Developing Multiple Intelligence in The Classroom

BY

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ABSTRACT

DEVELOPING MULTIPLE INTELLIGENCES IN THE CLASSROOM

This thesis was designed to assess students' dominant levels of multiple intelligences in Gardner's list of seven, following an analysis of their principal lines of development. The statistical study was completed in two parts. The first part included 20 teachers, and a comparative analysis was done on their scores on three tests (self-assessment, Gardner's inventory of multiple intelligences and Teele's (TIMI) inventory of multiple intelligences. The second part involved 495 students and was divided into two sections. The first section assessed the students' intelligence on individual grade level's from primary to grade twelve. The second section grouped the students' scores into grade levels (primary grades 0-2, lower grades 3-5, middle grades 6-8, and high school grades 9-12). A variety of tables and charts was used to show differences in the areas of gender, grade and sex/grade. The experiment in multiple intelligences showed some significant results in the areas of sex, grade, and sex/grade that would be useful for educators and curriculum developers in designing curriculum changes to meet the needs of all students.

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Special Dedication

This book is dedicated to Phillip Corbett, a dear friend doing an admirable job of coping with the ravages of brain injury . It is my hope that someday researchers will find ways to improve his health as well as all other patients afflicted with injury or disease of the brain. Good luck Phillip!!

PREFACE

About three years ago while taking a Graduate level course in education at St. Mary's University in Halifax, I was introduced to Howard Gardner's "Theory of Multiple Intelligence" by professor Bette Hanrahan. Gardner's theory was relatively new in respect to application in the Nova Scotia school system at the time, and my interest was peaked as I felt it could have tremendous educational value within the realm of curriculum development. The thought of conducting an experiment to measure the profiles of Gardner's multiple intelligences within school populations interested me even more. I believed that testing for the dominant intelligences in Halifax area students could have a positive effect on the restructuring of Nova Scotia schools to meet the needs of future students.

The first chapter deals with an analysis of Gardner's development of the seven intelligences and this chapter presents the core of the theoretical foundation for any testing program on multiple intelligence. Evidence for each intelligence will be marshaled in the following areas: definition or specific differentiation, array of core operations (ordinary and high end-states), symbol systems, and their autonomy, and overlap with other intelligences. The awesome diversity of sources contributing to the evidence for the autonomy of individual intelligences is a key point to the success and survival of Gardner's theory.

The statistical study conducted was completed in two parts. The first study would measure teachers' seven intelligences on three test instruments and correlate their results to find the differences in these correlations; essentially the logical-mathematics, music and the bodily-kinesthetic intelligences obtained higher correlations than the other intelligences and would be more reliable measures to be applied to a school population. The second study would measure the student's seven intelligences using Dr. Sue Teele's (TIMI) Teele Inventory of Multiple Intelligences; this inventory would determine how much interest the student has in learning in a particular way and which are the students' preferred ways of problem-solving or how students perceive themselves in the learning tasks. It would rank the students' seven intelligences and give curriculum developers ideas as to how they may restructure the present curriculum to best utilize the student's strengths to their maximum while at the same time improving on their weaknesses. Four hundred ninety-five students, from four years of age on to high school would be used in the study in Halifax area schools.

The scope of the study will provide us a ranking of the students' seven intelligences in the areas of linguistic, logical-mathematical, visual-spatial, musical, bodily-kinesthetic, intrapersonal and interpersonal intelligences. It was anticipated that some gender differences might show up, possibly in the area of mathematical intelligence, and that grade level effects might also arise within each intelligence. The findings in the report did indicate gender differences in the area of mathematical intelligence, along with specific grade level differences.

There are some important implications for educators and curriculum developers that will help structure the classroom by meeting the needs of students, helping them build on their strengths and improve on their weaknesses in the areas of the seven intelligences. Gardner's theory has made a great impact on schools; hopefully, schools within Nova Scotia will follow some of the trends in multiple intelligence that have already been developed across North America.

TABLE OF CONTENTS

CHAPTER 1

THE MULTIPLE INTELLIGENCES

The Eight Intelligences

Kathleen Gaffney (1995, p.1) stated that to begin to understand the MI Theory and the Arts applications you have to begin with a very basic overview of the concept of human cognition (also known as human information processing). Until now, it was believed that human intelligence was fixed at birth, a result of heredity, and that nothing much could affect the given amount a person had. Gaffney describes this situation metaphorically:

> "If intelligence was a blob of clay, you could fashion your clay into specific shapes. Even if you had the same amount as someone else, the result might "look" different. One fact was indisputable, that blob was all the clay you had to work with, you couldn't get any more" (Gaffney, 1995, p. 1).

For years this was held to be true and was a presumption for Binet's testing for intelligence, and testing in education had a massive success predicting a child's progress in school but no success predicting a child's progress in life. A momentous change in educational ideas was coming:

> In 1979 a small team of researchers at the Harvard Graduate School of Education was asked by the Bernard Van Leer Foundation of the Hague to undertake an inquiry on a grand topic: The Nature and Realization of Human Potential (Gardner, 1993b, p. xi).

Gardner's Theory of Multiple Intelligences was born from this inquiry. In 1983, Gardner published a seminal work, *Frames of Mind*; it proposed and defended the autonomy of seven intelligences, but an eighth intelligence, the naturalist, was proposed by Gardner in 1996 and it is still in the preliminary stages.

Gaffney emphasizes four general characteristics about MI theory that are essential: all human beings possess all seven intelligences; most people have the ability to develop every intelligence to a higher level; the intelligences are always interacting with each other in complex ways; and there are many ways to be intelligent within each area (Gaffney, 1995, p. 2). Gardner, in his 1993 publication, *Creating Minds*, illustrates high end-states of these seven intelligences through the contributions of noted individuals: T.S. Eliot-Linguistic; Albert Einstein-Logical Mathematical; Igor Stravinsky-Musical; Pablo Picasso-Spatial; Martha Graham-Bodily Kinesthetic; Sigmund Freud-Intrapersonal; Mahatma Gandhi-Interpersonal Intelligence, all of whom have made significant contributions that may help us understand the roots of these intelligences (Gardner, 1993a). These modern masters have displayed varying degrees of marginality as they led paradigm shifts within their areas of expertise. Gardner's studies of these creative lives (Ibid.) found evidence for a ten-year rule for creative breakthroughs that applies across the spectrum of the intelligences.

Their seven intelligences as proposed by Howard Gardner have specific differentiation and will be considered in terms of their autonomy, their overlap with each other, the range of their activities or core operations, and their symbol systems.

Verbal/Linguistic Intelligence

Definition

Linguistic intelligence (Gardner, 1983, p. 77) refers to an individual's mastery in using language competently as a instrument for communication and expression and this competence is best exemplified by poets and writers. Armstrong offers a comprehensive definition of the linguistic competence:

> The capacity to use words effectively, whether orally (e.g., as a storyteller, orator, or politician) or in writing (e.g., as a poet, playwright, editor, or journalist). This intelligence includes the ability to manipulate the syntax or structure of language, the phonology or sounds of language, the semantics or meanings of language, and the pragmatic dimensions or practical uses of language. Some of these uses include rhetoric (using language to convince others to take a specific course of action), mnemonics (using language to remember information), explanation (using language to inform), and metalanguage (using language to talk about itself). (Armstrong, 1994a, p.2)

"A well-developed linguistic intelligence shows itself in attention to words, overtones, relations among them, and the beauty and substance of style" (Grow, 1997, p.4).

Core Operations

Gardner first considers the core operations of language as revealed in their greatest clarity or high end-states as in the works of poets (Gardner, 1983, pp.73-77). The labors of the poet will manifest supreme command of the 'linguistic tetrad': *phonology, syntax, semantics, and pragmatics* (Ibid., p.77). The poet's sensitivity to the shades of meaning in words is exemplified in Robert Graves' search for a substitute word for "pattern" in "and fix my mind in a close pattern of doubt"; He rejects "frame of doubt" as too formal and "net" as too negative, but after a trip at sea, he settles on "caul" as bearing all the senses he needs: "and fix my mind in a close caul of doubt" (Ibid., p.74) In another example of discriminating the meanings of connotations of words, which is the priority of *semantics*, Stephen Spender built a poem from this notebook jotting:

> There are some days when the sea lies like a harp stretched flat beneath the cliffs. The waves like wires burn with the sun's copper glow (Ibid., p.74).

After six attempts, the final version poetically captures his initial thought:

> There are some days the happy ocean lies
> like an unfingered harp, below the land.
>
> Afternoon gilds all the silent wires
> into a burning music of the eyes. (Ibid., p.75)

These struggles with wording are efforts "to preserve as many of the sought-after meanings as possible. This is why *caul* was the most desirable of the choices considered by Graves". (Ibid.) As well, poets must be singularly concerned with the sounds of words; they must have a keen sensitivity to *phonology* since words relate primarily to the aural sense (Ibid.,p.76). Graves' "close caul" was chosen as much for the sound effect as for the semantic one. (Ibid.) *Syntax*, rules governing the ordering of words, must be well understood by the poet, even when choosing to flaunt those rules. (Ibid.) And finally, the poet reveals an appreciation of the uses of language in its *pragmatic* function; poetic speech acts show many purposes in their range from lyric to epic. (Ibid.)

As a perspective of a high-end state of linguistic intelligence, T. S. Eliot's poem "The Love Song of J. Alfred Prufrock" unlocks a vital addition to the development of English literature (Gardner, 1993A, p.236). Its opening lines bring an encounter with a poetic voice that can easily associate the most dissimilar elements.

> One immediately encounters a poetic voice that can comfortably juxtapose the most disparate elements: a romantic evening with an anesthetized patient: Thus

> Let us go then you and I,
> When the evening is spread out against the sky
> Like a patient etherized upon a table (Gardner, 1993A, Pg 236-237.)

Eliot, of course, would later write " The Waste Land", a poem that more than any other work of its era conveyed the tones and the themes that occupied the consciousness of his literary contemporaries after the 1st World War (Gardner, 1993A, p.246) (Eliot, 1963, p. 61-79). This poem inspired a consensus among the young and the intellectual that the war had achieved little and that the prospects for a vital, progressive civilization were slender and diminishing (Gardner, 1993, p.247). Eliot has become Gardner's prototypical example of a defined high end-state of linguistic intelligence.

The poetic master is one whose expression of words and ideas seems to flow naturally, a creative capacity described by the poet Karl Shapiro:

> Genius in poetry is probably only the intuitive knowledge of form. The dictionary contains all the words and a textbook on verse contains all meters, but nothing can tell the poet which words to choose and in what rhythms to let them fall, except his own intuitive knowledge of form (Gardner, 1983, p. 83).

While poetry provides us the clearest instances of linguistic skills, everyone exhibits some command of "the linguistic tetrad of phonology, syntax, semantics, and pragmatics" (Ibid., p.77). In fact, linguistic competence is the intelligence "that seems most widely and most democratically shared across the human species" (Ibid., p.78). Gardner singles out four aspects of linguistic knowledge that are widely used in the general populace: first, the rhetorical aspect of language to convince others; secondly, the mnemonic use to maintain information; thirdly, the explanatory role for teaching and learning; and finally, the knowledge of language for metalinguistic analysis; especially valuable for clarifying meaning. (Ibid., p.78) Humans share an immense sensitivity to the meaning of words, the order among words, the sound and inflections of words, and the different functions of words to suit goals and purposes---all being the core operations of language illustrated by the poet..

Linguistic intelligence is answerable for the composition of language in all its elaborate possibilities in the forms of poetry, humor, reading, syntax, various genres of literature, cerebral reasoning, symbolic analyzing, theoretical patterning, and, of course, the written and spoken word (Lazear, 1991a, p.14). Linguistic intelligence is awakened by the spoken word; by reading someone's ideas or poetry; and by writing one's own ideas, thoughts, or poetry (Ibid).

Symbol Systems

The symbol systems of this intelligence are phonetic languages (Armstrong, 1994a, p.6). "Almost every culture including the deaf culture (Gaffney, 1995, p.3) has a symbol system for words or sounds." The simplicity of the linguistic technique inspires awe:

> ....The phonemes and letters that constitute the primary units of spoken and written language are meaningless in themselves. Linguistic information is coded into the sequence of the units and the length of the chain, thus permitting our language to use fewer than 100 meaningless sounds and written symbols to efficiently process an incredible amount of meaningful information. (Sylwester, 1995, p.108)

"Around the age of two the child becomes capable of symbol use: now he can use images or elements--such as words, gestures, or pictures--to stand for 'real life' objects in the world" (Gardner, 1983, p.19). Gardner describes waves of symbolization, in which "event structuring is most closely tied to linguistic intelligence", so that around the age of five, a child knows what a story is and can construct short narratives (Ibid., p. 309). Also, "around the age of five a child is able to express himself freely without undue critical apprehension and has no commitment to producing just what others have fashioned.... it is a heady time" (Gardner, 1983, p.309). It is during a final wave of competence with symbol systems "during adolescence and adulthood that an individual becomes a fully competent user of symbols, one who is able to transmit symbolic knowledge to younger individuals, and who has the potential for fashioning original symbolic products" (Gardner, 1983, p.303).

Gardner states that for nearly all investigators, "language is the prototypical system of symbolization: and indeed for some it is the only system worth study" (Gardner, 1991, p.58). Because of the dominant position of language as a symbol system, "a great deal of knowledge has been accumulated about the syntax, semantics, and pragmatics of language", with other symbol systems being modeled on the studies of language (Ibid.). The syntactic and phonological processes develop relatively independently while the semantic and pragmatic maybe more closely tied to other competencies such as the logical-mathematical and the personal intelligences (Gardner, 1983, pp. 80-81).

> In terms of my "criteria" for an intelligence, we might say that syntax and phonology lie close to the core of linguistic intelligence while semantics and pragmatics include inputs from other intelligences (such as logical-mathematical and personal intelligences). (Ibid., p. 81).

Symbol systems will constitute a major concern in each intelligence since "much of human representation and communication of knowledge takes place via symbol systems--culturally contrived systems of meaning which capture important forms of information (Gardner, 1983, p. 66)."

Developmental Trajectory

Each intelligence-based activity will have its own developmental trajectory; "that is, each activity has its own time of arising in early childhood, its own time of peaking during one's lifetime, and its own pattern of either rapidity or gradually declining as one gets older" (Armstrong, 1994a, p.5) . The linguistic intelligence does not peak early in life; it "explodes in early childhood and remains robust until old age" (Armstrong, 1994a, p.7). That early explosion is even more surprising in light of its rigorous demand on life resources:

> Children tend to develop oral competence in language prior to written competence, and they must master an average of about ten new words a day to reach the high school senior's vocabulary of about 60,000 words (Sylwester, 1995, p. 108).

On the other hand, one can become a successful novelist after the age of fifty; at the age of seventy-three Norman Maclean wrote his first novel, *A River Runs Through It*, which received the Pulitzer Prize. Gardner "points out that we need to use several different development maps in order to understand the seven intelligences" (Armstrong, 1994a, p.5). Not all of the intelligences will have the longevity of development that is found in the linguistic intelligence.

Autonomy

The autonomy of any intelligence will involve some specific location in the brain's architecture. Addressing the Western tradition of enumerating distinct functions or parts of the brain, as in Gall's suggestion of 37 faculties or powers for the brain or Guilford's expansion of linguistic intelligence that figure to some 120 vectors of the mind (Gardner, 1983, p. 7), Gardner finds evidence for only seven autonomous systems of intelligence.

The specific areas of the brain that are related to linguistic intelligence are centered in most people in the left temporal and frontal lobes. Two important structures in that part of the brain are the Broca's Area in the frontal lobe which processes syntax, grammatical forms and word production and Wernicke's Area in the temporal lobe which relates language and thought (Sylwester, 1995, p.109).

> Two especially important interconnected structures in that part of the brain are *Wernicke's Area* in the temporal lobe, which links language and thought (word comprehension), and *Broca's Area* in the frontal lobe, which processes grammatical structures and word production. The bundles of nerve fibers called the *Arcuate Fasciculus* connects these two structures, and when it develops (at about two), children begin to speak in sentences. (Sylwester, 1995, p.109)

Gardner reviews the evidence from a variety of mental deficits to support his thesis for the autonomous development of the linguistic competence. Part of this study involves the many normal children who display selective difficulties in the phonological and syntactic aspects of language skills (Ibid., p. 84) Yet, "Many mentally handicapped children display a surprising ability to master language--particularly its core phonological and syntactic aspects--though they have relatively little of significance to utter" (Ibid.). Some retarded children read well without regard to semantic information. Following the research showing that in normal right-handed people language is closely tied to certain areas of the left half of the brain, Gardner considers cases where almost a full hemisphere is removed from the brain, for therapeutic reasons, in the child's first year; yet the child's speech still develops very well (Ibid., p. 85). He reasons that "in early life the brain is sufficiently plastic...and language sufficiently important that language will develop in the right hemisphere, even at the cost of compromising those visual and spatial functions that would normally be localized there" (Ibid.). But he also notes that, "such flexibility diminishes rapidly after puberty" (Ibid., p. 52). Such children, however, display different linguistic strategies from those who employ the normal areas of the left hemisphere; typically, those depending on the right hemisphere for language rely on the semantic information and are unable to use syntactic clues

(Ibid., p. 85). As well, children void of a left hemisphere generally show inferior speech skills (Ibid., p. 86).

All of these examples of linguistic development despite left hemisphere damage attest to the perseverance of language zones to canalize normally and to find different ways to communicate when normal routes are blocked (Ibid., p. 86). Gardner has earlier noted the biological feature of canalization, the tendency of the organism to follow certain developmental paths even when blocked or thwarted (Gardner, 1983, pp. 37-38). Gardner cites C. H. Waddington's comment within his own analysis of the tenacity of developmental patterns:

> Yet according to Waddington, it proves surprisingly difficult to divert such patterns from what appears to be their prescribed developmental goals--in the present case, an adequately functioning nervous system. As Waddington put it, 'it is quite difficult to persuade the developing system not to finish up by producing its normal end result'. Even if one seeks to block or otherwise to divert the expected patterns, the organism will tend to find a way to finish up in its "normal" status; if thwarted, it will not return to its point of origin but will rather make its peace at a later point in the developmental course (Ibid., p. 38).

Other populations support the principle of canalization; deaf children born to hearing parents will on their own devise basic sign languages using the crucial features of language (Ibid., p. 86). This evidence of canalization offers strong support for the autonomy of the linguistic intelligence.

Gardner also relates that some serious aphasic patients afflicted by brain disorder have preserved their abilities to be composers, artists, or tradespeople (Gardner, 1983, p. 89). His extrapolation from this finding is that this discriminate protecting of vocational skills and talent would be impossible if language were not autonomous and separate from other types of intellect (Ibid.). "Thus, in its strictest sense, when one focuses on phonological, syntactic, and certain semantic properties, language emerges as a relatively autonomous intelligence (Gardner, 1983, p. 89).

Until recently, it was a universal belief that the two parts of the brain were biologically indistinguishable from each other and this fact encouraged belief in the nonlocalization view of human language and the "assumption that the human brain is equipotential for language" (Ibid., p. 90). Research, as indicated above, does not support this point of view; and it has been established that the two hemispheres are not identical and that "in the majority of people, the communication areas in the left temporal lobes are larger than the homologous areas in the right temporal portions" (Ibid.).

Scholars in the field of evolution studies have traced the asymmetry between the hemispheres as far back as Neanderthal, thirty to a hundred thousand years ago (Ibid.). A reasonable inference is that language capacities certainly predate recorded history; but, notation, the beginning of writing systems, has been found from thirty thousand years ago (Ibid.). Gardner concludes that human linguistic competence resulted from the evolution of a number of discrete systems, some of which are reflected in other species, but that the humans' exceptionality lies in the evolution of the appropriate vocal tract:

> Where humans seem unique is in the presence of a supralaryngeal vocal tract that is capable of distinct articulation, and in the evolution of neural mechanisms that make use of the pre-adapted properties of this vocal tract for rapidly induced speech (Gardner, 1983, p. 91).

Overlap

Evidence of linguistic overlap with spatial intelligence through the visual medium may offer some comparisons, but Gardner is careful not to dismiss his argument that favors the autonomy of linguistic intelligence, thus:

> My belief in the centrality of the auditory--and oral--elements in language has motivated my focus upon the poet as the user of language *par excellence* and my citation of the evidence from aphasia as a strong argument in favor of the autonomy of language. To the extent that language were to be considered a visual medium, it would flow much more directly into spatial forms of intelligence; that this is not the case is underscored by the fact that reading is invariably disturbed by injury to the language system, while, amazingly, this linguistic decoding capacity proves robust despite massive injury to the visual-spatial centers of the brain (Gardner, 1983, p. 98).

Gardner (1983, p.97) states that while language can be expressed through gesture and through the written word, it continues at its nucleus an output of the oral tract and human ear messages. "Understanding of the evolution of human language and its current representation in the human brain is likely to fall wide of the mark if it minimizes the integral tie between human language and the auditory-oral tract" (Ibid., p.97). Language may be used in a variety of ways to exploit our linguistic heritage for expression and communication purposes (Ibid., p.98). Even after the brain has suffered injury, the linguistic decoding proves to be resilient in its capacity to survive and serve as a medium for communication. The auditory-oral form of intelligence is translated into a symbol system for words and sounds, even for the deaf culture (Gaffney, 1995, p.3); and for this reason-- the language of gestural systems--Gardner does not term this linguistic capacity simply "as an auditory-oral form of intelligence" (Gardner, 1983, p.98). In 'The Miracle Worker', Anne Sullivan's work with Helen Keller bridges the communication gap for both the deaf-mute and blind in possibly the greatest challenge for linguistic intelligence. Nevertheless, Gardner is constant in maintaining "the centrality of the auditory--and oral--elements in language" (Ibid.). Gardner also notes cultural change and variety of linguistic practice, such as the ability to retain information in the form of lengthy oral lists (Gardner, 1983, p.92). This form of linguistic intelligence had value in the ancestral pre-literate populace; and while this skill may be valued in today's society, it is no longer a pre-requisite for being considered to have a high degree of linguistic intelligence, since printing has rendered this use of intelligence less valuable (Ibid). Therefore, in the today's world we may see the effect of cultural differences in what people term linguistic intelligence. "The abilities that allow a Westerner to solve a crossword puzzle or an acrostic puzzle may be akin to the abilities, in other cultures, to pun readily or to invent and master nonsensical or recondite languages" (Gardner, 1983, p.93). Thus, from a cultural predisposition, a person may be extremely strong in some areas of linguistic intelligence while seeming to be void of linguistic intelligence in other areas, and these differences may seem to affect autonomy claims for the linguistic intelligence.

Overlap has also been noted above (supra, p.5) in so far as certain linguistic processes, syntactic and phonological, lie close to the core of the linguistic intelligence. But other linguistic operations, such as the semantic, show close ties with the logical-mathematical intelligence in deductive and analytic powers. The pragmatic operations of language seem to be most closely tied to the needs of personal intelligence.

There are interactions with various other intelligences in respect to the auditory -oral tract. Linguistic intelligence overlaps with musical intelligence--that ability of people to ascertain meaning and importance in groups of pitches rhythmically aligned and also to compose metrically co-ordinated pitch sequences for the purpose of communicating (Gardner, 1983, p.98). But, " these musical abilities rely even less than the linguistic intelligence on visual translation and are presently negotiated by separate parts of the nervous system, despite a possible common medium in the evolutionary past" (Ibid, p.98).

> Buried far back in evolution, music and language may have arisen from a common expressive medium. But whether that speculation has any merit, it seems clear that they have taken separate courses over many thousands of years and are now harnessed to different purposes. What they share is an existence that is not closely tied to the world of physical objects (in contrast to spatial and logical-mathematical forms of intelligence), and an essence that is equally remote from the world of other persons (as manifest in various forms of personal intelligence) (Ibid, p.98).

Although linguistic intelligence has overlap with musical intelligence and others, it is clearly set apart from musical capacities because different parts of the nervous system are used to control both intelligences. Linguistic intelligence emerges as an autonomous intelligence.

Musical/Rhythmic intelligence

Definition

Musical-Rhythmic intelligence includes receptiveness to pitch, timbre, and rhythm and sensitivity to music (Nelson, 1995, p. 26). It also includes such abilities as the cognizance of tonal patterns and rhythm, awareness of sounds such as human, animal, environment sounds, and musical instruments (Lazear, 1991a, p.15) Armstrong also provides us with some of the capacities that a person with musical intelligence might exhibit:

> The capacity to perceive (e.g., as a music aficionado), discriminate (e.g., as a music critic), transform (e.g., as a composer), and express (e.g., as a performer) musical forms. This intelligence includes sensitivity to the rhythm, pitch or melody, and timbre or tone color of a musical piece. One can have a figural or "top-down" understanding of music (global, intuitive), a formal or "bottom-up" understanding (analytic, technical), or both (Armstrong, 1994a, p.3).

This intelligence involves the ability to understand the world and give information back to the world by using and understanding sound (Gaffney, 1995, p.6). Clearly, musically intelligent people are sensitive to rhythm, melody, and pitch as exemplified by singers, musicians, and composers (Armstrong, 1994a, p. 3).

Symbol Systems

The symbol systems for musical intelligence deal with musical notational systems and Morse Code (Armstrong, 1994a, p.6). Somewhere around the age of five to seven children develop the capability of notational symbolization, or the potential to create or use various notional systems (Gardner, 1983, p.309). Children attend to the symbolic channels that are favored by their individual cultures, whether it be in the form of a dance or the music that is listened to in the household (Gardner, 1983, p.310). Children are somewhat restricted by the society in which they live and rarely encouraged to notable high end-states of this intelligence:

> There is in most populations little interest in innovative uses of symbol systems, in departures from the *status quo*. It is given to only a few individuals in most cultures to reach the apogee of symbolic competence and then move off in unanticipated directions, experimenting with symbol systems, fashioning unusual and innovative symbolic products, perhaps even attempting to devise a new symbol system (Gardner, 1983, p.311).

Core Operations

Gardner's stated procedure is to examine the most accomplished array of skills among composers, whose competencies are end-states of the musical intelligence (Ibid., p. 100). Gardner's strategy here is consistent with his introduction to the linguistic operations through the profound abilities of poets (Ibid.). Having presented a profile of the end-states found among composers, Gardner will then show how the ideal mode of the musical intelligence reflects the core abilities that underlie the musical competence of ordinary individuals.

He begins with Roger Sessions who thinks of composing in terms of having "tones in his head" (Gardner, 1983, p.101). Composers always have these tones active in their consciousness, whether it be in the form of listening to tones and rhythms or envisaging larger musical systems (Ibid.).

> Working with tones, rhythms, and above all, an overall sense of form and movement, the composer must decide how much sheer repetition, and which harmonic, melodic, rhythmic, or contrapuntal variations, are necessary to realize his conception (Gardner, 1983, p.102).

Arnold Schoenberg believes that a composer cannot "compose if you give him numbers instead of tones--this from the individual who has been accused of expelling melody and converting all music to a numerical manipulation system" (Gardner, 1983, p.103). In the mind of the conductor we see the individual who has clearly the notational system of symbols fully developed as he controls the direction that the orchestra's musical patterns must follow.

Sessions also directs attention to the inherent logic in the musical process, a logic often mistaken for mystery:

> What I have called logical musical thinking is the consequential working out of a sustained musical impulse, pursuing a result constantly implicit in it..... The aural imagination is simply the working of the composer's ear, fully reliable and sure of its direction as it must be, in the service of a clearly envisaged conception (Gardner, 1983, p. 101).

Aaron Copland indicates that composing is as natural as eating or sleeping: "It is something that the composer happens to have been born to do; and because of that it loses the character of a special virtue in the composer's eyes (Copland, 1939 p.20) ." Two examples of this natural process are given: Wagner compared his skill to that of a cow giving milk and Saint-Saens said his efforts were like an apple tree yielding apples (Gardner, 1983, p. 102). Copland does identify "the sole element of the mystery" of this natural process as the birth of "an initial musical idea", seeming a gift from heaven (Ibid.). After the coming of the idea, its musical development follows almost automatically through conventional structural forms or schemes. (Ibid.). Schoenberg sees this process as the endless "reshaping of a basic shape"; in other words, everything in a piece of music comes from its theme, springs from it and returns to it (Ibid.). Shapero says that the musical mind must absorb a stock of different tonal experiences, which become submerged in the unconscious to arise as tonal memories in metamorphism with emotional experiences (Ibid.). These core operations have reflections in the ordinary experience with music.

It is impossible to leave composers without mentioning Igor Stravinsky, the Russian composer who can be given much of the credit for bringing music into the modern age and who has become Gardner's optimum model of a high end-state of musical intelligence. We perceive in his productions multiple links with the other intelligences.

> Not an inspired melodist, he relied as much on the scraps of the classical and folk musical cultures as on his own experience with the optimal instruments and ensembles in fulfilling his musical ideas and in determining how to juxtapose these various fragments and themes to achieve the musical and expressive effects that he sought.... Stravinsky had to balance literary themes, dramatic personalities, and dominant moods against the available instrumental and musical resources. While the primary symbol system in which he worked was tonal music, that music had to be reworked constantly in light of linguistic, personal, visual-scenic, bodily-kinesthetic, and metrical considerations (Gardner, 1993a, p. 214).

Turning to the core operations of the musical intelligence as they are found in the general populace, Armstrong provides a brief but comprehensive survey of these core operations: "the ability to produce and appreciate rhythm, pitch, and timbre; appreciation of the forms of musical expressiveness" (Armstrong, 1994a, p.6). Most central of the principal components of music "are *pitch* (or melody) and *rhythm*: sounds emitted at certain auditory frequencies and grouped according to a prescribed system" (Gardner, 1983, p.104):

> Pitch is more central in certain cultures--for example, those Oriental societies that make use of tiny quarter-tone intervals; while rhythm is correlatively emphasized in sub-Saharan Africa, where the rhythmic ratios can reach a dizzying metrical complexity. Part of the organization of music is horizontal--the relations among the pitches as they unfold over time; and part is vertical, the effects produced when two or more sounds are emitted at the same time, giving rise to a harmonic or dissonant sound. Next in importance only to pitch and rhythm is *timbre*--the characteristic qualities of a tone (Gardner, 1983, pp. 104-105).

It is clear in these cores of music that the auditory sense is crucial but that the rhythmic foundation can easily exist isolated from auditory awareness (Ibid.). Deaf individuals often use the rhythmic qualities of music as their entry point to musical experiences and composers such as Scriabin have translated "their works into rhythmic series of colored forms..." (Ibid.) This ability to see and feel music, as with a dance group, makes certain features of musical encounters attainable to those people who cannot enjoy the auditory aspects of music (Ibid.). In fact, some research proclaims that only the very naive are not capable of appreciating at least something in musical fabric (Ibid.,p.107). Research reveals that persons can make judgements about the appropriate ending if they have heard a certain key that begins a piece of music (Gardner, 1983, p.107). Schoenberg, in attempting to give a basic definition of tones, put it this way:

> Music is a succession of tones and tone combinations so organized as to have an agreeable impression on the ear and its impression on the intelligence is comprehensible.....These impressions have the power to influence occult parts of our soul and of our sentimental spheres and .....this influence makes us live in a dreamland of fulfilled desires or in a dreamed hell. (Gardner, 1983, p.105

Thus, music has an emotional impact on listeners; if music does not convey emotions, "it captures the forms of these feelings" (Ibid., p. 106). Patterns of sound, a key element in musical intelligence are perceived either by building up to music from component parts or by reacting to the global properties of music(Gardner, 1983, pp.106-107).

Musical intelligence is not limited to those who can play, but also serves the millions of music lovers, collectors and others who work in the industry. "Yet, there is also a core set of abilities crucial to all participation in the musical experience of a culture. These core abilities should be found in any normal individual brought into regular contact with any kind of music" (Gardner, 1983, p.104). Musical intelligence has considerable application in the world of science. Physicians (Gaffney, 1995, p.6) must listen carefully to a stethoscope to give a prognosis to the patient, thus conjoining an appreciation of sound and the patterns it creates. The comparison to language is not out of context here. Individuals are sensitive to musical contour and ultimately have schemes; or 'frames' for hearing music (Gardner, 1983, pp. 107- 108). Although the core abilities may be found in most people within the general population, the high-end states that Gardner provides us with separate the cream from the milk and leave the majority of the normal population in awe.

Autonomy

In part, attesting to the autonomy of the musical intelligence, music has great value in most if not all cultures worldwide. It is used in ceremonial events such as weddings and funerals along with being a major focal point in our entertainment world (Gardner, 1983, p.110 Gaffney, 1995, p.7). Put a guitar at a campfire and start singing a few melodies and see the crowd it gathers. It bridges the language barrier and makes acquaintances where other mediums may have failed. The Island of Cape Breton for its Scottish background and fiddle-playing presents evidence of the cultural significance of musical intelligence; music seems to emanate from the Island and the folklore that encompasses it. If one member of a family has a penchant for music, then all seem to have some degree of musical intelligence, as in the case of the Rankin Family and their neighboring cousins. To the outsider every man, woman, and child in the tiny village of Mabou must have music in their veins and that could possibly be a clue to the hereditary nature of this intelligence. Family acts seem to be abundant in Nashville as well. To this kind of data Gardner would respond: "If there is any area of human achievement in which it pays to have adequate or lavish genetic background, music would be a formidable contender". (Gardner, 1983, p.112) But he considers more persuasive evidence about the question as to a genetic origin of musical intelligence to come from child prodigies in the absence of positive stimuli in the home environment. (Ibid., p.113) For him, the young Arthur Rubinstein is an example of such genetic proclivity, coming from a family, none of whom had "the slightest musical gift", and at the age of three an accomplished singer, while still refusing to speak". (Ibid.) As another example, Igor Stravinsky at the age of two could sing the peasants' songs after hearing them for the first time, much to the astonishment of his family (Gardner, 1983, p.121).

Armstrong specifies the primary neurological area for music to be the right temporal lobe and singles out music to be the earliest intelligence to develop (Armstrong, 1994a, p. 7). As to the developmental trajectory for music, Gardner describes a life long process:

> One can posit a pattern of growth for the young musical performer. Up until the age of eight or nine, in a manner reminiscent of the young literary Sartre, the child proceeds on the basis of sheer talent and energy: He learns pieces readily because of his sensitive musical ear and memory, gains applause for his technical skill, but essentially does not expend undue effort. A period of more sustained skill building commences around the age of nine or so, when the child must begin to practice seriously, even to the extent that it may interfere with his school and his friendships. This may, in fact, occasion an initial "crisis" as the child starts to realize that other values may have to be suspended if his musical career is to be pursued. The second and more pivotal crisis occurs in early adolescence. In addition to confronting the clash between figural and formal ways of knowing, the youth must ask whether he actually wishes to devote his life to music (Gardner, 1983, pp. 111-112).

While supporting the autonomy of the musical intelligence, Gardner concedes that the evolutionary origins of music "are wrapped in mystery", despite much scholarly speculation that linguistic and musical expression split off from one another as early as a million years ago. (Gardner, 1983, p.115) Evidence for musical instruments may be dated back to the Stone Age. (Ibid.) A more promising line of investigation, for Gardner, is the parallel of human music to bird song which exhibits a wide range of developmental patterns and a mix of innate and environmental factors. (Ibid. 116) The development of bird song takes a "prescribed path" from beginning *subsong* like children's babble, through *plastic song* like children's experiments with fragments of songs, to final song or repertoire (Ibid.). Bird song representation in the nervous system is most pertinent to the concept of the autonomy of the human musical intelligence, since being located in the left part of the avian nervous system makes it one of the few instances of regular lateralization for a skill in animals. (Ibid.) The stock of bird songs varies within the species, and this information may be detected from clear indices in the avian brain, especially the alteration effected by the seasons. (Ibid.) Gardner is careful not to suggest any direct phylogenetic link between human and bird music; rather, he suggests, the value of this analogy lies in the possibility of avian mechanisms for the production of music proving to be analogous to those of humans. (Ibid. P. 117)

Gardner, in seeking to establish the autonomy of the musical intelligence turns to another parallel, that being between human music and language. In this endeavor, he stresses the need for experimental support:

> Investigators working with both normal and brain-damaged humans have demonstrated beyond a reasonable doubt that the processes and mechanisms subserving human music and language are distinctive from one another. (Ibid.)

Gardner cites the experiments of Diana Deutsch which show that the mechanisms for apprehending and storing pitch are different from those that process other sounds, especially language. (Ibid.) The autonomy of the musical perception is also confirmed by the deficits suffered by stroke victims; musical capacities are compromised by injury to right frontal and temporal lobes, whereas injury to the left hemisphere, causing major language difficulty, generally leaves "musical abilities relatively unimpaired" (Ibid. p.118). Gardner concludes that music is, indeed a separate intellectual competence, that like language, "can proceed without relation to physical objects, both rely on the oral-auditory system; though, as it turns out, they do so in neurologically distinct ways." (Ibid. p. 122)

Overlap

Gardner notes the close ties of the musical competence to other intelligences, in addition to the linguistic intelligence; most notably, the close tie to the bodily intelligence makes music "best thought of as an extended gesture". (Ibid. p. 123) Ties with spatial intelligence are less evident; yet the localization of music in the right hemisphere supports psychologists' claims that composers require spatial abilities to deal with "the complex architectonics of a composition". (Ibid.) Music is closely aligned to feelings and emotions in the power of its expressive qualities--hence , its connection to the personal intelligences (Ibid., p.106). The strongest connections are those with mathematics dating back to the Pythagoreans, especially in the areas of proportion, ratios, recurring patterns, and the Twentieth Century development of the twelve-tone scale and computer generated music. (Ibid. p. 125) Yet again, Gardner underscores the autonomy of this form of intelligence in that "the core operations of music do not bear intimate connection with the core operations of other areas". (Ibid. p. 126) A fitting conclusion for this intelligence is stated by David Lazear:

> Musical/Rhythmic Intelligence includes such capacities as the recognition and use of rhythmic and tonal patterns, and sensitivity to sounds from the environment, the human voice, and musical instruments. Many of us learned the alphabet through this intelligence and the "A-B-C song." Of all forms of intelligence, the "consciousness altering" effect of music and rhythm on the brain is the greatest (Lazear, 1991a, p. 15).

Just think of how music can calm you when you are stressed, stimulate you when you're bored, and help you attain a steady rhythm in such things as typing and exercising. It has been used to inspire our religious beliefs, intensify national loyalties, and to express great loss or intense joy.

Logical-Mathematical Intelligence

Definition

Mathematical intelligence emanates from the manipulating of objects, grows into the ability to think concretely about those objects, then develops into the ability to think formally of relations without objects (Grow, 1995, p.5) Gardner points out that the mathematicians must be capable of writing their proofs with meticulous accuracy, along with having the expertise to reason precisely (Ibid, p. 6). "The idea of logical-mathematical intelligence directs one's attention to the precision of language and precision of thought in a piece of writing--whether the sustained structure of a long work, the organization of paragraphs, sentences, or transitions" (Ibid.). Armstrong defines mathematical intelligence as:

> The capacity to use numbers effectively (e.g., as a mathematician, tax accountant, or statistician) and to reason well (e.g., as a scientist, computer programmer, or logician). This intelligence includes sensitivity to logical patterns and relationships, statements and propositions (if-then, cause-effect), functions, and other related abstractions. The kinds of processes used in the service of logical-mathematical intelligence include: categorization, classification, inference, generalization, calculation, and hypothesis testing (Armstrong, 1994, p.2).

Symbol Systems

The symbols system (Armstrong, 1994a, p.6, Gaffney, 1995, p.5) includes numbers, equations, geometric shapes, formulas, icons and languages, especially of the computer. Symbolization of mathematical intelligence begins around the age of four when, for the first time, a child can in fact count a small cluster of objects decisively (Gardner, 1991, p.75). "This ability of course builds upon the numerical sensitivity of infancy but goes well beyond it in terms of the size of quantities appreciated and the deliberateness of the quantification" (Ibid). Gardner refers to this stage of symbolization; around the age of four, as a wave of digital, or quantitative mapping (Gardner, 1983, p. 309).

Around the age of seven to ten, inferences, digressions, syllogisms, and others are factual, not just because they substantiate a state of affairs, but also because implicit laws of logic must pertain (Gardner, 1983, p. 132). During this time which Piaget refers to as "concrete operations", " these actions—whether physical or mental—remain restricted to physical objects, which have the potential to be manipulated" (Ibid).

Throughout the initial years of adolescence the average child becomes adept in "formal mental operations" and can now operate not only on objects, and on mental images or models of these objects, but also on "words, symbols, or strings of symbols like equations that stand for objects, and for actions upon objects" (Gardner, 1983, p.132). The move from operations on objects to analogous inferences on a purely representative or symbol level may take numerous years to mature--and these "higher-level" operations are plausible only during the teens (Ibid, p. 133).

> These symbol-manipulating capacities prove "of the essence" in higher branches of mathematics, with the symbols standing for objects, relations, functions, or other operations. The symbols to be manipulated may also be words, as in the case of syllogistic reasoning, scientific hypothesis formation, and other formal procedures" (Gardner, 1983, p. 132).

Developmental Trajectory

The logical-mathematical intelligence begins to surface in the nursery with the child's arrangement of objects; the logical-mathematical understanding "derives in the first instance from one's actions upon the world" (Ibid., p. 129). By the age of six or seven the child has reached the level of the young mathematician-to-be (Ibid., p. 131). This intelligence "peaks in adolescence an early childhood" it is not until after the age of forty that higher math insights begin to decline (Armstrong, 1994a, p. 7). "Alfred Adler says that the work of most mathematicians is over by the age of twenty-five or thirty. Productivity drops off with each decade"--a very different trajectory from other humanistic areas where major work appear during the fifth, sixth or seventh decade of life (Gardner, 1983, p. 154).

Core Operations in Mathematical and Scientific Thought

Just as the previous intelligences had their core operations introduced through the most gifted individuals, so too the work of the mathematician will be examined through leading figures in the field. Core operations inherent in the logical mathematical intelligence will apply to both mathematical skills and scientific thought. The core components of logical-mathematical intelligence are "sensitivity to, and capacity to discern, logical or numerical patterns; ability to handle long chains of reasoning"(Armstrong, 1994a, p. 6). Different mathematicians highlight particular qualities of the mathematical intelligence.

From the mathematician Adler comes the notion of the mathematician's "love of dealing with the abstraction", exploring difficult problems that in some way must be relevant to physical reality (Gardner, 1983, pp. 138-139). According to Poincaré the most important ability is "the appreciation of the nature of the links between the propositions" of a proof--where the conclusion of one syllogism serves as the premise of the next (Ibid., pp. 137-138). Another renowned mathematician, G. H. Hardy held that a mathematician is "a maker of patterns...that are more likely to be permanent because they are made with ideas" rather than words (Ibid., p. 139). The most central gift is "the ability to handle long chains of reasoning in which very simple theories are applied to very complicated contexts, and in all this mathematicians tend to sense a solution before they have worked it out in detail (Ibid., p. 139).

Gardner notes that "mathematics has become increasingly abstract with the years" (Ibid., p. 140). He enumerates the major steps in this advance of abstraction beginning with the idea of *number*; then the creation of *algebra*, where numbers form a system and allow the introduction of *variables*; the variables become "simply specialized cases of the more generalized dimensions of *mathematical functions*, where one variable has a systematic relation to another variable" and can confer meaning on other functions at even higher levels (Ibid.). This abstracting and generalizing of *number, variable* and *function* brings mathematics to an extremely abstract level of thought. While Gardner affirms this major direction in mathematics, he also detects a pull towards "finding simpler expressions and for returning to the fundamental notion of number" (Ibid.).

The life of mathematicians may be characterized as finding in their isolation from the world "a self-sufficiency in mathematics"; an exhilaration in solving a difficult and important problem, especially one that has been considered insoluble; delight in discovering an analogy between kinds of analogies; and gratification from dealing with elements that are counter-intuitive, such as imaginary numbers, irrational numbers, paradoxes, and properties of possible and impossible worlds (Ibid., p. 141). Gardner opinions that it is not by accident that an outstanding logician, Lewis Carroll, is the inventor of a famous contrary to fact world (Ibid., p. 141-142). Yet, paradoxically, there is no Nobel prize in mathematics (Ibid., p. 142). The great John von Neumann is often cited as the exemplar of mathematical power in his ability to instantly grasp the form of mathematics and translate insights into proper notation (Ibid., p. 143).

The field of mathematics is concerned also to offer heuristics to help and train others to solve problems. One technique is to generalize from a given set to a larger set that contains the given one (Ibid., p. 144); another is to propose a solution and work backward to the problem; and a popular method is 'indirect proof' in assuming the opposite of what one is trying to prove and ascertaining the consequences (Ibid.). The important feature of these heuristics is that they are useful in solving problems in other areas of life as well as mathematics (Ibid., p. 144).

We turn now to the great works of science which are so closely dependent upon mathematics; indeed, the progress of Western Science can be traced "to the invention of differential and integral calculus" (Ibid., p. 145). An orderly scheme of abstract relations is the mathematical tool needed to make order of physical reality of material things (physics and chemistry), of living things (biology), of human beings (social sciences), or of human thinking (cognitive science) (Ibid.). Modern Science traces its progress from Francis Bacon and Galileo who "championed the introduction of mathematics into scientific work" (Ibid., p. 146). But it was Isaac Newton who "postulated an absolute framework of time and space, within which physical events unfold according to a set of immutable laws" (Ibid., p. 146). It is this desire to explain nature that distinguishes the scientist from the mathematician whose efforts aim to create patterns for their own sake (Ibid., p.147).

Einstein offers himself as a paradigm of a high end-state for scientific intelligence. His "genius lay in his persistent questioning of the absoluteness of time and space", his use of personal analogies to approximate the speed of light, and his persistence and courage in executing this line of thinking on his own for many years despite the opposition of conventional wisdom (Ibid., pp.149-150 and Gardner, 1993a, p. 123).

> As the physicist Gerald Holton has persuasively argued, such a program requires more than just technical facility, mathematical acuity, and keen observational powers--though each of these is probably a prerequisite. Scientists are also guided by underlying themes of the themata--beliefs about how the universe must work, and basic convictions about how these principles are best revealed. In Einstein's case, the very belief that there will be a few simple laws, that they will unify diverse phenomena, and that there will no element of chance or indeterminacy in these laws, are part and parcel of his professional code: Einstein is said to have remarked, 'God wouldn't have passed up the opportunity to make Nature this simple' (Gardner, 1983, p. 150).

Einstein's beliefs or themata about how the universe works may be more central to the scientists' endeavors than objective facts; these themes at the core of the scientist's system are a puzzling feature of scientific practice, one that Gardner characterizes as "virtually a religion, a set of beliefs that scientists enhance with a zealot's conviction" (Ibid.) Even Newton devoted much of his life to his views on metaphysics, cosmology and mysticism (Ibid.). Such concerns for a unifying structure also indicate an important divergence from mathematics.

Gardner questions whether such desires to solve "philosophical puzzles of existence may be a special feature of the childhood of the young scientist (Ibid., p. 151). At the age of four or five, Einstein was in awe of a magnetic compass he had received, Stanislaw Ulam as a young child was fascinated by the patterns of an Oriental rug, Pascal marked the walls of his playroom with charcoal sketches of geometrical figures, and Bertrand Russell at the age of eleven found his greatest happiness in Euclid (Gardner, 1983, pp. 151-152). These childhood events confirm that the logical-mathematical tendency announces itself very early in life and suggest that early experiences of the child play a role in the development of this intelligence (Ibid., p. 153).

Autonomy

The autonomous nature of the mathematical intelligence may be directly correlated to deficiencies in the core mathematical skills. The ability to calculate quickly is at best an accidental advantage for mathematicians and certainly it is far from central to their talent, which must be of a more general and abstract variety (Gardner, 1983, p. 155). "*Idiots savants*, individuals who, with meager or even impaired abilities in most areas, display from their early childhood years an ability to calculate very rapidly and very accurately" (Ibid.). These calculating abilities set the child apart at an early age and rise from a sparing or proliferation of brain areas representing automatic processes (Ibid., p. 155). Other normal children may display certain numerical weaknesses, comparable to the handicaps demonstrated by some youngsters with written grammar (dyslexics) and with oral language (dysphasics) (Ibid., p. 156).

In contrast with language and music very little is known about the evolutionary predecessors of numerical competence and a relatively limited measure about its organization in the mind of the ordinary adult today (Ibid., p. 157). Evidence of notational systems does go back thirty thousand years (Ibid.). Other animals are a source of information:

> There are certainly, in other animals, precursors of numerical ability: these include the abilities of birds to recognize arrays of up to six or seven objects reliably; the instinctive ability of bees to calculate distances and directions by observing the dance of their conspecifics; the capacity of primates to master small numbers and also to make simple estimates of probability (Ibid.).

As to brain organization of numerical proficiencies, there are people who have lost the capacity to compute while staying linguistically sound, as well as a larger number of individuals who are aphasic but can still play games involving calculation and handle their financial concerns (Ibid.). "Language and calculation, at even the most elementary level, prove to be quite separate" (Ibid.).

The autonomous nature of mathematical intelligence has at times been the topic of debate; however, Gardner insists that because humans can experience breakdowns in the logical-mathematical area, it must exist as an autonomous system (Ibid., p. 159). There is some consensus that the area of the brain that deals with logical-mathematical intelligence is located in the left parietal lobes and in the right hemisphere (Armstrong, 1994a, p. 7 and Gardner, 1983, p. 157). Gardner specifies the mathematical competencies for each of these brain locations:

> The ability to read and produce the signs of mathematics is more often a left hemisphere function, while the understanding of numerical relations and concepts seems to entail right hemisphere involvement (Ibid).

Logical-mathematical intelligence may not be considered to be as autonomous as some of the other intelligences--and some argue it should count as general intelligence (Ibid., p. 159). Gardner, after expressing some sympathy for this view, argues that "the fact that one can encounter specific and particular breakdowns of logical-mathematical intelligence ability, as well as many kinds of extreme precocity, makes the elimination of logical-mathematical intellect far too extreme" a position; he affirms that "most of the signs of an 'autonomous intelligence' register positively in the case of logical-mathematical thought"; and he cautiously suggests that logical-mathematical competence may involve a number "of essential, but somewhat redundant systems" (Ibid., p. 159).

Overlap

Mathematical intelligence has considerable overlap with linguistic intelligence. "Elementary difficulties in language can impair the understanding of number terms, even as impairments in spatial orientation can render inoperative the ability to use paper and pencil to carry out sums or geometrical demonstration" (Ibid., p. 157). Willard Quine a famed logician in the last half century indicates that logic is involved in statements, and "at its 'higher reaches' linguistic logic leads by natural stages into mathematics" (Gardner, 1983, p. 135). Since mathematics deals with abstract, nonlinguistic entities, in order for it to be synthesized in applications, a medium is required and linguistic intelligence serves as a link between the concept and the learner. Philosophers such as Michael Novak (MacGregor, 1959, p. 95) test its use to the maximum in logically presenting arguments for the existence of God whether it be Ontological or Cosmological. However, linguistic logic is bound by the language which encompasses it.

There are various links between logical-mathematical intelligence and other forms of intelligence. The patterns found in music may be the attraction that causes so many mathematicians to love music; and this attraction may apply to art as well, as evidenced in Hofstader's *Gödel, Escher, Bach* (Gardner, 1983, p. 168). Interactions between the logical-mathematical and spatial intelligences are revealed in chess, engineering and architecture (Ibid.).

Perceiving patterns and trying to make something out of them is, indeed, the logical-mathematical intelligence at work (Gardner, 1983, p. 169). This activity is not a reflection of the other intelligences such as musical, linguistic, or bodily-kinesthetic, and it does not reflect the core operations of other forms of intelligence. "Each intelligence has its own ordering mechanisms, and the way that an intelligence performs its ordering reflects its own principles and its own preferred media" (Ibid.).

Visual/Spatial Intelligence

Definition

Spatial intelligence refers to the capacity to think visually, orient oneself spatially, see the visual-spatial world clearly, and to execute transformations on one's initial perceptions (Armstrong, 1994a, p.6). The spatial competence involves:

> The ability to perceive the visual-spatial world accurately (e.g., as a hunter, scout, or guide) and to perform transformations upon those perceptions (e.g., as an interior decorator, architect, artist, or inventor). The intelligence involves sensitivity to color, line, shape, form, space, and the relationships that exist between these elements. It includes the capacity to visualize, to graphically represent visual or spatial ideas, and to orient oneself appropriately in a spatial matrix (Armstrong, 1994a, p. 2).

"Often referred to as visual-spatial this intelligence involves the ability to understand, perceive, internalize and/or transform space ..... People who have this intelligence often enjoy chess, like many colors, do jigsaw puzzles and can imagine the world from a bird's eye view" (Gaffney, 1995, p.8).

Symbol Systems and their Development

The symbol systems for spatial intelligence include the ideographic languages like Chinese (Armstrong, 1994a, p. 6). The first signs of spatial intelligence on a symbol level may come between the age of one and two, intermingled with bodily activities, when the child begins to reach out in search of objects and to touch objects at a distance (Gardner, 1983, p. 304). Gardner refers to waves of symbolization in their developmental process:

> A second wave, which we call *analogical* or *topological mapping*, comes to the fore about a year later, at approximately the age of three. In analogical mapping, the child's use of the symbol captures, within the actual symbolic vehicle itself, some relations originally observed in the field of reference that he is symbolizing. And so, for the first time, in drawing, the child becomes able to extend two appendages from the base of a circular form and dub the resulting form 'person'. Or the child is able to place several blocks atop one another and declare the resulting form 'snowman' (Gardner, 1983, p. 307).

These creations of the child are considered symbols which "bear an analogic resemblance to their referents" (Ibid). "The young child engages as well in symbolization in the realms of drawing, modeling with clay, building with blocks, gesturing, dancing, singing, pretending to fly or drive, trafficking with number, and a host of other symbol-studded domains" (Gardner, 1991, p. 72). Later on in life a person with strong logical-mathematical and spatial abilities may have the tools necessary to become a physical scientist; spatial abilities are of particular importance for the experimental scientist (Gardner, 1983, p.319).

In this second wave of symbolization, the "topological mapping" at age two or three, may be noted two-and three-dimensional drawing or illustrations by the child (Gardner, 1991, p. 75). As an example, a two year old child may have the ability to draw two adjoining circles on top of each other and specify the top one as the head and the bottom one as the body, or he may build a house from blocks and place a covering block that is stipulated as a roof (Gardner, 1991,

p. 75).

Gardner detects stream like qualities in symbolic development, where *stream* is defined as "an aspect that seems inherently tied to a specific symbol system and that exhibits no apparent link to any other symbol system" (Gardner, 1991, p. 73). "In three-dimensional constructions, the capacity to master and vary spatial layout turns out to have stream like properties.....Even in the neighboring domain of two-dimensional depiction, learning the properties of line, contour, and color arrangement has no evident relationships to milestones in other domains" (Gardner, 1991. p. 74). The aptitude to cherish spatial or topological affiliations appears to be echoed in other applications of symbol use (Ibid.). Other waves of symbolization, in addition to "topological mapping", include "event-structuring", "digital mapping" and "notational symbolization" (Ibid., pp. 74-78). Teachers, administrators, and curriculum developers should make themselves aware of these waves of symbolization so they can make the best curriculum decisions for the overall development of the child (Gardner, 1991, p. 78). These waves of symbolization are crucial because they form the foundation to all conceptual content introduced in schooling. They also arouse a renewed awe of the young child, the genotype who has acquired these forms of symbolization by the age of five or six, "with relatively little formal tutelage' (Ibid., p.77).

Core Operations in Ordinary Life

Gardner introduces spatial intelligence with three tests (Gardner, 1983, pp. 170-172) to challenge the reader's spatial capability: the first test is the easiest in that you only have to match a form the same as the target object, illustrating the ability to perceive a form or object (Ibid., p. 174), the second test requires you to pick a form that is a rotation of the of the target object, and the third test challenges you to identify rotations of target objects in three-dimensional diagrams (Gardner, 1983, pp. 170-174). Roger Shepard "has shown the amount of time that it takes to judge whether two forms are in fact identical (as in figure 3) is tied directly to the number of degrees through which one form must be displaced in order to coincide with the other" (Gardner, 1983, p. 174). Such tests of basic understanding of spatial intelligence are followed by a linguistic description that requires you to create mental images, "the preferred mode of solution" (Ibid., p. 175), to reach an explanation of Einstein's theory of relativity:

> Imagine a large mass, A, traveling in a straight line through space. The direction of travel is North from South. The mass is surrounded by a huge glass sphere etched with circles parallel to each other and perpendicular to the line of travel, like a giant Christmas tree ornament. There exists a second mass, B, in contact with the glass sphere at one of the etched circles. B's contact with the sphere is at some point below the largest circle which is the middle circle. Both Mass A and B are traveling in the same direction. As A and B continue their motion, B will be continually displaced along the etched circle which is the point of contact with the sphere. Since B is continually displaced, it is actually tracing a spiral path through space-time, time being the North-bound movement. Yet this path when viewed from someone on Mass A from inside the glass sphere, appears to be a circle, not a spiral (Gardner, 1983, pp.172-173).

Difficult problems, especially in the mathematical branch of topology, require the ability to manipulate complex forms in several dimensions (Ibid., p. 175). In a summary of the core operations of spatial intelligence experienced in these test illustrations, Gardner notes that the most fundamental operation is to perceive a shape or object, and that transformation tasks requiring "mental rotation" are more difficult, while transformation of complex forms in a number of dimensions is exceedingly difficult (Ibid., pp. 174-175).

Certain problems, like the final one above, allow a person to solve the problem by creating internal mental images or by manipulating propositions. Experimental evidence indicates that the preferred way of problem-solving is "through the positing of an internal mental image which can be manipulated in ways that parallel operations in the workaday world" (Ibid., p. 175)

"That the ability to solve these problems efficiently is special, apart from straight logical or linguistic ability, has been an article of faith for many years among students of intelligence" (Ibid.):

> The pioneering psychometrician L. L. Thurstone, who saw spatial intelligence as one of his seven primary factors of intellect....(others have) reinforced his conclusion that there is something special about spatial ability , though the precise way in which the domain has been carved out has differed across authorities (Ibid.).

Further to this position, Thurstone argued for the existence and independence of spatial ability and specified the distinctive nature of spatial intelligence in terms of three components:

> Thurstone himself divided spatial ability into three components: the ability to recognize the identity of an object when it is seen from different angles; the ability to imagine movement or internal displacement among the parts of a configuration; and the ability to think about those spatial relations in which the body orientation of the observer is an essential part of the problem (Gardner, 1983, p. 175).

Another early researcher, Truman Keeley, distinguished between the ability to make and retain mental images and the capacity to mentally manipulate spatial relationships (Ibid.). And A. A. H. El-Koussy, "yet another authority, distinguished between two-and three-dimensional spatial aptitude, with each having both static and dynamic aspects" (Ibid).

Gardner defines the core capacities of visual/spatial intelligence in this manner:

> Central to spatial intelligence are the capacities to perceive the visual world accurately, to perform transformations and modifications upon one's initial perceptions, and to be able to re-create aspects of one's visual experience, even in the absence of relevant physical stimuli. One can be asked to produce forms or simply to manipulate those that have been provided. These abilities are clearly not identical: an individual may be acute, say, in visual perception, while having little ability to draw, imagine, or transform an absent world (Gardner, 1983, p. 173).

Thus, "spatial intelligence emerges as an amalgam of abilities", which may be dissociated from one another, as was also true of the linguistic and musical capacities (Ibid.). The fact that practice in anyone of these abilities "stimulates development of skills in related ones" provides a reason for considering spatial skills all "of a piece", a separate intelligence (Ibid., p. 174). The descriptor 'visual' is often used to name this intelligence, but just as the linguistic intelligence is not wholly dependent on the auditory channel for the deaf, the spatial intelligence can develop for the blind and is not wholly dependent on the visual realm (Ibid.).

Gardner states that spatial intelligence involves an array of loosely related skills: "The ability to recognize instances of the same element; the ability to transform or to recognize a transformation of one element into another; the capacity to conjure up mental imagery and then to transform that imagery; the capacity to produce a graphic likeness of spatial information; and the like" (Ibid., p. 176).

These spatial abilities are vitally important in many arenas of life over the world; in orienting oneself on land and ocean; in recognizing objects and scenes when some aspect of their original surroundings has been altered or changed; and in working with two and three dimensional depictions of real-life scenes, maps, and diagrams (Ibid.). Gardner goes on to explain two other uses of spatial capacities, the first one being in the area of the arts:

> Two other uses of spatial capacities prove more abstract and elusive. One involves sensitivity to the various lines of force that enter into a visual or spatial display. I refer here to the feelings of tension, balance, and composition that characterize a painting, a work of sculpture, and many natural elements (like a fire or waterfall) as well. These facets, which contribute to the power of a display, occupy the attention of artists and viewers of the arts. (Ibid., p. 176).

Gardner's second use of spatial intelligence concerns resemblances that exist between apparently different forms--for example, the metaphorical ability to draw analogies that see the sky as a membrane or mankind as a heap of earth; these kinds of resemblances may well have occurred to one initially in spatial form (Ibid.). Even science employs spatial metaphors:

> Darwin's tree of life, Freud's unconscious submerged like an iceberg, Dalton's tiny solar system....This ability to use mental models and images may then likely play a role in everyday problem-solving (Ibid., p. 176-177).

In respect to this final use of the spatial intelligence in thinking, a stronger thesis than the typical view, that images are seen as aids to thinking, is supported by Rudolf Arnheim in *Visual Thinking*: "the most important operation of thinking comes directly from our perception of the world" (Ibid., p. 177). Arnheim minimizes the role of language in thinking and holds that "truly productive thinking...takes place in the realm of imagery" (Ibid.). Gardner's alternative view is that visual or spatial intelligence contributes to scientific and artistic thought (Ibid.).

This study of core operation points directly to the autonomy of the spatial intelligence. Gardner affirms that is reasonable, on the basis of theory and testing, to consider "spatial intelligence as a discrete form of intellect, a collection of related skills" (Ibid.). He also notes that, in the view of many, spatial intelligence is equal in importance to linguistic intelligence, there being two systems of representation--'a verbal code and an imagistic code' where localizers place the linguistic code in the left hemisphere and the spatial code in the right. Gardner refuses to support such total dichotomization but affirms both linguistic and spatial intelligences as the source of ideas and solutions to problems (Ibid.).

Core Operations of High End-States in the Visual Arts

No reader could miss the structural variation in the treatment of the spatial intelligence in contrast to the linguistic, musical, and logical-mathematical intelligences. The latter three were informed by an analysis of the operations of experts, the high end-states in their fields, and the characteristics described were then related to the ordinary life core operations. The fact that spatial intelligence remains so fundamentally in the concrete world and the long staying power of that intelligence, proving robust into old age, must have influenced Gardner's prioritizing the ordinary experiences as the major source for realizing the core activities of the spatial intelligence.

Gardner acknowledges that "the centrality of spatial thinking in the visual arts is self-evident" (Ibid., p. 195). Then he reviews some of the "shop talk" of artists themselves. Vincent Van Gogh's letters to his brother Theo reveal his intense consideration of "how to get the depth of color, the enormous force and solidness of that ground....how much light there was in the darkness" and later his puzzlement about "laws of proportion, of light and shadow, of perspective which one must know in order to draw well" (Ibid., p. 196). Le Corbusier talks of the need to have total knowledge to capture objects (Ibid.). Other artists astound us with new solutions--Dürer to master perspective by geometrical grids and Leonardo in his concern for his students to discover pregnant forms had them contemplate the cracks on an old wall (Ibid., p. 197). John Constable declared, "Painting is a science, and should be pursued as an inquiry into the laws of nature" (Ibid., p. 198). Gardner concludes, "In the last analysis, there is a definite logic in the pursuit of the arts, one that sets it apart from the imitation of nature and places it close to other areas of vigorous investigation" (Ibid.).

Developmental Trajectory

Jean Piaget, almost single-handedly, has studied the development of spatial understanding in children (Ibid., p. 178). Piaget spoke of the sensori-motor understanding of space, emerging during infancy through two abilities: the appreciation of "trajectories observed in objects and the eventual capacity to find one's way between various locales" (Ibid., pp. 178-179). Then, in early childhood, "youngsters become capable of mental imagery"; but "such imagery remains static during early childhood, however, and children cannot perform mental operations upon it" (Ibid., p. 179).

Though both logical-mathematical and spatial intelligence arise from the child's action upon the world, Piaget has introduced a distinction between "figurative" knowledge as in mental image and "operative" knowledge "where the emphasis falls upon transforming the configuration (as in the manipulating of such an image)" (Ibid.). As "Piaget saw it, this split in knowledge marked a line between the static configuration and the active operation", and Gardner considers that this distinction could fit "under the rubric of spatial intelligence" (Ibid.).

'Concrete Operations', for Piaget, at the beginning of school mark the point of "active manipulation of images and objects in the spatial realm" (Ibid.). Now, realizing the phenomenon of *decentration,* the child can indicate what a scene would look like to a person seated in another part of the room; that is, from a different perspective while still being restricted to the concrete situation (Ibid.). "Only during the formal operation era, at the time of adolescence, can the youth deal with the idea of abstract spaces or with formal rules governing space" (Ibid.). Then, geometry can be appreciated by the adolescent by relating figural images to propositional statements.

> We thus see a regular progression in the spatial realm, from the infant's ability to move around in space, to the toddler's ability to form static mental images, to the school child's capacity to manipulate such static images, and finally, to the adolescent's capacity to relate spatial relations to propositional accounts. The adolescent, being able to appreciate all possible spatial arrangements, is in a favorable position to join together logical-mathematical and spatial forms of intelligence into a single geometric or scientific system (Ibid., pp. 179-180).

Spatial intelligence has great longevity, as suggested by the developmental stages and the general human capacity for these core operations (supra, p.39). Gardner concludes:

> My own view is that each form of intelligence has a natural life course: while logical-mathematical thought proves fragile later in life, across all individuals, and bodily-kinesthetic intelligence is also "at risk," at least certain aspects of visual and spatial knowledge prove robust, especially in individuals who have practiced them regularly throughout their lives. There is a sense of the whole, "gestalt" sensitivity, which is central in spatial intelligence, and which seems to be a reward for aging--a continuing or perhaps even an enhanced capacity to appreciate the whole, to discern patterns even when certain details or fine points may be lost. Perhaps wisdom draws on this sensitivity to patterns, forms, and the whole (Ibid., p. 204).

Autonomy

Strong evidence from research in neuropsychology supports the autonomous nature of spatial intelligence. The right hemisphere of the brain (Gardner, 1983, p. 181), notably the posterior rear sections of the right hemisphere, proves to be the area most critical for spatial processing. Injury to the right posterior regions is more likely to impair spatial processing than injury to an other comparable regions (Ibid.). But injury to the left posterior regions can also cause deficits in spatial processing (Ibid.).

> It has been amply documented that lesions to the right parietal regions cause difficulties in visual attention, spatial representation and orientation, imagery production, and memory. The bigger the lesion, the more pronounced the difficulty. Presence of even a small lesion in the left hemisphere, in addition to right hemisphere damage, suffices to devastate and individual's spatial functioning (Ibid.).

But, even massive right hemisphere damage rarely impairs linguistic capabilities to a consequential degree because the left hemisphere dominance for language is sufficiently pronounced (Gardner, 1983, p. 182).

Bisiach has documented claims that: "It turns out that individuals who exhibit a neglect of the left half of visual space in ordinary life display much the same symptoms in dealing with mental imagery. Evidence shows that these patients prove able to image the right half of objects or scenes, but not the left" (Ibid.). In a dramatic instance, such brain-injured persons could image only the right half of Duomo square, Milan, from one vantage point; they had to move to the opposite side of the square to name objects now on their right side, but which were unseen from their former vantage point. Gardner cites this experiment as a "compelling case for the 'psychological reality' of visual imagery" (Ibid., p. 183).

Another source of information about the right hemisphere involves the processing of spatial information in the studies of normal adults (Ibid., p. 183). Subjects, exposed to visual stimuli in the right visual field with connections to the left hemisphere of the brain or in the left visual field with connections to the right hemisphere of the brain, were asked to perform various tasks and their findings provided confirmation that in each of these realms, "the right hemisphere proves more important for the solution of problems than does the left, though it should be pointed out that the results are not as dramatic in normal individuals as in those who sustained injury to the brain" (Ibid.). Gardner concludes that "this picture of right hemisphere involvement in spatial tasks, and particularly the involvement of the parietal lobe seems solidly established" (Ibid.).

Other regions of the brain, the temporal and frontal lobes, are involved in spatial processing. From studies by Gross, Mishkin and others we have learned a considerable amount about the perception and recognition of whole objects (Ibid., p. 183):

> It appears that inferior temporal neurons participate in coding of the physical attributes of visual stimuli, perhaps by serving as integrators of that information about depth, color, size, and shape which is recorded in the pre-striate cortexes (Ibid.).

As well, the frontal lobes seem crucial "for remembering a spatial location" (Ibid.).

Gardner finds that the evolution of spatial intelligence holds more in common with primates and cross-cultural indices than would seem the case in the other intelligences (Ibid., p. 184). Spatial intelligence would have been of critical importance to early roving bands of peoples;

the extraordinary ability of Eskimos to find their way through "featureless terrain" suggests the strength of their visual configurations (Ibid.). Sex differences in spatial skills relate also to the early hunting mode of life, where males developed the selective advantage of highly developed visual-spatial skills. Spatial abilities for solving problems have been noted by Wolfgang Köhler in the great apes of Tenerife during the first World War; "some great apes, in particular the fabled sultan, could make tools by combining two or more objects, whose visual- spatial integration they were able to anticipate" (Ibid.).

In cases of blind children, the spatial dimension is able to persevere and to "canalize", finding different ways to communicate when normal routes are blocked, as was noted in linguistic development (supra, p. 10). Gardner cites John Kennedy's view that there is a "perceptual system common to both the tactile and the visual modalities" (Ibid., p. 185). Kennedy furthers his thesis:

> The blind individual tends to convert spatial experiences into the number of steps (or finger movements) taken in a certain direction and into the kind of motion needed. Size must be discovered through indirect methods, such as running one's hand along an object: The more movement in time, the larger the object appears to be. The blind individual can exploit cues like straightness, curvature, and prominence of features, to recognize more complex figures (shades of visual imagery measures). In Kennedy's view, there is a perceptual system common to both the tactile and the visual modalities: insights gleaned by normal individuals from a combination of these modalities prove accessible to the blind from the tactile realms alone (Gardner, 1983, p. 185).

When blind children draw they often expose in their sketches many of the same peculiarities and difficulties that normal children reveal (Ibid.). For example blind children are initially uncertain about how to place objects in a two-dimensional drawing or on a canvass (Ibid., p. 185-186). Gloria Marmor states that the blind are capable of admiring reflected pictures and rotating shapes (Ibid., p.185-186). She concludes:

> Without using mental imagery, the early blind appear to organize the attributes of tactile forms into spatial representations that, like visual images, allow all attributes to be entertained simultaneously and are specific enough to make possible mirror image discrimination (Gardner, 1983, p. 186).

One of the most amazing accounts of a blind person with great spatial abilities comes from Barbara Landau's study with a congenitally blind two-and one-half-year-old child who could figure out the path between two objects after traveling to each only from a new third location (Ibid.). The child was clearly able to detect the distances and angular relationship of the familiar path and then derive the angle of the new path from this information (Ibid.). Though never exposed to a map, "she was able immediately to grasp the concept of one" and use it in this task (Ibid.).

In respect to other unusual forms of spatial ability, there are *idiots savants* such as the "Japanese Yamashita and Yamamura", with exceptionally high degrees of artistic talent that illustrate "the flowering of a single intelligence", but the most compelling case is that of Nadia, an English teenager suffering from severe autism, who is capable of "drawings of the most remarkable finesse and representational accuracy" which in this case could not be explained by family teaching (Gardner, 1983, p. 188):

> In the most extreme cases, such as the young Nadia, however, no such explanation suffices. Nadia was drawing like a skilled adolescent by the time she was four or five, and her parents seem not even to have been aware of her talent (which was first noted by her therapist). Nadia had an ability to look at objects, to remember their size, shape, and contour, and to translate these into the appropriate motor pattern, which was quite apart from that found in even the most gifted normal child. Probably one component was eidetic imagery--that photographic ability to retain in one's mind's eye the appearance of objects once seen directly (Gardner, 1983, p. 188-189).

Nadia's gift did not come without a cost as she lacked conceptual knowledge, could not carry out sorting functions, and lacked little or no concern for the specific things being drawn, although her sketches do endorse the autonomy of spatial intelligence from other forms of intellect (Gardner, 1983, p.190). Gardner concludes: "her drawings stand as an eloquent demonstration of the dissociability of spatial intelligence from other intellectual strengths and of its potential for a singularly high degree of development" (Gardner, 1983, p. 190).

Overlap

The intricate use of spatial intelligence in chess reflects overlaps with other intelligences. Chess masters such as Bobby Fischer (Gardner, 1993, p. 138) have generally outstanding visual memory or visual imagination. Binet shows successful blindfold chess that depends upon great powers of concentration, memory and imagination (Gardner, 1983, p. 193). The blindfolded player must remember primarily lines of reasoning and strategies(Fancher, 1987, p.63). Chess players have fantastic memories, most notably of significant games in their past (Gardner, 1983, p.193). "Binet contrasts this memory with that of an *idiot savant*. The *idiot savant* can remember something slavishly; but once it has played out, the memory as a whole vanishes because it harbors no intrinsic significance"(Gardner, 1983, p.193). This spatial memory used in chess is closely tied to the logical-mathematical intelligence that requires spatial reasoning.

"Clearly spatial intelligence can also serve a variety of scientific ends, as a useful tool, an aid to thinking, a way of capturing information, a way of formulating problems, or the very means of solving the problem"(Gardner, 1983 p. 192). We have already noted above the use of spatial imagery by the scientific luminaries: Dalton, Darwin and Freud (Gardner, 1983, pp. 176-177). Einstein's intuitions were deeply rooted in the spatial dimensions of geometry; "he had a very spatial mind. He thought in terms of images--gedanken experiments, or experiments carried out in the mind" (Ibid., p. 190). Kekule's imagery in the fire flames played a large part in his discovery of the structure of the benzene ring (Ibid., p. 191). DNA models serve as another example of the part played by spatial intelligence (Ibid.). In fact, Gardner says:

> "Perhaps McFarland Smith is right when he suggests that, after individuals have attained a certain minimal verbal facility, it is skill in spatial ability which determines how far one will progress in the sciences" (Ibid., p. 192).

There is also evidence of substantial overlap of the mathematical intelligence with spatial intelligence. Clark compares the euphoria surrounding the sight of ravishing beauty in a painted flower to that of a young mathematician's joy at encountering the infinity of prime numbers or the young musician's understanding of a fugue (Gardner, 1983, p. 199). Also, as in mathematical intelligence, with "spatial intelligence, we have encountered a second form of intelligence involved with objects. In contradistinction to logical-mathematical knowledge, which concludes its developmental trajectory with increasing abstraction, spatial intelligence remains tied fundamentally to the concrete world, to the world of objects and their location in a world" (Gardner, 1983, p. 204). "We can here see in nonhuman primates an initial manifestation of the kind of spatial intelligence which many humans have brought to an extemely high level of accomplishment. How spatial abilities unite with the bodily skill and kinesthetic intelligence in the area of tool use..." (Gardner, 1983, pp. 184-185) will have further consideration in our chapter on the kinesthetic intelligence. Similarly, painting and sculpture involve sensitivity to the visual and spatial world as well as fine motor movement, but the essence of "graphic artistry inheres in the spatial realm" (Ibid., p. 196).

Bodily-Kinesthetic Intelligence

Definition

Bodily-kinesthetic intelligence requires the adeptness to comprehend the world through body experiences, to express ideas and emotions, and communicate with others physically (Gaffney, 1995, p.7). This intelligence is strongly evidenced in ballet dancers, entertainers, sportsmen, sculptors, doctors, tradesmen, and craftspeople (Ibid.). Armstrong describes bodily-kinesthetic intelligence as having:

> Expertise in using one's whole body to express ideas and feelings (e.g., as an actor, a mime, an athlete, or a dancer) and facility in using one's hands to produce or transform things (e.g., as a craftsperson, sculptor, mechanic, or surgeon). This intelligence includes specific physical skills as coordination, balance, dexterity, strength, flexibility, and speed, as well as proprioceptive, tactile, and haptic capacities. (Armstrong, 1994a, p.3)

This intelligence often comes to our attention with "children who cannot sit still for long, those who are well coordinated, or those who need to touch things in order to learn" (Gaffney, 1995, p.7).

Symbol Systems

The kinesthetic symbol systems are embedded among the other symbol systems of childhood. "The young child engages in symbolization in the realms of drawing, modeling with clay, building with blocks, gesturing, dancing, singing, pretending to fly or drive, trafficking with number, and a host of other symbol-studded domains (Gardner, 1991, p.72). "According to John Martin, a student of performance, we are all equipped with a sixth sense of *kinesthesis*--the capacity to act gracefully and to apprehend directly the actions or the dynamic abilities of other people or objects" (Gardner, 1983, p. 228). For example, if we pick up an object that we haven't lifted before, we anticipate what our body will have to perform from drawing on our muscle memories of lifting similar objects of the same bulk or density (Ibid.). This example illustrates the fact of kinesthetic symbolization: "Past experiences of lifting are symbolized in a kinesthetic language, which is drawn on directly by the body, without the need for any other symbolic intervention" (Ibid.). The bodily-kinesthetic intelligence symbol systems include sign languages and braille (Armstrong, 1994a, p. 6).

Core Operations

The mime performances of Marcel Marceau are used to describe the characteristics of kinesthetic abilities in a high end-state:

> An especially talented mime like Marceau is able to create not only personalities (like a bully) and actions (like climbing) but also animals (butterflies), natural phenomena (waves cresting), and even abstract concepts such as freedom or bondage, good or evil, ugliness or beauty. More amazingly, still, he often creates a number of these illusions simultaneously (Gardner, 1983, p. 206).

A mime example comically illustrated the basic core operations of using one's body in different ways and carrying out fine motor movements:

> Characteristic of such an intelligence is the ability to use one's body in highly differentiated and skilled ways, for the expressive as well as goal-directed purposes: These we see as Marceau pretends to run, climb, or prop up a heavy suitcase. Characteristic as well is the capacity to work skillfully with objects, both those that involve the fine motor movements of one's fingers and hands and those that exploit gross motor movements of the body. Again, these can be observed in a Marceau performance, as he delicately unscrews the cap of the thermos or lurches from side to side in the hurtling train. (Gardner, 1983, p. 206).

The core operations of bodily-kinesthetic intelligence center around a person's "ability to control one's body movements and to handle objects skillfully (Armstrong, 1994a, p. 6). Gardner looks at two capacities when he speaks of the cores of bodily-kinesthetic intelligence. They deal with "exploiting gross motor movements" and the ability to carry out tasks involving "fine motor movements" (Gardner, 1983, p. 206). And while these two operations may be carried out separately, "skill in the use of the body for functional or expressive purposes tends to go hand in hand with skill in the manipulation of objects" (Ibid., p. 207).

A study of these core components will involve two categories of individuals: first, swimmers and dancers, exhibiting a mastery over the motions of their bodies, as well as basketball players and musicians who demonstrate the ability to handle objects expertly and, in a second group, inventors and actors, where the body is central but other intelligences, linguistic, personal or musical, for example, play a role (Ibid.). In fact, Gardner adds, "Nearly all cultural roles exploit more than one intelligence" (Ibid.). The overlap of various intelligence with the kinesthetic will be very evident in the profiles that Gardner generates The use of one's body skill has been a critically important aspect with our species, for may years, if not millions of years (Gardner, 1983, p.207).

Gardner notes the Greeks' reverence for their bodies:

> In speaking of masterful use of the body, it is natural to think of the Greeks, and there is a sense in which this form of intelligence reached its apogee in the West during the Classical Era. The Greeks revered the beauty of the human form and, by means of their artistic and athletic activities, sought to develop a body that was perfectly proportioned and graceful in movement, balance, and tone. More generally, they sought a harmony between mind and body, with the mind trained to use the body properly, and the body trained to respond to the expressive powers of the mind (Gardner, 1983, p. 207) .

The body expressing intelligence in language is discerned clearly by Norman Mailer in his description of prize-fighting:

> There are languages other than words, language of symbol and languages of nature. There are languages of the body. And prize-fighting is one of them. A prizefighter...speaks with a command of the body which is as detached, subtle, and comprehensive in its intelligence as any exercise of the mind. [He expresses] himself with wit, style, and an aesthetic flair for surprise when he boxes with his body. Boxing is a dialogue between bodies, [it] is a rapid debate between two sets of intelligences (Gardner, 1983, p. 207).

Recent culture has developed a separation between reasoning and physical activity. This divorce between the mind and the body has managed to suggest that body activity "is somehow less privileged, less special, than those problem-solving routines carried out chiefly through the use of language, logic, or some other relatively abstract symbolic system" (Gardner, 1983, p. 208). Many cultures do not draw a sharp distinction between the use of the body and other cognitive intellectual powers (Ibid.). Sir Frederic Bartlett, the renowned British psychologist draws the analogy between different types of skills where the physical and the rational are linked (Gardner, 1983, p.208).

> According to Bartlett's analysis, all skilled performances include a well-honed sense of timing, where each bit of a sequence fits into the stream in an exquisitely placed and elegant way; points of repose or shift, where one phase of the behavior is at an end, and some calibration is necessary before the second one comes into play; a sense of direction, a clear goal to which the sequence has been heading, and a point of no return, where further input of signals no longer produces a result because the final phase of the sequence has already been activated. Bartlett goes beyond the sheer analysis of bodily skill in his intriguing claim that much of what we ordinarily call thinking--routine as well as innovative--partakes of the same principles that have been uncovered in overtly physical manifestations of skill. (Gardner, 1983, pp. 208-209).

Thus, just as Gardner has offered an analysis of differentiations of forms in whole body movement like those of the mime and the boxer, he will now turn to an elaboration of fine motor movements. He notes that it takes great dexterity to control the use of one's hands when dealing with relatively small objects and to use one's hands and fingers to carry out delicate movement involving precise control (Gardner, 1983, p.209). A skilled pianist not only produces different patterns of movement in each hand, but also maintains different rhythms in both hands; "while using the two hands together to speak to one another" (Ibid.). In typing or firing a rifle, in contrast, tiny finger movements or slight eye adjustments allow meticulous adjustments (Ibid.). Even these most subtle movements can show the intelligent characteristics of the core components of bodily-kinesthetic intelligence.

Finally, Gardner will develop profiles of mature forms of bodily expression through high end-states of both categories of individuals mentioned above. These high end-states will be examined through *the dancer, the actor, the athlete, and the inventor.*

Dancing may be defined as "culturally patterned sequences of nonverbal body movements that are purposeful, intentionally rhythmic, and have aesthetic value in the eyes of those for whom the dancer is performing", and is considered the second most prominent human activity, after hunting, dating back to Paleolithic times (Gardner, 1983, p. 222). Dancing had, according to anthropological evidence, a wide array of social uses: a vehicle of religious expression, recreation, aesthetic value, a reflection of economic patterns, an educational initiation rite, an embodiment of the supra natural, and a stimulus for sexual procreation (Ibid., p. 223). Especially important for this thesis is Gardner's analysis of the intelligent variables of the dance illustrated by American dancer and choreographer Paul Taylor:

> The dancer is concerned with placement, stage spacing, the quality of a leap, the softness of a foot--whether a movement goes out to an audience or spirals into itself. Many movements are possible, ranging from swaying ones to those that are like a piston, from percussive ones to those that are sustained. It is from the combination of these qualities--varied in speed, direction, distance, intensity, spatial relations, and force--that one can discover or constitute a dance vocabulary (Ibid., p. 224).

A further reflection on the dance comes from Martha Graham's emphasis on logic--that it "occurs on the level of motor activity" (Ibid.). Martha Graham's essential contribution to dance involved her reaction to the major strands of dance. On the one hand, classical ballet was a form that dated back several hundred years while the other major strand consisted of dances associated with non-European peoples, particularly the folk dances of Asia, Africa, and native American populations. Isadora Duncan is generally recognized as having first led dance into the modern era and, as Agnes de Mille expressed it, she cleared away the rubbish, 'a kind of theater cleaning' (Gardner, 1993a, p. 267). "Martha Graham and her associates were laying out the domain of modern dance. Its scope was to be quintessentially American and indubitably modern; its aim was to capture the energy, the dynamics, and the social spirit of the country and, especially the cities" (Ibid., p. 274). Graham and her bodily movements empowered by emotion would bring dance into the 20th century (Ibid., p. 307).

Dancers and choreographers, Alwin Nikolai and Donald McKayle, describe the process by which an idea becomes dance. (Ibid., p. 225) In some cases the close tie with narrative is cut, as in Balanchine's ballets or the tie with music in Cunninghams's formalistic rendering of the dance (Ibid.). Gardner concludes his profile of dance as a *bodily intelligence* with Baryshnikov's comment that "Dancing is like many new languages, all of which expand one's flexibility and range" (Ibid., p. 226).

Acting, as well as dancing exploits knowledge of the body. This skill is illustrated by Ron Jenkin's education in becoming a Balinese clown: first, comes the proficiency in dance, the canonical stances, and the wearing of masks; then, the knowledge of texts, current affairs, drama, and the making of masks; and beyond the performance prerequisites, the interpersonal relationships in the troupe; only after he is given a role of an old man in which to develop his knowledge of comedy and timing and movement is he finally allowed a dramatization of his own stories (Ibid., p. 226). Essential to this task is the ability to imitate, to concentrate observation and to re-create feelings (Ibid.). The great acting teacher, Stanislavski, underscores the attainment of the creative state of feeling the emotion in every performance; this emotion centered technique "highlights the *intra*personal intelligence", while the surface form, stressing attention to outer detail "mobilizes *inter*personal intelligence (Ibid., p. 227). Martin expands the need for *inner mimicry* to even the simple act of appreciating architecture in which we feel in our bodies the mass and proportion of buildings; this mimetic skill is found in even very young children and in the embodiment of "proclivities, abilities and deficits" of particular persona by "the great silent clowns of the past--Chaplin, Lloyd, and Keaton" (Ibid., p. 229). Gardner notes that humor is the exclusive property of human beings and that it is perhaps the perception of mimetic sequences that is the key component of humor (Ibid.).

Athletic activity also highlights the intelligence of the body. Observations in the support of talent in baseball come from B. Lowe who analysis the physical intelligence illustrated by the baseball pitcher:

> There is control--the ability to throw the ball just where one wants it. There is craft--the knowledge that comes with experience, analytic power, skillful observation, and resourcefulness. There is poise--the ability to apply craft under great pressure and to produce when the need is most pronounced. An there is "stuff"--
>
> Stuff is the physical element: How hard can he throw, how big is the break on his curve? Stuff is the product of strength and exceptional hair-trigger coordination and seems to be an innate quality, perhaps improvable by practice and technique but not acquirable (Ibid., p. 230).

And Gardner admits that inherited personal qualities are essential: the need for height, weight about 240 pounds, speed of a sprinter and the hitter needs to be cross-dominant, having a dominant eye on the opposite side of the body from the dominant hand to obtain a view of the pitch; but a sense of timing, coordination, and rhythm are developed (Ibid., p. 230). Jack Nicklaus describes the kinesthetic sense:

> Feeling the weight of the clubhead against the tension of the shaft helps me to swing rhythmically. As the backswing progresses I like to feel that clubhead's weight pulling my hands and arms back and up. Starting down I like to feel the weight of the clubhead lagging back--resisting, as my thrusting legs and hips pull my arms and hands down. When I can "wait" for these feelings, I am almost certainly swinging in proper tempo. I am giving myself enough elapsed time to make all the various moves in rhythmical sequence (Ibid.).

And further, while sense of timing time may be a consequence of bodily intelligence, the craft may draw on logical ability to plot a strategy, the ability to recognize spatial patterns and exploit them, and the interpersonal sense of the strengths and weaknesses of the other players (Ibid., p. 231). Gretzky 's description of a play illustrates how the kinesthetic works with and capitalizes on these other intelligences:

> In front of the net, eyeball to eyeball with the goalie, he will...hold the puck one ...extra instant, upsetting the rhythm of the game and of the goalie's anticipation....Or, in the heat of play, he will release a pass before he appears ready to do so, threading it through a maze of players who are a beat behind him....If there is such a thing as sleight of body he performed it....He sends a pass into a spot behind Goring. Nobody is there yet to receive the puck--but suddenly a teammate arrives to accept it. What seems like either luck or magic is neither. Given the probable movements of the other players, Gretzky knows exactly where his teammate is supposed to be (Ibid., p. 231).

As what some take to be the mystery and instinct in the case of the musical intelligence, others see here with Gretzky an *instinct* in the kinesthetic intelligence; Gretzky sets the record straight:

> Nine out of ten people think what I do is instinct....It isn't. Nobody would ever say a doctor had learned his profession by instinct: yet in my own way I've spent almost as much time studying hockey as a med student puts in studying medicine (Ibid.).

One should try to reflect oneself out of Western biases about intelligent behavior by a consideration of life in Bali; "The Balinese learn virtually nothing from verbal instruction" (Gardner, 1983, p. 234).

In conclusion, the present writer considers that Olga Korbut's perfect 10 score in Gymnastics at the 1976 Olympics in Montreal may have tuned the TV audience into the nearly perfect art and mind that encompasses the body hurtling itself through space with apparent reckless abandon only to land in a perfect pike position on the athlete's two feet. Such art and its appreciation shows the immense degree of bodily-kinesthetic intelligence that the human body is capable of.

Invention completes Gardner's tetrad of kinesthetic profiles and concerns "the capacity to manufacture and transform objects, both directly with one's body and through the use of tools" (Ibid., p. 231). Conceptualizing has an extra bonus with the feeling for each individual part of a mechanism, so that a fusion of bodily and spatial intelligences is a beginning that often must be augmented by logical-mathematical skills to meet the precise demands of the task (Ibid., p. 232). Early developmental links of this nature can be seen in children's inventions; Gardner mentions Tracy Kidder's account of "whiz-kids' who build new computer hardware; a manipulation of objects, literally taking them apart and putting them together and later acquaintance with theory seemed the formative components of invention in these cases.

Developmental Trajectory

Piagets' description of the unfolding of sensori-motor intelligence in the young child would apply here, recognizing, of course, that Piaget was not considering bodily intelligence as such (Ibid., p. 220). When the child begins to operate on mental representations, tool use becomes a possibility (Ibid.). Jerome Bruner saw the development of skills, not simply in reference to bodily activities, but in respect to all manner of cognitive operations of which completed acts or skills become subcomponents of higher and more complex skills:

> Thus , for example, the child first combines reaching and looking into grasping; the grasping of single objects evolves into the passing of objects from one hand to the other; the use of sets of objects for daily tasks is transformed into the building of simple structures; such simple structures become combined into more elaborated displays; and so on. Scholars who pursue the idea of knowledge-as-skill recognize the increasing internalization of public action into private thought but insist that every new skill sequence must nonetheless pass through a parallel developmental sequence. In this way, they recall the approach of Frederic Bartlett, who brooked no sharp distinction between physical actions and thinking skills; and they align themselves with contemporary students of human performance, who focus on the development of skills like typing, chess playing, or computer programming, and see each as manifesting increasing mastery of, and smoother coordination among, various types and levels of skill (Ibid., p. 221).

In this view knowledge is viewed as the building of skill structures. The development of symbolic functions such as representation and expression provides individuals with the capacity to use the body for communication; "the flowering of symbolization forges a major chasm between bodily intelligence as it is practiced in humans and bodily intelligence as deployed by other animals" (Ibid., p. 222).

Autonomy

Gardner locates the primary areas or neurological systems of bodily-kinesthetic intelligence in the cerebellum, basil ganglia, and motor cortex (Armstrong 1994a, p. 7) . "Within the nervous system, large portions of the cerebral cortex, as well as the thalamus, the basal ganglia, and the cerebellum, all feed information to the spinal cord, the way station *en route* to the execution of action" (Gardner, 1983 p.210). In the instance of throwing or catching an object there is a highly specialized hand-eye interaction (Ibid., pp. 210-211). These movements are exposed to constant improvements and adjustments depending on their correlation with established aims until they are improved (Gardner, 1983, p. 211). Seamless voluntary motor activity features the interaction between perceptual and motor systems which allows the pianist, the typist, and the athlete to perform *perfect* maneuvers that happen at great speeds as a consequence of overlearning and highly programmed sequences. (Ibid.).

Gardner states that in humans, unlike primates, there is the capacity for lateral dominance (Ibid., p. 212). Most normal individuals will have their language capabilities located in the left hemisphere; motor activities are also located in the left hemisphere.

Supporting Gardner's claim "for a separate bodily intelligence, it turns out that injuries to those zones of the left hemisphere that are dominant for motor activity can produce selective impairment" (Gardner, 1983, p. 212). Gardner describes specific apraxias that hamper the ability to perform tasks:

> Neurologists speak of the *apraxias*, a set of related disorders, in which an individual who is physically capable of carrying out a set of motor sequences, and cognitively capable of understanding a request to do so, is nonetheless unable to carry them out....More commonly, individuals exhibit *limb-kinetic* apraxia, where they cannot carry out a command with either hand; *ideomotor* apraxia, where they clumsily execute actions and the body part itself as an object.....or *ideational apraxia*, where individuals exhibit a special difficulty in running through a sequence of actions smoothly and the correct order. It is of some interest that these various lapses....are also found in normal individuals, particularly when they are operating under pressure (Gardner, 1983, p. 212-213).

Even though frequently these apraxias occur simultaneously with aphasia, substantial evidence exists that apraxia is not merely a linguistic or symbolic disease (Gardner, 1983, p. 213). "Moreover, a number of studies have confirmed that the degree of impairment in understanding various symbols does not correlate highly with the ability to carry out voluntary motor actions (Ibid.). Numerous researchers say that people having totally lost their linguistic recall apparently remain capable of absorbing and committing to memory elaborate motor arrangements and patterns of deportment (Gardner, 1983, p. 213). "All of which adds up to a picture of bodily intelligence as a realm discrete from linguistic, logical, and other so-called higher forms of intellect" (Ibid.) and supports the claim of an autonomous competence for the kinesthetic intelligence. In summary,

> Bodily intelligence completes a trio of object-related intelligences: logical-mathematical intelligence, which grows out of the patterning of objects into numerical arrays; spatial intelligence, which focuses on the individual's ability to transform objects within his environment and to make his way amidst a world of objects in space; and, bodily intelligence, which, focussing inward, is limited to the exercise of one's own body and, facing outward, entails physical actions on the objects in the world (Ibid., p. 235).

The Personal Intelligences:

Interpersonal and Intrapersonal

Introduction

Although the next two intelligences (interpersonal and intrapersonal) will be discussed separately, neither intelligence can develop totally without the other (Gardner, 1983, p. 241). They are born of each other and their developmental trajectories follow patterns in sync with one another. Through the discussion of high end-states in each intelligence, core operations, symbol systems, autonomy and overlap with each other, there are times when the simultaneous developmental of the personal intelligences may not be able to be discriminated, but different outcomes distinguishing both forms become abundantly clear. The roles that different cultures play in stressing the values of the two intelligences may also lend support in respect to their relative autonomy. Gardner's summary for his rationale for supporting the two personal intelligences follows:

> There is an identifiable core to each, a characteristic pattern of development, a number of specifiable end-states, as well as impressive evidence for neurological representation and for discernible patterns of breakdown (Ibid., p. 242).

Definitions of these two competencies should initiate the distinction between these two forms of intelligence.

Definition

Interpersonal Intelligence

Interpersonal intelligence includes the individual's capacity "to understand, perceive and discriminate between peoples moods, feelings, motives, and intentions" (Gaffney, 1995, p. 8). Particularly the artists, being the experts in the human terrain, know their audiences, how to make them laugh or cry, while providing insight into their lives (Gaffney, 1995, p. 7). Armstrong provides further marshaling of this concept by his definition:

> The ability to perceive and make distinctions in the moods, intentions, motivations, and feelings of other people. This can include sensitivity to facial expressions, voice, and gestures; the capacity for discriminating among many different kinds of interpersonal cues; and the ability to respond effectively to those cues in some pragmatic way (e.g., to influence a group of people to follow a certain line of action) (Armstrong, 1994a, p. 3).

Paragons of this intelligence are often talk show hosts, teachers, sales people, politicians and preachers. Some people who may be examples of high end states are Carl Rodgers and Nelson Mandela (Armstrong, 1994a, p. 6).

Intrapersonal Intelligence

Intrapersonal intelligence refers to the capacity to accurately know one's self, have the ability to understand one's internal makeup; and some words that reflect levels of the intrapersonal intelligence are: originality, discipline, imagination, self-respect, temperament, inspiration and motivation (Gaffney, 1995, p. 8). Armstrong complements this definition:

> Self-knowledge and the ability to act adaptively on the basis of that knowledge. This intelligence includes having an accurate picture of oneself (one's strengths and limitations); awareness of inner moods, intentions, motivations, temperaments, and desires; and the capacity for self-discipline, self-understanding, and self-esteem (Armstrong, 1994a, p. 3).

This intelligence is valued in our society as reflected in "religious systems, psychological theories, rites of passage..." (Ibid., p. 7). The origins of intrapersonal intelligence may be found in people who make lists; not lists of things to do or buy, but lists that are made to motivate themselves or take the initial step in solving a problem (Gaffney, 1995, p. 8). Gaffney mentions some other ways of advancing this intelligence may be through personal reflection, meditation or spending time enjoying nature (Ibid., p. 10). As a footnote to intrapersonal intelligence some sources are proposing that another intelligence be added to Gardner's list. Emotional intelligence may someday have that distinction, but for now it remains a vital component of the personal intelligences (Gretchen, 1997, p. 1).

Core Operations

The sense of self and the development of personhood is equally developed through both of the personal intelligences (interpersonal and intrapersonal) and these qualities may be seen to flower in the high end-states in each intelligence. Around the turn of the century Sigmund Freud of Austria was giving lectures in America on his new theory of psychoanalysis and an aging William James, the guru of American psychologists, gave his stamp of approval to Freud telling him that, "The future of psychology belongs to your work" (Gardner, 1983, p. 237). The historian, H. Stuart Hughes, commented that, "There is no more dramatic moment in the intellectual history of our time" (Ibid.). Freud did much of background work necessary to enable people to fully understand the meaning of their inner selves, while James would give significant contributions to the field of the social sciences. James "stressed the importance of relationships with other individuals, as a means of gaining ends, effecting progress, and of knowing one self" (Ibid., p. 238).

James had a great influence on future social scientists, especially on James Mark Baldwin and George Herbert Mead, "Who came to focus on the social origins of knowledge and on the interpersonal nature of an individual's sense of self" (Ibid.). James and Freud's work in the field of the social sciences gives clear distinction between the two personal intelligences (Ibid.). The division between their interests in the two intelligences can be seen this way:

> Freud was interested in the self as located in the individual and, as a clinician, was preoccupied with an individual's own knowledge of himself; given this bias, a person's interest in other individuals was justified chiefly as a better means of gaining further understanding of one's own problems, wishes, and anxieties and, ultimately, of achieving one's goals. In contrast, James's interest, and, even more so, the interests of the American social psychologists who succeeded him, fell much more on the individual's relationship to the outside community. Not only did one's knowledge of self come largely from an ever-increasing appreciation of how others thought about the individual; but the purpose of self-knowledge was less to promote one's personal agenda, more to ensure the smooth functioning of the wider community (Ibid., pp. 238-239).

James and Freud have laid the groundwork for the modern age to take an introspective look into how we view ourselves and how we deal with others.

Gardner further defines the core capacity of the personal intelligences as "an emerging sense of self" (Ibid., p. 242).. "The wide variety of 'selves' encountered throughout the world suggests that this 'sense' is better thought of as an amalgam, one that emerges from a combination or fusion of one's intrapersonal and one's interpersonal knowledge....I shall use the term *sense of self* to refer to the balance struck by every individual--and every culture--between the promptings of "inner feelings" and the pressures of "other persons" (Gardner, 1983, p. 242). Thus, the sense of self can be traced in every person to two separate forms of personal intelligence--one directed inward and the other outward, and they can develop individually and merge with each other (Ibid., 243).

Gardner states that these two intelligences have much in common in their capacity to know self and others; yet they also reveal clear distinctions in respect to each other and to other forms of intelligence:

> The personal intelligences amount to information-processing capabilities---one directed inward, the other outward....The capacity to know oneself and to know others is as inalienable a part of the human condition as is the capacity to know objects or sounds, and it deserves to be investigated no less than these other "less charged" forms. Personal intelligences may not prove completely cognate with the forms of intelligence we have already encountered--but as I pointed out at the start of this inquiry, there is no reason to expect that any pair of intelligences will be completely comparable. What is important is that they should be part of the human intellectual repertoire, and that their origins should take roughly comparable form the world over (Gardner, 1983, p. 243).

Although these intelligences develop with each other, their core components have a distinct realm and deserve separate treatment.

Interpersonal Intelligence

The core components of interpersonal intelligence deal with a person's "capacity to discern and respond appropriately to the moods, temperaments, motivations, and desires of other people" (Armstrong, 1994a, p. 3). Gardner describes the core capacity of interpersonal intelligence to involve all the modalities of mood, temperament, motivation and intentionality:

> The core capacity here is *the ability to notice and make distinctions among other individuals* and, in particular, among their moods, temperaments, motivations, and intentions. Examined in its most elementary form, the interpersonal intelligence entails the capacity of the young child to discriminate among the individuals around him and to detect their various moods. In an advanced form, interpersonal knowledge permits a skilled adult to read the intentions and desires--even when these have been hidden--of many other individuals and, potentially, to act upon this knowledge--for example, by influencing a group of disparate individuals to behave along desired lines (Gardner, 1983, p. 239).

An example of a high end-state for interpersonal intelligence would come in religious or political leaders such as Lyndon Johnson or Mahatma Gandhi, exceptional parents or teachers, and in people involved in what is termed the "helping professionals", such as counselors, therapists, or an Indian medicine man (Ibid.). Although these skills may be weaker in some individuals, we all demonstrate some form of interpersonal intelligence or else we would not have any way of communicating with other people.

Certainly reflecting a high end-state of the interpersonal intelligence, Mahatma Gandhi is given credit for inventing the arbitration process, when he intervened and settled a labor dispute between Mill workers and management in 1918 (Gardner, 1993a, p. 325) . This gift of finding common ground between two groups when they seemed to be at an impossible impasse would prove invaluable to Gandhi when he led his people to political independence. This also led to the practice that would come to be known as Satyagraha, a problem-solving technique used to guide one's life (Ibid., p. 333). "Gandhi's understanding of the personal realm-- that of one's self and the others around one-- was crucial to this process, as were his abilities to reason logically about options, to put ideas into words, and to alter course when indicated" (Gardner, 1993. Pg 336). His work in Satyagraha displayed the use of these intellectual competencies in humans (Ibid.).

Intrapersonal Intelligence

The core capacities of intrapersonal intelligences include the ability to gain entrance to one's own feeling life and the capability to differentiate among one's own emotions; knowledge of one's own strengths and weaknesses (Armstrong, 1994a, p. 6). Gardner summarizes the core components of the intrapersonal in this manner:

> The core capacity at work here is *access to one's own feeling life*--one's range of affects or emotions: the capacity instantly to effect discriminations among these feelings and, eventually, to label them, to enmesh them in symbolic codes, to draw upon them as a means of understanding and guiding one's behavior. In its most primitive form, the intrapersonal intelligence amounts to little more than the capacity to distinguish a feeling of pleasure from one of pain and, on the basis of such discrimination, to become more involved in or to withdraw from a situation. At its most advanced level, intrapersonal knowledge allows one to detect and to symbolize complex and highly differentiated sets of feelings (Gardner, 1983, p. 239).

One can find an example of the high end-state for this intelligence in the novelist Proust, who can easily communicate introspectively about feelings; as well, we have the therapist who gains deep knowledge of his personal feeling life, or we have our elders who draw from previous experiences to give advice to others (Ibid.).

As a high end-state of the intrapersonal intelligence, the father of psychoanalysis, Sigmund Freud, may be acknowledged as providing the first scientific exploration of a person looking within to more fully understand life (Gardner, 1983 pg.238). Gardner further states that Freud was superbly endowed in the linguistic and the personal intelligences--comfortable and competent in dealing in the realm of words and the realm of human beings (Gardner, 1993a, pp 52-52). Freud obviously loved to arrive at a paradox of some sort and then to ponder thereupon until a solution emerged (Ibid, p.54). Through these solutions and Freud's growing interest in Neurology; the Psychiatric movement was born.

Symbol Systems

The personal intelligences express themselves through the symbol systems of each particular culture; therefore, the personal intelligences prove less comparable to other intelligences and "perhaps even unknowable to someone from an alien culture" (Gardner, 1983, p. 240). Similarly, the forms of breakdowns and pathologies of the personal intelligences prove numerous as well, and there is "an especially wide range of end-states" (Ibid.). But Gardner is most emphatic that the personal intelligences would be very rudimentary were it not for symbol systems provided by cultures:

> Last, while one does not ordinarily think of forms of personal knowledge as being encoded in public symbol systems, I deem symbolization to be of the essence in the personal intelligences. Without a symbolic code supplied by the culture, the individual is confronted with only his most elementary and unorganized discrimination of feelings: but armed with such a scheme of interpretation, he has the potential to make sense of the full range of experiences which he and others in his community can undergo. In addition, it seems legitimate to construe rituals, religious codes, mythic and totemic systems as symbolic codes that capture and convey crucial aspects of personal intelligence (Ibid., p. 242).

In addition to this general principle about cultural effects, symbol systems adhering to each developmental stage of the personal intelligences will be highlighted in the following section on the "Developmental Trajectory".

Developmental Trajectory and its Symbol Systems

Both personal intelligences arrive early in life, for the most part due to the bond created between the mother and the child (Gardner, 1983, p. 243). This tie between the mother and infant is at its maximum strength for the first year and can be noticed when the child becomes disturbed when separated from its mother, and after the first year this link becomes more flexible (Ibid., p. 243-244). John Bowlby's work with institutionalized infants and Harry Harlow's studies of motherless monkeys both show that the lack of a mother-infant bond can have a harmful effect on an individual's normal development; as a symbol, that bond is all important for the child for establishing contacts in the future (Ibid., p. 244). Similar to that of the other intelligences the personal intelligences have a number of stages: the infant, age two to five, the school-age child, middle childhood, adolescence, and maturity.

It seems likely that *the infant* experiences feelings and these may be displayed through facial expressions, whether they relate to pain or pleasure (Ibid.). Facial expressions play a large symbolic role in every culture. There is no set age as to when the child is able to distinguish between his own bodily reactions (Ibid.).

> By two months of age, and perhaps even at birth, the child is already able to discriminate among, and imitate the facial expressions of, other individuals. This capacity suggests a degree of "pre-tunedness" to the feelings and behavior of other individuals....by the age of ten months, the infant's ability to discriminate among different affective expressions already yields distinctive patterns of brain waves...There are already the first signs of empathy. The young child will respond sympathetically when he hears the cry of another infant or sees someone in pain: even though the child may not yet appreciate just *how* the other is feeling, he seems to have a sense that something is not right in the world of the other person. A link amongst familiarity, caring, and altruism has already begun to form" (Gardner, 1983, p. 245).

The personal intelligence development in symbol systems is well entrenched by the end of the infant's first year of life. It is during the first two years of life that the infant becomes aware of his* physical and personal identity , and to refer to himself* by name (Ibid., p. 245-246).

*In the interest of gender dimensions of language, we are adopting Gardner's own stated strategy in his various publications, that of alternating the feminine and masculine forms of the pronoun.

The child aged two to five experiences an intellectual revolution, as her* use of symbols increase in names referring to herself: "me", "my", "you", "her", "Mum", "my idea" and "you sad" (Ibid., p.246). This kind of meaning is also expressed in cultures where there are no personal pronouns (Ibid.). This period of personal ownership of objects including toys is especially important as the child decides what she wishes to own and what she wishes to share. The child's use of symbols is not limited to objects, she can also deal with her experiences interacting with others and must discriminate the moods of herself and others (Ibid.). The child's symbolic development is now moving and quite active in the personal realm; her symbolizing will explore community roles:

> One way in which this emerging symbolizing ability is turned toward personal development is through the exploration of different roles visible (and viable) in the community. Through talk, pretend play, gestures, drawing, and the like, the young child tries out facets of the roles of mother and child, doctor and patient, policeman and robber, teacher and pupil, astronaut and Martian. In experimenting with these role fragments, the child comes to know not only which behavior is associated with these individuals but also something about how it feels to occupy their characteristic niches....One's sexual identity is an especially important form of self-discrimination which becomes confirmed during this time (Ibid., pp. 246-247).

The child at this age must be looked upon as an individual and her autonomy and also her empathy for others is beginning to emerge (Ibid., p. 247). Her world is now more complex as she must sometimes think first before carrying out an activity which may hurt the feelings of others. "Stated most strongly, without a community to provide the relevant categories, individuals (like feral children) would never discover that they are 'persons'" (Ibid., p. 248).

The school-age child's world displays differentiation between himself and others and some sense of reciprocity by the time he begins his first year of schooling; we can now see the beginning of 'concrete mental operations' (Ibid.). This is also the age where the child experiences first hand knowledge of what other people know and can do and also their intentions, and the child may exhibit feelings of inadequacy and fear of appearing unskilled in the view of others (Gardner, 1983, p. 247).

It is during the *middle childhood* from approximately six to eleven years of age that the child develops friendships and will do almost anything to maintain them (Ibid., p. 249). The middle school child spends much time trying to secure his standing within a group or clique, and "Life is 'heady' for those fortunate enough to be included and correspondingly bleak for those who have lowly places in the group or are excluded altogether" (Ibid., p.250). This hierarchy within groups is comparable to that of primates, such as the wolf society or other animal groups that exhibit social rank. Second order symbolizing begins in respect to personal interactions in such forms as "He thinks that I think that he thinks...." (Ibid.).

As the middle-school child moves closer to *adolescence*, she becomes much more psychologically attuned to the hidden motives, desires and fears of others; and her relationships with others include more psychological support as opposed to physical rewards (Ibid.). There is considerable maturation during this period of time. Adolescence is the time in life when the two forms of personal intelligence work together in a larger more organized sense to help people form a deeper sense of identity and a sense of self (Ibid., p. 251). Erik Erikson a psychoanalyst formulated this view:

> An emerging identity entails a complex definition of self, of the sort that might have pleased both Freud and James: the individual arrives at a delineation of roles with which he himself is comfortable in terms of his own feelings and aspirations, and a formulation that makes sense in terms of the community's overall needs and its specific expectations regarding the individual in question (Ibid., p. 251).

This sense of belonging to groups in the community at large is a necessary ingredient in the overall maturation of the two personal intelligences.

Researchers have made strides in trying to describe the phases involved in the *maturing self* and base their decisions on tension points that occur in every life (Gardner, 1983, p. 252). Erikson addresses some of these crisis points accordingly:

> Erikson, for example, speaks of a crisis of intimacy which follows the crisis of identity, as well as of subsequent struggles involved in the issue of generativity in middle age (transmitting values, knowledge, and the possibility of life to the following generation) and in the issue of integrity in old age (Does one's life make sense and cohere? Is one prepared to face death?) (Ibid.).

The end goal of this process is a highly developed individual; some desirable role models may include Jesus Christ, Socrates, Eleanor Rossevelt, and Mahatma Gandhi--as individuals who appear to understand their inner selves, the societies in which they lived, and the frailties of the human condition, while inspiring us to live a more productive life (Ibid.). Through the actions of such individuals, people find a guiding set of principles to lead their lives by. Such a view of maturity centers on an autonomous self with emphasis on the intrapersonal dimension (Ibid.). Another view sees the individual as a set of selves, rather than a central 'core self'; this second view, seeing the individual as a collection of different potential roles, masks, or selves which emerge as needed, places emphasis on the *interpersonal intelligence (Ibid., pp.252-253):*

> According to this point of view, an individual is always and necessarily a set of selves, a group of persons, who perennially reflect the context they happen to inhabit at any particular moment. Rather than a central "core self" which organizes one's thought, behavior, and goals, the person is better thought of as a collection of relatively diverse masks, none of which takes precedence over the others, and each of which is simply called into service as needed and retired (Gardner, 1983, p. 252).

Interpersonal Intelligence

The symbol systems of interpersonal intelligence include social cues such as facial expressions and gestures (Armstrong, 1994a, p. 6). As previously mentioned the bond between the infant and mother aids the development of these expressions and gestures through interaction (Gardner, 1983, pp. 243-244). As an infant the child may "associate various feelings with the particular individuals, experiences, and circumstances" (Ibid., p. 245). This perspective is developed further when the child leaves the infancy stage.

It is between the ages of two and five that the child starts to interact with his peers and Gardner relates his behavior accordingly: "At the same time, children come to correlate the behavior and the states of other persons with their own personal experiences: by identifying what is positive or negative, anxiety provoking or relaxing, powerful or impotent, youngsters effect an important step in defining what they are and what they are not, what they wish to be and what they'd rather avoid" (Ibid., p. 247). These children are displaying some of the characteristics that will increase their sense of identity. George Herbert Mead, Charles Cooley along with Lev Vygotsky and Alexander Luria share this perspective:

> Thus, according to this account, the young child is an inherently social creature: as such, he looks to others for their interpretive schemes and draws upon these schemes as the preferred--indeed, the sole--means of discovering and gaining initial understanding of that person within his own skin....the interpersonal view assumes an orientation toward, and a gradual knowledge of, other individuals as the only available means for eventually discovering the nature of one's own person (Gardner, 1983, pp. 247-248).

This social development of the child is developing quickly and the individual is capable of absorbing and remembering large amounts of knowledge. Consequently, knowledge of the child's place among others can only be sought through interaction with the community at large: the individual is forced to focus on the behavior of others and use them as clues as to how to behave within the community (Ibid., p. 248). These social developments help prepare the child for the next phase in his life, the beginning of school.

As school begins the child is given the opportunity to step outside the family realm and start relationships with his peers and most notably aspire to be a member of the group, rather than being singled out for positive or negative behaviors which may push him to the outside (Ibid., p. 249). Most people even into their adult years cherish the thought of being accepted by their peers. This is especially important to keep in mind as we move to middle childhood which spans a five year period culminating with the advent of adolescence.

During middle childhood, interest in friendships become high priority for the child and "The child can carry on a set of mental manipulations about possible interactions with other individuals" (Ibid., pp. 249-250). Some of these forged relationships will blossom into life-long friendships that the child will respect, cherish and covet. As the children move toward the teen years they will face a difficult time in examining and valuing their personal relationships.

As previously mentioned the beginning of adolescence marks a stage where individuals become far more 'psychologically attuned' and consider other peoples's motivations, although young school age children are aware of others' intentions subsequently, during this stage their social worlds become, to a large extent, differentiated; now individuals recognize that sharing everything is not plausible and some things are best be kept to themselves (Ibid., p. 251). As individuals approach a mature sense of self the emphasis for developing personal relationships is based on their interpersonal skills and previous experiences (Ibid., p. 253). Thus, the interpersonal development was initiated in infancy and progressed to maturity and old age, and it will also be seen to merge with the intrapersonal.

Intrapersonal Intelligence

The symbol systems for intrapersonal intelligence include symbols of the self as seen in people's artwork and dreams (Armstrong, 1994a, p. 6). The infant's sense of intrapersonal intelligence is somewhat limited in the fact of having no way of addressing the how or why of feelings (Gardner, 1983, p. 244). Gardner clarifies this development:

> But the range of bodily states experienced by the infant--the fact that he feels, that he may feel differently on different occasions, and that he can come to correlate feelings with specific experiences--serves to introduce the child to the realm of intrapersonal knowledge. Moreover, these discriminations also constitute the necessary point of departure for the eventual discovery that he is a distinct entity with his own experiences and his unique identity (Ibid., pp. 244-245).

Even as an infant the child is already forming experiences and ideas that will help him develop a sense of his individual nature or autonomy from others. This sense of self is further enhanced as the child grows past the age of two.

Between the age of two and five the child shows as increased use of symbols; where "The child makes an irrevocable transition from the kinds of simple discrimination of his own moods, and those of others that have been possible on an unmediated basis, to a far richer and more elaborated set of discriminations guided by the terminology and the interpretive system of his entire society" (Ibid., p. 246) This interaction and view of others leads the child through an effort to begin to stand up for his beliefs through argument. Sigmund Freud notes that: "The young child is engaged in battles with others--with his parents, his siblings, his other peers, and even protagonists of fairy tales--all in an effort to establish his own unique presence and powers" (Ibid., p. 247). Gardner considers that, "an *intra*personal-centered view of early childhood begins with an isolated individual who gradually comes to know (and perhaps care) about other persons"

(Ibid., p. 248). The school-aged child is beginning to show some level of social-knowledge (Ibid.).

The school-aged child "has attained some mastery of a number of different roles adopted by other individuals, as well as an increasingly clear understanding that he is a discrete individual with his own needs, desires, projects, and goals" (Ibid.). As previously mentioned, although children enjoy making friends and joining groups at this age, there is also a strong desire to openly display their sense of individuality. Gardner points out that it is during this time that:

> The child becomes especially concerned with the acquisition of objective skills, knowledge, competencies. In fact, his own definition of self is no longer mired in physical attributes, though it has not yet become focused on psychological features either. For the child of six, seven, or eight, it is the things he can do--and the degree of success with which he can execute them— that constitute a chief locus of self-knowledge. This is the age of the acquisition of competence, the building up of industry: the child is colored by a fear of feeling inadequate, of appearing to be an unskilled self (Gardner, 1983, p. 248).

During the middle school years when the child is approaching adolescence these trends continue to emerge. Many young girls at this age fear looking inadequate when it comes to solving math problems, and they avoid these tasks (Ibid., p. 250). These feelings of fear are less clear when we view the young child, but are extremely disconcerting and may preoccupy the youngster's contemplations as they move towards adolescence (Ibid.).

The onset of adolescence may signal a period in life that is most chaotic for the teenager. Both forms of the personal intelligences take significant turns during adolescence. "Adolescence turns out to be that period of life in which individuals must bring together these two forms of personal knowledge into a larger and more organized sense, a sense of identity or (to use the term I shall favor hereafter) a sense of self" (Ibid., p. 251). The nature of this development determines whether the teenager can function within the parameters of his chosen social context (Ibid.). As previously mentioned the teen years can prove to be a very difficult time for the adolescent.

As a person approaches a 'mature sense of self', the intrapersonal intelligence may even be evidenced through an individual's actions or service to others (Ibid., p. 252). We have noted above how Gardner illustrates even the mature flexibility that is required in considering what constitutes a mature 'sense of self' (supra, p.70). As with the great models offered by our culture, for the intrapersonal self

> The end goal of these developing processes is a self that is highly developed and fully differentiated from others...all highlight a relatively autonomous sense of self, one that places a heavy accent upon intrapersonal features, even when they are marshaled in the service of others (Gardner, 1983, p. 252).

The organization of one's thinking ability is critical in the development of intrapersonal intelligence. Certain societies place value in individual end-states that exhibit a high degree of intrapersonal growth, while other societies are more attuned to the values of the interpersonal (Ibid., pp. 268-273, p. 275).

Gardner concludes with a word of caution in respect to possible extreme dominance of the intrapersonal intelligence:

> In certain cultures, such as our own, the emphasis on the individual self may become sufficiently extreme that it leads to the appearance of a second-order capacity, which presides over and mediates among the other forms and lines of intelligence. This, then, is a possible outcome of cultural evolution--but an outcome, it must be stressed, that is difficult for us to judge and may be based, at least in part, on an illusory view of the primacy of our own powers and the degree of our own autonomy (Gardner, 1983, p. 276).

This is one of Gardner's strongest positions for the autonomy of each of the personal intelligences.

Autonomy

Evolutionary considerations suggest that self-awareness may be found among the higher animals, especially the chimpanzees (Ibid., p. 255). First, they experience close ties in a prolonged childhood; chimpanzees spend their first five years close to the mother and can learn so much during that time. The first important factor in developing personal knowledge "is the prolonged childhood" (Ibid.).

Another factor to be considered in our past cultures is the importance of the hunting parties (Ibid.). It is possible that some of the hunting of small animals could be done on an individual basis or in a group; but the killing, tracking and gathering of food from larger animals would involve the participation and cooperation of larger groups of people (Ibid., pp. 255-256). This may have provided the avenue for our ancestors to develop their personal knowledge through their interactions with others; learning to work together, to plan, to communicate and to cooperate would encourage "the building of strong interpersonal bonds" (Ibid., p. 256).

There is some evidence that suggests animals exhibit various forms of emotions through their actions. The investigator John Flynn shows:

> That it is possible to trigger in cats a complex form of affect-laden behavior by direct electrical stimulation of the brain. For instance, even in cats who do not under ordinary circumstances attack mice, one can produce full-blown attack behavior and associated facial expressions simply by stimulating certain brain regions. This means that the "attack system" has evolved to function as a unit; neither experience nor training or learning is required for full and proper firing. We see here evidence that a whole set of behavior patterns, one presumably accompanied (or even triggered) by specific affective states, can be set off by endogenous (internal) as well as by conventional environmental triggers (Ibid., p. 258).

Donald Hebb has shown that the origins of a particular emotion can be seen in a species more closely related to human beings (Ibid.). Hebb says "that a full-blown fear state can be evoked in the chimpanzee", and that the chimps become excited, anxious and remarkably frightened when they see the mutilated bodies of other chimpanzee's (Ibid.). Hebb's theory asserts that fear begins with a disruption in cerebral operations that are involved with perception and is distinctive by its accompanying reaction of flight from the threatening object (Ibid.). These examples are significant in suggesting that "the origins of personal intelligences can be discerned in species other than our own" (Ibid., p. 258).

Harry Harlow's previously mentioned studies with motherless monkeys dictates that this separation produces a young monkey that displays abnormal behavior in the personal intelligences (Ibid., p. 259). To some limited extent these effects are reversible if the motherless monkey is given a surrogate mother. However, in these cases of maternal deprivation, the development of other areas of intelligence such as problem solving may not show any ill effects (Ibid.). Thus, even in primates, "intellectual competencies enjoy a certain autonomy from one another" (Ibid.).

On a neurological level, surgical intervention may cause some deviant social responses, and according to Ronald Myers there are sites in the primate's neurological system that play critical roles in social demeanor that are directly related to their interpersonal intelligence(Ibid.). Of importance to Gardner's assertion that there are two distinct intelligences in humans are those studies that show there are two distinct neural mechanisms in monkeys, that serve, respectively, to convey the inner feelings of monkeys and to express emotions facially, whether felt or spontaneous (Ibid., p. 260). Similarly, in studies concerning the human personal intelligences:

> Studies conducted by Ross Buck with human beings for dealing with volitional as opposed to spontaneous expression of emotions: apparently, like other primates, our ability to convey emotions deliberately to others proceeds along a separate track from our spontaneous and involuntary experiencing and expression of emotions (Ibid.).

Interpersonal Intelligence

Areas of the brain that support the autonomy of interpersonal intelligence are the frontal lobes, temporal lobe (in particular the right hemisphere), and limbic system (Armstrong, 1994a, p. 7). The area most important to the development of the personal intelligences in humans is the frontal lobes, where injury can "wreak severe damage on one's personality"; yet leave other intelligences, computational, for example, intact (Ibid.). Benson and Dietrick suggest that damage to the frontal lobes, (in particular the lower orbital area) is likely to produce a person prone to euphoria, hyperactivity, freedom from care or anxiety and irritability; while the higher regions of the frontal lobe produce a depressive personality that displays apathy, slowness, not caring in things and indifference (Ibid., p. 261)

On the other hand, Alexander Luria, a Russian neuropsychologist relates the fascinating story of a young Second World War soldier named Zasetsky, who suffered severe brain damage to the left parietal-occipital area, causing a full range of conceptual destruction; yet he still retained his personality (Ibid., pp. 260-261). In respect to "person related functions associated with the frontal lobes", he continued to possess will, desire, sensitivity, and constructive life planning (Ibid., p. 262):

> Luria reported several years ago the fascinating case of "the man with the shattered world"....an injury that drastically crippled him across a distressingly full range of conceptual and symbolic faculties. His speech was reduced to the most elementary forms of expression; he could not write a single word or even a single letter; he could not perceive in his right visual field; he could not hammer a nail, carry out simple chores, play a game, find his way outside; he was confused about the order of the seasons, unable to add two numbers, or even to describe a picture....He continued to possess will, desire, sensitivity to experience, and the treasured ability to form and sustain plans and carry actions through as effectively as his condition permitted...over a twenty-five-year period, Zasetsky worked steadily to improve his own performance. Under Luria's guidance he was able to re-educate himself to read and write (Ibid., pp. 261-262).

What is most pertinent to this thesis is the manner in which this example illustrates the two kinds of personal information, (interpersonal and intrapersonal), being processed largely by the frontal lobes:

> At the core of personal knowledge, as represented in the brain and particularly in the frontal lobes, seem to be two kinds of information. One is the ability to know other people--to recognize their faces, their voices, and their persons; to react appropriately to them; to engage in activities with them. The other kind is our sensitivity to our own feelings, our own wants and fears, our own personal histories (Ibid., pp. 262-263).

In other cases, Alzheimer's disease and Pick's disease offer a contrast of effects; patients with Alzheimer's exhibit damage to the posterior regions and Pick's patients suffer more frontal lobe damage (Ibid., p. 265). Pick's victims show a rapid early loss of social appropriateness, while Alzheimer victims may have severe loss in spatial, logical and linguistic skills at first, all the while remaining well groomed and socially appropriate (Ibid.).

David Bear discloses two forms of behavioral breakdown; one set of damage to the parietal region of the cortex results in indifference and the *loss of a sense of caring about one's own person,* and in the other set Bear reports that lesions in the temporal portions of the cortex bring about "*a lack of concern with external stimuli*"and patients reveal forms of sexual aggression (Ibid., p. 266). This unacceptable display of aggression does not allow the patient to forge meaningful personal relationships. This condition has ties with patients who suffer damage to the right hemisphere where spatial, emotional and interpersonal domains are of primary concern (Ibid.). Their ability to carry on with social relationships is severely hampered. Bear's second form of behavioral breakdown reveals again evidence of autonomous systems for the interpersonal intelligence, this time in the temporal area of the brain (Ibid., p. 260). Gardner offers his usually reserved judgment that there is "suggestive evidence that the personal intelligences are a domain apart. Perhaps even two domains apart" (Ibid.).

Intrapersonal Intelligence

The key areas of the brain associated with intrapersonal intelligence are the frontal lobes, limbic system and the parietal lobes (Armstrong, 1994a, p. 6). Damage to any of these areas results in deficits of intrapersonal knowledge. Walle Nauta writes of frontal lobe damage:

> The frontal lobes constitute the meeting place *par excellence* for information from the two great functional realms of the brain: the posterior regions, which are involved in the processing of all sensory information (including perception of others); and the limbic systems, where individual motivational and emotional functions are housed, and whence one's internal states are generated). The frontal cortex turns out to be the realm where neural networks representing the individual's inner milieu...converge with...the external milieu....Thus, by virtue of their strategic anatomical location and connections, the frontal lobes have the potential to serve as the major integrating station--and this they do (Gardner, 1983, p. 262).

Thus, of this meeting place, Gardner will say, "the frontal lobes play a privileged and irreplaceable role" in the personal forms of intelligence (Ibid., p. 263). It is the site for linking "these forms of knowing to symbols, so that we can conceptualize our intuitive knowledge of our self and our more public knowledge of others" (Ibid.).

Some brain diseases may deter the cultivation of both personal intelligences; this seems true of *idiots savants* who rarely develop a sense of self (Ibid). In Down's syndrome, on the other hand, victims often develop effective interpersonal relationships, but their intrapersonal knowledge is questionable (Ibid., p. 265). Gardner concludes "knowledge and maturation of self appear to require so extensive an integration of other capacities that the individual would have to be an essentially normal person" (Ibid., p. 263).

As previously mentioned David Bear offers two sets of contrasting evidence for the personal intelligences (supra, p. 80): "One set of cortical regions, located in the dorsal (parietal) region of the cortex, seems critical for surveillance, attention, and arousal: its injury results in indifference and in the *loss of a sense of caring about one's own person*" (Ibid., p. 266). This set of evidence relates directly to the intrapersonal realm which has neurological systems in the parietal region.

As far as the question of autonomy of the personal intelligences is concerned, Gardner admits that in this task it is difficult to offer convincing interpretations of evidence, given the tremendous cultural canalization in the personal realms:

> In candor, the amount of knowledge available about personal intelligences is less, and certainly less compelling, than that available for other, more conventionally computational forms of intelligence, ones less susceptible to cultural canalization. The evidence from brain-damaged populations can be read in a number of ways, and it is by no means certain whether a contrast between left and right hemisphere lesions, between cortical and subcortical damage, between dorsal and ventral injuries will come closest to cutting the personal intelligences at their proper joints. Still, our discussion clearly suggests that forms of personal intelligence can be destroyed, or spared, in relative isolation from other varieties of cognition: there are highly suggestive hints, in both the evolutionary and the pathological literature, that intrapersonal and interpersonal intelligences can be discriminated from one another (Ibid., p. 267).

These personal intelligences are clearly the most difficult when trying to establish whether they are neurologically autonomous from others, and whether they should be conceived at the same level of specificity as the other intelligences:

> Perhaps it makes more sense to think of knowledge of self and others as being a higher level, a more integrated form of intelligence, one more at the behest of the culture and of historical factors, one more truly emergent, one that ultimately comes to control and to regulate more "primary orders" of intelligence (Ibid., p. 274).

Overlap

As previously mentioned there is tremendous overlap between the two personal intelligences. "In tackling this question, it is important not to gloss over differences between the personal and other forms of intelligence" (Gardner, 1983, p. 240). Gardner links these two forms of intelligence to avoid repetition; whereas, the other forms of intelligence can be discussed independently of each other (Ibid.). Evidence that has been marshaled throughout the chapter does support the claim that the personal intelligences experience overlap with each other and all of the other intelligences, especially since the whole culture provides the symbol systems that allow full expression of the personal intelligences.

The question may be raised about the primacy of overlap of the personal intelligences with language--the linguistic intelligence. Gardner says, "It might seem that language holds the key to self-knowledge; and that, in the absence of this form of symbolization, the ability to conceive of oneself or to cooperate with other individuals would be seriously, if not fatally compromised" (Ibid., p. 264). There is, in fact, evidence that "severe aphasia can be sustained without equally devastating implications for personal knowledge" (Ibid.). Among those who have recovered, though experiencing some loss of alertness and increased depression, the individual "in no way felt himself to be a different person", nor did his family and friends (Ibid.). But, in cases where the damage has been sustained by the right, non dominant, hemisphere, a different picture arises; in these cases, the ability to deal with others has been maintained chiefly, if not exclusively, at a verbal level, and there exists a large gap between the former personality and the present modes of relating to others (Ibid). These kinds of cases tie very closely to Gardner's determination that the *interpersonal intelligence* has its primary neurological systems in the frontal lobes, temporal lobe, especially in the *right hemisphere*, as well as in the limbic system (Armstrong, 1994a, p. 7).

Naturalist Intelligence

Definition

Dr. Howard Gardner has added the Naturalist Intelligence to his original seven in 1996 (Campbell, 1996, p.1 and Hoerr, 1997, p.1). There has been a keen interest in what Gardner has to say on this topic, although it is only in its infancy in theory. This intelligence refers to perusing, comprehending and marshaling patterns in the natural surroundings (McDermott, 1997a, p. 2). An example might be someone who seeks patterns in the world, seeing order instead of chaos, and who shows proficiency in the recognition and classification of plants and animals (Barkman, 1997, p. 1). "This could be anyone from a molecular biologist to a traditional medicine man using herbal remedies" (Campbell, 1997, p. 1).

Core Operations

Gardner responds in an interview that "The core of the naturalist intelligence is the human ability to recognize plants, animals, and other parts of the natural environment, like clouds or rocks" (Durie, 1997, p. 1). This capacity has been a key to the survival of mankind and to his climb up the evolutionary ladder. Although all of us have some of this intelligence, some children become experts on dinosaurs and some adults excel at their pursuits in hunting, botany, and anatomy (Ibid., p. 1). While the ability doubtless evolved to deal with natural kinds of elements, it has been extended to deal with the world of man-made objects. We are good at distinguishing among cars, sneakers, and jewelry, for example, because our ancestors needed to be able to recognize carnivorous animals, poisonous snakes, and flavorful mushrooms (Durie, 1997, p. 1).

Several people come to mind when thinking about naturalists in high end-states and suggestions for such a list might include George Washington Carver, Rachel Carson, Meriwether Lewis, Charles Darwin, Gregor Mendels, or a child who efficiently catalogues and categorizes insects, rocks, dinosaurs, or sea-shells (Campbell, 1997, p. 1 and Barkman, 1997, p. 2). Charles Darwin's "exquisite precision" in recognizing and classifying "derives from a natural expertise in identifying patterns" (Ibid., p. 1), and his famed *Origin of Species* may be ranked "as perhaps the major intellectual contribution of the nineteenth century" (Hoerr, 1997, p. 2). "These same skills of observing, collecting, and categorizing might also be applied in the "human" environment as witnessed in a child sorting sports cards, or an adult who shrewdly distinguishes between the sounds of different engines or analyzes the variations of fingerprints" (Campbell 1997, p. 1).

Gardner suggests that his original list of seven intelligences was only a temporary one, and some other intelligences that have been proposed are sensibility, humor, intuition, creativity, and spirituality (Gaffney, 1995, p.9). Gaffney also believes that spirituality may possibly be a function of our intrapersonal intelligence. "Other authors have suggested friendly revisions, such as the need for a 'moral' intelligence" (Klein, 1997, p.378). Gardner is apparently considering adding a ninth intelligence called existential intelligence which refers to the domain of philosophers and priests (McDermott, 1997b, p. 2).

Postscript

There have been some articles of note that critically analyze Gardner's theory; most are in a positive vein but some are negative: Matthews, 1988; Eisner, 1994; Steinberger, 1994; Morgan, 1992.

Perry Klein notes that Gardner's Theory: "has received little critical analysis...is on the horns of a dilemma. A 'weak' version of multiple intelligence theory would be uninteresting, whereas a 'strong' version is not adequately supported by the evidence Gardner presents" (Klein, 1997, p. 377). He also suggests that the theory is too widespread to be of any value in structuring a curriculum to meet the needs of students, although "MI has swept education in the 15 years since its inception. ERIC citations favorable to the theory run into the hundreds, including some in prestigious or widely circulating journals" (Ibid., p. 378).

Gardner himself presents some conditions that need to be held in mind when reflecting on the body of his work. First, Gardner admits that

> The exact nature and breadth of each intellectual "frame" has not so far been satisfactorily established, nor has the precise number of intelligences been fixed. But the conviction that there exist at least some intelligences, that these are relatively independent of one another, and that they can be fashioned and combined in a multiplicity of adaptive ways by individuals and cultures, seems to me to be increasingly difficult to deny (Gardner, 1983, p. 8-9).

Secondly, Gardner's intelligences have been established on the basis of a wealth of evidence-not on single definitions or isolated sources of evidence. He has, in fact, assembled evidence for each frame of mind from such diverse sources as cognitive and developmental psychology and neuropsychology, evolutionists' theories, cross-cultural studies, biology, as well as experts from the various disciplines, brain damaged patients, pathologies, prodigies, and normal people.

Gardner notes that the many attempts at establishing "separate minds or faculties" have failed in the past because they relied "chiefly on one or at the most two lines of evidence", particularly "solely on the basis of logical analysis, ...solely on the results of intelligence testing, or solely on the insights obtained from brain study" (Ibid., p. 9). He maintains that the time is at hand for the "confluence of a large body of evidence from a variety of sources" (Ibid., p. 8). But Gardner concludes to "several intellectual competences of whose existence I feel reasonably certain" (Ibid., p. 11).

In respect to concerns about autonomy, Klein argues that some of Gardner's definitions of individual intelligences are circular in proof: "the definition of bodily-kinesthetic intelligence is virtually a definition of dance, so the explanation says, in effect, that Michael is a good dancer, because he is a good dancer" (Klein, pp. 378-379). Gardner has always maintained from the beginning that the "core activities, in effect, define the intelligence" (Gardner, 1983, p. 9).

Klein argues against the possibility of 'overlap' of intelligences within Gardner's theory:

> Dance is both musical and physical; conversation is both linguistic and interpersonal; and solving a physics problem is both spatial and logical-mathematical. Modularity *per se* is not the problem, because the output of one module can become the input of another. But Gardner has defined the intelligences of MI in terms of their differing content, which raises the question of how they could exchange information. The intelligences conceivably could be coordinated by a central executive (Klein, 1997, p. 379).

Gardner maintains throughout that "Nearly all cultural roles exploit more than one intelligence" (Gardner, 1983, p. 207), and Gardner would be the first to welcome findings on a brain mechanism for the interaction of intelligences, although some are already in studies such as "cross talk" between the hemispheres.

Chess players are chosen by Gardner to suggest a high degree of spatial intelligence and some overlap with logical-mathematical intelligence (Gardner, 1983, p. 292). Klein criticizes this example:

> But chess is one of the most-researched human cognitive activities, and general abilities spatial or otherwise...Chess Masters are no better than other persons at spatial tasks...Highly ranked players are less likely to work in professions that involve solving spatial problems, such as engineering, than they are to work in professions in the humanities...A defender of MI might counter that there are many domains of spatial abilities, and an individual who excels in one need not excel in others . But as this rebuttal tacitly concedes, if this were the case, then there is no reason to speak of a general 'spatial intelligence' in the first place (Klein, 1997, p. 382).

Surely, simply having a minimum of skills or a major development of one skill in an intelligence would not be a sufficient reason to rule out the intelligence altogether. And Klein makes similar arguments for the examples concerning *'idiot savants'*--that they do not exhibit the total core of skills for a particular intelligence. Gardner never demands exhibition of all the core skills of any particular intelligence, nor would that be a realistic demand. This is evidenced most succinctly in the tetradic core of the linguistic intelligence. This core of operations is established on present evidence; only future research will specify how particular skills will fit into the neurological systems already established for each intelligence.

The value of Klein's analysis lies in opening new perspectives on the intelligences for discussion and for assessment in emerging research, particularly those instances of interference, especially in verbal and visual tasks that "disrupt one another somewhat, indicating that they share some kind of resource" (Klein, 1997, p. 386). These comments remind one of Gardner's discussion that the linguistic and spatial intelligences hold in common problem solving skills, and Gardner finds spatial "the preferred mode" for solving problems (Gardner, 1983, p. 175).

In respect to Gardner's responses to questions in chapter three of his book *Multiple Intelligences: The Theory in Practice*, the first issue centers around the difference, if any, between intelligence and talents or gifts, and Gardner simply states that there may be no difference;

intelligence is not a magical word and if one wishes to call them talents or gifts, then by all means do so (Gardner, 1993b, pp. 35-36). Next, as to whether multiple intelligences can substantiate a theory Gardner replies that the theory is only in its infancy and there has not been enough research findings as yet to adequately approve or disprove his theory (Ibid., p. 38). In the final analysis it is possible that some of the present intelligences may face scrutiny because their autonomy is weak and parts of the theory may have to be reformulated (Ibid., p. 39).

Another question concerns whether overlap is possible if intelligences are biologically and conceptually autonomous. Gardner responds: "However, there is no theoretical reason why two or more intelligences could not overlap or correlate with one another more highly than with the others" (Ibid., pp. 41-42). In reality there is overlap in every domain and especially in the area of musical and mathematical intelligence (Gardner, 1983, pp. 122-127).

And finally is it possible for educators to train individuals for specific intelligences (Gardner, 1993b, p. 48). Shinichi Suzuki certainly succeeded in teaching music to young students via the violin (Gardner, 1983, p. 367). Gardner concludes that:

> The method works because Suzuki has identified the factors that matter in developing musical skill in early life--such as the finger arrangements possible on the violin, the kinds of patterns that can be readily recognized and sung by young children, the capacity to imitate mothers, the tendency to identify with slightly older peers, and so on. What Suzuki did for musical performance can, I think, be accomplished for every other intelligence, and indeed each intelligence may require its own specific educational theory (Gardner, 1993b, p. 48).

It should be noted that the methods that Suzuki used are not necessarily transferred to the other forms of intellect. What works in one intelligence may not constitute the proper patterns of development that should follow in the others. As to pedagogical issues, Klein also raises problems about MI as an "ability approach" which shows the same problems as traditional teaching and testing. Thus, students who believe they are inadequate in some intelligences will avoid those areas (Klein, p. 388). The difference in MI learning is that students have access to their dominant intelligence for learning in areas that are least dominant for them. If these students were dominant in spatial and kinesthetic, for example, problems in learning mathematics could be approached through their strengths; and accordingly, contrary to Klein's conclusion, students would show less avoidance of their difficult subjects. With MI teaching these students would recognize their best avenues to attack more obdurate content.

In conclusion, Gardner is open to revision of his theory as breakthroughs in human thinking arise:

> I can readily live with such revision. But it is also possible that the theory will be found deficient in some more fundamental way. If it turns out that the most significant human intellectual activities cannot be explained in terms of M. I. theory or can be better explained in terms of some competing theory, then the theory will deservedly be rejected. If it turns out that the kinds of evidence heavily weighted here--for example, neuropsychological and cross-cultural findings--are fundamentally flawed, then the whole line of inquiry forged here will have to be re-evaluated (Gardner, 1983, p. 297).

CHAPTER 2

INTRODUCTION TO MI ASSESSMENT

Strategies for Assessment

Since appearing on bookshelves in 1983, Gardner's *Theory of Multiple Intelligence* has attracted immense interest among educators (Torff, 1996, p. 1). Many schools have started to organize their curriculum around Gardner's list of intelligences. Grant adds that learning takes place when learners regard what they need to know as being relevant to their lives (Teele, 1995, p. 133-134).. Fullan states that the purpose of educational change is to help schools accomplish their goals more effectively by replacing some structures, programs, and practices with better ones (Teele, 1995, p. 132).

In the conventional classroom, the educator has very few instruments for evaluating a pupil's work. In the primary and elementary grades, the teacher can grade computations, examine vocabulary and reading workbooks, and examine standardized tests by calculating correct responses. The teacher can also grade writing samples and teacher-made essay tests by counting errors in grammar, spelling, and punctuation and by giving points for original thought. In the secondary levels where lectures rule supreme, examinations and multiple-choice tests are the most common evaluation alternatives. Grading is simple and straightforward for the most part. How many correct answers does the students have? How many answers are true or false? Many teachers are using scanners to evaluate their tests and erase the boredom of correcting tests.

However, in the multiple intelligence classroom, the possibilities for measuring student learning are numerous as Chapman aptly demonstrates her use of the 'representative picture' in the portfolio (Bellanca et all, 1994, p. 200). Sizer "says that staff should have a sense of commitment to the school and that learning should be personalized to the maximum whenever possible" (Teele, 1995, p. 117). Multiple intelligence instruction calls for dynamic and authentic learning that engrosses "all students in the construction of their learning" (Bellanca et all, 1994, p. 13). Authentic learning replicates the potential situations that the students will confront outside the school environment (Ibid.).. Greene says that individuals should be "accepted for their equality and respected for the multiple perspectives and talents that they brought into the classroom and the school" (Teele, 1995, p. 109). Either working independently or in cooperative learning groups the students work as if they were in a shop, office or some other working environment (Bellanca et all, 1994, p. 13-14). To fortify the learning process and to assure that each student is challenged to develop all the intelligences; the teacher moderates the tasks so that the students grasp what they are learning (Ibid., p. 14). Some possible tasks that students may do are *exhibits, performances, journals, products, graphic organizers, projects, demonstrations* and involvement in the *problem solving process* (Bellanca et all, 1994, pp. 14-20).

Students can research a topic and prepare an exhibit to display what they have learned and this may come from a trip to a local museum and the student would be given extra credit for their work in this extracurricular field (Ibid., p. 14). Performances could be given from their participation in drama or music productions and shown to their peers, parents or visit another school or a senior citizens home (Ibid., p. 15). Journals or logs can be used to develop their communication skills in the seven intelligences and not just in traditional English classes, but throughout the entire curriculum (Ibid., pp. 15-16).. Students may take part in demonstrations to show that they have delved “more deeply into a topic” and show them to their peers, parents and community.

Products are the result of a ‘learn-by doing’ approach and are very effective when done in conjunction with “journals and exhibits” (Ibid., p. 17). They may also be helpful in “challenging students to make cross-disciplinary connections” when dealing with a particular issue that may entail both history and math (Ibid.). Graphic organizers help students gathering, analyzing and evaluate information; and students may do these individually or in cooperative learning groups (Ibid., p. 19). Students’ involvement in long-term projects that incorporate several intelligences should increase in their complexity as the child progresses throughout the year (Ibid., p. 20). Problem solving works best when it is at the “core of the curriculum....in this context, the curriculum emphasizes a process, not information” (Ibid., p. 18). The legion of learning strategies available to activate the multiple intelligences, develops many opportunities for assessing student knowledge. When carefully chosen, these instruments afford more knowledge about what and how the student understands than is possible using only standardized tests.

“Our educational system should be able to create school learning environments that allow students to learn basic skills that are applicable to real life situations, proceed at a rate that is achievable for them, makes no unfair comparisons with the progress of others, assures positive reinforcement and provides curriculum, instruction and assessment procedures that reflect the many different ways students learn and process information” (Teele 1996, p. 6). Thus, the need for an alternative view that would differ radically from the status quo and offer a different introspective of what the education system should entail. "Even before Gardner identified multiple intelligences, we knew that students were far too complex for quick stamps of approval, letter grades, or numbers as a measure of their capabilities" (Bellanca it all, 1994 p. x). Bruce Torff extrapolates on this idea and states accordingly:

> This attention to assessment is surprising in light of the detailed treatment given the topic in *Frames of Mind*. In particular, MI is a response to our society's heavy treatment on standardized testing--the practice of employing examinations (e.g., the Scholastic Aptitude Test) to capture the intellectual achievement of the individual and compare it to the norms set by the peer group. Standardized test play a prominent role in our society's educational practices--just ask any high school student sweating out the SAT(Torff 1996, p.3).

This problem also exists in the Nova Scotia school system. This pressure is passed down from the school boards to school administrators to classroom teachers and finally arrives on the students desks in the form of a question. Educators ask how can they better prepare our students for the NSAT's?

Standardized tests have met with increased scrutiny in recent years (Ibid., p. 2). Cole , Hood and McDermott intimate that "many psychologists and educators have questioned the extent to which standardized tests measure behavior as it occurs in the real world", and how well do standardized tests predict adult success in terms of job performance (Ibid.). Not so great as it turns out. Wigdor and Garner assert that cognitive aptitude tests, on average show us a variance of only four percent in an individual's job performance (Ibid.).

Tests, however, are better when it comes to predicting school performance and this suggests that there is much more to the real world than what has been grasped on standardized tests (Ibid.). Far too many students that have not performed well on standardized tests have become disillusioned by the education system. Teachers and society in general have given up on countless numbers of students falling through the cracks and ending up on street corners. The vast majority of these students I am confident are capable of becoming productive members of society. The key is how do we reach them and bring their multiple talents to fruition. In conclusion it is important to remember it is not "how smart we are, but how we are smart" (From the American Broadcasting Company home video, *Common Miracles: The New American Revolution in Learning,* 1993).

Research Development

In addition to Teele (1995) a great deal of work has been done in the field of MI assessment: Shearer, 1994; Shearer & Jones, 1994 for the *Hillside Assessment Instrument*; as well as Osborne, Newton & Fasko, 1995 for a Self-Evaluating instrument; There have been numerous articles dealing with assessment, especially those by Hatch & Gardner, 1986, 1996; and Plucker, 1996. The need for an instrument to measure children's dominant intelligences is necessary, as educators deal with the strengths and weaknesses in classrooms.

There are numerous articles that offer suggestions for administrators, curriculum developers, and classroom teachers to implement MI techniques in schools: Barth, 1990; Barron, 1996; Beckman, 1997; Bolanos, 1990,1994; Lightfoot, 1993; Marguiles, 1995; Marks-Torlow, 1995; Martin, 1996; Oddleifson, 1994; Reiff, 1996; Sizer, 1984; and Walters & Gardner, 1986.

There is also a goodly amount the literature on the development of specific lesson planning: Strahan, 1996; Breutsh, 1995; Chapman, 1993; Davidson, 1990; Haggerty, 1995; Jasmine, 1995; O'Connor & Callaghan-Young, 1994; Smagorinsky, 1995; and Dickinson, 1997.

In addition to his major works, particularly, *Frames of Mind,* 1983; *The Unschooled Mind,* 1991; *Multiple Intelligences: The Theory in Practice*, 1993; *and Creating Minds*, 1993, Howard Gardner has written a host of articles, of special mention is his "The Theory of Multiple Intelligences", 1987. He has also given numerous interviews that have been published; among these, Anglin's "Reflections on *The Unschooled Mind*" 1993; Shores' "Interview with Howard Gardner", 1995; and Viadero's "Howard Gardner Speaks Out on Multiple Intelligences", 1995.

Rationale

I undertook this study in order to determine the dominant intelligences of school age children in the Halifax area of Nova Scotia. Hopefully during the course of this experiment some of my long held beliefs would be answered; and these beliefs were cast in the form of predictions which may be proved or disproved in the course of my research. The predictions I made were that males would score higher in the areas of logical-mathematical, bodily-kinesthetic, and intrapersonal intelligences. Conversely, I predicted the females would score higher in the areas of linguistic, musical, and interpersonal intelligences. No prediction was made on spatial intelligence. I also wanted to see if any gender differences existed at various grade levels or between different grades as well as grade differences among the seven intelligences. The variables that I would need to use to test the seven intelligences would be sex, grade, and sex/grade. I was also hopeful that this information could be used by curriculum developers to see the need for restructuring in the schools and see multiple intelligences as the way to go. The students' dominant intelligences results could be used by teachers to help restructure their classrooms around the students' present needs in the seven intelligences. This study would also give me the opportunity to present some ideas to administrators, curriculum developers, and teachers by giving them specific examples and resources that are available to them.

It has been established that there are seven relatively autonomous forms of intellect.

Students may be dominant in one or more of these. The important point here is to realize where the strengths and weaknesses of students lie. The next section of the thesis will deal with an experiment conducted to measure students and some teachers' most dominant intelligences and to establish ways improvements can be made to benefit the student and establish schools as *A Place For All Students To Succeed* (Teele, 1995).

CHAPTER 3

THE MULTIPLE INTELLIGENCE INVENTORY

STUDY 1

Subjects:

Subjects for the study were 20 public school teachers who were taking a graduate level education course in multiple intelligence theory during the spring semester of 1997 at St. Mary's University, Halifax.

Instruments:

The first test instrument was a form that the subjects filled in to rank their interest in the multiple intelligences from 1 to 7. This will be referred to as the subjects self-assessment. I created this instrument. The instrument was collected after the subjects finished their rankings. They ranked their intelligences from 1 being most like them to 7 being least like them. *Please refer to Teacher form for Multiple Intelligences in appendix p.199.*

The second test instrument was the Gardner Multiple Intelligence Inventory For Adults which appears in Thomas Armstrong's book, "Multiple Intelligences In The Classroom" on pp.

18-20. The instrument offers subjects a checklist of 10 items for each of the 7 multiple intelligences. *Please refer to Multiple Intelligence Inventory For Adults (Gardner Form) in pp. 204-206.*

The third instrument was the (TIMI) Teele Inventory For Multiple Intelligences. The Teele Inventory (Teele, 1992) for Multiple Intelligences developed in 1992 is designed to observe the dominant intelligences of students in kindergarten through the twelfth grade, and acts as an indicator as to whether or not students in different grade levels possess different intelligences. It should be noted that the TIMI does not measure how much of each intelligence that an individual student has, but rather how much interest the student has in learning in that particular way. It is the students' preferred way of problem solving or how they perceive themselves in the learning of tasks. Dr. Sue Teele introduces her inventory thus:

> This inventory is a forced choice pictorial that contains 56 numbered pictures of panda bears representing characteristics of each of the seven intelligences and provides students twenty-eight opportunities to make their selections of two choices. The different intelligences are matched with one another and students have eight different times they can select each of the seven intelligences. Students are asked to select one of the two choices that they feel is the most like them. There are no right or wrong answers. When completed, the resulting data is compiled, and then the inventory identifies the dominant intelligences that each participant possesses when taking the inventory. The intelligences have been coded by number and by letter, and can be easily tallied on the answer sheet. The answer sheet is then scored and presents a profile of the responses empowering both the student and teacher to determine the students most dominant intelligences as indicated by the highest scores (Teele, 1995, p.25). *Please refer to appendix pp. 205-206.*

Procedure:

On May 30th the subjects were asked to complete the self-assessment of their multiple intelligences.. The May 30th class was the third weekend of classes for this particular course. I gave the subjects a preamble at the start of the class on the purpose of my study as it relates to my thesis and Gardner's Seven Intelligences. By May 30th all subjects had some previous knowledge of Gardner's Multiple Intelligence Theory. In fact, some of the teachers had previously taken a course in Multiple Intelligence Theory during the Fall and Winter sessions of 1996-97. On May 30th the subjects were asked to rank in order from 1 being most like you to 7 being least like you what their dominant intelligences were. Their responses were collected 5 minutes after they were completed. On May 31st the subjects completed the Gardner Inventory of Multiple Intelligences. I gave a short preamble to the subjects on the nature of the inventory. This was once again done at the beginning of the class. and it was explained to the subjects that they could score from 0-10 in each of the 7 intelligences. The previously mentioned instrument (form) that was used for recording their scores on the self-assessment was handed back to the subjects and they were asked to put their Gardner Inventory scores in rank order from 1 to 7, 1 being the highest and 7 being the lowest and record them on this instrument. This was done so that the three test could compared. The form was once again collected. On June 6th the subjects completed the Teele Inventory of Multiple Intelligences. This was done at the first of the class. I gave a preamble to the subjects along with the directions on how to complete the inventory. The previously mentioned form was handed back to the subjects again. Once again they were asked to convert their scores to a rank of 1 to 7 and record them on the instrument so that the results could be compared to the other two tests.

STUDY 2

Subjects:

The subjects were students from 25 classes taught by 24 teachers. The teachers would be the experimenters of the test instrument. The students ranged in age from 4 to 20 years of age. 495 students from 10 schools in Halifax, Nova Scotia were used in the study. There were 239 males and 256 females.

Instruments:

The instrument used in the 2nd study was the (TIMI) Teele Inventory of Multiple Intelligences as described earlier in study 1. Please refer to study 1 for an explanation of the instrument.

Procedure:

All of the teachers who were going to administer the (TIMI) inventories were gathered together on June 6th and given instructions and suggestions for administering the inventory. They were instructed to give the same instructions that they received when they did the inventory to their subjects before starting the inventory. The subjects were told the inventories would be collected in 30 minutes. The experimenters were also told that they would be responsible for scoring the inventories when the subjects were finished. The 2nd study involving the students was carried out over a 2 week period in June of 1997. The experimenters (teachers) were asked to administer the instrument to the subjects on Tuesday mornings. Students would then be into their mid-week routine and not be distracted by either the beginning of the week, end of the week or end of the school day. . All of the scoring inventories were checked again by myself for errors and to see that all the necessary responses were made. Then inventories were then further checked for the accuracy of their mathematical calculations. The subjects responses must add up to a total of 28. The suggestions for administering the Inventory were taken from The (TIMI) Teacher's Manual which all experimenters were given a copy. This package included suggestions for administering the inventory, introducing the inventory, scoring the inventory and interpreting the score. *Please refer to the appendix pages 203-208.*

RESULTS:

STUDY 1 DATA

The results on the three scales were correlated to see what extent the tests gave the same results. These results state on which intelligences the tests agree and on which tests they disagree. Correlations higher than .6500 were thought to be high enough to show a strong relationship.

PEARSON'S PRODUCT MOMENT CORRELATION COEFFICIENTS

	SELF/GARDNER (1 vs2)	SELF/TEELE(1vs3)	GARDNER/TEELE(2vs3)
LING	.5509	.6403	.4045
MATH	.8398	.7437	.6957
INTRA	.6484	.1935	.2908
SPAT	.6898	.3993	.5192
MUSIC	.8579	.8275	.9012
BODY	.8995	.7544	.6597
INTER	.6792	.3497	.2110
AVG.	.7379	.5583	.5260

SPEARMANS COEFFICIENT

	SELF/GARDNER(1vs2)	SELF/TEELE(1vs3)	GARDNER/TEELE (2vs3)
LING	.5267	.5884	.3569
MATH	.8289	.7561	.6834
INTRA	.5470	.1289	.2916
SPAT	.6943	.4302	.4594
MUSIC	.8421	.8271	.8981
BODY	.8679	.6542	.6738
INTER	.7012	.4127	.3471
AVG.	.7154	.5382	.5300

Multiple regressions were carried out in order to show significant differences among the three sets involving each of the seven intelligences. The three sets are 1. Self-Assessment 2. Gardner 3. Teele. This would be done for each of the seven intelligences.

LINGUISTIC INTELLIGENCE

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. LING 2
Variable(s) Entered on Step Number 1.. LING 1

Multiple R	.55087	Analysis of Variance			
R Square	.30346		DF	Sum of Squares	Mean Square
Adjusted R Square	.26477	Regression	1	18.58325	18.58325
Standard Error	1.53938	Residual	18	42.65425	2.36968

F = 7.84209 Signif F = .0118

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. LING 3
Variable(s) Entered on Step Number 1.. LING 1

Multiple R	.64026	Analysis of Variance			
R Square	.40993		DF	Sum of Squares	Mean Square
Adjusted R Square	.37715	Regression	1	20.55288	20.55288
Standard Error	1.28203	Residual	18	29.58462	1.64359

F = 12.50488 Signif F = .0024

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. LING 3
Variable(s) Entered on Step Number 1.. LING 2

Multiple R	.40448	Analysis of Variance			
R Square	.16361		DF	Sum of Squares	Mean Square
Adjusted R Square	.11714	Regression	1	8.20282	8.20282
Standard Error	1.52634	Residual	18	41.93468	2.32970

F = 3.52097 Signif F = .0769

MATHEMATICAL INTELLIGENCE

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. MATH 2
Variable(s) Entered on Step Number 1.. MATH 1

Multiple R	.83981	Analysis of Variance			
R Square	.70528		DF	Sum of Squares	Mean Square
Adjusted R Square	.68890	Regression	1	59.98388	59.98388
Standard Error	1.18007	Residual	18	25.06612	1.39256

F = 43.07448 Signif F = .0000

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. MATH 3
Variable(s) Entered on Step Number 1.. MATH 1

Multiple R	.74374	Analysis of Variance			
R Square	.55315		DF	Sum of Squares	Mean Square
Adjusted R Square	.52832	Regression	1	49.75579	49.75579
Standard Error	1.49433	Residual	18	40.19421	2.23301

F = 22.28192 Signif F = .0002

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. MATH 3
Variable(s) Entered on Step Number 1.. MATH 2

Multiple R	.69570	Analysis of Variance			
R Square	.48400		DF	Sum of Squares	Mean Square
Adjusted R Square	.45533	Regression	1	43.53583	43.53583
Standard Error	1.60579	Residual	18	46.41417	2.57856

F = 16.88374 Signif F = .0007

INTRAPERSONAL INTELLIGENCE

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. INTRA 2
Variable(s) Entered on Step Number 1.. INTRA 1

Multiple R	.64836	Analysis of Variance			
R Square	.42038		DF	Sum of Squares	Mean Square
Adjusted R Square	.38817	Regression	1	14.79720	14.79720
Standard Error	1.06465	Residual	18	20.40280	1.13349

F = 13.05457 Signif F = .0020

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. INTRA 2
Variable(s) Entered on Step Number 1.. INTRA 1

Multiple R	.19349	Analysis of Variance			
R Square	.03744		DF	Sum of Squares	Mean Square
Adjusted R Square	-.01604	Regression	1	1.52142	1.52142
Standard Error	1.47415	Residual	18	39.11608	2.17312

F = .70011 Signif F = .4137

**** MULTIPLE REGRESION ****

Equation Number 1 Dependent Variable.. INTRA 2
Variable(s) Entered on Step Number 1.. INTRA 2

Multiple R	.29877	Analysis of Variance			
R Square	.08927		DF	Sum of Squares	Mean Square
Adjusted R Square	.03867	Regression	1	3.62756	3.62756
Standard Error	1.43391	Residual	18	37.00994	2.05611

F = 1.76428 Signif F = .2007

SPATIAL INTELLIGENCE

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. SPAT 2
Variable(s) Entered on Step Number 1.. SPAT 1

		Analysis of Variance			
Multiple R	.68979		DF	Sum of Squares	Mean Square
R Square	.47581				
Adjusted R Square	.44669	Regression	1	36.75062	36.75062
Standard Error	1.49976	Residual	18	40.48688	2.24927

F = 16.33890 Signif F = .0008

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. SPAT 3
Variable(s) Entered on Step Number 1.. SPAT 1

		Analysis of Variance			
Multiple R	.39934		DF	Sum of Squares	Mean Square
R Square	.15947				
Adjusted R Square	.11278	Regression	1	8.23472	8.23472
Standard Error	1.55282	Residual	18	43.40278	2.41127

F = 3.41510 Signif F = .0811

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. SPAT 3
Variable(s) Entered on Step Number 1.. SPAT 2

		Analysis of Variance			
Multiple R	.51917		DF	Sum of Squares	Mean Square
R Square	.26954				
Adjusted R Square	.22896	Regression	1	13.91837	13.91837
Standard Error	1.44759	Residual	18	37.71913	2.09551

F = 6.64201 Signif F = .0190

MUSICAL INTELLIGENCE

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. MUSIC 2
Variable(s) Entered on Step Number 1.. MUSIC 1

		Analysis of Variance			
Multiple R	.85789		DF	Sum of Squares	Mean Square
R Square	.73598				
Adjusted R Square	.72131	Regression	1	71.94168	71.94168
Standard Error	1.19741	Residual	18	25.80832	1.43380

F = 50.17569 Signif F = .0000

**** MULTIPLE REGRESION ****

Equation Number 1 Dependent Variable.. MUSIC 3
Variable(s) Entered on Step Number 1.. MUSIC 1

		Analysis of Variance			
Multiple R	.82753		DF	Sum of Squares	Mean Square
R Square	.68481				
Adjusted R Square	.66730	Regression	1	65.57037	65.57037
Standard Error	1.29485	Residual	18	30.17963	1.67665

F = 39.10806 Signif F = .0000

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. MUSIC 3
Variable(s) Entered on Step Number 1.. MUSIC 2

		Analysis of Variance			
Multiple R	.90186		DF	Sum of Squares	Mean Square
R Square	.81335				
Adjusted R Square	.80298	Regression	1	77.87788	77.87788
Standard Error	.99644	Residual	18	17.87212	.99290

F = 78.43510 Signif F = .0000

BODILY-KINESTHETIC INTELLIGENCE

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. BODY 2
Variable(s) Entered on Step Number 1.. BODY 1

Multiple R	.89849	Analysis of Variance			
R Square	.80728		DF	Sum of Squares	Mean Square
Adjusted R Square	.79658	Regression	1	52.66509	52.66509
Standard Error	.83574	Residual	18	12.57241	.69847

F = 75.40094 Signif F = .0000

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. BODY 3
Variable(s) Entered on Step Number 1.. BODY 1

Multiple R	.75438	Analysis of Variance			
R Square	.56910		DF	Sum of Squares	Mean Square
Adjusted R Square	.54516	Regression	1	31.75550	31.75550
Standard Error	1.15577	Residual	18	24.04450	1.33581

F = 23.77255 Signif F = .0001

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. BODY 3
Variable(s) Entered on Step Number 1.. BODY 2

Multiple R	.65966	Analysis of Variance			
R Square	.43515		DF	Sum of Squares	Mean Square
Adjusted R Square	.40376	Regression	1	24.28113	24.28113
Standard Error	1.32327	Residual	18	31.51887	1.75105

F = 13.86662 Signif F = .0016

INTERPERSONAL INTELLIGENCE

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. INTER 2
Variable(s) Entered on Step Number 1.. INTER 1

Multiple R	.67923	Analysis of Variance			
R Square	.46136		DF	Sum of Squares	Mean Square
Adjusted R Square	.43143	Regression	1	15.98030	15.98030
Standard Error	1.01809	Residual	18	18.65720	1.03651

F = 15.41740 Signif F = .0010

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. INTER3
Variable(s) Entered on Step Number 1.. INTER1

Multiple R	.34973	Analysis of Variance			
R Square	.12231		DF	Sum of Squares	Mean Square
Adjusted R Square	.07355	Regression	1	6.98855	6.98855
Standard Error	1.66915	Residual	18	50.14895	2.78605

F = 2.50841 Signif F = .1307

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. INTER3
Variable(s) Entered on Step Number 1.. INTER2

Multiple R	.21102	Analysis of Variance			
R Square	.04453		DF	Sum of Squares	Mean Square
Adjusted R Square	-.00855	Regression	1	2.54421	2.54421
Standard Error	1.74154	Residual	18	54.59329	3.03296

F = .83885 Signif F = .3718

STUDY 2 DATA:

These tables show the second set of where the subjects are looked at by gender and grade. The first table shows the number of male and female subjects by grade and the total number of subjects by individual grade.

SEX Gender by GRADE

Grade	4-Plus	1	2	4	5	6	7	8	9	11	12	Total
Male	3	8	33	48	27	37	12	16	12	24	19	239
Female	5	2	34	47	43	33	23	21	18	14	16	256
Total	8	10	67	95	70	70	35	37	30	38	35	495

These tables show the mean scores of the seven intelligences for male and female at each grade level and how they differ in each grade. The tables also show how the intelligences differs from grade to grade within the sexes as. The total mean score for the individual intelligence is also given and reflects whether or not it is above or below average with 4.00 being the average score.

LINGUISTIC INTELLIGENCE

FACTOR	GRADE	CODE	Mean
GRADE	4 Plus P	Male	2.333
		Female	2.400
GRADE	Grade 1	Male	4.125
		Female	2.500
GRADE	Grade 2	Male	3.970
		Female	4.882
GRADE	Grade 4	Male	3.667
		Female	3.894
GRADE	Grade 5	Male	3.963
		Female	4.488
GRADE	Grade 6	Male	3.135
		Female	3.242
GRADE	Grade 7	Male	3.167
		Female	3.000
GRADE	Grade 8	Male	3.125
		Female	2.619
GRADE	Grade 9	Male	2.833
		Female	3.389
GRADE	Grade 11	Male	2.625
		Female	3.286
GRADE	Grade 12	Male	2.895
		Female	2.688
		For entire sample	3.535

LOGICAL-MATHEMATICAL INTELLIGENCE

FACTOR	GRADE	CODE	Mean
GRADE	4 Plus P	Male	4.333
		Female	3.400
GRADE	Grade 1	Male	4.500
		Female	3.000
GRADE	Grade	Male	4.333
		Female	3.382
GRADE	Grade 4	Male	4.771
		Female	3.404
GRADE	Grade 5	Male	4.148
		Female	3.651
GRADE	Grade 6	Male	4.432
		Female	3.152
GRADE	Grade 7	Male	4.750
		Female	2.565
GRADE	Grade 8	Male	4.750
		Female	2.952
GRADE	Grade 9	Male	4.083
		Female	3.333
GRADE	Grade 11	Male	4.500
		Female	3.929
GRADE	Grade 12	Male	3.789
		Female	2.625
		For entire sample	3.830

INTRA-PERSONAL INTELLIGENCE

FACTOR	GRADE	CODE	Mean
GRADE	4 Plus P	Male	5.333
		Female	3.600
GRADE	Grade 1	Male	2.375
		Female	3.500
GRADE	Grade 2	Male	3.242
		Female	3.618
GRADE	Grade 4	Male	2.729
		Female	3.170
GRADE	Grade 5	Male	2.630
		Female	2.953
GRADE	Grade 6	Male	3.162
		Female	3.000
GRADE	Grade 7	Male	2.833
		Female	3.130
GRADE	Grade 8	Male	2.938
		Female	3.000
GRADE	Grade 9	Male	3.333
		Female	2.889
GRADE	Grade 11	Male	3.167
		Female	3.214
GRADE	Grade 12	Male	3.474
		Female	3.250
		For entire sample	3.093

SPATIAL INTELLIGENCE

FACTOR	GRADE	CODE	Mean
GRADE	4 Plus P	Male	4.333
		Female	4.800
GRADE	Grade 1	Male	4.750
		Female	4.500
GRADE	Grade 2	Male	5.000
		Female	4.588
GRADE	Grade 4	Male	4.604
		Female	4.660
GRADE	Grade 5	Male	4.852
		Female	4.512
GRADE	Grade 6	Male	5.054
		Female	4.394
GRADE	Grade 7	Male	4.083
		Female	4.391
GRADE	Grade 8	Male	4.063
		Female	3.857
GRADE	Grade 9	Male	4.167
		Female	3.778
GRADE	Grade 11	Male	4.292
		Female	3.429
GRADE	Grade 12	Male	4.789
		Female	3.875
		For entire sample	4.485

MUSICAL INTELLIGENCE

FACTOR	GRADE	CODE	Mean
GRADE	4 Plus P	Male	3.333
		Female	2.000
GRADE	Grade 1	Male	4.375
		Female	5.000
GRADE	Grade 2	Male	3.182
		Female	3.088
GRADE	Grade 4	Male	3.417
		Female	3.532
GRADE	Grade 5	Male	3.333
		Female	3.093
GRADE	Grade 6	Male	3.297
		Female	4.212
GRADE	Grade 7	Male	3.000
		Female	4.870
GRADE	Grade 8	Male	4.000
		Female	4.571
GRADE	Grade 9	Male	3.667
		Female	4.444
GRADE	Grade 11	Male	3.208
		Female	4.000
GRADE	Grade 12	Male	3.842
		Female	3.438
		For entire sample	3.600

BODILY-KINESTHETIC INTELLIGENCE

FACTOR	GRADE	CODE	Mean
GRADE	4 Plus P	Male	4.000
		Female	6.200
GRADE	Grade 1	Male	4.500
		Female	6.000
GRADE	Grade 2	Male	4.273
		Female	4.353
GRADE	Grade 4	Male	4.583
		Female	4.660
GRADE	Grade 5	Male	4.778
		Female	4.837
GRADE	Grade 6	Male	4.216
		Female	5.000
GRADE	Grade 7	Male	5.750
		Female	4.826
GRADE	Grade 8	Male	4.250
		Female	5.238
GRADE	Grade 9	Male	5.083
		Female	4.889
GRADE	Grade 11	Male	4.583
		Female	4.786
GRADE	Grade 12	Male	3.842
		Female	5.813
		For entire sample	4.701

INTER-PERSONAL INTELLIGENCE

FACTOR	GRADE	CODE	Mean
GRADE	4 Plus P	Male	4.333
		Female	5.600
GRADE	Grade 1	Male	3.375
		Female	3.500
GRADE	Grade 2	Male	4.000
		Female	4.088
GRADE	Grade 4	Male	4.229
		Female	4.681
GRADE	Grade 5	Male	4.296
		Female	4.465
GRADE	Grade 6	Male	4.703
		Female	5.000
GRADE	Grade 7	Male	4.417
		Female	5.217
GRADE	Grade 8	Male	4.875
		Female	5.762
GRADE	Grade 9	Male	4.833
		Female	5.278
GRADE	Grade 11	Male	5.625
		Female	5.357
GRADE	Grade 12	Male	5.368
		Female	6.313
		For entire sample	4.756

This table shows the significant differences between groups divided by grade and by sex for the seven intelligences.

EFFECT .. GRADE BY SEX

Variable	F	Sig. of F
LING	.88481	.547
MATH	.69405	.730
INTRA	.80765	.621
SPAT	.66001	.762
MUSIC	1.60184	.103
BODY	2.24844	.014
INTER	.47413	.907

This table shows the significant differences between groups divided by grade and by sex for each of the seven intelligences.

EFFECT .. SEX

Variable	F	Sig. of F
LING	.05367	.817
MATH	22.93170	.000
INTRA	.00279	.958
SPAT	2.19203	.139
MUSIC	2.17413	.141
BODY	8.91952	.003
INTER	4.56141	.033

*A reported significance of .000 indicates a significance of <.001.

This table shows the significant differences between groups divided by grade and by sex for each of the seven intelligences.

EFFECT .. GRADE

Variable	F	Sig. of F
LING	5.90380	.000
MATH	.71593	.710
INTRA	1.57375	.111
SPAT	2.08667	.024
MUSIC	2.27542	.013
BODY	1.12569	.341
INTER	4.60489	.000

*A reported significance of .000 indicates a significance of <.001.

The table show the mean scores for each intelligence from the 4 Plus Program through to Grade 12 for each of the sexes. There was a significant difference noted between males and females in Grade 12. See chart on the following page.

Variable BODY **Bodily-Kinesthetic Intelligence** By Variable SEXGRADE

Group	Count	Mean
M0	3	4.0000
M1	8	4.5000
M2	33	4.2727
M4	48	4.5833
M5	27	4.7778
M6	37	4.2162
M7	12	5.7500
M8	16	4.2500
M9	12	5.0833
M11	24	4.5833
M12	19	3.8421
F0	5	6.2000
F1	2	6.0000
F2	34	4.3529
F4	47	4.6596
F5	43	4.8372
F6	33	5.0000
F7	23	4.8261
F8	21	5.2381
F9	18	4.8889
F11	14	4.7857
F12	16	5.8125
Total	495	4.7010

This chart shows the significant differences between the sexes at individual grades. If there is not an *(S)* marked or if there is no table of a particular intelligence then they were non-significant.

BODILY-KINESTHETIC INTELLIGENCE

Variable=Sexgrade *S*=Significant Difference

	M12	M0	M6	M8	M2	F2	M1	M4	M11	F4	M5	F11	F7	F5	F9	F6	M9	F8	M7	F12	F1	F0
Mean Sex Gr																						
3.8421 M12																						
4.0000 M0																						
4.2162 M6																						
4.2500 M8																						
4.2727 M2																						
4.3529 F2																						
4.500 M1																						
4.5833 M4																						
4.5833 M11																						
4.6596 F4																						
4.7778 M5																						
4.7857 F11																						
4.8261 F7																						
4.8372 F5																						
4.8889 F9																						
5.0000 F6																						
5.0833 M9																						
5.2381 F8																						
5.7500 M7																						
5.8125 F12	*S*																					
6.0000 F1																						
6.2000 F0																						

The table shows the mean scores for linguistic intelligence by grade. The total also shows the average linguistic intelligence score for all the grades combined. There were several significant differences noted between many grades. See chart on the following page.

LINGUISTIC INTELLIGENCE

Variable LING By Variable GRADE

Group	Count	Mean
4 Plus P	8	2.3750
Grade 1	10	3.8000
Grade 2	67	4.4328
Grade 4	95	3.7789
Grade 5	70	4.2857
Grade 6	70	3.1857
Grade 7	35	3.0571
Grade 8	37	2.8378
Grade 9	30	3.1667
Grade 11	38	2.8684
Grade 12	35	2.8000
Total	495	3.5354

This chart shows the significance differences in the mean scores for linguistic intelligence by grade. Significant differences are marked with a ***S***, and all others not marked with a ***S*** are said to be non-significant.

Linguistic Intelligence

Variable Grade *S*=Significant Difference

Mean	Grade	4 PLUS P	GRADE 12	GRADE 8	GRADE 11	GRADE 7	GRADE 9	GRADE 6	GRADE 4	GRADE 1	GRADE 2	GRADE 5
2.3750	4 PLUS P											
2.8000	GRADE12											
2.8378	GRADE 8											
2.8684	GRADE 11											
3.0571	GRADE 7											
3.1667	GRADE 9											
3.7789	GRADE 6											
3.7789	GRADE 4											
3.8000	GRADE 1											
4.2857	GRADE 5		***S***	***S***	***S***	***S***		***S***				
4.4328	GRADE 2	***S***	***S***	***S***	***S***	***S***	***S***	***S***				

The table shows the mean scores for spatial intelligence by grade. The total also shows the average spatial intelligence for all the grades combined. No two groups are significantly different at the .050 level.

SPATIAL INTELLIGENCE

Variable SPAT		By Variable GRADE
Group	Count	Mean
4 Plus P	8	4.6250
Grade 1	10	4.7000
Grade 2	67	4.7910
Grade 4	95	4.6316
Grade 5	70	4.6429
Grade 6	70	4.7429
Grade 7	35	4.2857
Grade 8	37	3.9459
Grade 9	30	3.9333
Grade 11	38	3.9737
Grade 12	35	4.3714
Total	495	4.4848

The table shows the mean scores for musical intelligence by grade. The total also shows the average musical intelligence for all the grades combined. A significant was noted between grade 8 and grade 12. All others not marked with an *S* so not have a significant difference. See chart on the following page.

MUSICAL INTELLIGENCE

Variable MUSIC		By Variable GRADE
Group	Count	Mean
4 Plus P	8	2.5000
Grade 1	10	4.5000
Grade 2	67	3.1343
Grade 4	95	3.4737
Grade 5	70	3.1857
Grade 6	70	3.7286
Grade 7	35	4.2286
Grade 8	37	4.3243
Grade 9	30	4.1333
Grade 11	38	3.5000
Grade 12	35	3.6571
Total	495	3.6000

The chart show the significance difference in the mean scores for musical intelligence by grade. It also shows the mean scores from lowest to highest by sex and grade.

MUSICAL INTELLIGENCE

By Variable Grade *S*=Significant Difference

Mean	Grade	4 PLUS P	GRADE 2	GRADE 5	GRADE 4	GRADE 11	GRADE 12	GRADE 6	GRADE 9	GRADE 7	GRADE 8	GRADE 1
2.500	4 PLUS P											
3.1343	GRADE 2											
3.1857	GRADE 5											
3.4737	GRADE 4											
3.500	GRADE 11											
3.6571	GRADE 12											
3.7286	GRADE 6											
4.1333	GRADE 9											
4.2286	GRADE 7											
4.3243	GRADE 8		*S*									
4.500	GRADE 1											

The table shows the mean scores for inter-personal intelligence by grade. The total also shows the average inter-personal intelligence for all the grades combined. There were several significant differences noted. See chart on the next page.

INTER-PERSONAL INTELLIGENCE

Variable INTER By Variable GRADE

Group	Count	Mean
4 Plus P	8	5.1250
Grade 1	10	3.4000
Grade 2	67	4.0448
Grade 4	95	4.4526
Grade 5	70	4.4000
Grade 6	70	4.8429
Grade 7	35	4.9429
Grade 8	37	5.3784
Grade 9	30	5.1000
Grade 11	38	5.5263
Grade 12	35	5.8000
Total	495	4.7556

The chart show the significant difference in the mean scores for inter-personal intelligence by grade. It also shows the mean scores from lowest to highest by sex and grade.

INTER-PERSONAL INTELLIGENCE

By Variable Grade *S*=Significant Difference

Mean	Grade	GRADE 1	GRADE 2	GRADE 5	GRADE 4	GRADE 6	GRADE 7	GRADE 9	4 PLUS P	GRADE 8	GRADE 11	GRADE 12
3.4000	GRADE 1											
4.0448	GRADE 2											
4.4000	GRADE 5											
4.4526	GRADE 4											
4.8429	GRADE 6											
4.9429	GRADE 7											
5.1000	GRADE 9											
5.1250	4 PLUS P											
5.3784	GRADE 8		*S*									
5.5263	GRADE 11	*S*	*S*		*S*							
5.8000	GRADE 12	*S*	*S*	*S*	*S*							

These tables show the total mean and average scores for each intelligence by sex.

Linguistic Intelligence By Variable SEX

Group	Count	Mean
Male	239	3.3891
Female	256	3.6719
Total	495	3.5354

Logical Mathematical Intelligence By Variable SEX

Group	Count	Mean
Male	239	4.4310
Female	256	3.2695
Total	495	3.8303

Intra-Personal Intelligence By Variable SEX

Group	Count	Mean
Male	239	3.0293
Female	256	3.1523
Total	495	3.0929

Spatial Intelligence By Variable SEX

Group	Count	Mean
Male	239	4.6569
Female	256	4.3242
Total	495	4.4848

Musical Intelligence By Variable SEX

Group	Count	Mean
Male	239	3.4310
Female	256	3.7578
Total	495	3.6000

Bodily-Kinesthetic Intelligence By Variable SEX

Group	Count	Mean
Male	239	4.4979
Female	256	4.8906
Total	495	4.7010

Inter- Personal Intelligence By Variable SEX

Group	Count	Mean
Male	239	4.5649
Female	256	4.9336
Total	**495**	**4.7556**

The student data was further subdivided into four groups for further analysis. For ease of interpretation the grades were grouped into four groups. The groups are primary grades 0-2, upper elementary grades 3-5, middle school grades 6-8, and high school 9-12. The numbers of subjects and their percentages can be found in the diagram below.

	Primary	Upper	Middle	High	Percent	Total
Male	44	75	65	55	48.3	239
Female	41	90	77	48	51.7	256
Percent	17.2	33.3	28.7	20.8	100	
Total	85	165	142	103		495

This table shows the mean scores in linguistic intelligence between the sexes at the four previously mentioned levels. The average for the entire sample is given as well.

Linguistic Intelligence

FACTOR		CODE	Mean
GRADE	Primary	Male	3.886
		Female	4.463
GRADE	Upper	Male	3.773
		Female	4.178
GRADE	Middle	Male	3.138
		Female	3.000
GRADE	High	Male	2.764
		Female	3.125
		For entire sample	3.535

This table shows the mean scores in logical-mathematical intelligence between the sexes at the four levels. The average for the entire sample is given as well.

Logical Mathematical Intelligence

FACTOR		CODE	Mean
GRADE	Primary	Male	4.364
		Female	3.366
GRADE	Upper	Male	4.547
		Female	3.522
GRADE	Middle	Male	4.569
		Female	2.922
GRADE	High	Male	4.164
		Female	3.271
		For entire sample	3.830

This table shows the mean scores in intra-personal intelligence between the sexes at the four levels. The average for the entire sample is given as well.

Intra-Personal Intelligence

FACTOR		CODE	Mean
GRADE	Primary	Male	3.227
		Female	3.610
GRADE	Upper	Male	2.693
		Female	3.067
GRADE	Middle	Male	3.046
		Female	3.039
GRADE	High	Male	3.309
		Female	3.104
		For entire sample	3.093

This table shows the mean scores for spatial intelligence between the sexes at the four levels. The average for the entire sample is given as well.

Spatial Intelligence

FACTOR		CODE	Mean
GRADE	Primary	Male	4.909
		Female	4.610
GRADE	Upper	Male	4.693
		Female	4.589
GRADE	Middle	Male	4.631
		Female	4.247
GRADE	High	Male	4.436
		Female	3.708
		For entire sample	4.485

This table shows the mean scores for musical intelligence between the sexes at the four levels. The average for the entire sample is given as well.

Musical Intelligence

FACTOR		CODE	Mean
GRADE	Primary	Male	3.409
		Female	3.049
GRADE	Upper	Male	3.387
		Female	3.322
GRADE	Middle	Male	3.415
		Female	4.506
GRADE	High	Male	3.527
		Female	3.979
		For entire sample	3.600

The table shows the mean scores for bodily-kinesthetic intelligence between the sexes at the four levels. The average for the entire sample is given as well.

Bodily-Kinesthetic Intelligence

FACTOR		CODE	Mean
GRADE	Primary	Male	4.295
		Female	4.659
GRADE	Upper	Male	4.653
		Female	4.744
GRADE	Middle	Male	4.508
		Female	5.013
GRADE	High	Male	4.436
		Female	5.167
		For entire sample	4.701

The table shows the mean scores for inter-personal intelligence between the sexes at the four levels. The average for the entire sample is given as well.

Inter- Personal Intelligence

FACTOR		CODE	Mean
GRADE	Primary	Male	3.909
		Female	4.244
GRADE	Upper	Male	4.253
		Female	4.578
GRADE	Middle	Male	4.692
		Female	5.273
GRADE	High	Male	5.364
		Female	5.646
		For entire sample	4.756

This table shows the significant difference that grouping by level and by sex for each of the seven intelligences.

EFFECT .. GRADE BY SEX

Variable	F	Sig. of F
LING	1.01726	.385
MATH	1.04134	.374
INTRA	1.14035	.332
SPAT	.88168	.450
MUSIC	4.11116	.007
BODY	.89855	.442
INTER	.20220	.895

This table shows the significant difference that grouping by level and sex for each of the seven intelligences.

EFFECT .. SEX

Variable	F	Sig. of F
LING	3.60610	.058
MATH	40.72606	.000
INTRA	.99911	.318
SPAT	7.02716	.008
MUSIC	2.97804	.085
BODY	7.79478	.005
INTER	5.56704	.019

*A reported significance of .000 indicates s significance of <.001.

This table shows the significant difference that grouping by level and sex for each of the seven intelligences.

EFFECT .. GRADE

Variable	F	Sig. of F
LING	15.29970	.000
MATH	.80730	.490
INTRA	2.83140	.038
SPAT	3.98609	.008
MUSIC	4.66333	.003
BODY	.73230	.533
INTER	13.67412	.000

This table shows the average means between the sexes at the four levels in the area of musical intelligence. The average mean for the total group is also shown. Only those intelligences with a significant difference are shown. Musical intelligence is the only intelligence that showed significant difference by sex/grade. The other six intelligences did not show a significant difference by sex/grade. See chart below.

Variable MUSIC Musical By Variable SEXGRADE

Group	Count	Mean
M Primary	44	3.4091
M Upper	75	3.3867
M Middle	65	3.4154
M High	55	3.5273
F Primary	41	3.0488
F Upper	90	3.3222
F Middle	77	4.5065
F High	48	3.9792
Total	495	3.6000

The chart shows the significant difference between the sexes at the four levels.

Musical Intelligence by Variable Sex Group Grade
S=Significant Difference

Mean	Sex	Grade	F PRIMARY	F UPPER	M UPPER	M PRIMARY	M MIDDLE	M HIGH	F HIGH	F MIDDLE
3.0488	F	PRIMARY								
3.3222	F	UPPER								
3.3867	M	UPPER								
3.4091	M	PRIMARY								
3.4154	M	MIDDLE								
3.5273	M	HIGH								
3.9792	F	HIGH								
4.5065	F	MIDDLE	*S*	*S*	*S*	*S*	*S*	*S*		

The table shows the average means for linguistic intelligence at the four levels. The total average mean is shown as well. Only those levels with a significant difference will be shown. Linguistic, spatial, interpersonal and intrapersonal do show significant differences by grade while mathematical, bodily-kinesthetic, and musical intelligences did not show significant differences in by grade. See chart below.

Linguistic Intelligence By Variable GRADE

Group	Count	Mean
Primary	85	4.1647
Upper	165	3.9939
Middle	142	3.0634
High	103	2.9320
Total	495	3.5354

The chart shows the significance difference in linguistic intelligence by grade at the four levels.

Linguistic Intelligence By Variable Grade

S=Significant Difference

Mean	Grade	High	Middle	Upper	Primary
2.9320	High				
3.0634	Middle				
3.9939	Upper	*S*	*S*		
4.1647	Primary	S	*S*		

The table shows the average means for intra-personal intelligence at the four levels.

Intra-Personal Intelligence By Variable GRADE

Group	Count	Mean
Primary	85	3.4118
Upper	165	2.8970
Middle	142	3.0423
High	103	3.2136
Total	495	3.0929

The chart shows the significant difference in intra-personal intelligence by the four levels. If two levels show a significant difference it will be marked with a S. All others do not show a significant difference.

Intra-Personal Intelligence By Variable Grade

S=Significant Difference

Mean	Grade	Upper	Middle	High	Primary
2.8970	Upper				
3.0423	Middle				
3.2136	High				
3.4118	Primary	*S*			

This table shows the average means for spatial intelligence at the four levels. The total average mean is shown.

Spatial Intelligence By Variable Grade

Group	Count	Mean
Primary	85	4.7647
Upper	165	4.6364
Middle	142	4.4225
High	103	4.0971
Total	495	4.4848

This chart shows the significant difference in spatial intelligence by the four levels.

Spatial Intelligence By Variable Grade

S=Significant Difference

Mean	Grade	High	Middle	Upper	Primary
4.0971	High				
4.4225	Middle				
4.6364	Upper	*S*			
4.7647	Primary	*S*			

This table shows the average mean scores for inter-personal intelligence at the four levels.

Inter- Personal Intelligence By Variable GRADE

Group	Count	Mean
Primary	85	4.0706
Upper	165	4.4303
Middle	142	5.0070
High	103	5.4951
Total	495	4.7556

This chart show the significant difference in inter-personal intelligence at the four levels.

Inter-Personal Intelligence By Variable Grade

S=Significant Difference

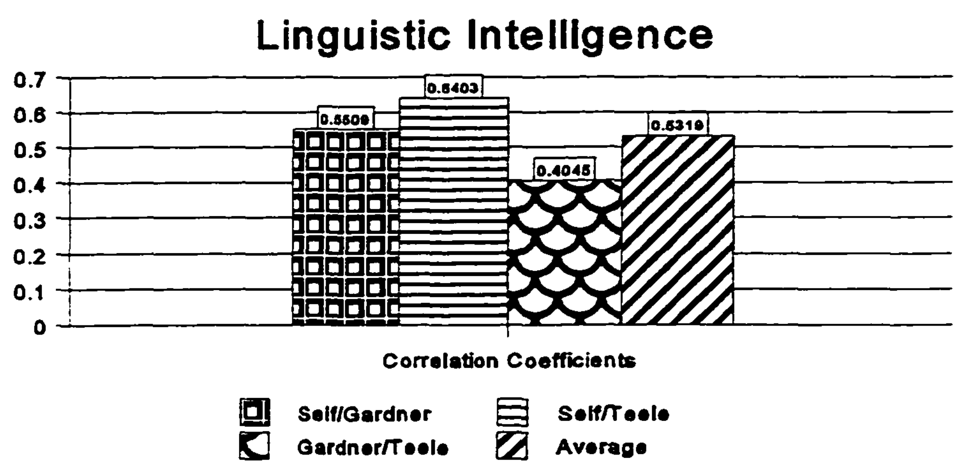
Mean	Grade	Primary	Upper	Middle	High
4.0706	Primary				
4.4303	Upper				
5.0070	Middle	*S*	*S*		
5.4951	High	*S*	*S*		

CHAPTER 4

DISCUSSION

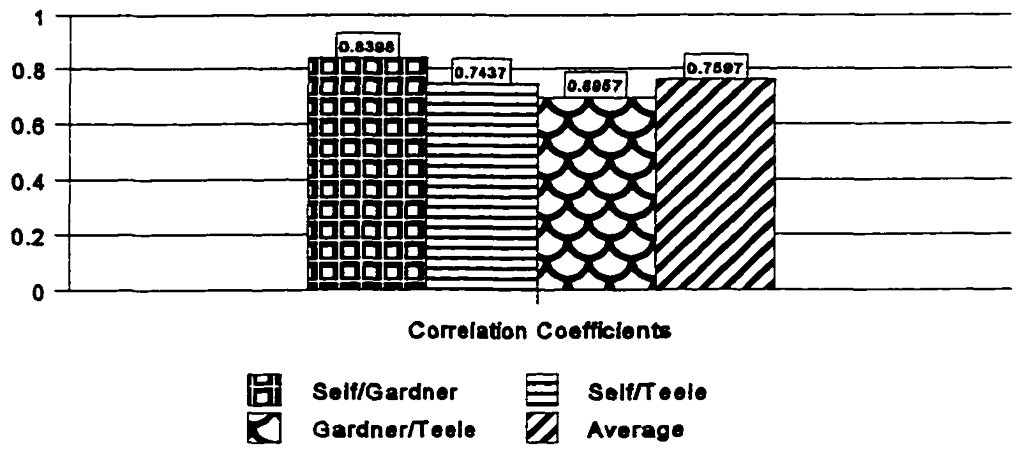
Teacher Data:

Teacher data was gathered on how the 20 teachers ranked their order of preference on the self-assessment, the Gardner inventory, and the Teele inventory. Correlation coefficients between the 3 instruments will be compared.

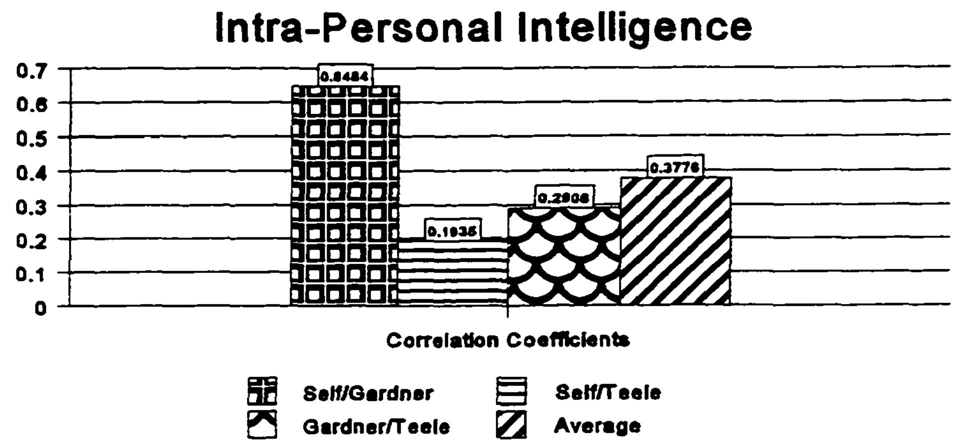


Based on these correlations it is not clear that the three tests are a good measure of a person's linguistic intelligence. The self-assessment/Teele scored the highest at (R=.64026, Sig=.0024). The self-assessment/Gardner (R=.55087, Sig=.0118) and Gardner/Teele (R=.40448, Sig=.0769) were lower and did not reach acceptable significance levels. Teele's panda bears were clear for the most part as the panda bears were usually reading a book, spelling or writing.

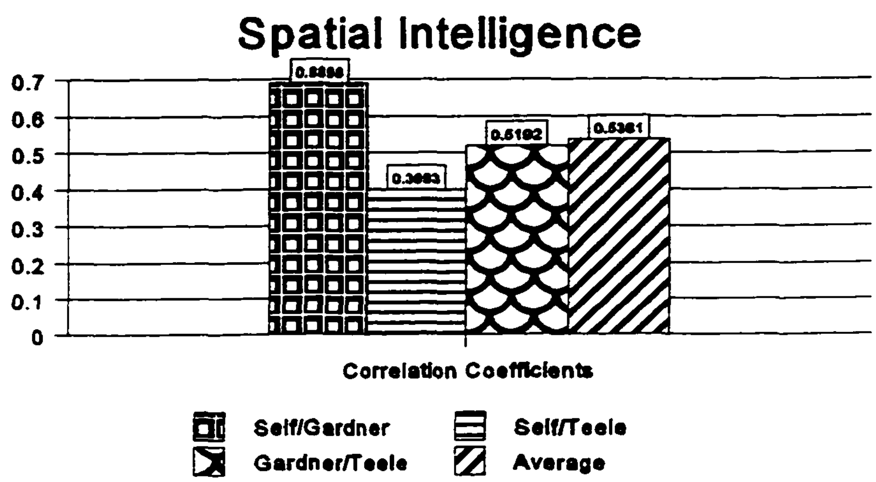
Logical-Mathematical Intelligence



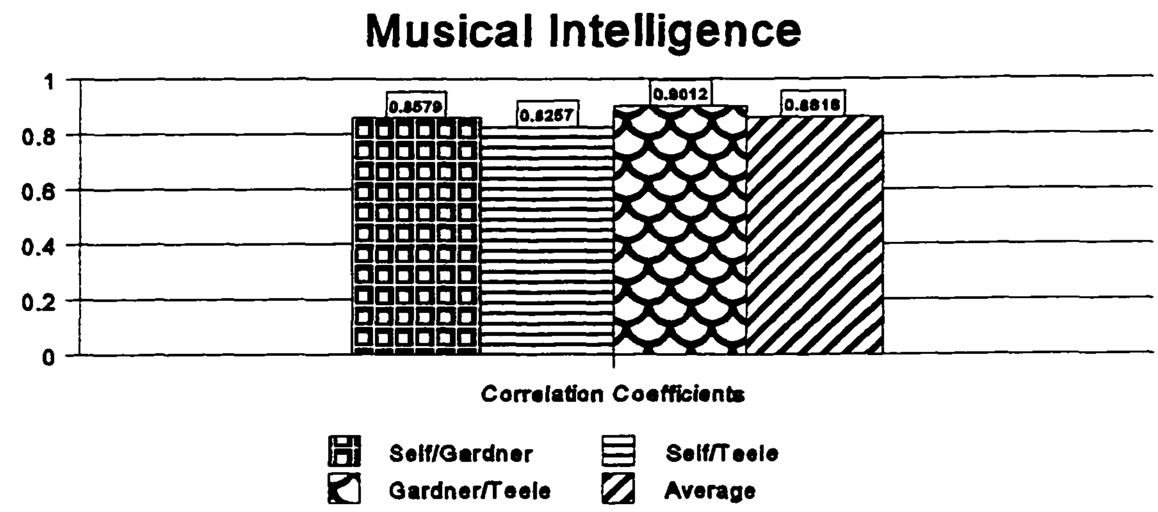
All three correlations were very high in the area of mathematical intelligence. This may indicate that all three tests are good predictors of mathematical intelligence. The highest correlation in logical-mathematical intelligence was between the self-assessment/Gardner at (R=.83981, Sig=.0000) The self/Teele (R=.74374, Sig=.0002) and Gardner/Teele (R=.69570, Sig=.0007) were also quite high. If we could find out why math was so easy to predict and relate it to the other areas of intelligence some improvements could be made in the measurement of those areas. It is possible that mathematical intelligence is easier than some of the other intelligences to assess because there is not as much ambiguity. When a subject sees numbers and formulas they know that it is logical-mathematical intelligence that the test instrument is trying to measure. Teele's pictures of the panda bear's were quite clear because they dealt with numbers or charts on a chalkboard or notebook. The subjects were clearly selecting mathematical over the other paired intelligence in Teele's inventory.



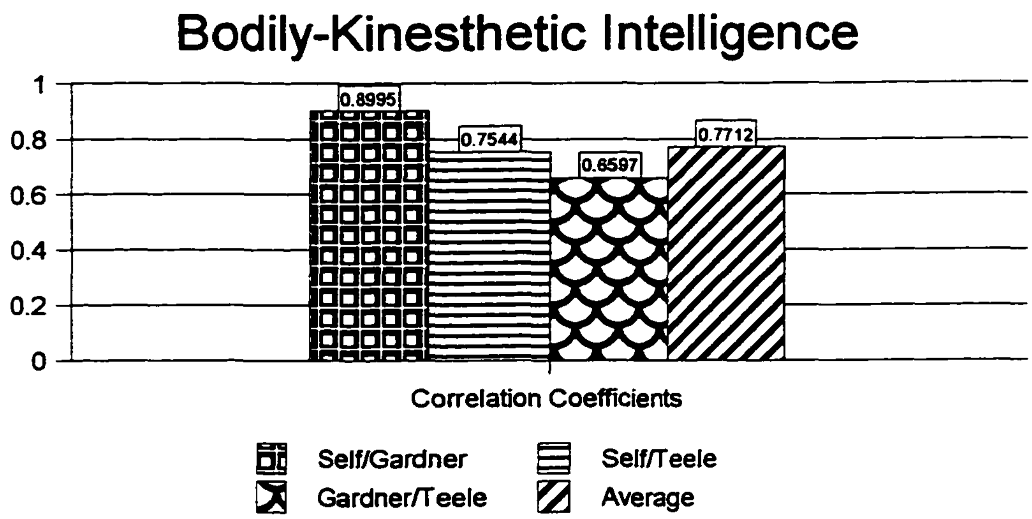
The highest correlation in intrapersonal intelligence was between the self-assessment and the Gardner at (R=.64836, Sig=.0020). The Gardner/Teele (R=.29877, Sig=.2007 and the Self-assessment/Teele (R=.19349, Sig=.4137) were quite low. Test makers will have to take a serious look at what they are trying to measure on these tests and try to make some adaptions that may better enable their tests to accurately measure what they are trying to find. It is possible the subjects had difficulty telling whether Teele's panda bears were displaying intrapersonal intelligence while working on their own or displaying some other kind of intelligence. They could have been displaying bodily-kinesthetic intelligence.



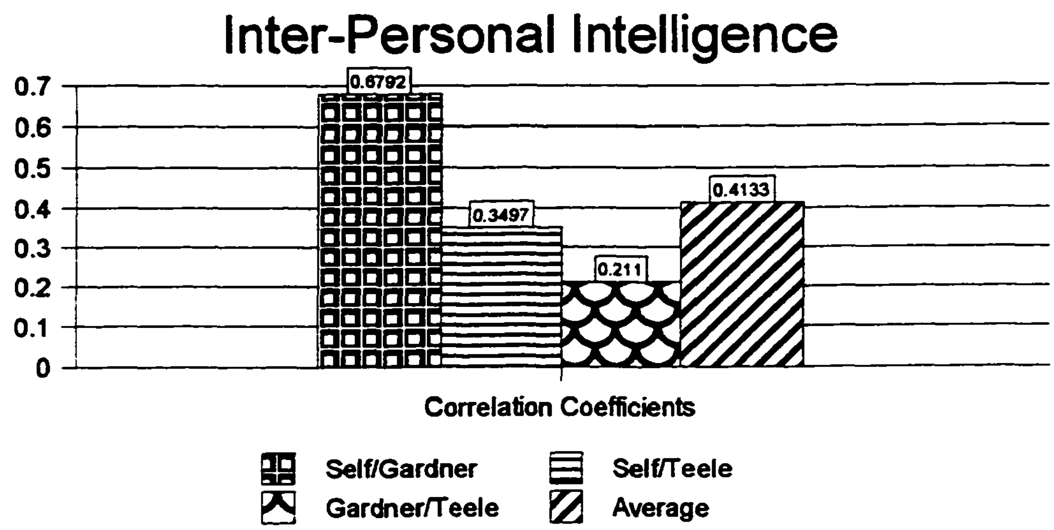
Once again the highest correlation in spatial intelligence was between the self-assessment/Gardner with a correlation of (R=.68979, Sig=.0008). The Gardner/Teele correlation (R=.51917, Sig=.0190) and the self-assessment/Teele correlation (R=.39934, Sig.0811) are below acceptable significance levels. Teele's panda bears may have created some ambiguity here in that a bear playing with building blocks may have been a bear displaying intrapersonal intelligence by preferring to playing alone as opposed to playing with a group of bears. The Gardner Likert scale could have been a benefit here as well for the subjects rather than giving subjects yes or no choices in a checklist as to whether or not they display spatial intelligence to some degree. I think with a Likert scale you would find subjects seeing themselves as having some degree of spatial intelligence, without thinking they had to be of the same stature as a Buckminster Fuller or Frank Lloyd Wright.



The highest correlation in musical intelligence was between the Gardner/Teele (R=.90186, Sig=.0000). The self-assessment/Gardner (R=.85789, Sig=.0000) and self-assessment/Teele (R=.82753, Sig=.0000) were also very high. The average correlation was .8616. All three tests are very good predictors of musical intelligence. These tests scored the highest average correlation and it can be safely said that these tests do measure a person's musical intelligence. It may also be very possible that musical intelligence is concrete and more easily measured. Teele's inventory was quite clear in terms of musical intelligence. The panda bears were usually playing with a musical instrument of some sort which made it clear to the subjects that they were choosing musical intelligence over the other paired intelligence. Gardner's checklist was easier to assess. Most people who play musical instruments have an interest in that area while people who read books are not always reading because it is something they enjoy.

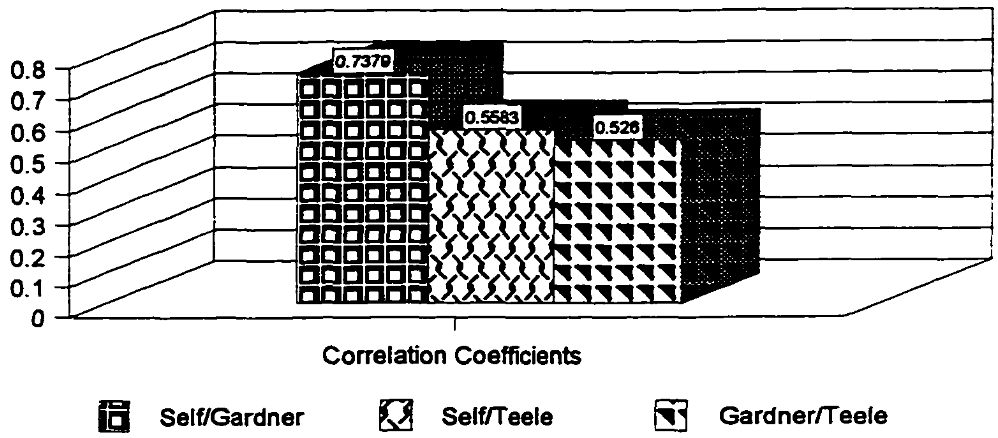


Once again the highest correlation for bodily-kinesthetic intelligence was the self-assessment/Gardner with a correlation of (R=. 89849, Sig=.0000). The self-assessment/Teele (.75438, Sig=.0001), and the Gardner/Teele (R=.65966, Sig=.0016) were also high and above acceptable levels of significance. The average correlation was .7712. The three test instruments are good predictors of a person's bodily-kinesthetic intelligence. It is possible that from the questions asked on the checklist and the pictures from the Teele inventory that the subjects measure of bodily-kinesthetic can be successfully measured. Most bears were clearly playing some type of sport or game whether in a group or by themselves. Gardner's checklist would be more positive to the subjects as well because they would be identifying activities that they enjoy participating in as opposed to something where they are not sure of their level of interest in.



The highest correlation once again for interpersonal intelligence was the self-assessment/Gardner at (R=.67923, Sig=.0010). The self-assessment/Teele (R=.34973, Sig=.1307) and Gardner/Teele (R=.21102, Sig=.3718) had very low correlations. With correlations this low it is very possible that they are not measuring what they have attempted to do and some adaptions should be made with these tests. In the case of the panda bears there may be some ambiguity with three bears playing, singing or working together in a group. Are these bears displaying interpersonal intelligence or bodily-kinesthetic, musical or some other type of intelligence. In the case of Gardner's checklist we have the same problem in terms of the degree as to how much we like doing something. We all have various interactions with people, but the degree as to how much we enjoy this is sometimes difficult to measure.

Average Correlation



The highest average correlation was between the self-assessment and the Gardner inventory with a correlation of .7379. The self-assessment and the Teele had an average correlation of .5583 while the Gardner/Teele had an average correlation of .5260.

Summary:

Based on the results of the study some differences exist. The higher the correlation the easier an intelligence is to measure. Logical-mathematical intelligence .7579, musical intelligence .8616 and bodily-kinesthetic intelligence .7712 had high correlations and the three test instruments can be used as adequate predictors of these intelligences. Conversely, linguistic intelligence .5319, intra-personal intelligence .3776, spatial intelligence .5361 and inter-personal intelligence .4133 have low correlations and are not as easily measured. The question of which instrument is the best predictor of a person's multiple intelligences is still open for debate. Another instrument may be necessary if we want to accurately assess a person's multiple intelligences. More work is needed is needed in the areas of linguistic, intra-personal, spatial and inter-personal intelligences to improve the accuracy of the test instrument. However, these three instruments could act as a guide to show where improvements can be made.

Since the experiment was completed nine months ago I have found some improvements made to one of the above test instruments. Gardner's Inventory of Multiple Intelligences (Armstrong, 1994) now uses a Likert Scale to measure the level of a person's multiple intelligence. I see this as a major improvement, because, previous to this the subject had to do a checklist and was not sure as to what degree the statements seemed like them. The five point Likert scale allows for this degree to be measured. This type of instrument is much more sensitive. It allows for a range from 10 to 50 as opposed to 0 to 10. This scale with a range of 40 is four times more sensitive than the scale with a range of 10. It should be noted that five point scales are difficult for young children. They can manage two and three point scales. The subjects dilemma is now easier because of the wider range of choices. The Teele Inventory for Multiple Intelligences (Teele, 1995) could I think also benefit from this type of instrument as well. There could still be the paired choices, but subjects would be allowed to choose to what degree they feel the pictures of the panda bears are most like them. This would alleviate the problem that the subjects had with the forced choice. The scores in both of these test instruments could still be tabulated and I think we would get a score closer to that subject's actual interest in the seven intelligences. Another possibility that may help the Teele Inventory would be the use of simple phrases below the sets of pictures. There was a problem for some subjects recognizing what some of the panda bear pictures represented.

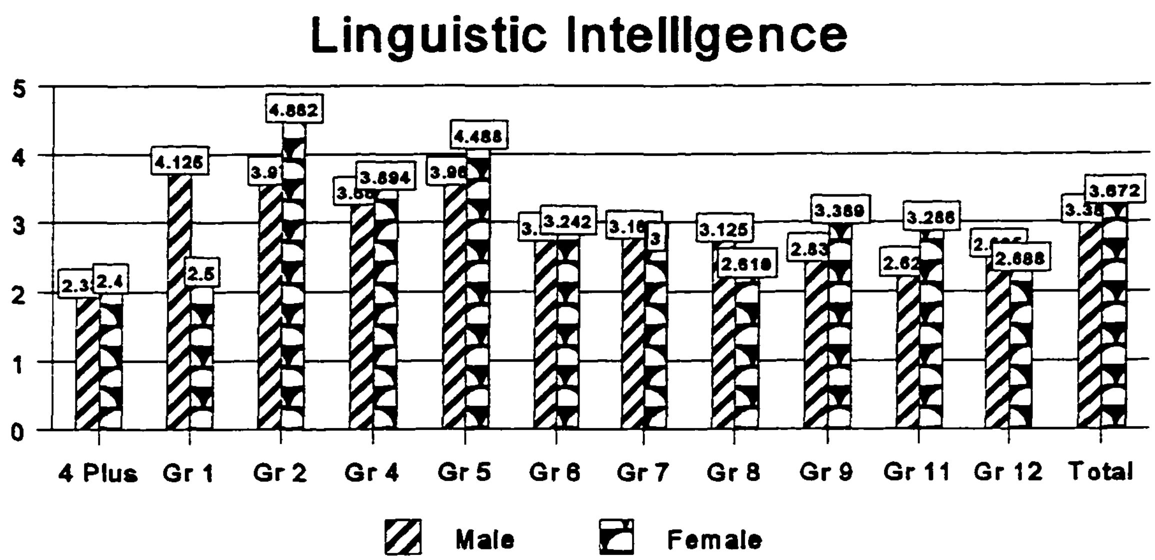
Student Data:

Student data was gathered on individual grade levels (4-Plus program, Grade 1, 2,4,5,6,7,8,9,11, and 12) as well as grouping the grades into four levels; Primary which includes 4-Plus, Grade 1 and 2; Upper Elementary which includes Grades 4 and 5; Middle school which includes Grades 6,7 and 8; and High School which includes Grade 9, 11 and 12. There were no subjects form either grade 3 or grade 10 that took part in the study.

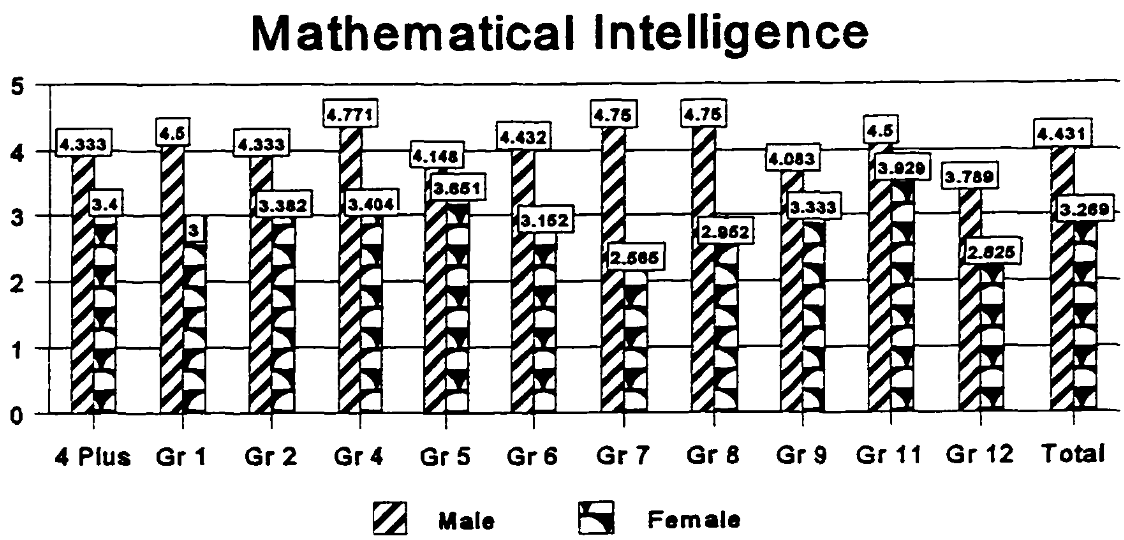
The data will be discussed as it relates to gender and individual grade differences in Gardner's list of 7 intelligences (linguistic, logical-mathematical, musical, spatial, bodily-kinesthetic, intra-personal, and inter-personal intelligence).

There will as well be some analysis of the data as it compares to the data collected by Dr. Sue Teele from the University of California at Riverside. Dr. Teele has collected data on over 10,000 students from all across North America who have taken her (TIMI) inventory of multiple intelligences (Teele, 1995).

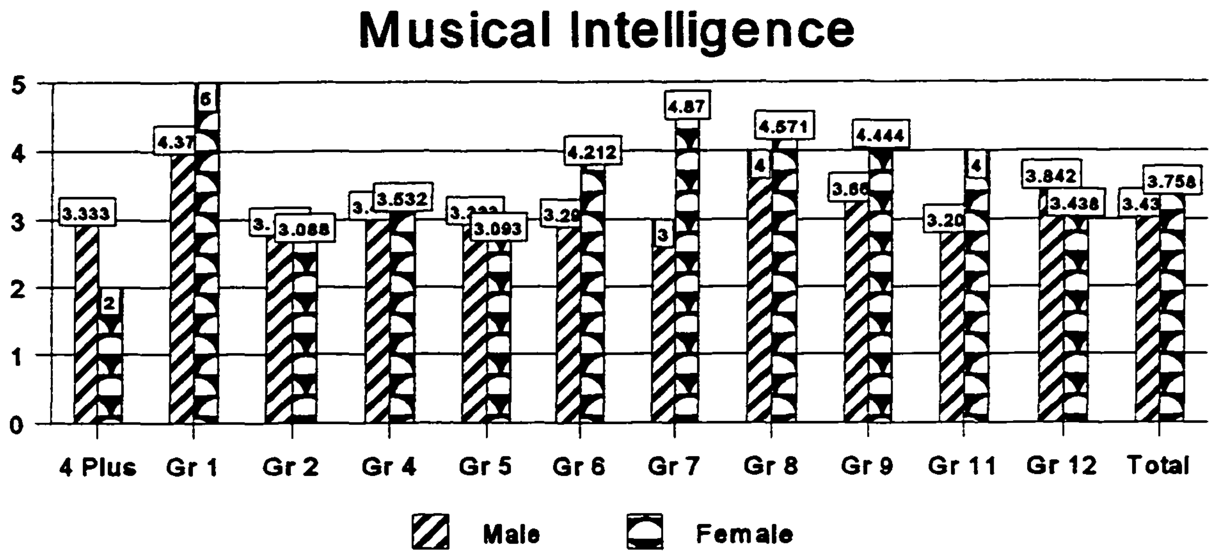
Gender Data By Grade:



Females scored slightly higher than males in linguistic intelligence with grades 2,5, 9 and 11 showing much higher levels for the females. Males scored much higher in linguistic intelligence in grade 1 although the numbers are too small to show a significant difference. Although it was predicted that females would score significantly higher than males in the area of linguistic intelligence the total of 3.672 for the females and 3.389 for the males does not show a significant difference. The interesting trend that follows for both the male and female is that linguistic intelligence is high in the early grades and then declines as the subjects continue throughout their school years. When we look at linguistic intelligence we see that the highest scores are from grades one through grade five and then there is a decline through to high school. The scores indicate that students may be more receptive to learning linguistic skills in the early grades and that more emphasis should be placed on these skills in the later grades. The use of journals is an effective way for students to develop this intelligence (Bellanca et all, 1994, p.71).

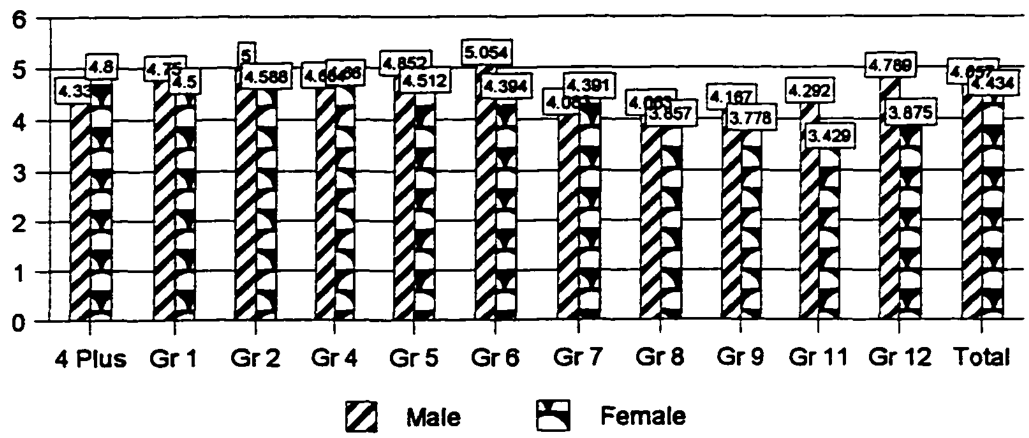


Males scored much higher than the females in logical-mathematical intelligence 4.43 to 3.27. Of interest to note here is that males scored much higher at every grade and the females mean score never reached 4.00. Only once did the male score dip below that level and that was in grade 12 where their score was 3.79. It was predicted that males would score higher than females in logical-mathematical intelligence, however it should be noted that this does not mean that females are weaker in their math skills than males, only that it is not their preferred interest in learning skills. There appears to be several grades where more emphasis should be placed on logical-mathematical intelligences for females. Grade 7 would be once such grade where more work in the area of logical-mathematical intelligences is needed. This may be reflected in girls lack of confidence in math classes. Boys and girls think differently, exhibit different strategies, when it comes to problem solving (Carr & Jessup, 1997, Ryan & Pintrich, 1997). This strategies can be further enhanced through cooperative learning groups (Campbell, 1994, p.43)



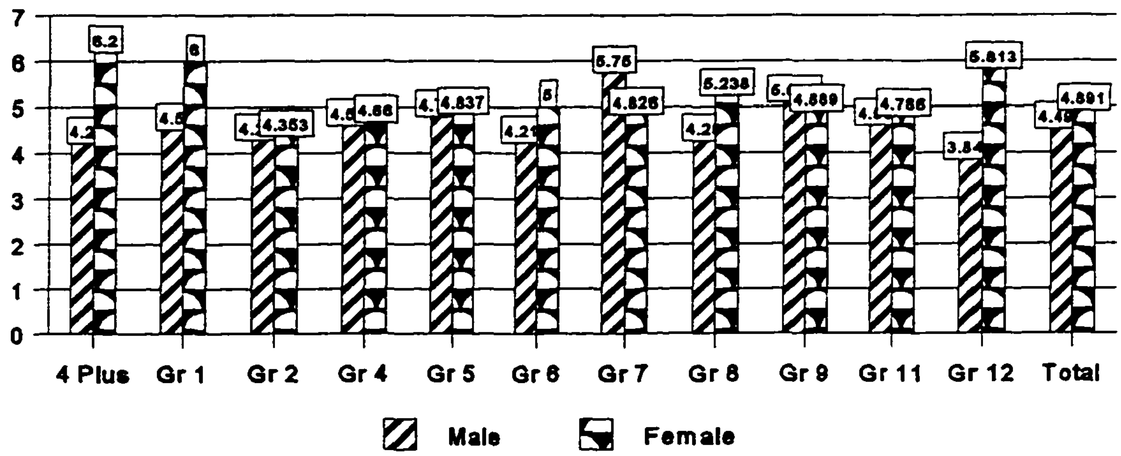
Females scored slightly higher than the males in musical intelligence by a score of 3.75 to 3.43. This was most evident through grades 6 to 11 where the females scores were in the 4.00 to 5.00 range. Meanwhile male scores remained constant throughout as their scores fell in the 3.00 to 4.00 range. Although male scores went up in the junior high years they did not experience the same growth as their female counterparts. This may possibly be due to the point that more females than males are involved in musical activities in the middle grades. More emphasis should be placed on musical intelligences for all students in the elementary and high school years. The opportunity should be given to all students to experience growth in musical intelligence. Some type of musical activity should be introduced into the classroom to give students the opportunity to develop their musical intelligence (Campbell, 1994 p.83). The school system should be careful not to create an elite class of musical students whose design is to separate students based on wealth and social standing (Bellanca et all, 1994, p.86).

Spatial Intelligence



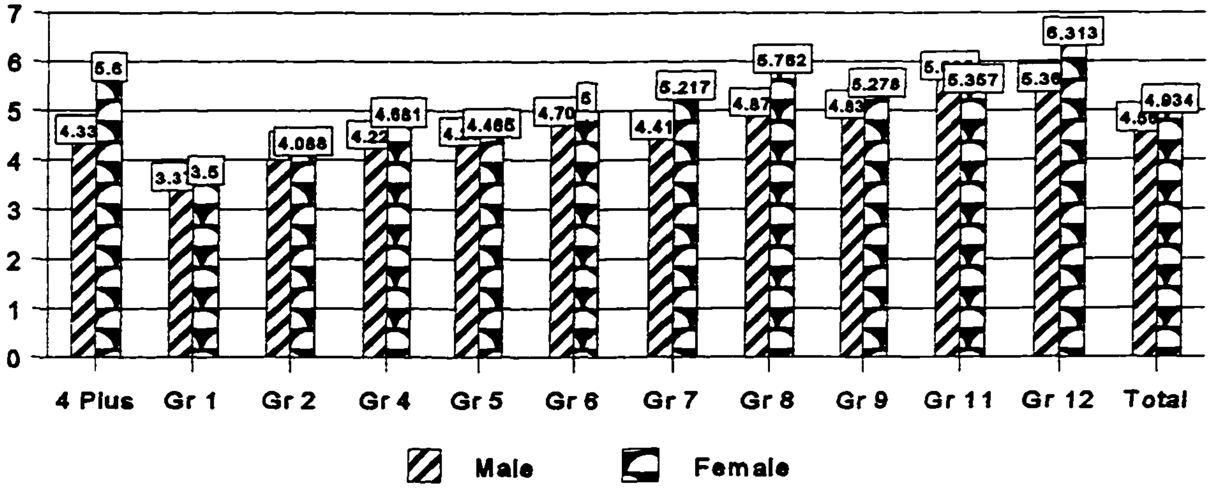
Males scored slightly higher than females in spatial intelligence and this was especially evident at grades 2, 5,6, 10 and 11. Universally sex differences are more pronounced in tests of spatial skills than for any other intelligence and Gardner speculates, the reason males score higher than females may be due to genetic selection, dating back to the hunting-gathering days (Grow, 1995). Although no prediction was made on which sex would score higher in the area of spatial intelligence; it is interesting to point out that while the male score shows a slight drop in the higher grades the females at the same time showed a greater drop in their scores. Spatial intelligence for males is average to above average through all their school years, while at the same time female scores dip below average in grade 8 and continue through to grade 12. With spatial intelligence scores being well above average for both males 4.66 and females 4.32 The school system should emphasize more instructional activities to take advantage to the students' proclivities in this area (Teele, 1994, p. 15-16). Some teacher training with the use of manipulatives maybe necessary in this area (Campbell et all, 1992, p.83).

Bodily-Kinesthetic Intelligence

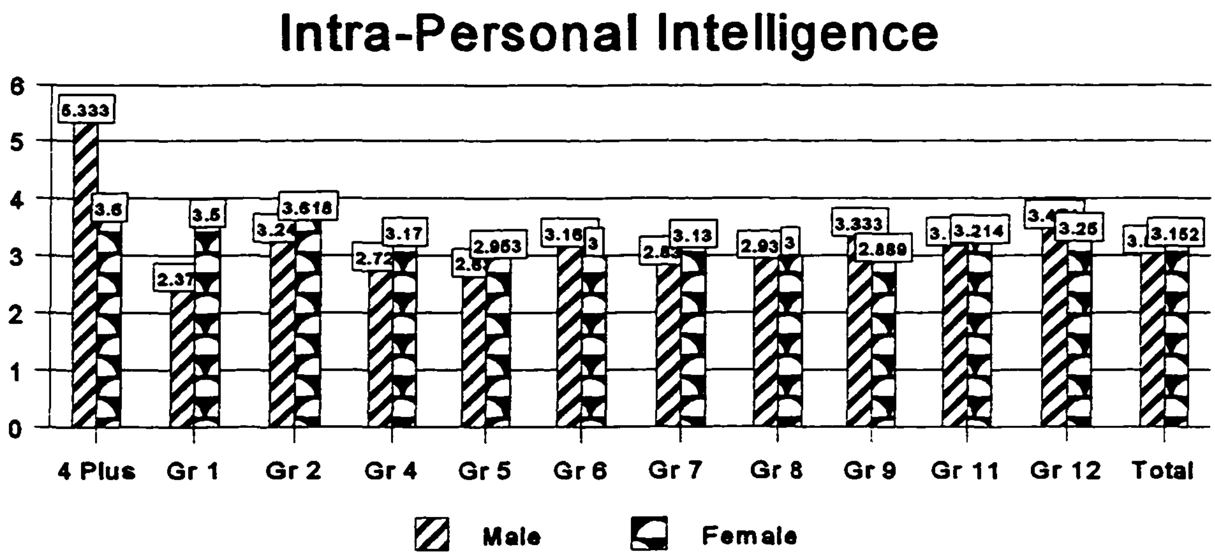


Both males and females scored high in bodily-kinesthetic intelligence with the females scoring slightly higher 4.891 to 4.498. Although it was predicted that the males would score higher in bodily-kinesthetic intelligence this is obviously not the case. The males scored much higher at grade 7 and the females scored much higher in grades 6, 8 and 12. Male scores showed no consistent pattern as they went up and down from grade to grade. Conversely female scores were well above average throughout all the grades. The average mean score for bodily-kinesthetic intelligence was a close second to interpersonal intelligence and both male and female scores were quite high at all grades. More consideration should be given to instructional activities that would take advantage of the students interest in this area (Campbell et all, 1992, p.8). If this is an area that students enjoy participating in then it should be exploited. Once subjects have found keen areas of interest then other intelligences maybe be introduced through these activities. The bodily-kinesthetic intelligence might be introduced in the writing classroom by closely describing an action, or by characterizing a person through gesture, rhythm, and ways of moving (Grow, 1995).

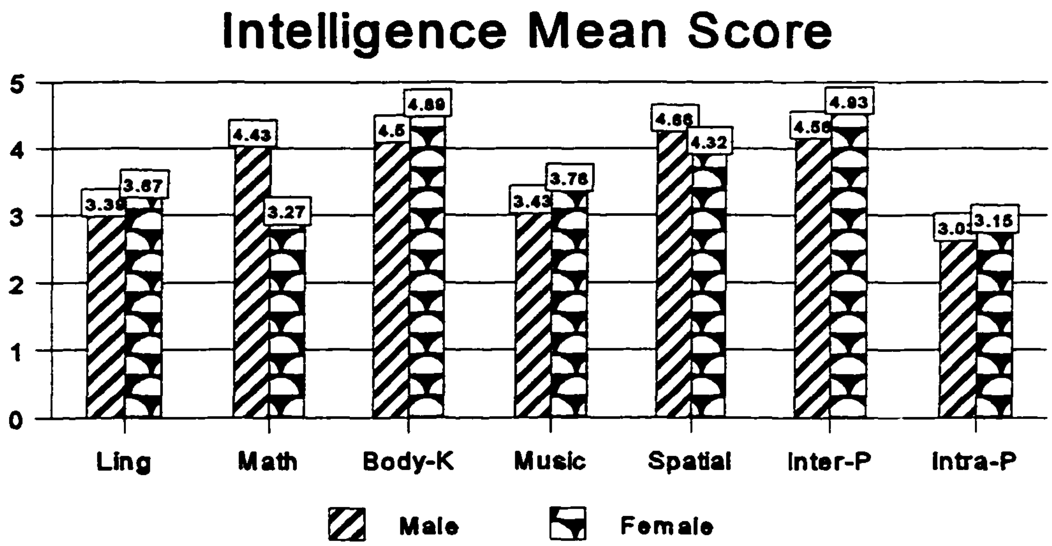
Inter-Personal Intelligence



Interpersonal intelligence for both male and female once again was high with the females scoring slightly higher 4.93 to 4.57. It was predicted that the females would score higher in this area. The females scored higher at grades 4, 7,8, 9 and 12. Of interest to note in the area of interpersonal intelligence is that the scores for both male and female rose dramatically from year to year peaking in the high school years. The interpersonal intelligence mean score was the highest of all the seven intelligences. With this being the case instructional activities should be designed so that cooperative learning groups involving both male and female participants can be set up to discuss strategies for the other six intelligences (Bellanca et all, 1994, p. 170-171). This opportunity may give elevation to conflict resolution groups that enable students with the tools to solve problems encountered when dealings with their peers (Campbell, 1994, p.133). As students reach adolescence relationships are no longer based on the physical rewards from others. But rather on psychological support and understanding that an empathetic person can provide (Gardner, 1983, p.250).



There was no huge difference in intrapersonal intelligence between male and female and the scores remained constant throughout the grades well below average. It was predicted that males would score higher in the area of intrapersonal intelligence. This prediction did not happen as the females scored slightly higher than the males 3.15 to 3.09. Intrapersonal intelligence was the closest in terms of scores for males and females of all the seven intelligences. Intrapersonal intelligence was also the lowest of the seven intelligences in terms of mean scores for both male and female. It is possible that students are not getting enough time to clearly think on their own and make independent decisions. Instructional activities should be designed to let students examine their own inner conscience and become free thinkers, nurturing the sense of self (Campbell et all, 1992, p. 138), rather than the common approach of trying to wow students with volumes of inundating material that does not beg analysis. Intrapersonal intelligence clearly being the lowest for both male and female needs a new instructional approach. Ellison (1992) uses multiples intelligences to set goals in the classroom as an effective teaching strategy.



The most significant difference between the sexes is in the area of logical mathematical intelligence where the male score is 4.43 and the female score is 3.26. It is clear from the data that researchers need to examine the ways in which girls and boys approach problem solving (Carr & Jessup, 1997, p. 327). For both male and female interpersonal, bodily-kinesthetic and spatial intelligences were well above average in their mean scores while linguistic, music and intrapersonal intelligences were well below average in their mean scores. Other than the obvious mathematical difference which had the male well above average and the females well below average, there is consistency among the sexes in the other six intelligences. As the male and females scores for interpersonal intelligence is well above average their corresponding scores for intrapersonal intelligence are well below average. This holds true for bodily-kinesthetic and spatial intelligences being above average and linguistic and musical intelligences being well below average for both sexes. While educators have consistently noted differences among learners, they have been strongly inclined to embrace the notion that all students can learn in similar ways (Gardner, 1991, p. 244).

Chisholm vs Teele Results:

I will compare the Halifax area students' results to the stats that Dr. Teele already has in her data bank. I will show how they compare on a grade level, as well on the four levels of primary, upper elementary, middle school and high school. I will also compare gender data at the grade intervals of 4, 7, 9 and 12. Gender data for Teele was also available at grade 1, but I chose not to show these comparisons because my grade 1 sample was too small.

Grade Level:

(Teele=T)(Chisholm=C)

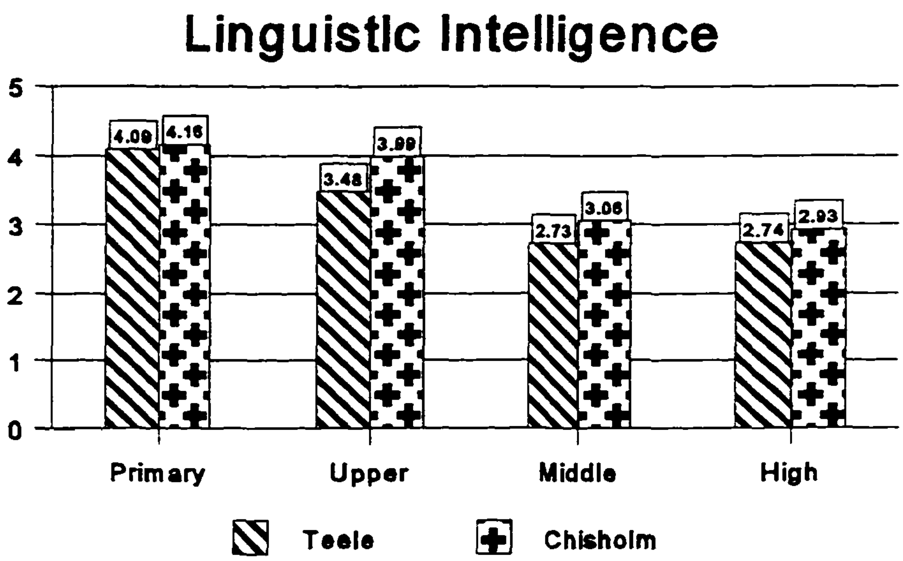
Gr	Ling		Math		Spatial		Music		Bodily		Intra-P		Inter-P	
	T	C	T	C	T	C	T	C	T	C	T	C	T	C
0	4.07	2.38	3.61	3.75	4.84	4.63	3.24	2.50	4.54	5.38	4.05	4.25	3.61	5.13
1	3.98	3.80	4.29	4.20	4.72	4.70	3.35	4.50	4.14	4.80	3.61	2.60	3.84	3.40
2	4.21	4.32	4.27	3.85	4.54	4.79	3.28	3.13	4.39	4.31	3.30	3.43	3.88	4.05
4	3.87	3.78	3.88	4.10	4.84	4.63	3.96	3.48	4.56	4.62	2.96	2.95	3.94	4.45
5	3.45	4.29	3.66	3.84	4.88	4.64	3.86	3.19	4.62	4.81	2.95	2.83	4.59	4.40
6	3.01	3.19	3.38	3.83	5.01	4.74	3.66	3.73	5.11	4.59	2.94	3.09	4.83	4.84
7	2.71	3.06	2.96	3.31	4.90	4.29	3.83	4.23	4.72	5.14	3.27	3.03	5.47	4.94
8	2.74	2.84	3.11	3.73	4.77	3.95	3.81	4.32	4.80	4.81	3.24	2.97	5.48	5.38
9	2.98	3.17	3.46	3.63	4.43	3.93	3.34	4.13	4.84	4.97	3.45	3.07	5.37	5.10
11	2.36	2.87	2.52	4.29	4.63	3.97	3.53	3.50	5.25	4.66	3.64	3.18	5.90	5.53
12	2.82	2.80	2.75	3.26	4.50	4.37	3.83	3.66	4.77	4.74	3.67	3.37	5.48	5.80

Although some variances can be noted at individual grades the largest difference can be seen in the area of mathematical intelligence where the scores from Chisholm are higher at all grades except grade 2. With few exceptions scores for Teele and Chisholm in the other six intelligences showed no great differences.

Grade Level Groupings:

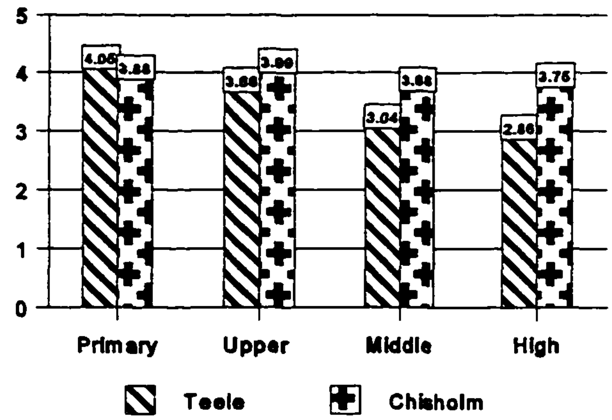
(Teele =T)	Primary		Upper		Middle		High	
(Chisholm=C)	T	C	T	C	T	C	T	C
Linguistic	4.09	4.16	3.48	3.99	2.73	3.06	2.74	2.93
Mathematical	4.05	3.88	3.66	3.99	3.04	3.68	2.86	3.75
Spatial	4.76	4.76	4.89	4.63	4.83	4.42	4.52	4.09
Musical	3.32	3.24	3.84	3.35	3.82	4.01	3.82	3.74
Bodily-Kinesthetic	4.39	4.47	4.75	4.70	4.76	4.78	4.98	4.78
Intrapersonal	3.39	3.41	2.95	2.89	3.26	3.04	3.54	3.21
Interpersonal	3.93	4.07	4.39	4.43	5.48	5.01	5.58	5.49

Primary scores between Chisholm and Teele were extremely close in all of the seven intelligences and no large differences were noted. Upper scores between Chisholm and Teele began to show the start of some interesting trends. Chisholm scores were notably higher in the areas of linguistic and mathematical intelligences, while Teele scores were notably higher in the areas of spatial and musical intelligences. Middle scores for Chisholm were once again notably higher in the areas of linguistic and mathematical intelligences, while Teele scores were notably higher in the areas of spatial and interpersonal intelligences. Musical intelligence actually had Chisholm scoring slightly higher than Teele. High school scores for linguistic and mathematical intelligences were once again higher for Chisholm especially in the area of math where the Chisholm score was 3.75 to 2.86 for Teele. Teele once again scored higher in spatial intelligence along with bodily-kinesthetic and intrapersonal intelligences.

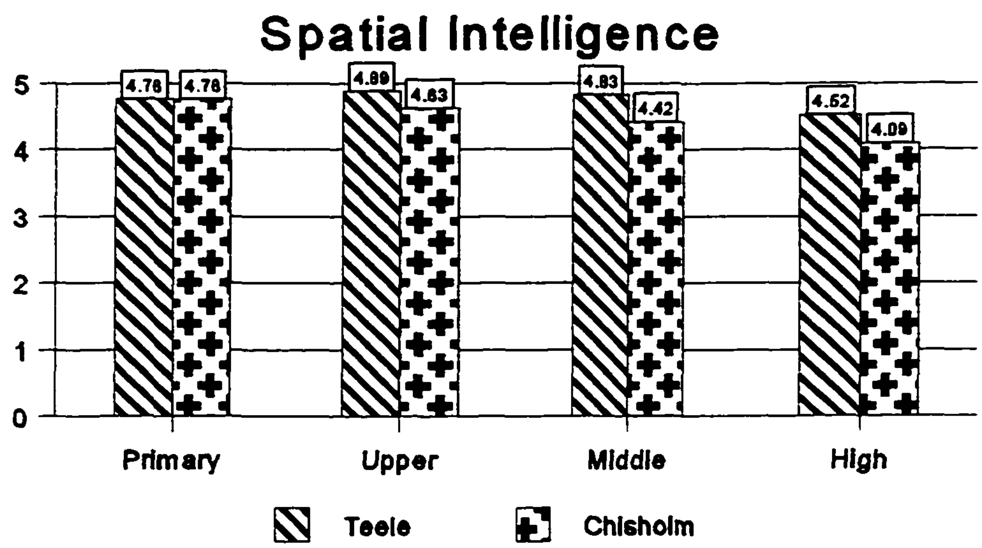


There was not much difference in linguistic intelligence between the Teele and Chisholm scores. Both the Chisholm and Teele scores started out slightly above average Chisholm (4.16) and Teele (4.09) at the Primary level and showed a decrease at each level until they reached their lowest in High School at Chisholm (2.93) and Teele (2.74). The Chisholm scores remained slightly higher than the Teele scores at each level. Although the scores for Chisholm were slightly higher at each of the four levels the pattern of linguistic intelligence spiraling downward is similar to that of Teele. Students it seems do not share the same passion for linguistic intelligence in high school as they did in primary (Teele, 1995, p.6). Students should start by setting goals to achieve by the end of prescribed periods of time. I would like to read chapter 5 by the end of this month (Ellison, 1992, p.70). The dictionary game provides an opportunity for students to develop their linguistic skills through creative writing (Grow, 1995).

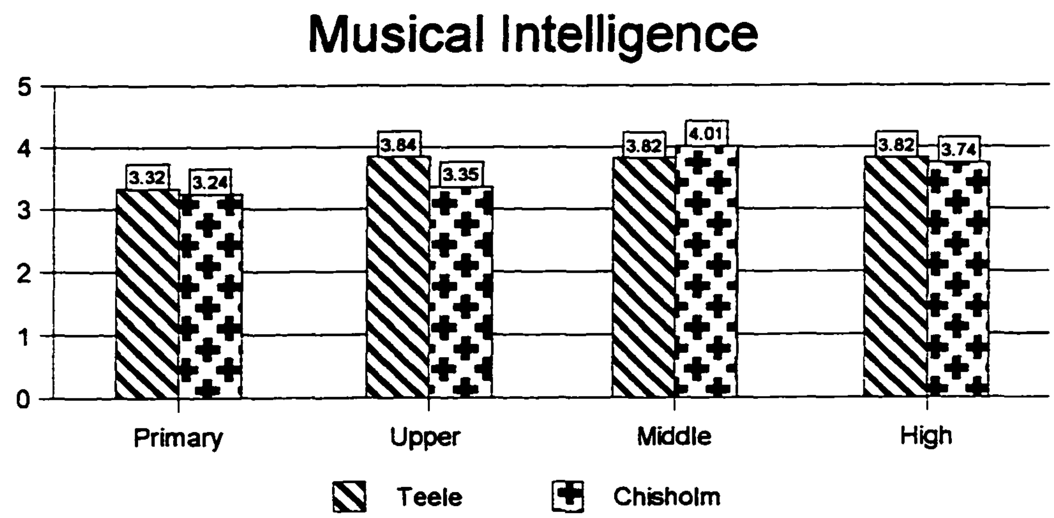
Mathematical Intelligence



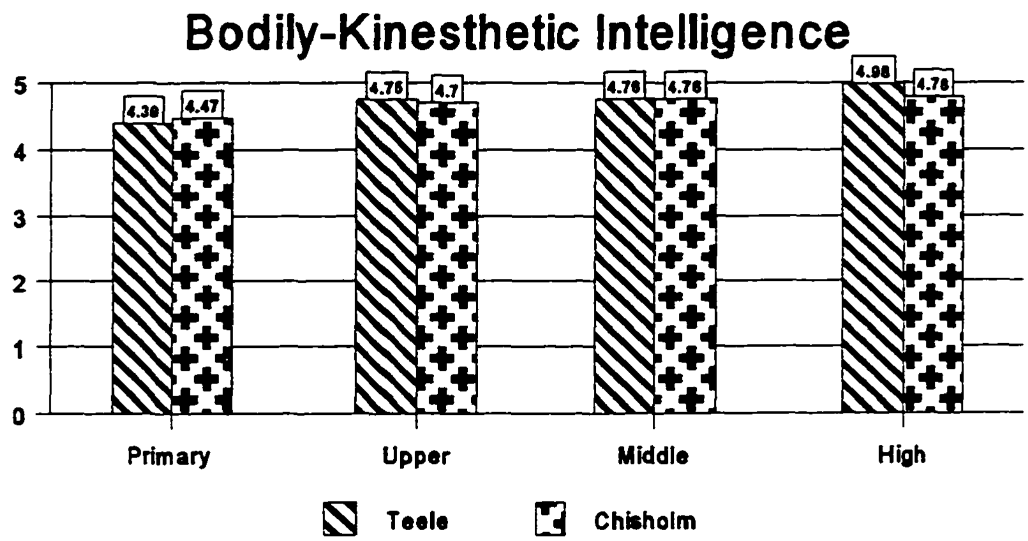
In mathematical intelligence the scores for Teele went down from 4.05 at the primary level to 2.86 at the high school level. The same trend did not hold for the Chisholm scores as they started at 3.88 and maintained that level through to high school where the score was 3.75. The scores in mathematical intelligence in high school were much higher for Chisholm 3.75 as compared to Teele at 2.86. Assuming that most of Teele's results are from the United States there seems to be a distinct difference between the Halifax area students and their peers from below the border. Heredity and Environment may also play a major role in measuring a person's level of multiple intelligence (Gardner, 1995a). The results of this study suggest that there may be some systemic differences in the area of mathematical intelligence between these two studies. Parents and teachers need to encourage students to concentrate on their own progress and de-emphasize making comparisons with others (Ryan et all, 1997, p.402). Goal setting for students is very important in the area of logical-mathematical intelligence and students tend to be very specific when setting their goals. For instance I would like to feel comfortable with long division (Ellison, 1992, p.71). Math may be further enhanced through the use of cooperative learning groups (Davidson, 1990).



There was no great difference in spatial intelligence between the Teele and Chisholm scores, although the Teele scores were marginally higher at each level except primary. The largest difference was noted at high school where Teele scored 4.52 as compared to 4.09 for the Chisholm scores. While Teele scores remained fairly constant from primary to high school Chisholm scores spiraled downward and from 4.76 to 4.09. Once again the difference noted in high school suggests that there may be some systemic differences between the two studies. This could be due to the fact that there is less emphasis placed on spatial activities for the Halifax area students. The importance of spatial intelligence should be stressed as is it easily found in any community in people such as, architects, contractors, engineers and carpenters and many other tradesmen (Grow, 1995). Some instructional strategies used to develop visual-spatial intelligence may include creating a visual environment, pictorial representation and visual memory techniques (Campbell et all, 1992, p.43). Art classes have been low on the totem pole in Nova Scotia schools and this could possibly reflect in the differences exhibited between Teele and Chisholm students at middle and high school levels.

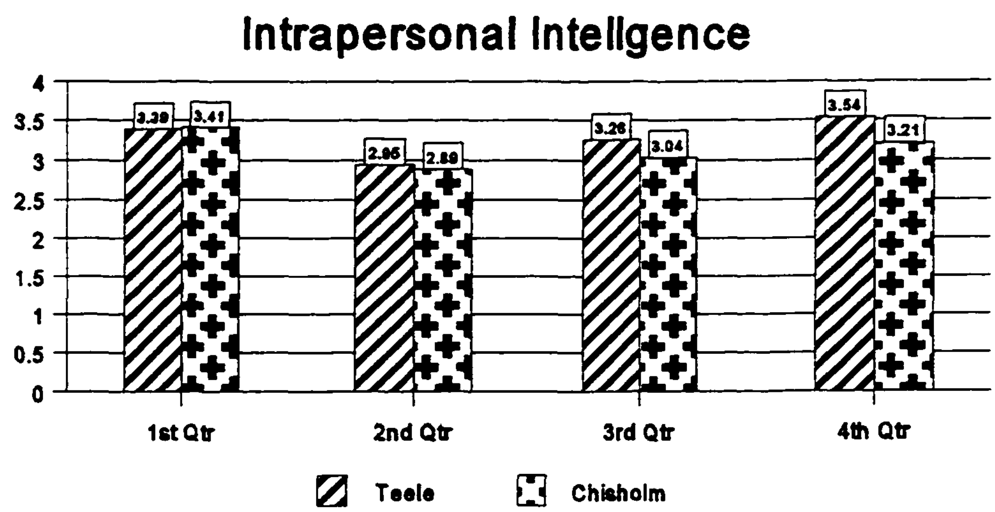


There was no large difference in the scores for musical intelligence. The scores for musical intelligence were below average for both Teele and Chisholm. The Teele scores started out at 3.32 in primary and then went up to 3.84 in upper elementary and remained basically the same in middle school and high school. Conversely the Chisholm scores started out at 3.24 in primary and then rose slightly to 3.35 in upper and then rose sharply to 4.01 in middle school before taking a drop to 3.74 in high school. The only area where there is a large difference in score is at the upper elementary level where the Teele subjects were higher by a score of 3.84 to 3.35. It is possible that Teele's subjects at the upper elementary are more aware the musical elements in their environment. Music classes are not currently available for all students in Nova Scotia, and this information is not known about the Teele subjects. "Describing music might be a way to bring the musical intelligence into the classroom (Grow, 1997)". Students can be organized into small groups to write an entire song or to contribute a stanza to a class song (Campbell, 1994, p.49).



There was no large difference in the scores for bodily-kinesthetic intelligence. The scores for Teele and Chisholm were well above average and rose slightly in the higher grades. The biggest difference was noted in the high school area where Teele scored 4.98 to 4.78 for Chisholm. Both Chisholm and Teele students scored well above average in the area of bodily-kinesthetic intelligence suggesting that this intelligence is viewed favorably by students from both studies. This should be seen as a positive statement and exploited to its fullest. More activities involving physical movement should be integrated into the curriculum as aids to learning. There are a wide variety of kinesthetic activities that may be introduced at all ages such as drama, dance, exercise breaks and field trips (Campbell et all, 1992, p.10). It is also important to stress the health habits to all students.

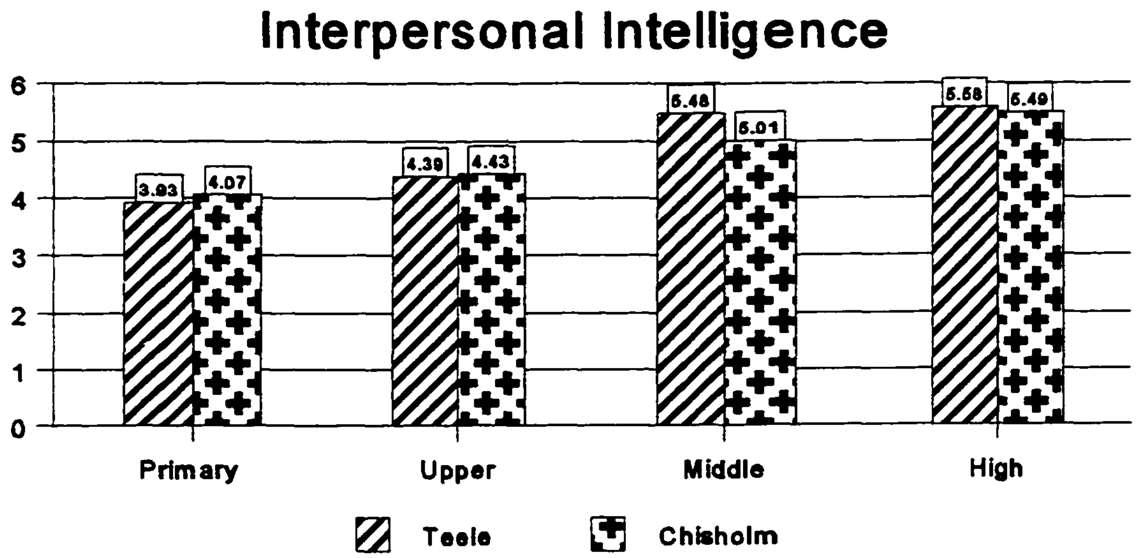
> Within the traditional curriculum, health and physical education have been considered frills for the many or extracurricular activity for the elite athlete. But now as our society begins to understand the cost of poor health attitudes and habits, the need to integrate health programs across the curriculum for all students is becoming apparent (Bellanca et all, 1994, p.135).



There was no great difference in the scores for intrapersonal intelligence with Teele scoring only slightly higher at the middle 3.26 to 3.04 to Chisholm and at high where Teele scored 3.54 to 3.21 for Chisholm. Both Teele and Chisholm were well below average and both showed their lowest scores in the upper elementary grades where their mean scores dipped below 3.00. These results suggest that more emphasis be placed in the area of intrapersonal intelligence.

> This intelligence requires that students have the time to think, reflect, and complete self-assessments that will help them take control and be responsible for their learning choices. The responsible student is most able to access full intellectual potential (Bellanca et all, 1994, p. 151).

To often educators think there may be something wrong if a student is not always interacting with their peers. If students are to become free thinkers they need time by themselves to solve their own problems. Journals provide powerful vehicles for recording introspections, for reflecting on experience, and for understanding people's core interests, skills, emotions, and values (Grow, 1995, p. 8).



There was no large difference in the scores for interpersonal intelligence. Both the Teele and Chisholm and scores started at their lowest in primary; Teele 3.93 and Chisholm 4.07 and then rose steadily until they peaked in high where Teele scored 5.58 and Chisholm 5.49. The biggest difference shown was at the middle school level where Teele scored 5.48 to the Chisholm score of 5.01. Chisholm and Teele results exhibited the same trends spiraling upwards and peaking in high school. These trends mirror the development of Gardner's interpersonal intelligence ostensibly, as it grows from the infant's dealings with its mother, to the mature development of this intelligence as it approaches adolescence (Gardner, 1983). As well Chisholm and Teele students favor interpersonal intelligence and the use of cooperative learning groups should be encouraged as a method of learning (Bellanca et all, 1994, p.170-171).

Gender and Grade Level:

These four grades were chosen because Teele reported data (1995, p.29) from grades 1, 4, 7, 9, and 12. I chose not to include my grade 1 data because my sample was too small.

(Teele)	Grade 4		Grade 7		Grade 9		Grade 12	
	M	F	M	F	M	F	M	F
Linguistic	3.64	4.09	2.52	2.92	2.78	3.21	2.40	3.28
Mathematical	4.28	3.47	3.34	2.54	3.78	3.09	3.16	2.26
Spatial	5.21	4.46	5.27	4.51	4.72	4.10	4.95	4.22
Musical	3.55	4.37	3.76	3.91	3.33	3.36	3.73	3.95
Bodily-K	4.46	4.66	4.56	4.89	4.65	4.06	4.64	4.95
Intrapersonal	2.81	3.11	3.08	3.48	3.40	3.50	3.55	3.79
Interpersonal	4.05	3.83	5.32	5.63	5.18	5.57	5.48	5.48

(Chisholm)	Grade 4		Grade 7		Grade 9		Grade 12	
	M	F	M	F	M	F	M	F
Linguistic	3.66	3.89	3.17	3.00	2.83	3.39	2.89	2.69
Mathematical	4.77	3.40	4.75	2.57	4.08	3.33	3.79	2.63
Spatial	4.60	4.66	4.08	4.39	4.17	3.78	4.79	3.88
Musical	3.42	3.53	3.00	4.87	3.67	4.44	3.84	3.44
Bodily-K	4.58	4.66	5.75	4.83	5.08	4.89	3.84	5.81
Intrapersonal	2.73	3.17	2.83	3.13	3.33	2.89	3.47	3.25
Interpersonal	4.23	4.68	4.42	5.22	4.83	5.23	5.37	6.31

In Grade 4 a difference was noted in the female musical intelligence scores with Teele scoring 4.37 much higher than Chisholm's 3.53. Conversely Chisholm's Grade 4 female score in interpersonal intelligence was much higher at 4.68 than Teele's at 3.83. The Teele Grade 4 male scores for spatial intelligence were 5.21 as compared to 4.60 for the Chisholm scores. In mathematical intelligence Grade 4 Chisholm males scored 4.77 compared to the Teele score of 4.28

The Grade 7 male scores for showed some large differences in every area but intrapersonal intelligence where Teele scored 3.08 and Chisholm slightly lower at 2.83. In the other Grade 7 male scores Chisholm scored higher in linguistic intelligence 3.17 to 2.52; in mathematical intelligence 4.75 to 3.34; bodily-kinesthetic intelligence 5.75 to 4.56. The Grade 7 Teele males scored higher in spatial intelligence 5.27 to 4.08; musical intelligence 3.76 to 3.00; and interpersonal intelligence 5.32 to 4.42. The most significant difference noted for the Grade 7 females was in the area of musical intelligence where Chisholm scored 4.87 compared to the Teele score of 3.91. Teele females in Grade 7 scored slightly higher in intrapersonal intelligence 3.48 to 3.13 and in interpersonal intelligence 5.63 to 5.22.

In Grade 9 the Teele males scored 4.72 to the Chisholm's 4.17 in the area of spatial intelligence, while in bodily-kinesthetic intelligence Chisholm males scored 5.08 to 4.65 for Teele. The Teele females in Grade 9 scored significantly higher than the Chisholm females in the area of intrapersonal intelligence 3.50 to 2.89 while the Grade 9 Chisholm females scored higher in bodily-kinesthetic intelligence 4.89 to 4.06 and in musical intelligence 4.44 to 3.36.

In Grade 12 the Teele males scored higher in bodily-kinesthetic intelligence 4.64 to 3.84, while the Chisholm males scored higher in mathematical intelligence 3.79 to 3.16. The Grade 12 females saw the Teele group scoring higher in linguistic intelligence 3.28 to 2.69; in intrapersonal intelligence 3.79 to 3.25; and musical intelligence 3.95 to 3.44; while the Grade 12 Chisholm females scored higher in bodily-kinesthetic intelligence 5.81 to 4.95; and interpersonal intelligence 6.31 to 5.48.

Conclusions:

Based on the results of this study we can conclude that males score much higher than females in logical-mathematical intelligence. Boys scored higher at every grade level over the girls and their average mean was 4.43 to 3.26 for the girls. This does not mean that girls do not have the same capacity to learn that boys do nor does it mean that boys will do better academically than girls.

Carr & Jessup (1997) did a study that shows that as early as the first grade differences exist in the strategies boys and girls use to solve math problems. Their results showed that by January of their first year in school, gender differences existed, but only in the way that the children approached problem solving, not in the number of problems the students solved correctly. In both individual and group settings girls were more likely to use overt methods; such as counting fingers to solve problems (Ibid). Conversely boys were more likely to use retrieval methods; such as relying on memorized answers in both individual and group settings. Carr & Jessup (1997)further stated that in group settings retrieval, the boys preferred strategy dominated group work. They also stated that this was not due to any group pressure as the boys did not ridicule the girls for counting on their fingers. It seems that the gender differences that exist in primary in logical-mathematical thinking are permanent and continue into the high school years. Puzzle tanks, an interactive computer game is a great way of introducing group that involves males and females sharing information (Davidson, 1990, p.148). Confidence levels is a key element whenever introducing group at the classroom level.

Three high correlations clearly show that logical-mathematical intelligence exists as an autonomous system (Gardner, 1983, p.159).

General Comments:

In light of the fact that Gardner's Theory of Multiple Intelligence has only been around since 1983 it has progressed quite rapidly in the classroom. (Campbell et all, 1992, Bellanca et all, 1994) have produced handbooks that should prove useful to the classroom teacher. Based on the results of my 1st study I am not sure if there is anyway at present to definitively assess a person's level of intelligence in the seven or categories (Gardner, 1997 audio). The Gardner inventory or checklist has moved forward, with the addition of a Likert scale making the instrument more sensitive. It is possible that some combination of these tests may result in a better analysis of a student's multiple intelligence interest. A more sensitive test may give a wider range to accurately assess the subject's interest in this intelligence. However this instrument has yet to be tested in a scientific study. One problem with this inventory, however is that a person needs to have a certain level of linguistic intelligence just to read and comprehend the statements in the checklist. Teele's forced choice pictorial certainly solves that problem, but there may be some ambiguity when choosing between the two paired intelligences in the pictorial. With some refinements both instruments have the possibility of accurately assessing a person's level of multiple intelligence.

There seems to be some credence in the 2nd study that indicates there is a comparison or link between Teele's subjects and those in the Halifax area study. There appears to be common trends in students' scores in the seven intelligences. These trends give educators analytic foundations that may help them as they redesign classrooms to suit the needs of the students as we approach the 21st century (Blythe & Gardner, 1990) . Although some differences exist between Chisholm and Teele students, the results suggest where educators may place more emphasis in the seven intelligences and where some intelligents may be exploited to gain maximum performance in the classroom. From the results in the 2nd study it is clear that there is differences from grade to grade and also differences between the sexes (Teele, 1995). The debate over Gardner's Theory of Multiple Intelligence may now shift from the merits of whether or not the seven intelligences exist, to how we can better facilitate these intelligences in the classroom setting (Armstrong, 1994a).

Gardner's Theory of Multiple Intelligences should be used as a means to an end to aid teachers in finding as many of their students' multiple entry points as possible (Gardner, 1991, 244-247). Too often teachers teach to their own strengths; typically linguistic and logical-mathematical, which is plausible in its own right , but does not address the interests of all learners. Professional development workshops for teachers and support staff should be a priority for the school planning committee if the implementation of Gardner's Theory is to be executed properly (Hoerr, 1994, p. 29). It is important to stress how teachers may respond to students with diverse patterns of ability (Guskin et all, 1992, p.36). A well-rounded education should have students learning through their seven intelligences with cross-sectional boundaries intermingling freely with one another (Hoerr, 1992). The idea of learning the social sciences through music should not be foreign to today's classroom; just as interpersonal skills must be used in problem solving techniques across all genres of the curriculum (Shuster & Ploghoft, 1977, p.315). Today's classroom should be rich in new and vibrant activities that encompass all students in the learning process and encourage full and active participation through creative activities (Fait, 1976, p.28). Multiple intelligence schools such as Public School 42 in the South Bronx area of New York compare to the traditional schools in that they still work on the basic skills, but the major difference is they consider what the student knows already and the philosophy is to work at things they can do and "build on what they can do" (McDermott, 1997c). Lesson plans should be as much fun for the teacher as they are for the student. So how do MI schools deal with the many problems that our schools face in today's world?

Why are there so many problems in our schools today? High drop-out rates, school fights, boredom, frustrated students and discipline problems in class all have their roots embedded in some common threads. "Understanding the dropout problem, which is common in big city districts, has concealed the crisis in urban schools, where as many as half of the students either drop out or graduate without basic skills" (Fossey, 1996, p. 144). A large number of students are not capable of handling the curriculum. They have been passed on through non-retention policies and end up facing a curriculum that they are not prepared to handle. They do not have nor have they mastered the skills necessary to complete their high school education. Whenever students become overwhelmed with what they have on their plates they do what comes naturally to them and that is to rebel. They become discipline problems and these negative effects can be seen throughout the whole school as a community. The solution has been to put band-aids on the problem for the short fix. Try finding out what intelligence they can be reached with and ask for their help in developing that intelligence. They may help with music or dance (bodily-kinesthetic) intelligences in your classroom (Black & English, 1986, p. 103).

Suspensions and detentions do not deter this kind of behavior. I am not saying that they are not necessary, only that the root of the students' problems still remain and it is only a matter of time before they resurface again. Ask a group of parents to sit through a series of three hour lectures on quantum physics. In only a relatively short period of time I think we can agree that most would have a very difficult time understanding the concepts that are being introduced and would become bored. We would probably start to find small groups of the parents talking about matters that are of interest to them. This being the case how can we expect our students to sit through classes that they may view as mundane or inappropriate to what they need to learn.

The challenge for teachers is enormous. They are faced with larger classes and turned-off students that are having problems with the curriculum. Gardner's Multiple Intelligence Theory allows teachers seven entry points on each topic. Students can not only learn through the traditional linguistic and mathematical intelligences, but through their five other intelligences. Some detractors of MI say that it is only good for the lower grades, but students don't lose their multiple intelligences when they approach adolescence, the fact is they become even more developed, especially in the areas of bodily-kinesthetic, intrapersonal, and interpersonal intelligences (Armstrong, 1994b, p. 27). It is not only plausible, but highly probable that many of your students will have a wide range of dominant intelligences that topics may be introduced through. In conclusion it is best to educate the youth of today through the Multiple Intelligence Theory.

Study Results and Gardner's Theory

Part I

In respect to the major findings of my experiment showing a direct relationship to Gardner's theory, we will first consider the average correlations among the three instruments: specifically, the three high correlations in musical, .8616; logical-mathematical, .7579; and bodily-kinesthetic, .7712, in which the higher the correlation the easier that intelligence is to measure; and finally, the very low correlations with interpersonal, .4133; and intrapersonal, .3776. The key issue will be to see if these results reflect any of Gardner's dimensions for the autonomy of these intelligences.

All three intelligences, musical, logical-mathematical, and bodily-kinesthetic obtaining high correlations in this study, have their core operations clearly demarcated and illustrated in high end-states that are universally accepted, whether that be in the famous musical compositions, the scientific revolutions with their accompanying mathematical systems, or in the accomplishments of the World Olympics. Music, having the highest correlation, is one of the few instances of regular hemispheric lateralization for a skill in animals (Gardner, 1983, p. 116). In respect to humans, neurological studies have shown "beyond a reasonable doubt that the processes and mechanisms subserving human music and language are distinctive from one another" (Ibid., p. 117). As well, music is found universally across the cultures of the world and is singled out to be the earliest intelligence to develop (Armstrong, 1994a, p. 7), and Gardner affirms that the core operations of music do not bear intimate connections with those of other intelligences (Gardner, 1983, p. 126). Gardner's evidence for the autonomy of both the logical-mathematical and the bodily-kinesthetic intelligences follows similar lines. There are examples of people who have lost the capacity to compute while remaining strong in linguistic skills, and as well, there are studies of individuals who are aphasic but are still capable of handling their financial concerns or playing games involving calculation (Ibid, p. 157). Suffice to say, Gardner affirms that most of the signs of an autonomous intelligence register positively in the case of the logical-mathematical (Ibid., p. 159). For the kinesthetic intelligence, which is partially located in the left hemisphere as is the linguistic, it is known that linguistic deficits can occur without causing apraxias, all of which adds up to the bodily-kinesthetic being a discrete realm of intelligence (Ibid., p. 213). My high correlations for each of these three intelligences are not surprising, given Gardner's strong position on the autonomy of each of them.

On the other hand, the low correlations of both personal intelligences suggest some ambiguity in those areas for the respondents in the experiment. Gardner notes that both of the personal intelligences are highly dependent on the symbolic code of the culture (Ibid., p. 242); "when it comes to personal knowledge, the culture assumes a determining role" (Ibid., p. 274). As well, these personal intelligences generally take their outer expression through other competencies, especially the linguistic (Ibid., p. 264), making the sense of self somewhat hidden in these overlaps. The sense of self generated in the personal intelligences is not immediately evident in the way other productions are. The present escalation of social problems and crime, especially of murder by young children, has brought the personal intelligences to the foreground. Recently, the surge of such problems and the decline of family teaching in these areas has caused a critical demand for moral and emotional literacy courses in the school systems and a spate of literature and programs to stem the neglect of the personal intelligences.

Part II

When comparing the Chisholm results with those of Teele for grade level effects some pertinent differences should first be observed. The Chisholm study included students from the area of Halifax, Nova Scotia, while it is most likely, that, not all, but most of Teele's subjects would be coming from the southwestern portion of the United States. The sample size is much different as well, Chisholm, 495 and Teele over 6,000, with no specific numbers telling us how many subjects in each level or grade.

The one big difference to note between the Chisholm and Teele scores was in the area of logical-mathematical intelligence. Teele started out higher than Chisholm in primary, 4.05 to 3.88. Teele's scores then spiraled downward bottoming out in high school at 2.86. Conversely, the Chisholm scores basically maintained their level and were 3.75 in high school. It is possible that some systemic differences between the school systems may exist. The material covered in the curriculums may have a different emphasis on individual subject areas. Both Chisholm and Teele students' scores start out fairly close at the primary level once again, but by the time they reach high school there is a net difference of 1.01 basis points and this is probably due to the systemic differences that exist between different school systems. It is also possible that the child's transfer of skills from the manipulation of physical objects to the abstract world of mathematical symbols has not been clearly developed. "Further cognitive growth is essential before the child reaches the next--and for Piaget--the final stage of mental development" (Ibid., p. 132). The child must have total comprehension of numerical calculations and approximations before being able to develop abstract reasoning and complex problem-solving techniques (Ibid., p. 156). Too often parents and teachers take the easy way out and place a calculator in the child's hand before he has a solid understanding of numbers, or makes good approximations, or gives sensible answers to problems. Speaking of the enculturation of the logical-mathematical intelligence, Gardner states: "Using our algorithms for calculation, we are more likely to be completely accurate, but also far more likely to come up with a total that is widely off--if, for example, we misalign the columns in a sum or press the wrong buttons on a hand-held calculator" (Ibid., p. 161). Cultural differences, in the home and school, a factor Gardner addresses for each of these intelligences, likely account for the differences between the Chisholm and Teele scores in the logical-mathematical intelligence.

Some large patterns in the Teele and Chisholm scores arising from grade level effects show alignment with Gardner's theory. A major pattern that might even pass unnoticed is that all of the primary level scores uniformly center around the average (4) or a little above, except for the case of the intrapersonal intelligences, and yet these children would enter school from widely varied backgrounds. Applicable here may be Gardner's theory of developmental waves of symbol systems: the first, *event or role structuring*, occurring around two years of age, captures in symbols knowledge of events that involve agents, actions and objects, with their consequences; and while this wave begins with language, it spills into other domains (Gardner, 1991, p. 74). A second wave, around the age of three, *topological mapping* captures general temporal and spatial relations; and while it first begins with two- and three-dimensions of space, it spills over into such structures as narrative and melodic contours (Ibid., p. 75). The third wave of symbolization, around the age of four, *digital mapping* captures precise numerical quantities and relations, and again this arena of counting includes every possible experience for the child (Ibid., pp. 75-76). The final wave, between the ages of five and seven, *notational or second-order symbolization* refers to a set of marks that refers to another set of marks, a tally system; and eventually completed systems can be absorbed as part of more powerful systems (Ibid., p. 76). Gardner concludes that these forms of symbolization are, well developed in every normal child by the beginning of school:

> Every normal human being is capable of these forms of symbolization. Moreover, they seem to be acquired with relatively little formal tutelage, in the period before schooling and in the order that I have described. Nearly every five- or six-year old has a 'first-draft' knowledge of stories, songs, dramatic sequences, counting games, drawings, dances, and other emblems of the regnant cultural system. Children of this age are well equipped for later adventures in the symbolic realm even if they have never spent a day inside a school (Ibid., p. 77).

And Gardner continues that the implications for schooling are very powerful; namely, that prior to schooling children are predisposed to learn the contents of school and to represent this new information in terms of these four symbolic systems that came to be realized at Project Zero:

> If these waves do indeed represent the major ways in which human beings construe meanings, they may have powerful implications for education in and out of school. We may expect that students will be predisposed to learn materials that are presented in forms that highlight event-structures (stories), topological maps (relations of size, space, or time), digital maps (quantitative aspects), and/or second-order symbolic forms (notations that refer to other forms of knowledge). We can anticipate as well that, irrespective of how materials are initially presented, students may themselves represent the information--and later recall it--in terms of these principal modes of human symbolic reference (Ibid., p. 78).

After such an auspicious beginning for school learning, there is some cause for concern that the linguistic, scoring 3.98 and 3.80 in primary, concludes at 2.82 and 2.80 in grade twelve and the mathematical, scoring 4.29 and 4.20 in primary, concludes at 2.75 and 3.26 in grade twelve. The downward spiral for both begins at about grade 6. This is a phenomenon worthy of additional study; but one might hazard the suggestion that the tendency in elementary schools to teach in a holistic fashion, which is closer to the natural learning of the unschooled child, may encourage the child's interest in learning the subjects. Gardner is a strong advocate of contextualizing learning within the life situation, especially in the making of products.

Returning now to the case of the personal intelligences, the intrapersonal intelligence scores at the primary level were, once again, very close between Chisholm, 3.41, and Teele, 3.39. They remained quite low with Teele scoring slightly higher than Chisholm at the upper, middle, and high school levels. It should be noted that there were no scores in the intrapersonal for either Chisholm or Teele that came close to approaching 4 in any of the four levels. Intrapersonal intelligence varies among different cultures, and there also appears to be some distinct patterns of development that are crucial within specific cultures. When the child reaches school-age there is "an increasingly clear understanding that he is a discrete individual with his own needs, desires, projects, and goals" (Gardner, 1983, p. 248). However, as the child moves through middle childhood he tends to move towards a 'greater social sensitivity' and invest more deeply in friendships (Ibid., p. 249). There seems to be a greater emphasis placed on the interpersonal skills rather than reflection and development within the inner self. It is only when the child approaches adolescence and more notably, high school, that he begins to move away from his social interactions of previous years and "become far more psychologically attuned" (Ibid., p. 250). He no longer just wants to have a sense of belonging to a group, but rather "seeks friends who value him for his own insights, knowledge, and sensitivity, rather than for his strength or material possessions" (Ibid., p. 251). As the child appears ready to leave school his intrapersonal intelligence seems to be on the rise. Yet despite all these emerging tendencies, the scores for the intrapersonal were low throughout the school years (except for some pre-school results which were quite high).

Interpersonal intelligence scores for Chisholm and Teele were quite different from their results in intrapersonal intelligence. These scores start around the 4 level (Chisholm, 4.07; Teele, 3.93) at the primary level and then continue to spiral upwards as the students grow older. The high school scores of Teele, 5.58, and Chisholm, 5.49, reflect a high degree of interest in the interpersonal intelligence. In relation to their developmental trajectory, once the children reach the age of middle childhood (age 7-12), that five year period between the start of school and the beginning of adolescence, they expand on their social interactions each year (Ibid., p. 249). They value friendships and the sense of belonging to a group or clique. Gardner states accordingly:

> Children become more deeply invested in friendships and will go to considerable lengths to maintain a personal relationship; loss of treasured chums proves much more painful. A great deal of energy is devoted toward cementing one's place within a friendship network. These groups or cliques may be structured informally, but sometimes (particularly in the case of boys) they will be as formally ordered as a primate dominance hierarchy (Ibid., pp. 249-250).

Therefore the interpersonal intelligence takes on greater value as the child grows older and children, who are denied this opportunity to develop, will suffer immensely. We should also note that this middle childhood stage is the period when children "devote much time to thinking about the interpersonal realm", and it is also the time when a child can carry on a set of mental manipulations about possible interactions with other individuals: "He thinks that I think that he thinks..." (Ibid., p. 250). The pre-adolescent is also able to appreciate more subtle forms of literature (Ibid.). Later, the adolescent "becomes more sensitive to the underlying motivations of other individuals, to their hidden desires and fears" (Ibid.), and that understanding extends also to a sense of justice in the social world ((Ibid., p. 251). These are strong developmental tendencies in the interpersonal life of the child; if they are thwarted, trouble erupts. It should be remembered that the interpersonal drive has been propelled by the natural bond between the mother and child; that tie "may be looked upon as Nature's effort to ensure that the personal intelligences are properly launched" (Ibid., p. 244). Adolescence is the period that "must bring together these two forms of personal knowledge into a larger more organized sense, a sense of self identity" (Ibid., p. 251), and that is a tenuous accomplishment. The upward spiral in both Teele and Chisholm scores for the interpersonal intelligence is best reflected in Gardner's strong statement:

> Knowledge of one's place among others can come only from the external community: the child is inextricably impelled to focus on others, as a clue to himself. Stated most strongly, without a community to provide the relevant categories, individuals (like feral children) would never discover that they are 'persons' (Ibid., p. 248).

Increasing strength in the interpersonal realm is an expected outcome in respect to the development trajectory of the young person. Since the intrapersonal must take 'its clue' from the relationship with others or the interpersonal, it is not surprising that the scores for the intrapersonal would lag behind those of the interpersonal. If anything, the disparity between the interpersonal and the intrapersonal scores could be seen to weigh heavily on the side of the autonomy for each of these intelligences.

It is of fundamental importance that the Teele and Chisholm scores in the primary level are very closely aligned in revealing the child's auspicious initiation to school learning. It is the middle and late school years that yield differences in the scores, some having negative impact for learning. Schools do appear to make a difference in the child's inclination toward different forms of intelligence. Perhaps the increment in understanding children and schooling arising from this experiment in multiple intelligences will provide a moment of metaknowledge and self reflection in the collective consciousness of the institution of schooling.

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APPENDIX

Contents

THE TEELE INVENTORY OF MULTIPLE INTELLIGENCES

NAME____________________________SCHOOL_________________________
DATE_________TEACHER______________________________GRADE______
SEX: M F (Circle) AGE:__________

ANSWER SHEET

	A	B		A	B
1.	___	___	15.	___	___
2.	___	___	16.	___	___
3.	___	___	17.	___	___
4.	___	___	18.	___	___
5.	___	___	19.	___	___
6.	___	___	20.	___	___
7.	___	___	21.	___	___
8.	___	___	22.	___	___
9.	___	___	23.	___	___
10.	___	___	24.	___	___
11.	___	___	25.	___	___
12.	___	___	26.	___	___
13.	___	___	27.	___	___
14.	___	___	28.	___	___

TOTALS	____	____	____	____	____	____	____
	Ling	Math	Intra-P	Spat	Music	Body	Inter-P

DOMINANT INTELLIGENCES

1.______________2.____________3.____________4.______________

THE TEELE INVENTORY OF MULTIPLE INTELLIGENCES

NAME______________________________SCHOOL__________________________
DATE__________TEACHER_________________________________GRADE______
SEX: M F (Circle) AGE:____________

SCORING TRANSPARENCY

	A	B		A	B
1.	1	4	15.	7	6
2.	5	6	16.	2	6
3.	1	7	17.	5	2
4.	7	2	18.	5	3
5.	4	6	19.	4	7
6.	1	3	20.	2	4
7.	5	4	21.	1	7
8.	1	6	22.	6	5
9.	2	4	23.	2	3
10.	5	7	24.	3	4
11.	1	5	25.	1	3
12.	1	2	26.	4	6
13.	3	6	27.	2	5
14.	3	7	28.	7	3

Teacher Form For Multiple Intelligences

Teacher Name:______________________Grade___________
Subject________________Sex M F (Circle)
School_________________
DOMINANT INTELLIGENCES:
In column A please rank in order from 1 being most like you to 7 being the least like you how the 7 intelligences fit yourself. In Column B put your dominant intelligences from your scores on Gardner's Inventory when completed. In Column C please put your scores from the TIMI forced choice pictorial when completed.

	(A)	(B)	(C)
LINGUISTIC	___	___	___
MATHEMATICAL	___	___	___
INTRAPERSONAL	___	___	___
SPATIAL	___	___	___
MUSICAL	___	___	___
BODILY-KINESTHETIC	___	___	___
INTERPERSONAL	___	___	___

*Comments: you may wish to give some general comments on what you think of the TIMI Inventory. Other comments on the Multiple Intelligence Theory are welcome as well.

Multiple Intelligence Self-Assessment

(Gardner Form)

Assess your intellectual strengths by taking the inventory below. Simple check those statements that apply in each intelligence.

Linguistic Intelligence

_____Books are important to me.
_____I can hear words in my head before I read, speak, or write them down.
_____I get more out of listening to the radio or a spoken-word cassette than I do from television or films.
_____I enjoy games like scrabble, anagrams, or password.
_____I enjoy entertaining myself or others with tongue twisters, nonsense rhymes, or puns.
_____Other people sometimes have to stop and ask me to explain the meaning of the words I use in my writing and speaking.
_____English, social studies, and history were easier for me in school than math and science.
_____When I drive down a freeway, I pay more attention to the words written on billboards than to the scenery.
_____My conversation includes frequent references to things that I've read or heard.
_____I've written something recently that I was particularly proud of that earned me recognition from others.

Logical- Mathematical Intelligence

_____I can easily compute numbers in my head.
_____Math and/or science were among my favorite subjects in school.
_____I enjoy playing games or solving brain teasers that require logical thinking.
_____I like to set up little "what if" experiments (for example, "What if I double the amount of water I give to my rosebush each week?")
_____My mind searches for patterns, regularities, or logical sequences in things.
_____I'm interested in new developments in science.
_____I believe that almost everything has a rational explanation.
_____I sometimes think in clear, abstract, wordless, imageless concepts.
_____I like findings logical flaws in things that people say and do at home and work.
_____I feel more comfortable when something has been measured, categorized, analyzed, or quantified in some way.

Spatial Intelligence

_____I often see clear images when I close my eyes.
_____I'm sensitive to color.
_____I frequently use a camera or camcorder to record what I see around me.
_____I enjoy doing jigsaw puzzles, mazes, and other visual puzzles.
_____I have vivid dreams at night.
_____I can generally find my way around unfamiliar territory.
_____I like to draw or doodle.
_____Geometry was easier for me than algebra in school.
_____I can comfortably imagine how something might appear if it were looked down upon from directly above in a bird's-eye view.
_____I prefer looking at reading material that is heavily illustrated.

Bodily-Kinesthetic Intelligence

_____I engage in at least one sport or physical activity on a regular basis.
_____I find it difficult to sit still for long periods of time.
_____I like working with my hands at concrete activities such as sewing, weaving, carving, carpentry, or model building.
_____My best ideas often come to me when I'm out for a long walk or a jog, or when I'm engaging in some other kind of physical activity.
_____I often like to spend my free time outdoors.
_____I frequently use hand gestures or other forms of body language when conversing with someone.
_____I need to touch things in order to learn more about them.
_____I enjoy daredevil amusement rides or similar thrilling physical experiences.
_____I would describe myself as well coordinated.
_____I need to practice a new skill rather than simply reading about it or seeing a video that describes it.

Musical Intelligence

_____I have a pleasant singing voice.
_____I can tell when a musical note is off-key.
_____I frequently listen to music on the radio, cassettes, or compact discs.
_____I play a musical instrument.
_____My life would be poorer if there were no music in it.
_____I sometimes catch myself walking down the street with a television jingle or other tune running through my mind.
_____I can easily keep time to a piece of music with a simple percussion instrument.
_____I know the tunes to many different songs or musical pieces.
_____If I hear a musical selection once or twice, I am usually able to sing it back fairly accurately.
_____I often make tapping sounds or sing little melodies while working, studying, or learning something new.

Interpersonal Intelligence

_____I'm the sort of person that people come to for advice and counsel at work or in my neighborhood.

_____I prefer group sports like badminton, volleyball, or softball to solo sports such as swimming or jogging.

_____When I have a problem, I'm more likely to seek out another person for help than attempt to work it out on my own.

_____I have at least three close friends.

_____I favor social pastimes such as monopoly or bridge over individual recreations such as video games and solitaire.

_____I enjoy the challenge or teaching another person, or groups of people, what I know how to do.

_____I consider myself a leader (or others call me that).

_____I feel comfortable in the midst of a crowd.

_____I like to get involved in social activities connected with my work, church, or community.

_____I would rather spend my evenings at a lively party than stay at home alone.

Intrapersonal Intelligence

_____I regularly spend time alone meditating, reflecting, or thinking about important life questions.

_____I have attended counseling sessions or personal growth seminars to learn more about myself.

_____I am able to respond to setbacks with resilience.

_____I have a special hobby or interest that keep pretty much to myself.

_____I have some important goals for my life that I think about on a regular basis.

_____I have a realistic view of my strengths and weaknesses (borne out by feedback from other sources).

_____I would prefer to spend a weekend alone in a cabin in the woods rather than at a fancy resort with lots of people around.

_____I keep a personal diary or journal to record the events of my inner life.

_____I am self-employed or have at least thought seriously about starting my own business.

Suggestions for administering the Teele Inventory of Multiple Intelligences

1. This inventory should be given in a relaxed environment that allows individuals to carefully make a forced choice selection.

2. The examiner should be pleasant, positive and encouraging.

3. To motivate the participation to do his or her best, please let the participants know there are no right or wrong answers. This inventory simply identifies the strengths or dominant intelligences each participant possesses.

4. Directions to the participants should be read verbatim, rather than given from memory in order to provide continuity.

5. Do not assist participants in making their selections unless they do not understand the picture. Then carefully and objectively describe the picture.

6. The subjects may take any reasonable amount of time per item to make their selection. However, participants should be encouraged to choose one of the two choices . Be sure all participants respond and make a choice on all numbers.

7.Some of the subjects, especially younger students may not realize they have to select one of the two pictures lettered "A" or "B". It is necessary to repeat often: "Be sure to look carefully at both pictures and select either A or B."

8. If an individual changes his or her choice, be sure the other choice is erased on the answer sheet.

9. If working with a handicapped individual, the examiner may point to each of the choices asking for a finger response of "1" for A and "2" for B or shake the head once for A or twice for B.

10.The tests were to be given on a normal school day. (i.e.)not just before the students are to be dismissed on a Friday afternoon or on the same day that the students are about to visit the Zoo on a field trip.

Introducing The Inventory

Introduce the inventory by saying: "Please put your first and last name on the line of the answer sheet" (show the answer sheet). Then, "put today's date on the next line" (write today's date on the board). Then "put the grade you are in" (write the grade on the board and tell the students the grade) and " the teacher's name" (write the teacher's name on the board). "Circle M if you're a boy and F if you're a girl. Write down your age beside the word age.

We are going to look at some pictures of panda bears and see which pictures are the most like you." Turn to the first page and say: "See the four pictures on the first page." (Indicate this by holding up page 1, 1A and 1B and 2A and 2B. Say "Look at the pictures on 1A and 1B. Think about which picture is most like you? Is 1A more like you or is 1B more like you? Select the picture that is most like you. Then look at your answer sheet. Find the number 1 and put a check in either the A or B column. Do not put a check in both A and B, only A or B. There are no right or wrong answers. Whichever picture you feel is most like you is the one you should check. Do the same for 2A and 2B. Is 2A more like you or is 2B? Put a check mark in 2A or 2B on your answer sheet."

Depending on the grade level, the examiner may want to take the whole group through the inventory together. For kindergarten and first grade students the inventory may need to be done on an individual basis with an examiner entering the score on the answer sheet. If not done individually these two grades may want to complete their answers on the picture booklet by circling the letter of their choice. Grades two through six are usually able to put their responses on the answer sheet which enables the inventory to be reusable. If the participants are working independently ask them to double check their answer sheet to make sure they've put a response down for each number.

Scoring the Inventory

Take the transparency sheet and place it over the responses on the answer sheet. Record marks in the appropriate boxes below the answer sheet for each of the responses. For example, response one is either 1 or 4. Place a mark in either 1-Linguistic or 4-Spatial. For number two the responses are either 5 or 6. Continue marking all 28 responses. When you finish, tally up the marks for the responses in each of the seven intelligences. Based on the number of each, determine the four most dominant intelligences and record them in the appropriate lines with 1 being the highest number of selections in that intelligence and four being the fourth selection. This can also be done orally with older students by telling them the number and letter of the questions and then giving them the appropriate response numbers that appear on the answer sheets.

Interpreting the Score

It is helpful to have some information about each of the seven intelligences in order to understand the strengths of the dominant intelligences that have been identified from the inventory. There are distinct characteristics in each of the intelligences that should affect teaching methodologies and assessment measures.

Linguistic students have highly developed auditory skills, enjoy reading, writing, like to play word games and have a good memory for names, dates and places. They possess well developed vocabularies and use language fluently and are often able to spell words accurately and easily.

Logical-mathematical students like to explore patterns and relationships and enjoy doing activities in a sequential order. They like mathematics, experiment to test things they don't understand, enjoy opportunities to problem solve and reason logically and clearly.

Intrapersonal students prefer their own inner world, like to be alone and are aware of their own strengths, weaknesses and inner feelings. They have a deep sense of self-confidence, independence and a strong will, and motivate themselves to do well on independent study projects. They often respond with strong opinions when controversial topics are being discussed and prefer to "march to the beat of a different drummer."

Spatial students enjoy art activities, read maps, charts and diagrams and think in images and pictures. They respond positively to movies, slides, pictures and other visual media. They are able to visualize clear images when thinking about things, enjoy doing jigsaw puzzles and solving artistic problems.

Musical students are sensitive to the sounds in their environment, enjoy music and prefer listening to music when studying or reading. They appreciate pitch, rhythm and timbre and often sing songs to themselves.

Bodily-kinesthetic students process knowledge through bodily sensations and use their body in differentiated and skilled ways. They need opportunities to move and act things out. They like to touch and feel things. They respond best in a classroom that provides manipulatives....., action packed stories, role playing, simulations, physical activities and hands-on-learning experiences.

Interpersonal students enjoy being around people, have many friends, prefer social activities, and learn best by relating and participating in cooperative learning groups. These students express empathy for the feelings of others, can respond to the moods and temperament of other individuals, and enjoy participating in group activities.

IMAGE EVALUATION TEST TARGET (QA-3)

150mm

6"

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