped as

stemming from educational rather than medical means. He developed a series of graduated exercises designed to promote motor development (Ball, 1971). Both men were heavily influenced by the philosopher Rousseau who saw education as a process which emanated from the child's own experiences and senses, moving from the concrete to the abstract (Clayton, 1969; Sahakian & Sahakian, 1974).

In addition to these men, the works of Pestalozzi and Froebel were of great importance in the development of Montessori's pedagogical philosophy (Hainstock, 1978). Pestalozzi devised an educational system centred on the training of the senses through the use of exercises which progressed in complexity (Silber, 1965). Froebel, originator of the term and concept of "Kindergarten", saw the need to cultivate young children in a non-authoritarian play-based environment. The goal of his program was to assist children in the process of self discovery and development. He devised his own set of educational materials and established one of the first schools for young children (Cole, 1961).

MONTESSORI EDUCATIONAL PRACTICE

With the understanding that children possess innate abilities requiring stimulation and discovery and with the concept of guided, graduated development, Montessori devised a program for the education of mentally handicapped children. She soon saw the applicability of such a program for use in the mainstream or "normal" population, and began to refine her ideas and materials to suit this group (Kramer, 1976). Her initial pilot project was a school for young children of socially disadvantaged means. As with the mentally handicapped population, Montessori was able to train children to be responsible and curious learners (Orem, 1968). Her philosophy and program soon became popular throughout Europe and North America. In later years, a society of Montessori educators was established as a worldwide network for training teachers and the manufacture of Montessori style materials (Fisher, 1964).

Montessori's educational system is deeply rooted in her beliefs in the nature of children and their developmental patterns. In works such as The

Absorbent Mind (1967), The Child in the Family (1970) and The Secret of Childhood (1966), Montessori stresses the importance of the first six years of life in the overall development of a child who is independent, contented and self-assured. Children are, in Montessori's view, born with an innate and unique potential which must be allowed to unfold without constraint. This individualized potential or "psychic pattern" (Lillard, 1972) can only be fully revealed through the process of maturation and development. For proper development to occur, two elements must be present: a stimulating environment with which the child interacts (in order to discover the self or "psychic pattern") and the freedom in which to explore this environment in a complete and unencumbered manner (Montessori, 1962).

Montessori did not ascribe to the traditional Western understanding of the human as divided between the physical and intellectual spheres, but did instead believe in an interrelationship between the two (Lillard, 1972). Education of the young child should, therefore, encompass both (unlike the traditional model of education which stresses intellectual pursuits

over physical or social/emotional ones). Montessori postulated a developmental model of sorts, believing that children enter into certain "sensitive periods" or phases when the need to explore one aspect of the environment (exclusively) predominates activity and thinking. If exploration during this period is hampered, it's potential as an agent for growth and learning is lost forever and the child's overall potential is proportionally diminished. Thus, allowance for such exploration must be built into the educational environment (Montessori, 1948).

Montessori saw the child as possessing a capacity for learning that was qualitatively different than that of the adult. Because children begin with no knowledge, they must not only incorporate new information but must construct a means by which to classify and comprehend. This remarkable ability was termed "the absorbent mind"(Montessori, 1967). The absorbent mind "permits an unconscious absorption of the environment by means of a pre-conscious state of mind... (this) unconscious activity prepares the mind..." (Lillard, 1972, p.36). Slowly, a transition takes place whereby the unconscious preparatory phase gives

rise to a conscious one, complete with memory, reason and understanding. Montessori maintained that this all important development occurred during the first three years of life (Montessori, 1967).

During the early years, Montessori observed that children seem driven towards and contented by constant activity. Thus, she believed, it was through the use of constructive tasks that children come to discover themselves more fully. By providing children with a wide range of purposeful activity, and by granting them the freedom to choose from among these activities, children will develop a sense of self and an understanding of their unique "psychic pattern" (Montessori, 1961). As such, the Montessori classroom seeks to provide children with opportunities that involve physical, intellectual, and social/emotional components in order to allow for self-discovery on all levels. (Montessori, 1965)

The Montessori methodology, however steeped in philosophy (and what some see as mystical underpinnings), is nonetheless highly specific and well structured. While her writings may seem inaccessible

to the average reader, her strength lies in the fact that she has devised a careful action plan designed to implement her beliefs about the nature and development of children. There are two basic elements to a Montessori classroom, the environment and the teacher. The teacher functions as the facilitator of the experience, preparing the environment and setting the tone for the six major issues that form the focus of the classroom. These six issues are: freedom, development of the community, structure/order, nature/reality, beauty/atmosphere and use of the Montessori materials . These six strands are brought together to form the overall experience in the Montessori classroom and they are the basis upon which all activity occurs (Lillard,1972).

Freedom, as mentioned above, is central to the activity in the Montessori classroom. Children are given the freedom to choose from among the various centres and activities offered. These centers are arranged in advance by the teacher and are meant to concur with the child's developmental needs. Freedom in the context of the Montessori classroom does not imply an absence of responsibility. In fact, students are

encouraged to maintain their surroundings in a neat and orderly fashion (Montessori, 1964).

Closely related is the issue of community. Children are responsible for the maintenance of their physical surroundings as well as the care and feeding of their fellow classmates. Peer interaction is encouraged and children of various ages are purposely placed in the same environment. Adult intervention in conflict resolution is minimal, coming only when the rights and freedoms of others are violated. Often there is only one piece of equipment available to the children in order to facilitate sharing and consideration for others (Blessington, 1973).

Order and structure are said to give the child a sense of security and a comfort level necessary for discovery and interaction with the environment. Learning to contribute to the order/structure of the environment not only encourages later responsibility but allows children the immediate ability to contribute to their own continued development (Montessori, 1976).

Montessori believed that as children structured their understanding of the world, they should begin to understand the laws of nature and learn to differentiate between fantasy and reality (Montessori, 1965, 1967). Thus, an environment that contains realistic and natural elements is key to the Montessori classroom. Furniture, kitchenware, appliances and other items are fully functioning and child sized. "Practical-life" centers are set up so that children can cook, clean and even iron with increasing efficiency. Plants and pets are common in the classroom, for they not only demonstrate the workings of nature, but provide for excellent work opportunities (Fisher, 1964).

The element of beauty/atmosphere is directly linked to that of structure/order. The structure and order of the classroom present an aesthetically pleasing environment which is seen as a stimulant to children who learn best through their senses. Often works of art and classical music are part of the classroom so as to enhance the esthetic appeal. A calm, orderly, beautiful environment is seen as enhancing the discovery process. Teachers are expected to

exemplify this in their appearance and conduct (Rambusch, 1962).

Of all the elements present in the Montessori classroom, it is the specialized equipment which is perhaps the most noticeable and well-known. The purpose of the equipment is multifaceted. It is meant to strengthen budding attention spans and motor coordination as well as acquaint children with basic laws of nature, physics, mathematics and writing. The materials are meant to be self correcting and progress in complexity according to the developmental pattern of the child (Orem, 1965). There is only correct usage for the equipment and children must first observe a demonstration lesson before being allowed to handle the equipment alone. Montessori claims that children do not find it necessary to invent alternative uses for the equipment because it is so engaging and purposeful, unlike many popular toys which lack in quality and obvious direction (Lillard, 1972).

MONTESSORI AND DIVERGENT THINKING- AN
OBSERVATION

The impetus for this study has come about as a result of observations made by the author at a local Montessori pre-school program. The program, open to students from ages three to six, is considered (and considered by others in the field) to fall within the parameters of the Montessori philosophy, but with a greater emphasis on creative arts than the standard model. In fact, the school's facilities include an art area and music lessons which are not common to all Montessori programs.

During the two-month observation period several interesting trends and phenomena were witnessed which ultimately lead to the generation of the current research question. Firstly, it was noted that, unlike most other pre-school programs, the Montessori classroom regularly used pre-drawn coloring work sheets. These were meant to assist students in reading readiness and in other areas such as geography and social studies. In one instance, a map making centre was set up (for use by all students) in the classroom

with a model map on which the continents were color coded. Students routinely colored in the pre-drawn maps, following the specified model exactly.

Within the two art areas available to students (one in the Montessori equipment area, the other a separate "free art" area) there existed similar pre-fabricated art projects. In the Montessori equipment area students created "books" using rubber stamps (usually set out by teachers) and staplers. Several pre-drawn cut and paste projects were also available. This included a model of a human figure which could be traced and features added.

The "free art" area (which differentiates this particular center from the standard Montessori model) contained equipment for water- color painting, clay making and wood-working projects. As with all Montessori areas, the emphasis was as much on the process of setting and cleaning as it is on the actual production of art projects. Some students were observed cleaning the art area having engaged in no artwork previously. Despite the fact that there are no specific pre-set projects, the area contains many clay

cutters and ready-made shapes which were most often used by students. Often groups of students were observed working at the art area, producing identical pieces of clay work cut from the same mold. The art area is filled with examples of past projects which fall along similar lines. The "free art" area is not used as extensively as other areas and is often used to prepare props and pre-made items for use in other facets of the program.

In addition to the trends observed in the art areas of the Montessori program, two other features were noted which may indicate a de-emphasis of divergent thinking. The first is the absence of organized reading time. Simple reading and picture books are available to students, but teachers do not read to students. The lack of story-book themes may be contributing to a lack of fantasy play and the production of modeled stories common in other early years classrooms.

Another element noticeable by its absence is a make-believe play area. Montessori programs do not as a rule contain fantasy play materials such as dolls,

dress-up clothes and play kitchens or grocery stores. There were child-size kitchen counters, sinks and dishes, but these are working areas. Children are expected to practice kitchen skills (such as measuring and spooning) and are responsible for serving the daily snack. The free play area contained a minimal number of dress-up clothing, consisting mostly of shoes and hats.

It is assumed that the absence of these elements reflects the Montessori belief in reality and independence from fantasy (Montessori 1965, 1967). It does however contradict much of the current literature describing the positive correlation between fantasy play and emotional maturation and creative ability (Bruner, Jolly & Sylva, 1976; Connolly & Doyle, 1984; Golomb & Cornelius, 1977; Sutton-Smith, 1967). It therefore seems reasonable to explore the relationship that exists between Montessori education and divergent thinking ability, in order to understand the potential influence of the program in this area.

HYPOTHESIS

The Montessori pre-school programs present an inherent contradiction between practice and principle. Montessori and her followers stress the importance of freedom and the process self-discovery in the overall development of young children. They claim to be adherents of discovery-based learning and state a desire to free the child from the constraints of adult domination. However, in examining the educational program put forth by the Montessori movement it becomes clear that this philosophy and the actual classroom practice are incongruent. Montessori schools can, in fact, be seen as working in ways which directly oppose their own principles.

Despite the insistence that children should be free to discover and learn, Montessori classrooms contain a plethora of rules and procedures which predominate other activity and liberty. The rationale for this is a stated sympathy for children who would otherwise be forced to discover order for themselves. The specificity of rules governing the use of equipment is said to allow the child a level of comfort and pride in the knowledge

gained from learning how to master every necessary task with skill and ability.

By stressing a reality based education and a reduction of fantasy play, the program hopes to unburden children from feelings of powerlessness and the need to act out the routine of adult life. Instead, they are afforded the opportunity of practicing for that adult life in their everyday activities.

However, in presenting children with one option in the use of equipment and activity and denying them the ability to rehearse and fantasize through play, the Montessori program compromises its commitment to freedom and the emergence of the unique "psychic-self". If there is only one correct mode of operation in all areas (which is taught and not learned through experience) the child may begin to discount their own discovery process as well as their unique thoughts and vantage point. Far from liberating them, this method appears to be encapsulating children in a pre-digested existence. Rather than allowing children to discover the value of their own intellectual construction the Montessori system appears to place a high value on the

search for the one correct answer in many spheres of life.

It is therefore hypothesized that exposure to the practices (and beliefs) of the Montessori classroom will result in below average scores on the Torrance Tests of Creative Ability- Figural Form "A" on the part of kindergarten-age subjects who are students Montessori programs.

Chapter 2

LITERATURE REVIEW

CONTENTS

This review will discuss research relevant to the assessment of divergent thinking ability among Montessori kindergarten students using The Torrance Test of Creative Thinking- Figural Form "A". The review will consist of the following sections:

1. Creativity & Divergent Thinking- Definition and Testing.
2. Influence of External Factors on Scores of Divergent Thinking Tests.
3. Short and Long- Term Effects of Pre-School Programs.
4. Montessori Pre-School Programs and Divergent Thinking-A Critical Review.

CREATIVITY AND DIVERGENT THINKING- DEFINITION AND TESTING

The definition and assessment of creative ability remains one of the most contentious issues in modern psychology and education. As with other human traits, such as intelligence, numerous theories have attempted to define the nature of creative thinking ability and detect its presence in individuals (Sternberg, 1988). This too has met with much conflict and controversy. Social scientists and educators seem to be evolving toward a more uniform understanding of creative processes and people, yet perspectives continue to differ widely (Gardner, 1987).

Definitions of creativity are not exclusively the products of modern thought nor are they limited to clinical epistemologies alone. For centuries the concepts of creativity and inspiration have been addressed by poets, philosophers and scientists. It was once thought that creative behavior was the result of Divine intervention or the workings of mysterious muses

(Janson, 1981). The ability to conceive of new ideas and products has always been highly valued in many sectors of society and an understanding of its process is likewise prized and pursued (Roweton, 1976).

Modern definitions of creativity are diverse and range from the poetic to the practical. Freud (1905) saw creativity as a means of diverting sexual energies into a more acceptable form. Behaviorists view creative behavior as emanating from environmental conditions. When unusual ideas and thoughts are combined and reinforced by societal acceptance the process of deriving such thoughts is similarly reinforced (Malzman & Gallup, 1958, 1964).

Stasheim (1971) claims that creativity is a response to a need and an expression of curiosity and ambition. Mott states that it is the "Magic of the Mind" (Bloomberg, 1973), a fulfillment of potential which draws on intense emotions such as wonder and surprise. Smith (1973) views creativity as the use of an individual thinker's past experience and knowledge in the generation of the previously unknown. The fact that this new insight may have been conceived of by

others is thought to be irrelevant, for it is the individual's discovery which lies at the heart of creative talent in Smith's opinion.

Crutchfeild (1962) and Wilson (1956) define creativity as an act of non-conformity, where an individual rises above the conventions of normal thought processes in order to devise revolutionary concepts . In contrast, Starkweather (1976) sees creative thought as the ability to choose a conformist direction or to reject it, depending on the particular circumstance.

Some theorists are interested in environmental conditions which spark creative behavior (Amabile, 1979; 1986; Koestner, Ryan, Bernieri & Holt, 1984; Sanders, Tedford & Hardy 1977), others investigate the lives of the talented and accomplished as a source of understanding (Arnheim, 1962; Gurber & Gurber, 1962; Simonton, 1984; Gardner, 1988a.). Several researchers view creativity as trait that varies with individual difference (Barron, 1988; Guilford, 1956, 1959, 1960, 1986, Strasheim, 1971; Taylor, 1988 Torrance, 1966, 1972a, 1972b). Others stress the

universality of the mental process underlying creative thought (de Bono, 1967; Brikmaier, 1971; Sternberg, 1988, Weisberg, 1980, 1986 Weisberg & Suls, 1973).

All theories attempt to define the general ability to derive new thought or meaning (Vernon, 1970) and the generation of unique and unusual products or solutions (Getzels & Csikszentmihalyi, 1976). Gardner (1988) states that there is a consensus in the literature as to this broad definition of creative ability and achievement. Beyond this however, there is much disagreement as to the specific mechanics of creativity and the role of other mental abilities in the process of creative thought.

One of the most influential voices in the recent history of the creativity debate has come from those theorists attempting the general assessment of human ability and potential. This "psychometric" movement has concentrated its efforts on the task of devising testing mechanisms which, when applied, would yield valuable insight into the behavior of individuals and groups. This is done in order to evaluate the general ability level of the population as a whole and as a

means of discovering individuals with heightened capacity in one or more specific domains. In addition, it is assumed that such devices would allow the educational system to evaluate its performance and effect on students as well as pinpointing individuals in need of special attention (and training) either because of great strength or relative weakness (DuBois, 1970).

Several theorists have attempted to define creative behavior in such a way as to allow for the construction of a psychometric measure which would identify the relative creative talent of individual subjects (Davidson & Sternberg, 1984; Getzels & Jackson, 1962; Guilford, 1956, 1959; Mednick, 1962; Mendick & Andrews, 1967; Torrance, 1966a, 1966b, 1972; Wallach & Kogan, 1965). As with many other testing procedures and devices, these creativity measures were almost immediately utilized by a society in search of excellence and potential (DuBois, 1970). Surprisingly, many educators and psychologists use these tests without questioning their central philosophical assumptions and without examining the aspects of creativity which are purported to be assessed.

Guilford (1956; 1959; 1960; 1986) provided one of the first definitions of creative behavior within the framework of the psychometric movement. He viewed creativity in terms of specific mental abilities, at the heart of which is divergent thinking, or the ability to think in ways which are diverse and uncommon (Sternberg, 1988; Rowerton, 1976). Guilford further reduced divergent thinking into four basic elements, fluency, flexibility originality and elaboration for purposes of definition (Guilford, 1956). By stating that creative ability is analogous to divergent thought production, Guilford succeeded in isolating a trait that could be inferred through the use of a standardized testing procedure (which he also devised) (Lissittz & Willhoft, 1987).

Despite his primary emphasis on divergent thinking, Guilford is careful to note that creativity is complex and multidimensional (Sternberg, 1988). He distinguishes divergent thinking and creativity from intelligence as a separate and unrelated human trait (Guilford, 1986). Several authors concur with this position (Milgrim & Milgrim, 1976; Runco & Albert,

1986; Singer & Whinton, 1971; Torrance, 1986; Wallach, 1970, 1971), noting the fact that divergent production ability and intelligence scores do not correlate. Other studies have indicated that divergent thinking ability is a superior predictor of creative talents such as expressive drawing when compared with intelligence test scores (Jordan, 1975; Kogan & Pankove 1974; Wallbrown & Huelsman, 1975).

Torrance and colleagues (Osborn, 1948; Parnes, Noller & Biondi, 1971; Treffinger, 1980, 1983) utilize the basic definition of creativity as stated by Guilford, but have attempted to broaden it somewhat. Torrance (1988) states that creativity involves:

...the process of sensing difficulties, problems, gaps in information, missing elements, something askew, making guesses, and formulating hypotheses about these deficiencies; evaluating and testing these guesses and hypotheses; possibly revising and re-testing them; and finally communicating them (p 47).

Treffinger (1980) summarizes this belief in a simplified model consisting of three branches; divergent

thinking; complex thinking (and emotion); and involvement of real life challenges.

The Torrance Tests of Creative Thinking

(Torrance, 1966, 1972a, 1972b) provide a simply administered measure of creative ability. These tests purport to reflect the somewhat complex definition of creativity posited by Torrance and his colleagues. While Torrance does not believe that his test (or any) captures creative thinking in its entirety, he does feel that it is a good indicator of creative talent and later creative success (Torrance, 1980, 1981a, 1981b). The Torrance tests have become one of the most popular assessment tools in use by researchers and educators. The eighth edition of the Mental Measurements Yearbook (Burrows, 1978) lists the Torrance tests as one of the most widely used psychometric devices and the most commonly utilized creativity test. Sternberg (1988) states that the test is a reliable tool with impressive predictive validity.

Despite the fact that Torrance's tests claim to assess creative ability in the broadest sense of his definition, this does not appear to be the case. The

verbal and figural forms of the test are ostensibly separate instruments for determining creative thinking ability and can be utilized individually (Torrance, 1966, 1974). Thus, creativity can be measured using only the non-verbal figurative tests, ignoring other available measures of creative ability. A close examination of these figural tests reveals that they are primarily aimed at examining divergent thinking ability (Simons & Simons, 1985). The structure of the test is such that three of the four components of divergent thinking as established by Guilford (1956) (namely fluency, originality and elaboration) form part of the main emphasis of the test and the most reliable (Torrance and Ball, 1984; Treffinger, 1985). Other traits such as fantasy, unusual visualization and richness of imagery are included in the test procedure but are not thought to be as reliable as the divergent thinking skill components (Chase, 1985).

If the Torrance figural tests are primarily a measure of divergent thinking and if they are to be utilized independently from other tests, then what remains is an instrument which, like the Guilford tests,

philosophically equates divergent thought with general creative ability. This equation is contested by authors who view the test as a limited instrument in the evaluation of a complex constellation of traits which together constitute creativity (Bailin, 1984, 1987; Simons & Simons, 1985).

Bailin (1984) reports that there is some disagreement in the literature as to the primacy of divergent thinking in the creative process and argues that it should not be seen as the only factor. She further states that it is unreasonable to assume that an individual is not creative simply because of a low score on a psychometric device, nor conversely, can creative talent be assumed to exist in light of a high score. Bailin (1987) claims that convergent thinking and the use of normative thought patterns are important aspects of the creative process and should be given consideration equal to that lavished on divergent production.

Several other theorists appear to be seeking a broader definition of creativity. They have examined the role of other traits and elements, such as memory,

ideational association (Wiesberg, 1980, Weisberg & Suls, 1973), and even biological factors (Kennet, 1984). These authors cast further doubt on the assumption that divergent production is the primary component of creative thought. Instead, they broaden the scope of the definition and in so doing call for a more complex understanding of creativity (Gardner, 1988; Sternberg, 1988).

There is no doubt that the Torrance tests do evaluate divergent thinking ability with great reliability (Treffinger, 1985). Similarly, it is acknowledged that the test's predictive value is well established in certain areas of creative endeavor (Levy & Goldstien 1981; Sternberg, 1988). What is argued however, is the fact that the test purports to be an indicator of general creativity. This claim is apparently unsubstantiated due to the uncertain role of other traits in the makeup of creativity.

While it is known that divergent thought is a factor in overall creative ability and that it correlates well to predictions of later behavior, it is unclear how this trait relates to the overall understanding of

creative thought and production. It appears that what is being assessed is but one piece in the overall framework of creative thought. It is not yet known, however, how this piece fits in with other traits and how much of a role it plays in the total makeup of creativity.

As a result, this study will not endeavor to make general pronouncements as to the relative creative ability of Montessori students based on scores from the Torrance Test of Creative Thinking- Figural Form A. It will however, endeavor to understand the effect of the Montessori program on the divergent thinking ability of students, taking into consideration that ability in this area constitutes a feature of creative behavior and that scores on this test correlate well with later creative choices and production.

INFLUENCE OF EXTERNAL FACTORS ON SCORES OF DIVERGENT THINKING TESTS

The fact that the Torrance tests (and other tools) may not fully assess all aspects of creative thought

does not invalidate them as a measure of divergent production ability. While it is not known exactly how this ability fits in to the overall weave of creative talent, it is assumed to be an integral part of creativity and problem solving skill (Guilford, 1956, 1959, 1960, 1986). The question is then, whether divergent production is a skill that can be heightened or hampered by external forces or whether it remains constant regardless of environmental influences.

Many studies have attempted to answer this question, examining the effects of educational programs and strategies (Glover, 1981; Harrison, 1981; Jaben, 1982a, 1982b, 1983, 1985, 1986a, 1986b, 1986c; Foster & Penick, 1985), family environment (Jenkins, 1988) and even the general effect of the environment (Ziv, 1983). Conclusions from these studies indicate that ability to perform on measures of divergent thinking are influenced by external conditions and that these factors can affect divergent production levels significantly.

Ziv (1983) examined the effect of a humorous environment on the divergent thinking ability of

seventy-eight adolescents. Those subjects who viewed humorous film clips scored higher on measures of divergent thinking production than control subjects who did not.

Groves (1986) studied the effect of material reward on the divergent thinking skill scores of seventy-five pre-school subjects. Students who were offered a material reward scored significantly higher than those who were not.

Roweton (1982) reviewed studies pertaining to the effect of competition on divergent thinking ability as defined by Adams (1986), Abramson (1976), Raina(1968), Torrance and Krishnaiah (1961), . He concludes that there is evidence to suggest that heightened levels of competition positively affect the ability to think divergently.

It is clear from these studies that certain emotions (such as humor and expectation or competition) can affect the ability of students to perform on tests of divergent thinking. If these emotional states are present in the classroom, their

effect should be noticeable on divergent thinking test scores. Montessori classrooms traditionally down-play competition and reward and teachers do not normally engage in humorous interaction with students or the reading of humorous (or any other) stories (Lillard, 1972). It is of course difficult to assess the overall emotional state of the Montessori classroom however, because it must, as with most environments, vary considerably.

Some emotional states do not appear to affect divergent thinking ability. Jenkins (1988) found no link between distressed family environment and divergent thinking skill in a group of one hundred and six elementary school age subjects. Similarly, Peak & Hull (1983) found that among ninety-four elementary age subjects relaxation and imagination exercises did not effect scores on the Torrance tests.

While these studies do not directly relate to the issue of the Montessori schools, they do highlight the fact that divergent thinking can be affected by many factors. These studies do not directly address the question of educational philosophy and program of

instruction, both of which are the focus of the present study. They do however, point to the sensitivity of divergent thinking skill to environmental conditions. They highlight the need to examine programs such as Montessori in order to examine their relative ability to influence divergent thinking.

Several studies have attempted to examine specific educational practices and curricula in order to determine their effect on divergent thinking. Foster & Penick (1985) studied the effect of co-operative, small-group instruction on the ability of one hundred and eleven elementary age subjects to think divergently. The results indicate that these students were in fact better able to think divergently than control subjects in standard large-group classrooms. It is noted that Montessori classrooms contain mostly independent work centres, with some small group parallel activity. It is not known whether this enhances or reduces divergent thinking.

Harrison (1982) and Canipe (1981) review the information available from studies of open classrooms in an attempt to determine their relative effect on

students when compared with those in traditional classrooms. Both studies conclude that the effects of the open environment were neutral, with the exception of younger students whose divergent thinking ability tended to be somewhat higher.

Montessori classrooms are open environments and this may in fact be adding to the divergent thinking ability of students. However, it is important to consider the fact that most pre-school programs contain open area environments. Therefore, this effect will not distinguish Montessori students from the general population.

In addition to the fact that divergent thinking skill is seen by some as malleable in the face of the classroom environment, there is the issue of curriculum and its effects. Glover (1981), Rose & Lin (1984) and Ristow (1988) studied the effect of creativity training programs specifically designed to enhance divergent thinking ability. These authors consistently state that such programs do succeed at raising divergent thinking levels of students, often to above average levels.

Similarly, Jaben (1982a, 1982b, 1983, 1985, 1986a, 1986b, 1986c) conducted a series of studies examining the effect of a creativity training curriculum on the divergent thinking ability of learning disabled and behaviorally disordered subjects. As with studies involving students of average learning ability and behavior, Jaben found that use of this curriculum resulted in higher scores on the Torrance tests when compared with control subjects.

Sampson (1986) explains that the use of the instructional "cloze" procedure with ninety-three third grade students resulted in enhanced divergent thinking ability.

Chrisite (1983) determined that play tutoring raised not only the divergent thinking ability of pre-school students but also their verbal intelligence scores.

Severside (1985) tested the effectiveness of two creativity enhancement programs on fifty-three elementary subjects identified as gifted students. She

concluded that a creative problem-solving course positively affected the scores of students on tests for divergent thinking skills more so than did writing or puppetry seminars.

Clements (1982) found a positive correlation between scores on the Torrance tests and the amount of time students spent in a drama program. Students in the drama course scored significantly higher when compared with control subjects who were not in the course.

Rasch (1988) discusses the possibility of utilizing computer instruction as a means of enhancing creativity. Bonk (1988) tested such instructional software, dividing them into convergent and divergent types. After allowing subjects to interact with the instructional programming, they were tested in order to assess any changes in divergent thinking ability when compared with pre-test scores. Bonk concluded that computer instruction does affect the students divergent production capacity, as students tended to model the behavior of the software during a second round of testing.

Taken as a whole, this research highlights several informative points. First, it reflects a deep interest in creativity assessment and enhancement on the part of the educational community (Rowerton, 1976).

Educators are quite obviously concerned with the development of creativity in students and are seeking a better understanding of the influence they have as creators of the educational environment and curricula. Second, these studies demonstrate the fact that divergent thinking is highly influenced by the many external factors which can be present in an educational program. Far from proving the resilience of divergent thought, this research points to its dependance on positive influences. The authors of these studies appear to be calling for educational environments which allow for the cultivation of divergent thought.

Research into the development of divergent thinking does therefore indicate that educational programs such as Montessori can theoretically promote or suppress ideational fluency, flexibility, elaboration and originality. They allow for the possibility that Montessori programs do have some

effect on the divergent thinking of students and that this can be detected in test scores. Use of the Torrance Test of Creative Thinking- Figural Form "A" is therefore warranted in this search, as it has been proven to be a useful and sensitive indicator of divergent thinking ability (Sternberg, 1988). The results of this study will add to the long list of research utilizing this test and examining the relative ability of educational practice to influence the thinking skill of its students.

SHORT AND LONG-TERM EFFECTS OF PRE-SCHOOL PROGRAMS

Results of the above noted short term studies indicate a relationship between the environment and curriculum of an educational program and scores on tests of divergent thinking skill. Apparently, a program that promotes divergent thinking as part of its overall plan affects its students' abilities in favour of such thinking patterns. The question that remains unanswered from these studies is whether this effect lingers after the student has graduated from pre-school. If this is the case, it would strengthen the need

to assess divergent thinking skill in Montessori so as to effect a change in attitude and practise if the program is found to be lacking in this area.

Unfortunately, relatively few longitudinal studies have been conducted examining the effects of programs on the later divergent thinking skill of graduates. Several studies have, however, investigated both the short and long term effects of the Montessori program on a wide range of related cognitive traits and abilities. What follows is a review of these studies, several of which compare Montessori to other types of early childhood programs . While some do not relate directly to the issue of Montessori and divergent thinking skill, they do highlight the fact that educational experiences during the early years are formative and leave a lasting impression on the cognitive style of the students involved.

Chattin-McNichols (1981) reviewed the literature available on the subject of Montessori and its effect on graduates' abilities in a wide range of areas. She concludes that while Montessori graduates exhibit higher scores on IQ and other cognitive and

developmental measures, these gains are lost over time, with other programs demonstrating a greater resistance to score erosion.

The generalizations made by Chattin-McNichols with regard to short term effects are consistent with those made in the literature. This is not, however, the case with long-term research. Many longitudinal studies contradict the statement that Montessori students are inferior to students in other programs, though findings vary somewhat.

"The Consortium for Longitudinal Studies" is a research co-operative consisting of twelve studies into the long term effects of pre-school experience (Grotberg, 1983; Lazar & Darlington, 1975). These studies examine a variety of programs including Montessori. Subjects were given differing forms of psychometric measures designed to assess intellectual, motor and social skills development. Subjects were tested before entering the pre-school programs, immediately after and at varying points during their elementary and high school years. These studies were designed to assess programs in order to understand

the relationship between stated educational goals and later skill development and to compare the effects of various programs. Additionally, they were meant to determine whether students in various pre-school programs benefitted from them when compared with general populations of similar socio-economic background.

Results of these studies vary in their findings and conclusions. Generally, however, it is reported that among lower income students who were enrolled in pre-school programs, achievement and intelligence scores were higher, as were reports of self-esteem and achievement value (Miller & Bizzel, 1983). In addition, test subjects were less likely to be assigned to special education classes and were more likely to meet the requirements for graduation from high school (Karnes, Schwedel & Williams 1983). Lazar and Darlington (1983) state that these dramatic outcomes were detected long after completion of the pre-school program and despite the fact that such programs constituted only a small portion of the subjects' daily lives.

One of the most well known and respected works (Chattin McNichols, 1981; Simons & Simons, 1985) from among "The Consortium for Longitudinal Studies" is that of Miller and associates (Jones & Miller, 1979; Miller & Dyre, 1975; Miller & Bizzel, 1983a, 1983b, 1984). These studies compared students of various pre-school backgrounds (including Montessori) over the course of many years in an effort to determine how the various backgrounds specifically shaped ability and achievement. Results indicated many differences in the educational content and emphasis of the programs. These emphases tended to be manifested in subject's test scores.

Montessori students were found to be superior to others on certain measures (Metzis, 1971; McGrath, 1980). Montessori males scored highest on tests of IQ, curiosity, reading and mathematics achievement and in teacher ratings of ambition during the elementary years (Miller & Dyre, 1975). In a follow-up study of the original subjects, Jones and Miller (1979) found that Montessori students continued to display slight increases in IQ scores.

Another study from "The Consortium for Longitudinal Studies", conducted by Karens and associates (Karens Et al., 1969; 1970; 1970; 1978; 1983) focused on long-term effects of the Montessori and other programs. This study detected some differences in test scores and ability early on in the elementary years, with Montessori graduates exhibiting a slight lead in IQ scores. During the middle years little change was noted and benefits continued to remain. Montessori graduates were placed in special classrooms about as often as other students, but more were likely to complete high school. Karens (Et al., 1983) concludes that the influence of all programs could be detected in students' performance over a number of years.

Several other studies have concluded that students attending pre-school classes in general score higher on achievement and intelligence measures during both short and long-term assessments (Karnes Et al., 1969, 1970, 1978, 1983; Grotberg, 1983; Lazar & Darlington, 1982). These effects seem to be more pronounced in economically disadvantaged children (McKinnon, 1982). Montessori students

appear to exhibit some advantages in achievement and IQ scores and this appears to be maintained over time (Sciarra & Dorsey, 1976; Seefeldt, 1977).

Five separate studies have examined the question of Montessori's effect on the divergent thinking skill (or creativity) of students. Dryer and Rigler (1969) administered a form of the Torrance figural tests to Montessori and non-Montessori nursery students. Their findings indicate that Montessori students scored lower than those in other pre-schools. Brophy and Choquette (1973) administered another Torrance creativity measure to thirty-one pairs of Montessori and other pre-school students. They found no significant difference in scores, with the exception of one pair in which the Montessori student outperformed the partner.

Fleege (1967) conducted an assessment of Montessori students for the U.S. Department of Education, comparing them with same age peers in other pre-school programs. Fleege found no difference in Montessori children's creative ability as reported by teacher rating scales. No other measure of creative

ability was utilized in the formulation of the conclusion that all students were equally creative.

In a similar government report, Bereiter (1967) compared several pre-school programs (including Montessori) in an effort to assess whether these programs affected children's intellectual capabilities. He found that creativity, as measured by a self-designed unique construction activity, was equal among students who had been taught creative problem solving skills and those who had been instructed in guided construction of earlier projects. This finding implies that instruction in the correct manner of task completion, as is the norm in Montessori education, does not appear to affect the later ability to construct uniquely.

Miller and associates also administered a form of the Torrance creativity tests to their longitudinal study subjects in an effort to determine levels of divergent thinking (Miller & Bizzel 1984). No significant difference was found between Montessori subjects' divergent thinking skill and other subjects. The exception to this came during the first and second

grades when scores were reported to be slightly higher than some programs and on par with others. In other assessments of inventiveness, Montessori students tended to do better than the average population average but not significantly better than other subject programs.

Just as these studies do not agree as to the effect of the Montessori program on divergent thinking, interpretations of the results are similarly inconclusive. McGrath (1980) states that this research demonstrates the positive effect of Montessori on divergent thinking skill. Chattin-McNichols (1981) along with Simon and Simon (1985) do not concur, stating that the evidence is inconclusive. This is particularly true given the fact that the studies utilized differing measures of divergent thinking .

Despite these inconclusive results there appears to be support for the theory that early education can influence the abilities of students. Despite the fact that few have examined the question of divergent thinking, they are nonetheless important because they highlight the powerful effect of pre-school environments. If

children's intellectual ability and achievement in areas such as reading and mathematics can be affected for many years by their early experience, it stands to reason that attitudes towards creativity and the reflected classroom practices will likewise permeate the cognitive makeup of students.

MONTESSORI PRE-SCHOOL PROGRAMS AND DIVERGENT THINKING-A CRITICAL REVIEW

Having examined the evidence in support of the claims that educational environments and curricula can affect divergent thinking and that early childhood education impacts upon the cognitive style of students (even in the long term), the question remains as to the specific relationship between Montessori and divergent thinking skill.

There is, as stated previously, a distinct lack of empirical evidence establishing a link between Montessori education and levels of divergent thinking ability. The studies that have been conducted are inconclusive with no one finding emerging as the

normative trend. There is, however, some discussion that has taken place in the theoretical literature as to the relative strength and weakness of the Montessori approach to creativity. It is true that this literature does not support its claims with confirmational data, but it is the product of researchers and theoreticians familiar with the literature surrounding the issues of child development and early experience. As such, it is instructive material to consider in the absence of useful empirical research.

Montessori supporters are clear in their view that creativity can only emerge out of knowledge and discipline (Berliner, 1975; Khan, 1978; Simon, 1978). Although Montessori championed the cause of children's' freedom in the educational environment, she readily suspends this in the quest for learning and understanding (Lillard, 1972). Montessori feels that children must be taught the proper ways of the world so that they can go beyond and use what is known in search of what is possible. If children do not understand reality, they are, in Montessori's opinion, doomed to a powerless existence where they solve all

problems and remove all obstacles in fantasy only (Montessori, 1965).

Fantasy, then, is down-played in the Montessori classroom. It is not considered to be synonymous with imagination, but is rather a reflection of unfulfilled desire. Adults, in the Montessori view, are content with the reality of their lot and children should be taught this as well. Any change in life should come through efforts that are realistic and obey the laws of nature and rationality (Berliner, 1975). Thus, Montessori environment does not condone the use of fantasy play materials or mythical (fairy-tale-like) literature (Simons & Simons, 1985).

By engaging in realistic activity and by learning the laws of nature, children come to understand what is within the realm of the possible. Toys and equipment that are non-directive leave too much room for fantasy and improvisation based on non-realistic uses. This is discouraged by Montessori teachers who insist on pre-usage instruction, admittedly at the expense of the child's freedom (Lillard, 1972).

Montessori's supporters continue to interpret and enact this vision of creativity and discipline. Berliner (1975) concurs with the Montessori attitude stating that children should not be left to their own devices insofar as discovering the laws of nature and creative potential. He rebukes those who claim that children possess innate creative talent that should be fostered in a non-directive manner. Allowing this in Berliner's view would be tantamount to accepting the savage state of humankind, trapping it in an unenlightened existence of ignorance and disgrace.

Khan (1978) states that the "stereotyped creative bohemian" (p.4), highly prized by many in modern society, represents the belief that creativity is based on novelty and curiosity. He challenges this opinion, stating that these qualities exist in the primates but do not constitute creative potential. True creativity emerges from uniquely human existence which includes order and structure. Innovation is tolerated only within the confines of the structured environment.

Montessori stresses the importance of freedom and postulates the existence of sensitive periods during which critical aspects of the innate "psychic self" emerge (Montessori, 1963). Despite this apparent belief in the natural state of child development, a clearly directive philosophy emerges as a counter balance to fantasy and imagination. Montessorians justify the contradictory nature of these beliefs by stating that they are, through the teaching of restraint, liberating children from the burdens of discovering the reality of nature. They cite the fact that freedom from structure was not intended by Montessori (Standing, 1962) and that through her experience she has found that children prefer realistic work to "useless" fantasy play (Montessori, 1965).

Novelist Ayn Rand, an avid supporter of the Montessori educational movement, agrees in principle with the view that creativity and imagination should be grounded in reality and constraint. She states that the Montessori materials are superior to others because they force children to learn obedience to the laws of nature. If children are to deal with reality (which is in her view an absolute), they must learn to

find one right answer. Feelings and "whims" of children do not play a role in reality and should therefore be discouraged (Berliner, 1975).

Critics of the Montessori philosophy have for some time challenged this interpretation of creativity and freedom. American educator Dewey remarked that while the Montessori classroom liberates children from the physical constraints of previous educational models, it does little to free the intellect of children (Dewey, 1915). Australian educator Simpson (1912) reports the devaluation of fantasy in the Montessori classroom and links it to other educational practices of the day whose emphasis on cognitive learning outweighs any concern for imagination and emotion.

Modern criticism of Montessori education centers on the absence of open-ended equipment and fantasy books or play materials (Biber, 1984; Coopersmith & Feldman, 1974; DeVries & Kholberg, 1987; Evans, 1975 ; Frost, 1973; Metzis, 1971; Widmer, 1970). Elkind (1983) discusses the importance of fantasy play in the many aspects of children's development. In light of the overwhelming evidence establishing the benefits

of fantasy play (Johnson, Christie & Yawkey, 1987), Elkind states that Montessori programs should adapt and change their policy and include such activities.

Evans (1975) reports that Piaget (1973) discussed similarities and differences between his concept of child development and that of Montessori. Piaget notes that his model stresses the discovery of the mechanics involved in many tasks as part of cognitive development. As such he is concerned with the Montessori tendency toward closed-ended materials for use in one pre-determined fashion. Piaget felt that these convergent materials could potentially limit the child's desire to explore personal solutions.

Such criticism appears to be permeating the thinking of Montessorians who are slowly incorporating free art, open-ended play materials and fantasy props in their classrooms.

Torrence (1988) in an examination of American Montessori classrooms notes the fact that most now contain open ended play materials. Tittle and Ohlhaber (1975) state that modern play research does present

a compelling argument for change in the Montessori attitude towards fantasy play. Weiniger (1978) presents an art curriculum that fits within the Montessori framework of child development and discovery, yet is non-directive and allows for self-expression. Despite the fact that Montessorians such as Sullivan (1978) equate free-form modern art with confusion due to lack of structure, there appears to be a de facto admission on the part of many that fantasy play and unstructured creative expression do have a place in the classroom.

Despite this trend, however, the Montessori environment has maintained its basic adherence to structure as there remains only one right way for almost every toy and activity. Far from witnessing a decisive shift in philosophy, the changes noted above represent a slow evolution on the part of the Montessori community. While several pro-Montessori authors acknowledge the fact that such criticisms exist, they continue to defend the basic Montessori stance stating that the critics either misunderstand their position or have a skewed vision of creativity and freedom (Berliner, 1975; Kahn, 1978; Sullivan, 1978).

Thus, the question of Montessori's effect on divergent thinking ability remains relevant. In fact, it can be said that in light of an apparent evolution the question of divergent thinking takes on new importance, for it can potentially validate these adjustments.

Conclusion

In sum, the research presented in this review has covered several issues related to the general research question. This information can be summarized in the following manner:

A) Despite the fact that divergent thinking has been mistakenly assumed by the psychometric community to be the central characteristic of creativity, it remains an integral part of any creativity definition.

B) Divergent thinking appears to be affected by such influences as educational environment and curriculum. This assumption is validated by a large number of empirical studies linking scores on measures of divergent thinking with specific environmental and curricular variables.

C) Early childhood experiences tend to influence the cognitive ability of graduates in varying degrees. The effect of programs such as Montessori can be detected in students several years after completing these programs in scores of IQ and achievement, statistics of placement in special educational programs and completion of high school. Evidence supporting a lasting effect of pre-school programs on the divergent thinking ability of students is inconclusive, with some studies indicating that Montessori students were superior to other program graduates and others noting inferior performance.

D) Despite the lack of clear evidence suggesting that Montessori education adversely effects divergent thinking, there is ample theoretical criticism supporting such a possibility. Authors have challenged the Montessori insistence on reality and structure and the exclusion of open-ended play materials, fantasy literature and play props. Although some Montessorians have responded favorably to this criticism and have altered the environment somewhat, there remains an adherence to strict structure and

guidance that may be detracting from students' ability to think divergently.

This evidence suggests that a possible relationship between the Montessori environment and divergent thinking ability does exist and that it may be detected using a psychometric measure. While few empirical studies have concentrated on this in depth, there is reason to examine this important area of children's thought.

Chapter 3

METHODSUBJECTS (AND SUBJECT MONTESSORI SCHOOLS)

Subjects were 31 students from two local Montessori preschool programs, *Children's House* (19 students) and *The Montessori Learning Centere* (12 students). Subjects were comprised of the Kindergarten age group at both schools. The kindergarten age group was chosen for two main reasons: First, the study test (The Torrance Test of Creative Thinking- Figural Form "A") has been normed on populations from kindergarten age and upward. Thus, it will only be possible to compare the Kindergarten age students with the reference group for comparison of scores. Second, it was felt that this group had, for the most part, been exposed to the Montessori program for some time and would have been influenced most by its educational style.

Although the two Montessori programs to be studied contain mixed age groupings, each has a defined kindergarten group for students in their final year of the three year program. Both groups spend

some time with a Province of Manitoba-Department of Education certified pre-school educator (who is also trained and licensed by the Montessori movement) separately from the other students. This is done in order to comply with the Province of Manitoba-Department of Education regulations governing the operation of a kindergarten program. A large portion of the half-day program consists of free-time at the various activities and Montessori centers.

While these two programs are of similar philosophy, their orientation and emphasis differ somewhat. Children's House claims to be more eclectic in its inclusion of a free art and recreation centres. The Montessori Learning Centre stresses the academic aspect of its program as a reading and writing preparatory course. Its facilities are not as elaborate as those of Children's House which was designed to meet the specifications of the Montessori program. The Montessori Learning Centre is housed in an otherwise vacant elementary school and its facilities are not as easily accessible as those of Children's House.

Despite the fact that both programs profess differing attitudes and adherence to the Montessori philosophy, there appears much in common. Both schools operate two half-day programs for all students, including the kindergarten age groups. Both are staffed with Montessori trained and licensed teachers (as well as the above mentioned certified kindergarten teacher). Both are divided into play centres containing the Montessori equipment and both adhere to the six basic issues or elements described by Montessori as essential features of the classroom (Lillard, 1972).

Both programs contain physical and music education facilities and equipment easily accessible to the children if so desired. Both have limited circle and special lesson sessions (in music, physical education and kindergarten lessons) with varying degrees of choice for students. Kindergarten lessons are mandatory and while the other lessons are said to be voluntary, little choice was actually given to students during the observations made at both schools.

After observing both programs little difference was noted in the handling and use of Montessori

equipment or in the conduct of teachers. Montessori teachers were noted to be more removed from the actual activities, observing children more frequently and interacting with them less often. In addition, teachers seemed more distanced from students than average early childhood educators. There was little physical or eye contact with students and minimal emotional content noted during verbal exchanges.

The length of time each subject has attended the program varies from 10 to 30 months, with a mean for all subjects of 23.2 months. Subjects from Children's House have been in the Montessori program an average 23.1 months, while those subjects from Montessori Learning Centere have been in the program an average of 23.3 months.

Subjects from both schools range in age from 5 years, 3 months to 6 years, 4 months with a mean age of 5 years, 9 months. The average age of subjects from Children's House is 5 years, 10 months. The average age of subjects from The Montessori learning Centre is 5 years, 8 months.

Of the total 31 students, 8 are male, 23 female. Children's House participants consist of 4 males, 15 females. The Montessori Learning Centre subjects consist of 4 males and 8 females.

Teachers from both programs were interviewed in order to obtain further information on the background of subjects. According to the teachers, subjects are from a wide range of socio-economic and family backgrounds. Both schools are private institutions, however both receive government daycare and pre-school funding from the Province of Manitoba. In addition, special grants are made available to low income families. Both programs do have special needs students, however none was authorized to participate in this study. The teachers suggest that all subjects fall within the average range in ability and achievement.

Permission to conduct the study in the two Montessori schools was obtained from the teachers and parent committees. Later, parents of prospective subjects were mailed an informational letter and a

permission form to be returned to the school. Of the 36 letters originally sent to subject parents, 31 returned a positive response, 5 parents declined.

PROCEDURE

The test used in determining subject's divergent thinking ability was the Torrance Test of Creative Thinking (Figural Form "A"), devised by American psychologist Paul E. Torrance (Torrance, 1966, 1974; Torrance & Ball, 1984). There are four versions of the test, two verbal and two figural. Each test can be used individually and is not dependant on the others for accurate and reliable interpretation (Levy & Goldstein, 1984). The Figural Form "A" consists of three sub-tests: *Picture Construction* (a large oval shape placed in the middle of a blank page), *Picture Completion* (consisting of ten irregular shaped line drawings on two pages) and *Parallel Lines* (thirty pairs of parallel lines with varying intervals of space between lines). Each item is printed in black ink on a white background and includes space for a title as derived by the subject. Examples of the test protocol are included in the appendix.

Subjects were tested in groups of two, with ten minutes allotted for the completion of each sub-test for a total of thirty minutes. The test administrator explained the procedure for each sub-test using a text prepared by the test author. Subjects were asked to use the stimulus presented in each sub-test as part of an interesting and unusual drawing. Upon completion of each drawing or sub-test subjects were asked to devise an appropriate and original title. Torrance states that younger children who are unable to write may verbally present titles to be written by the test administrator (Torrance, 1966, 1974; Torrance & Ball, 1984).

The test is designed to be game-like, avoiding the use of language that would intimidate and contribute to performance anxiety. Torrance states that the prepared text read by test administrators and the design of the booklet serve to heighten and maintain interest in the test activities (Torrance & Ball, 1984). In a study conducted by Hattie (1980) conditions for test administration were examined. It was concluded that the somewhat formal test-like procedures

outlined in the Torrance Test of Creative Thinking manuals (Torrance, 1966, 1974 ; Torrance and Ball, 1984) did not affect test results when compared with other testing conditions.

Scoring for the Torrance Test of Creative Thinking can be completed by expert scorers or by a teacher or test administrator familiar with the Streamlined Scoring Manual & Workbook (Torrance & Ball, 1984), a compact version of the original scoring manual (Torrance, 1966, 1974). The authors claim that the newer streamlined manual has been found to be extremely time efficient and as effective as both the old manual and a two-hour training course given to scorers (Ball and Torrance, 1980). Correlation between scorers with various levels of experience (including classroom teachers) is quite high, ranging from .86 to .99 (Torrance, 1974).

Test protocols were scored for originality, elaboration and abstractness of titles in the first activity and for fluency, originality, elaboration and abstractness of titles in the second and third. The second activity was also scored for resistance to

premature closure. Scores from each activity were then combined to produce total figures for the sub-score areas of fluency, originality, elaboration, abstractness of titles and resistance to premature closure. These scores were listed initially as raw scores and were then converted to standard scores for each subject (Chase, 1985). Standard scores were compared with those of the norm-reference population provided by Torrance as an unbiased representative sample of average kindergarten students. Subjects were given a percentile ranking for each sub-score area as well as a calculation of the mean of all sub-scores. The norms are based on test responses and scores of 37,814 child and adult subjects from kindergarten age upward. The total number of kindergarten age students in this sample is 750 (Torrance & Ball, 1984).

Fluency is calculated in the second and third sub-tests by summing the number of different ideas derived from the presented stimuli. Because the first sub-test consists of only one section, it cannot be scored in this area. Originality is determined by comparing the subject responses with a frequency chart provided by the test authors. Thus, if a subject

draws an item commonly chosen by test -takers, few points are be assigned. Elaboration scores are based on the number of details contained in any response that go beyond the basic makeup of the figure. If a mouse is drawn, for example, with detail in shading and items such as whiskers, a curled tail etc., it is given extra credit.

Abstractness of titles is scored on the basis of the title response to each drawing. Higher value is given for titles which provide more than a mere description of the objects drawn in the response and which add to the narrative. Resistance to premature closure in the second activity refers to the ability to utilize the given shapes as part of a new and larger drawing which incorporates the presented stimulus but does not consist of the stimulus alone. If, for example, a "V" like shape is used as a representation of a bird with no addition to the basic shape, it is said to have been closed prematurely. If, however, the shape was transformed into a larger drawing which used the shape to form a new object separate from the "V" it is said to have resisted premature closure.

Treffinger (1985) reports that the reliability scores for the Torrance Test of Creative Thinking (using formats such as test-re-test studies) have proven to be quite high, ranging from .50 to .93. Despite the fact that this data was collected from studies using various forms of the test and several different grades and class sizes, Treffinger states that the tests "... display reasonable reliability for group and research applications." (1985, p.1296). Torrance's (1974) Norms-Technical Manual lists several studies supporting the reliability and validity of the figural tests. Subsequent studies have been conducted confirming the validity and reliability of the test and the newer streamlined scoring method (Mourad, 1976; Rungsinan, 1977; Al-el-din, 1978; Torrance, 1979).

In addition to this, the Torrance Tests of Creative Thinking have been validated in two important areas. Firstly, scores of individual subjects have correlated positively with other established measures of ability, including observational reports, teacher evaluations and academic/leadership/ dramatic achievement. Secondly, longitudinal studies of test subjects have been conducted over a period of many years. These

studies indicate that subjects scoring in the higher ranges of the creativity test tended to display high levels of achievement in certain specific endeavors (such as writing, leadership and medicine) and often chose unusual educational and occupational paths (Parker, 1979; Riesman & Torrance, 1978, 1980, Torrance, 1972a, 1972b, 1972c, 1972d, 1980, 1981a, 1981b; Torrance & Wu, 1981).

The Torrance Tests of Creative Thinking have proven to be one of the most popular measures for creative ability and divergent thinking skill used by both teachers and researchers. Levy and Goldstien (1980) report that the test has been cited by the Mental Measurements Yearbook (1985) in over 560 separate studies as the research tool of choice. Torrance and Ball (1984) claim that over 11,00 published studies have utilized the test. It is assumed that the ease of the test procedure, coupled with its respectable reliability and construct/predictive validity make the Torrance test a highly attractive option among researchers.

Despite its apparent popularity, The Torrance Test of Creative Thinking has come under considerable criticism in recent years. According to Chase (1985), Torrance establishes a definition of creativity which does not appear to be fully assessed by the sub-test items. Other criticism of the test and of the psychometric movement's definition of creativity cast some doubt on the ability of the Torrance Test of Creative Thinking to assess the varied and complex abilities which together constitute creative behavior. This view states that what the test is actually measuring is divergent thinking and ideational fluency ability, which are only two aspects of overall creativity (Bailin, 1987).

Supporters of the psychometric movement have acknowledged the fact that no existing test can accurately measure creative behavior in its entirety (Treffinger, 1985) . Instead, they feel that the tests can only assess certain abilities linked to creative behavior. While predictive validity studies have established a positive correlation between high scores on the Torrance Tests of Creative Ability and achievement in areas such as science and leadership,

correlations with achievement in the arts are not as conclusive. (Torrance 1980). There is however, evidence that a positive correlation does exist between achievement on the tests and later unusual or divergent choices in education, training and vocation (Torrance 1980). Thus, while the Torrance test may not be the accurate predictor of creative behavior in general, it does seem to assess divergent thinking well.

In light of this evidence and the psychometric community's apparent inability to accurately define and test creative ability as a whole, the present study will concern itself only with the issue of divergent thinking. Despite its criticisms, which centre on the issue of the test's ability to assess creative thinking as a whole, the Torrance tests remain an effective means of determining divergent thinking ability. The tests appear to be reliable in this area, have correlated well with similar tests examining divergent thinking ability (Torrance, 1982) and are therefore considered an acceptable option for this study.

ANALYSIS

Analysis of the results examines the following:

First, scores of all Montessori students were contrasted with those of the norm-reference group, in order to assess the comparative divergent thinking ability of the test subjects (as measured by the test).

Second, scores of students from each Montessori school were examined separately, in order to determine whether differences noted in the two programs (specifically the additional art area at Children's House) can be detected in the test results.

LIMITATIONS OF THE STUDY

Although this study was designed to accurately and fairly assess the divergent thinking ability of the two Montessori kindergarten programs, there exist several flaws which must be noted. These difficulties were, for the most part, unavoidable and may have influenced the results of the study to a certain degree.

It is felt, however, that these limitations do not invalidate the conclusions made from the collected data and that this research study as a whole is a useful and potentially insightful educational endeavor.

The limitations are as follows:

1) Subjects attend the Montessori environment for one half of the school day only. Some may be enrolled in other programs whose philosophy and practise differ from the Montessori classroom. While it is assumed that parents would not choose an environment that directly opposed the Montessori philosophy, the nature of the specific environment is not known. The influence of these environments on the divergent thinking ability of students cannot be assessed.

2) Home environments of the subjects may, in varying degrees, concur with, oppose, or be ignorant of the Montessori philosophy. There are several books and manuals available to the parent desirous of an extended Montessori environment in the home (Hainstock, 1976; Gitter, 1969; Wingfield & Wingfield,

1970). It is not known however, whether the home environments of the individual subjects contrast with Montessori beliefs or support them. In addition, it is not known how the home environment affects the divergent thinking ability of students and whether this influence supercedes that of the classroom (or vice versa).

3) Assessment of divergent thinking is made through the use of one instrument only. Optimally, such an assessment would include the psychometric testing, intense classroom observation, review of product samples such as writing and art projects and interviews with students and teachers. Due to time and privacy limitations, however, the testing method was chosen. Other options would have required more time in the classroom as well as significant disruption of student and teacher routine than was deemed possible.

4) It is impossible to assess the divergent thinking ability of students prior to entering the Montessori program. Normally, it would be prudent to conduct a pre and post-testing of subjects in order to compare the outcome results. However, the Torrance tests are

normed on subjects starting at kindergarten age and preclude the possibility of a pre-test on students under the age of five years.

5) Despite the claim made by both programs to be adherents of the Montessori philosophy, it is possible (though not probable) that neither reflects the true Montessori method. Both programs appear to follow the Montessori guidelines thoroughly, with individual modifications. The author is not an expert in Montessori education so it is therefore impossible to fully assess the impact caused by the various levels of adherence. However, because all teachers have been trained in the official Montessori training program and the equipment does, for the most part, reflect the Montessori philosophy outlined in the various books and manuals reviewed, it is assumed that these programs are reflective of the Montessori model. This is not, of course, stated conclusively.

Ideally, it would have been wise to have tested a larger number of Montessori schools in order to broaden the population and the range of adherence to Montessori philosophy. However, most other

Montessori programs begin at kindergarten unlike the two subject schools whose programs begin at the pre-school level. Because these students would have been entering the Montessori environment for the first time as kindergarten students, the impact of the program on their divergent thinking would have been difficult to assess. In addition, this structure cannot be compared with that of the existing subject programs because of the difference in age range.

6) Due to the fact that the subject programs are half-day programs which are run as private institutions, it is most likely that most students will be from the middle to upper socio-economic range. Despite the claims made by both programs that students represent all economic backgrounds, it seems highly unlikely that many would come from lower income families. This is because of the fact that tuition fees and the demands for midday transportation and feeding would most likely be prohibitive to a family depending on two incomes and unable to hire in-home child care.

As a result of this fact, the information gained from the study may not be representative of the

population as a whole. The effects of Montessori may differ among children of varying socio-economic groups. This is especially possible given the research of Reisman (1962), Ausubel (1963), McKinnon (1982) and others which suggest that home environments differ between income groups and affect the influence of school environments.

Chapter 4

RESULTS OF THE STUDY

Collection of the study data was completed over a period of six weeks. All of the 31 subjects whose parents agreed to their participation were given the Torrance Test of Creative Thinking-Figural Form "A". Reaction to the testing procedure on the part of the participating subjects was quite positive; all appeared to enjoy the process.

After collecting the data from both subject schools, the completed test protocols were sent to the Scholastic Testing Service (publishers and administrators of the Torrance tests) for scoring by professionally trained experts. This procedure was used to insure the highest possible reliability in scoring the test results. Test summaries were provided for each individual subject and the two subject groups. Each summary included a raw score as well as a standard score and percentile ranking for each of the test sub-sections and the overall test (see appendix).

The results are summarized in Table1 and are listed separately for both schools. For subjects from Children's House, average scores across all sub- areas was at the 78th percentile. Individual children from this school, however, ranged from the 48th percentile to the 97th. On specific sub-areas the scores for Children's House were as follows: For Fluency the mean group score placed the subjects in the 49th percentile with individual scores ranging from the 9th to the 87th percentiles. For Originality the mean group score placed subjects in the 54th percentile with individual scores ranging from the 9th to the 98th percentiles. For Abstractness of Titles the mean group score placed subjects in the 57th percentile with individual scores ranging from the 24th to the 88th percentiles. For Elaboration the mean group score placed subjects in the 86th percentile with individual scores ranging from the 63rd to the 99th percentiles. In the Resistance to Premature Closure sub-area, subjects from Children's House received a mean score placing them in the 94th percentile. Individual subject ratings ranged from the 70th percentile to the 99th.

In general, scores from the Montessori Learning Centre resembled those from Children's House closely. The average score across all sub-area areas was at the 83rd percentile, with individual ratings ranging from the 29th percentile to the 99th. In the specific sub-areas the scores were as follows: For Fluency the mean group score placed the subjects in the 57th percentile with individual scores ranging from the 9th to the 89th percentiles. For Originality the mean group score placed subjects in the 63rd percentile with individual scores ranging from the 9th to the 95th percentiles. For Abstractness of Titles the mean group score placed subjects in the 67th percentile with individual scores ranging from the 24th to the 99th percentiles. For Elaboration the mean group score placed subjects in the 90th percentile with individual scores ranging from the 41st to the 99th percentiles. In the Resistance to Premature Closure sub-area, subjects from the Montessori Learning Centre received a mean score placing them in the 91st percentile. Individual subject ratings ranged from the 70th percentile to the 99th.

Differences between the two school groups were tested for statistical significance, using a *T-Test* (Best & Kahn, 1989). The test revealed no significant difference between the two subject group scores. The total group scores have therefore been combined in Table 1 and will be discussed jointly in Chapter 5.

Average scores across sub-areas reveal that subjects from both schools (N=31) received a mean score at the 81st percentile. Individual subject ratings ranged from the 29th percentile to the 99th. On the specific sub-areas the scores were as follows: For Fluency the mean group score placed the subjects in the 53rd percentile with individual scores ranging from the 9th to the 89th percentiles. For Originality the mean group score placed subjects in the 58th percentile with individual scores ranging from the 9th to the 98th percentiles. For Abstractness of Titles the mean group score placed subjects in the 62nd percentile with individual scores ranging from the 24th to the 99th percentiles. For Elaboration the mean group score placed subjects in the 88th percentile with individual scores ranging from the 41 to the 99th percentiles. In the Resistance to Premature Closure

sub-area, subjects from both subject schools received a mean score placing them in the 92nd percentile. Individual subject ratings ranged from the 70th percentile to the 99th.

TABLE 1
 PERCENTILE SCORES FOR MONTESSORI SUBJECTS
TORRANCE TEST OF CREATIVE THINKING-FIGURAL FORM "A"

	*CH (N=19)	**MLC (N=12)	***GROUP (N=31)
<i>GENERAL SCORE:</i>	78	83	81
<u>SUB - AREAS:</u>			
FLUENCY:	49	58	53
ORIGINALITY:	54	63	58
ABSTRACTNESS OF TITLES:	57	67	62
ELABORATION:	86	90	88
RESISTANCE TO PREMATURE CLOSURE:	94	91	92

* CH= CHILDREN'S HOUSE SUBJECT'S SCORES IN PERCENTILE

**MLC= MONTESSORI LEARNING CENTERE SUBJECT'S SCORES IN PERCENTILE

***GROUP= SCORES OF ALL SUBJECTS IN PERCENTILE

CHAPTER 5DISCUSSIONDISCUSSION

The results of the study outlined in chapter 4 serve to both confirm and contradict the general hypothesis. Contrary to the initial hypothesis the Montessori programs do not seem to suppress divergent thinking as defined by the Torrance test. With average student scores in the 81st percentile, children in this study were well above average in ability to think divergently.

What, then, is the causal relationship between these scores and the Montessori program? Perhaps the Montessori program actually enhances divergent thinking through its unique program and educational philosophy. It could be argued that the Montessori belief in establishing a sense of nature and reality and the need to pre-instruct students in the fundamental principals of many operations and activities does indeed free them from the constraints of simple knowledge acquisition. Having been liberated from the

need to discover basic "facts" on their own, students can concentrate on the process of using their knowledge in new and unusual ways. Hence, the elevated scores on the Torrance test.

Such an assumption, however, cannot be made without consideration of outside factors common to the subject population. These factors may have contributed to the high scores as much as exposure to the Montessori curriculum. Subjects attend private Montessori schools for half of every day. This circumstance means that the subjects likely come from middle to upper-middle class families who do not need full-time child care and who can afford the tuition of the programs. Such an arrangement would be difficult or impossible for families of lower socio-economic status.

Assuming, then, that these students tend to come from families in the upper socio-economic range several consequences follow. Such families typically spend more time encouraging children's education and achievement as compared with families from lower socio-economic groups (Katz, 1964; Hyman, 1965).

Families in this population have been shown to provide an atmosphere for children that prepares them with skills useful for classroom success (Reisman, 1962; Ausubel, 1963). In a study conducted by Mckinnon (1982) examining children from this class group, no difference was found in ability of those students who were enrolled in a Montessori program and those who stayed at home. Taken together these findings imply that a middle class home environment can enrich child development as much as or more than the preschool classroom.

In addition to the possibility that the home environments may have contributed to high scores on this measure of divergent thinking ability, most of the children may have benefitted from being placed in public school kindergarten when not in Montessori. It is unclear whether the Montessori program is supplemented or offset by these other educational programs which most likely influence the child with equal intensity.

The question of Montessori's ability to influence students' divergent thinking ability has not been

clearly answered through an examination of the overall average of scores from all sub-areas. As such, it is impossible to conclude with any certainty whether the influence of Montessori or other environmental factors have contributed to the high overall scores. These scores appear to be quite high. However, the range of sub-scores (which together constitute the overall scores) varies considerably. Despite the appearance of a generally high score, some scores on the test were unusually low. The fact that the subjects originated from predominantly higher income homes would have suggested that scores would consistently be in the upper ranges. This, however, is not the case. It appears that the Montessori classroom may in fact be exerting some influence on the divergent thinking behavior of students which is not mitigated by the home and public school environments.

An alternate means of determining the influence of the Montessori program on divergent thinking is to examine the sub-scores of the subjects in an attempt to understand the relationship between the Montessori curriculum and ability in these specialized skills. If students appear to exhibit strength in one or more

areas which are emphasized by the Montessori program then it can be said that the influence of Montessori can be detected in their performance.

An evaluation of the sub-areas reveals a significant difference between the general scores on the Torrance test and scores on the sub-areas of fluency and originality. Fluency, described by Torrance as the most critical aspect of creative ability is consistently correlated with divergent thought. Similarly, originality represents the ability to derive unique ideas and views. Montessori subjects scored on average only in the 53rd percentile in the fluency area and in the 58th percentile in originality, as compared with an average score placing them in the 81st percentile overall.

Conversely, the areas of greatest strength were elaboration and resistance to premature closure with scores placing subjects in the 88th and 92nd percentiles respectively. These areas represent the ability to go beyond the confines of the given stimulus and create a product that incorporates it. Elaboration refers to the use detail beyond the basic definition of

the chosen object. If, for example, an animal is drawn which includes more than the basic features, such as fur, teeth, whiskers or claws, credit is given for this elaboration.

Resistance to premature closure refers to the second activity in which simple lines are presented as stimuli. It is the ability to incorporate the stimuli as part of a larger drawing rather than remaining confined by it. If, for example, the simple "V" like shape is added to and changed into a drawing that is not restricted to its obvious and limited shape it is credited for resistance to premature closure. If, however, the shape is turned into a bird without adding and changing the basic stimulus, it is said to have been prematurely closed.

The score patterns of the group in these particular areas are indicative of the curricular emphasis in Montessori. Because the program contains so many pre-set activities and projects, students are not encouraged to engage in ideational fluency in their everyday learning. They are, however, asked to utilize elaboration skills and resist the closure imposed on

them by materials and projects that are not particularly open-ended.

In these specific ways, Montessori students may have been prepared for a test such as the Torrance Test of Creative Thinking which presented pre-set structures for elaboration. The philosophy of the Montessori classroom is based on utilizing the given rules and constraints of nature in order to express individuality. Divergent, original thinking may not be necessary in a classroom that provides basic principles and operations. It is, however, important for Montessori students to take the given and transform it into an experience that is personally relevant and meaningful.

The addition, on the part of Children's House, of a free-art area does not seem to have affected the scores of subjects from this school. Despite the fact that this area allows students more artistic expression it does not appear to differ from the Montessori model significantly. Because of the Montessori-like emphasis placed on the maintenance of the area and the tendency of students to follow pre-designed activities,

the centre remains a traditionally run activity. In this way it does not represent a departure from the Montessori curriculum.

In sum, the scores on the Torrance Test of Creative thinking reveal that Montessori students performed well above average in skills related to divergent thinking. It is not known whether the Montessori program or outside influences contributed to these exceptional scores and it is possible that both play a key role. Examining the areas of relative strength and weakness reveals that Montessori students are less able to think with fluency and originality and display great skill at elaboration and resistance to premature closure. This is consistent with the general tendency in the Montessori curriculum to present students with activities which require little originality and fluency and to rely instead on the student's ability to work within the confines of the pre-structured materials in order to elaborate and expand on the given materials.

IMPLICATIONS FOR FURTHER RESEARCH

This study represents a beginning in the assessment of Montessori's (and other educational programs') effect on creative and divergent thought. Little study has been attempted in the general evaluation of curricula as it relates to divergent thought. Some work is now being done in the area of creativity enhancement in the classroom (Baer, 1987; Davis, 1989; Treffinger & Firestein, 1989). However, with no simple definition of creativity and little apparent research in the area of school effects, few programs can be expected to succeed.

This study highlights the need to examine learning environments, such as Montessori, in order to determine how they affect students' divergent thought. A more in-depth study of the Montessori classroom is warranted, where children's work and play habits are observed and compared to scores of formalized testing procedures. Attitudes of teachers can also be examined in order to understand better how their philosophies affect classroom outcomes.

Certainly, a better understanding of the effect of classroom processes on divergent and creative thought will require a more comprehensive definition of creativity. The search for such a definition and the components that enhance creativity is currently of great concern to researchers (Roweton, 1976; Lubeck & Bidell, 1987; Goswami, 1988; Farra, 1988; Kuo, 1987; Smith & Carlsson, 1987; Runco & Albert, 1986; Sternberg, 1987). The corporate sector in particular seems quite interested in understanding creativity so that it can train employees to be more productive and innovative (Prausnitz, 1985; Ludwig, 1988; Kanter, 1984). Creativity journals, workshops and specialists routinely sell their views on creativity and its enhancement (Brazziel, 1988; Groennings, 1987).

Defining creativity presents not only a problem but a philosophical dilemma as well. Even once a consensus about the nature of creativity is found, important questions of policy and value remain. Does society really want to produce a generation of highly independent and creative thinkers? Is it in the best interests of the society to raise children whose

divergent thought may challenge the established institutions and procedures?

CONCLUSION

The findings of this study imply the need for more flexibility on the part of Montessori teachers in structuring certain activities if divergent thought is to become an educational goal. It is apparent that while the Montessori style of activity in general does not impede divergent thinking ability, it does tend to focus on certain skills and de-emphasize others. As such, it may limit the potential of students to become truly divergent thinkers.

It can be argued that the ability to think with fluency and originality is an important skill in many areas of endeavor, including problem-solving. Unlike the Montessori environment, which provides children with tasks, life in the "outside world" calls for the ability to function with divergent thought and action. While it is vital for a problem to be solved utilizing the "laws of nature" (as Montessori puts it) and the given particulars of a situation, it is equally necessary to use

original thought in constructing viable solutions. Vocational educators such as Schon (1987) advocate the development of a professional who not only applies known theory with great skill but who is able to reflect new and unfamiliar situations with independence and ability. This suggests the possibility that original, fluid thought may play an important role as a means of generating new applications and directions.

Apparently the Montessori community is aware of this need and is, in some measure, beginning to heed the warnings of its critics. In an article published in a British Montessori teachers journal, Wheatley(1990) states that "creativity" should be emphasized in the Montessori classroom. The author calls on Montessori teachers to encourage original, imaginative thought. She suggests the abandonment of formalized art lessons and greater flexibility in all art projects. Most surprisingly, the author states that children should be given freer reign in use of the Montessori toys, allowing them to use this equipment as part of their desired fantasy play (once their "proper" use has been learned). This statement represents a radical

departure for the Montessori movement which has, thus far, denounced such activity.

The Montessori movement is an old and well-established philosophy. As such, it may be difficult for its advocates to revise. Many followers treat the philosophy with religious-like zeal and exhibit hostility towards criticisms and calls for new insight and direction (Simons & Simons, 1985). If the movement is to continue in the ground breaking tradition of its founder, it must always seek to evaluate its performance and alter its course in order to remain a powerful and vital force in early childhood education.

There is much to be said for the Montessori program. It leaves children feeling independent and autonomously competent in many areas. It also allows children to look concretely at the world around them and prepares them for many skills of adult life. It is for this reason that this study was undertaken, not as a denunciation of the Montessori philosophy, but as a means of examining the flaws of a system whose core is worthwhile and beneficial.

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APPENDIX A

February 15, 1990

Dear Parent(s) or Guardian(s):

I am writing to you with regard to a research project that I am conducting as part of my masters thesis. I am examining the effect of the Montessori program on the creative ability of Kindergarten age students.

As part of this study I would like to administer the Torrance Test of Creative Thinking to the Kindergarten age students in this and one other Montessori program in the city. The test, developed by a well respected American psychologist consists of several drawing activities where children are given a shape or lines and asked to create a unique picture and title. The test is meant to be game-like and fun and lasts approximately thirty minutes.

I would like to stress the fact that I am not interested in individual results but am rather looking at group performance. Complete anonymity is therefore guaranteed. I would be most happy to provide you with a report on my findings as soon as the thesis is complete (sometime in the late spring/early summer).

Let me assure you that your child will be under no pressure to participate in the test if he or she does not wish to and can decide to withdraw from the study at any time. I would, however, be most grateful if you would agree to allow your child to participate in this project

If you have any further questions or concerns please feel free to contact me at 589-2026. You can also contact the staff and parent board of your child's school, they will be supervising my activities at the school.

I would like to thank you for your assistance in this project and hope that you will agree to allow your child to participate.

Sincerely,
Avi Rose

LETTER OF CONSENT

I, _____ ALLOW MY CHILD _____ TO PARTICIPATE IN AUI ROSE'S RESEARCH PROJECT AS DESCRIBED TO ME IN THE ENCLOSED LETTER. I UNDERSTAND THAT THE TESTING WILL BE DONE EXACTLY AS OUTLINED IN THE LETTER AND THAT MY CHILD CAN REFUSE TO PARTICIPATE IF THEY SO DESIRE. I ALSO UNDERSTAND THAT COMPLETE ANONYMITY IS GUARANTEED AND THAT THE INDIVIDUAL TEST SCORE OF MY CHILD WILL NOT BE USED IN ANY WAY OTHER THAN AS PART OF AN OVERALL GROUP SCORE. RESULTS OF THE STUDY WILL BE MADE AVAILABLE TO ME UPON REQUEST.

SIGNED

(PARENT OR GUARDIAN)

IN ORDER TO ALLOW FOR BETTER ANALYSIS OF THE TEST RESULTS WOULD YOU KINDLY INCLUDE THE FOLLOWING INFORMATION:

NAME OF CHILD _____ MALE _
FEMALE _

DATE OF BIRTH: (DAY/MONTH/YEAR) ____ / ____ / ____

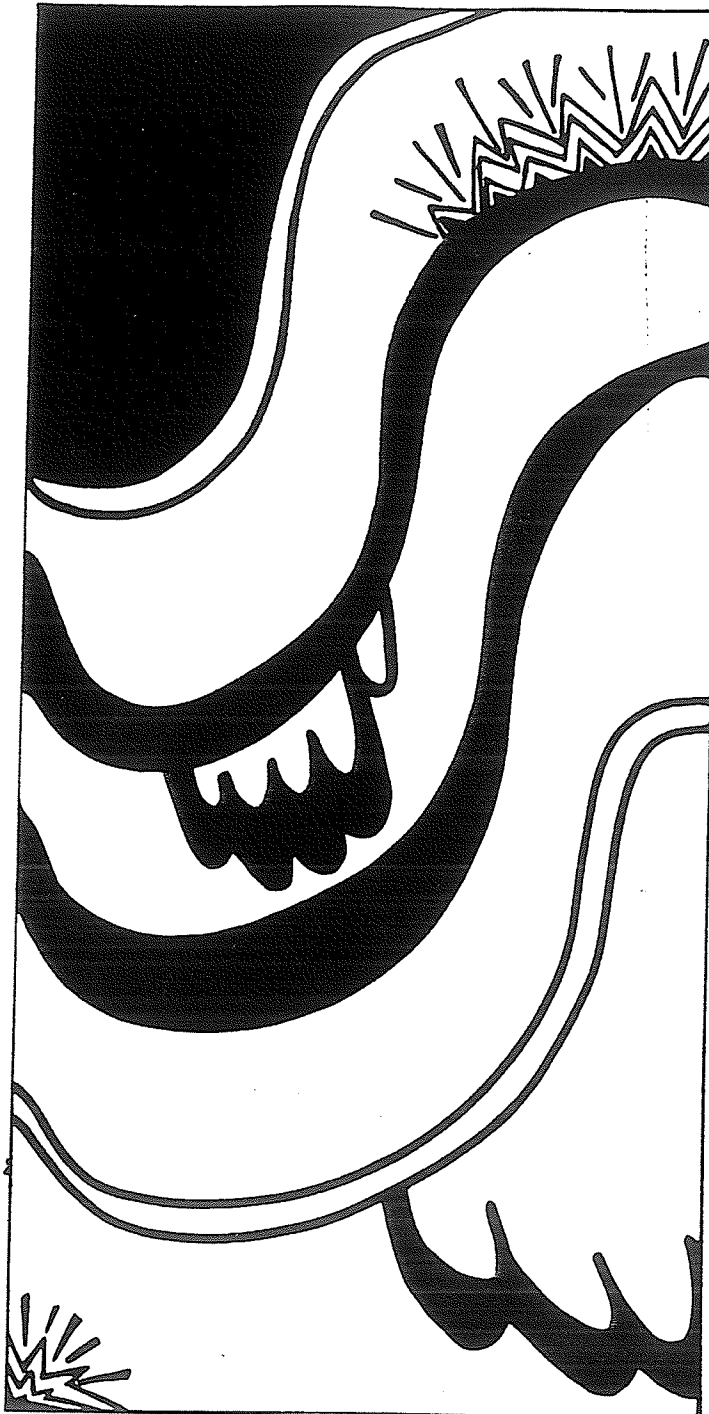
NAME OF MONTESSORI SCHOOL

HOW LONG HAS YOUR CHILD BEEN ATTENDING THIS MONTESSORI PROGRAM (YEARS/MONTHS)? _____

PLEASE RETURN THIS FORM TO YOUR CHILD'S SCHOOL AS SOON AS POSSIBLE (preferably by March 12th).

THANK YOU

APPENDIX B



THINKING
CREATIVELY
WITH
PICTURES

By E. Paul Torrance

FIGURAL
BOOKLET A

NAME _____
AGE _____ SEX _____
SCHOOL _____
GRADE _____
CITY _____
DATE _____

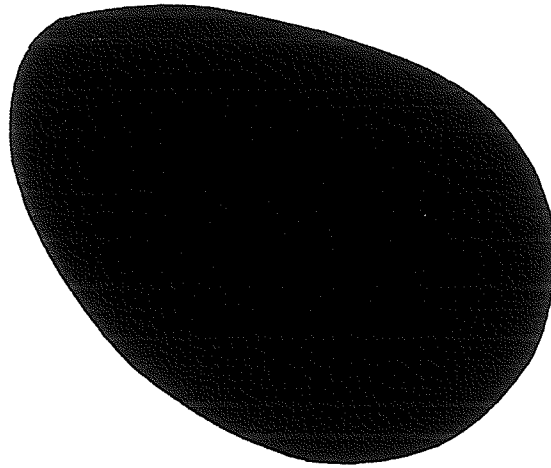


SCHOLASTIC TESTING SERVICE, INC.
480 Meyer Road, P.O. Box 1058
Bensenville, IL 60106-8058

On the opposite page is a curved shape. Think of a picture or an object which you can draw with this shape as a part.

Try to think of a picture that no one else will think of. Keep adding new ideas to your first idea to make it tell as interesting and as exciting a story as you can.





When you have completed your picture, think up a name or title for it and write it at the bottom of the page in the space provided. Make your title as clever and unusual as possible. Use it to help tell your story.



YOUR TITLE: _____

Activity 2. PICTURE COMPLETION

By adding lines to the incomplete figures on this and the next page, you can sketch some interesting objects or pictures. Again, try to think of some picture or object that no one else will think of. Try to make it tell as complete and as interesting a story as you can by adding to and building up your first idea. Make up an interesting title for each of your drawings and write it at the bottom of each block next to the number of the figure.

 1. _____	 2. _____
 3. _____	 4. _____

DIVERGENT PRODUCTION IN MONTESSORI

Activity 3. LINES

140

In ten minutes see how many objects or pictures you can make from the pairs of straight lines below and on the next two pages. The pairs of straight lines should be the main part of whatever you make. With pencil or crayon add lines to the pairs of lines to complete your picture. You can place marks between the lines, on the lines, and outside the lines—wherever you want to in order to make your picture. Try to think of things that no one else will think of. Make as many different pictures or objects as you can and put as many ideas as you can in each one. Make them tell as complete and as interesting a story as you can. Add names or titles in the spaces provided.



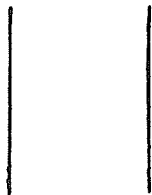
1. _____



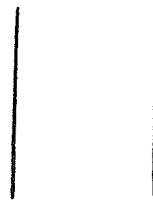
2. _____



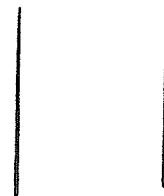
3. _____



4. _____



5. _____



6. _____

TORRANCE TESTS OF CREATIVE THINKING -- FIGURAL STREAMLINED FORM; A

SCHOOL: ROSE-MLC

(ZK001)

GRADE: KG

SECTION: 01

REPORT DATE: 06/90

PAGE: 1

SCORE CODES:

RS = RAW SCORE

SS = STANDARD SCORE

NP = NATIONAL PERCENTILE

LP = LOCAL PERCENTILE

NAME	SEX	AGE YR MO	---FLUENCY---				---ORIGINALITY---				---TITLES---				---ELABORATION---				---RESISTANCE---				---AVERAGE---				---CR-STRENGTHS---				---CR---				INDEX	NP
			RS	SS	NP	LP	RS	SS	NP	LP	RS	SS	NP	LP	RS	SS	NP	LP	RS	SS	NP	LP	RS	SS	NP	LP	RS	SS	NP	LP	RS	SS	NP	LP		
			22	97	44	37	12	95	41	31	15	153	99	98	0	132	95	60	19	145	99	79	122	94	79	1000	10000	10111	129	95						
F			24	102	53	53	19	117	80	66	7	118	82	76	8	126	90	42	19	145	99	79	122	93	73	1000	10000	10010	126	93						
M			26	105	61	63	13	99	48	42	4	102	54	44	11	144	99	90	17	135	96	50	117	88	50	1000	10000	11100	121	86						
F			37	125	89	98	15	105	60	53	6	114	75	63	11	144	99	90	19	145	99	79	122	96	87	1000	10000	10110	132	97						
M			34	121	86	85	26	133	95	95	4	102	54	44	10	138	97	74	12	111	70	5	121	92	65	1000	10000	10110	126	93						
F			30	117	80	79	16	108	66	58	6	114	75	63	9	132	95	60	18	140	98	61	122	93	73	1000	10100	10110	127	94						
F			13	75	11	11	9	85	23	18	3	95	40	26	7	117	81	21	13	116	78	13	90	45	5	1000	10000	10110	102	41						
F			36	123	88	92	23	127	91	82	11	138	97	92	11	144	99	90	16	130	94	34	122	99	90	1000	10000	10111	137	99						
F			12	73	9	6	6	74	9	3	5	108	66	53	5	95	41	3	12	111	70	5	92	29	2	1000	10000	10110	96	28						
F			30	117	80	79	16	108	66	58	2	86	24	61	9	132	95	60	16	130	94	34	122	99	42	1000	10000	10100	110	81						
M			23	99	49	48	20	120	84	73	3	95	40	26	11	144	99	90	17	135	96	50	119	90	56	1000	10000	10100	122	88						
M			22	97	44	37	21	122	87	76	12	145	99	95	0	126	90	42	17	135	96	50	125	95	82	1002	11000	11111	134	98						

NUMBER OF STUDENTS: 12

(SCHOLASTIC TESTING SERVICE, INC.)

APPENDIX C

DIVERGENT PRODUCTION IN MONTESSORI

FORMANCE TESTS OF CREATIVE THINKING -- FIGURAL STREAMLINED FORM: A

GROUP SUMMARY: FREQUENCY DISTRIBUTIONS

SCHOOL: ROSE-MLC

(ZK001)

GRADE: KG

SECTION: 01

REPORT DATE: 06/90

PAGE:

STANDARD SCORE INTERVALS		---FLUENCY---		---ORIGINALITY---		---TITLES---		---ELABORATION---		---RESISTANCE---		---AVERAGE---		---CREATIVITY---	
		FREQ.	PERCENT	FREQ.	PERCENT	FREQ.	PERCENT	FREQ.	PERCENT	FREQ.	PERCENT	FREQ.	PERCENT	FREQ.	PERCENT
159	-														
156	- 158														
153	- 155														
150	- 152					1	8								
147	- 149														
144	- 146														
141	- 143					1	8	4	33	3	25				
138	- 140														
135	- 137					1	8	1	8	1	8				
132	- 134									3	25			1	8
129	- 131			1	8			3	25			1	8	2	17
126	- 128			1	8			2	17	2	17			1	8
123	- 125	2	17									1	8	3	25
120	- 122	1	8	2	17							2	17		
117	- 119	2	17	1	8							3	25	2	17
114	- 116					1	8	1	8			2	17	1	8
111	- 113					2	17					1	8		
108	- 110									1	8				
105	- 107	1	8	2	17	1	8			2	17				
102	- 104	1	8	1	8										
99	- 101	1	8			2	17								
96	- 98	2	17	1	8									1	8
93	- 95														
90	- 92			1	8	2	17	1	8			1	8	1	8
87	- 89														
84	- 86			1	8	1	8					1	8		
81	- 83														
78	- 80														
75	- 77	1	8												
72	- 74	1	8	1	8										
69	- 71														
66	- 68														
63	- 65														
60	- 62														
57	- 59														
54	- 56														
51	- 53														
48	- 50														
45	- 47														
42	- 44														
	- 41														

SUMMARY STATISTICS USING MEAN = 104.3 MEAN = 107.8 MEAN = 114.2 MEAN = 131.2 MEAN = 131.5 MEAN = 117.8 MEAN = 122.5
STANDARD SCORES S.D. = 16.7 S.D. = 16.7 S.D. = 20.2 S.D. = 13.8 S.D. = 12.0 S.D. = 11.1 S.D. = 11.8

NUMBER OF STUDENTS = 12

(SCHOLASTIC TESTING SERVICE, INC.)

TOURANCE TESTS OF CREATIVE THINKING -- FIGURAL STREAMLINED FORM: A

SCHOOL: ROSE-CH

(ZK002)

GRADE: KG

SECTION: 01

REPORT DATE: 06/90

PAGE: 1

SCORE CODES:

RS = RAW SCORE

SS = STANDARD SCORE

NP = NATIONAL PERCENTILE

LP = LOCAL PERCENTILE

NAME

SEX

AGE
YR MO

---FLUENCY---				---ORIGINALITY---				---TILES---				---ELABORATION---				---RESISTANCE---				---AVERAGE---				---CR-STRENGTHS---				---CR-----			
RS	SS	NP	LP	RS	SS	NP	LP	RS	SS	NP	LP	RS	SS	NP	LP	RS	SS	NP	LP	RS	SS	NP	LP	RS	SS	NP	LP	1234567890123	1111	INDEX	NP
22	97	44	37	13	99	48	42	2	86	24	6	8	126	90	42	20	153	99	95	112	80	35	0001000010100	115	75						
35	123	87	92	24	129	93	89	2	86	24	6	7	117	81	21	19	145	99	79	120	91	60	0001000010110	124	91						
17	85	23	15	6	74	9	3	3	95	40	26	7	117	81	21	15	125	90	19	99	48	60	0001000010110	124	91						
30	117	80	79	29	140	98	98	7	118	82	76	10	138	97	74	16	130	98	34	129	97	92	0001000010100	102	41						
28	111	72	69	23	127	91	82	3	95	40	26	8	126	90	42	20	153	99	95	122	93	73	0021000010111	130	90						
35	123	87	92	25	134	94	92	8	123	88	87	11	144	99	90	16	130	94	34	130	98	95	0001000010111	129	95						
10	67	5	2	7	77	13	8	7	118	82	76	7	117	81	21	18	140	98	61	104	62	18	0001000010110	134	98						
22	97	44	37	14	102	54	50	3	95	40	26	8	126	90	42	16	130	94	34	110	76	27	0001000010100	109	60						
22	97	44	37	12	95	41	31	2	86	24	6	6	107	63	8	12	111	70	5	99	40	10	0001000010100	113	70						
12	73	4	6	9	85	23	18	4	102	54	44	5	95	41	3	19	145	99	79	100	51	15	0001000010100	102	41						
23	99	49	48	23	127	91	82	7	118	82	76	10	138	97	74	15	126	90	19	121	92	65	0001000011110	105	49						
18	87	26	19	13	99	48	42	5	108	66	53	7	117	81	21	19	145	99	79	111	78	31	0001000010110	105	49						
21	95	39	26	8	81	17	11	6	114	75	63	8	126	90	42	19	145	99	79	112	80	35	0001000010010	128	95						
28	111	72	69	19	117	80	66	8	123	88	87	11	144	99	90	18	140	98	61	127	96	87	0001000010110	115	75						
18	87	26	19	12	95	41	31	5	108	66	53	7	117	81	21	16	130	94	34	107	70	24	0001000010110	116	77						
21	95	39	26	9	85	23	18	3	95	40	26	7	117	81	21	18	140	98	61	106	68	21	0001000010010	131	97						
25	103	57	58	13	99	48	42	7	118	82	76	9	132	95	60	13	116	78	13	114	84	42	0001000000000	111	65						
28	111	72	69	19	117	80	66	3	95	40	26	10	138	97	74	16	130	94	34	118	89	53	0001000010010	107	55						
25	103	57	58	10	89	28	24	3	95	40	26	9	132	95	60	20	153	99	95	114	84	42	0001000010111	117	79						
																							0001000010110	123	89						
																							0001000010110	118	81						

NUMBER OF STUDENTS = 19

(SCHOLASTIC TESTING SERVICE, INC.)

TOURANCE TESTS OF CREATIVE THINKING -- FIGURAL STREAMLINED FORM: A

GROUP SUMMARY: FREQUENCY DISTRIBUTIONS

SCHOOL: MOSE-CM

(2K002)

GRADE: KG

SECTION: 01

REPORT DATE: 06/90

PAGE: 1

DIVERGENT PRODUCTION IN MONTESSORI

144

STANDARD SCORE INTERVALS		FLUENCY		ORIGINALITY		TITLES		ELABORATION		RESISTANCE -TO CLOSURE-		AVERAGE		CREATIVITY -INDEX-	
FREQ.	PERCENT	FREQ.	PERCENT	FREQ.	PERCENT	FREQ.	PERCENT	FREQ.	PERCENT	FREQ.	PERCENT	FREQ.	PERCENT	FREQ.	PERCENT
159															
156															
153															
150										3	16				
147															
144															
141								2	11	4	21				
138				1	5			3	16	3	16			1	5
135															
132								2	11						
129				2	11					5	26	2	11	1	5
126				2	11			4	21			1	5	2	11
123		2	11			2	11			2	11			1	5
120														2	11
117		1	5	2	11	4	21	6	32			3	16		
114						1	5					1	5	2	11
111		3	16							1	5	2	11	3	16
108						2	11					3	16	2	11
105								1	5			1	5	1	5
102		2	11	1	5	1	5					2	11	2	11
99		1	5	3	16							1	5	2	11
96															
93		2	11	2	11	6	32	1	5						
90															
87		2	11	1	5										
84		1	5	2	11	3	16								
81				1	5										
78															
75				1	5										
72		1	5	1	5										
69															
66		1	5												
63															
60															
57															
54															
51															
48															
45															
42															
39															
36															
33															
30															
27															
24															
21															
18															
15															
12															
9															
6															
3															
0															

SUMMARY STATISTICS USING MEAN = 99.0 MEAN = 103.6 MEAN = 104.1 MEAN = 124.9 MEAN = 136.1 MEAN = 113.4 MEAN = 117.7
 STANDARD SCORES S.D. = 14.8 S.D. = 19.7 S.D. = 12.8 S.D. = 12.4 S.D. = 11.9 S.D. = 9.5 S.D. = 10.5

NUMBER OF STUDENTS = 19

(SCHOLASTIC TESTING SERVICE, INC.)