THE EFFECTS OF PIANO-KEYBOARD INSTRUCTION ON COGNITIVE ABILITIES OF FEMALE AND MALE KINDERGARTEN CHILDREN

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by

Nikolaos Zafranas

Department of Education. Brunel University

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Abstract

In several studies, children who received piano instruction achieved better results on spatial-temporal tasks than various control group children did. This difference, though, was not always statistically significant. Gender differences favouring boys in spatial abilities appear to exist in children as young as 4 ½ years old. However, research linking piano instruction to spatial abilities did not report gender differences.

This thesis had three main investigative objectives: to control if children would show significant improvement in cognitive test scores following piano-keyboard instruction; to compare if certain cognitive tasks such as the spatial tasks would show greater improvement than other, non-spatial, tasks; to examine if the effects of piano-keyboard training on spatial tasks are gender differentiated.

Sixty-one kindergarten children, aged five to six years, participated in this research receiving two piano-keyboard lessons weekly during the school year 2001-2002. Six sub-tests from the Kaufman Assessment Battery for Children were administered before and after the instruction period.

Results revealed that participants improved significantly in the Hand Movements, Gestalt Closure, Triangles, Spatial Memory, and Arithmetic tasks following piano-keyboard instruction. No significant improvement was found in the Matrix Analogies task. Pre-tests in all sub-tests showed no significant gender differences. At post-testing though, boys significantly outperformed girls in the Hand Movements task while their gain scores were significantly higher than girls' scores in the Triangles task.

This research has demonstrated that piano-keyboard instruction produced enhanced spatial-temporal test scores in kindergarten children, and that these scores were gender differentiated. These findings are unique in presenting a gender difference in gain scores following piano-keyboard instruction favouring boys. It is hoped that these findings contribute to the growing body of research investigating the extra-musical effects of music instruction and that in the future, kindergarten program administrators might consider music and piano-keyboard instruction as an integral part of kindergarten education.

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INTRODUCTION

The aim of this study is to investigate the effects of piano-keyboard instruction on cognitive abilities of female and male kindergarten children. Traditional reasons and scientific data discussed herein provide a foundation upon which this research may rest.

In ancient Greece, the word music meant much more than it does today. A Muse, in classical mythology, was any one of the nine goddesses (sisters), presiding over certain arts and sciences. Etymologically, music is an adjectival form of the word Muse. Therefore, "*music*" implied anything reflecting activities of the Muses, which would be the pursuit of beauty, but also the pursuit of truth.

Pythagoras taught that music was integral to mathematics. According to him and his followers, the whole cosmos was explained with the use of numbers. Anything ordered by numbers, musical sound and rhythms included, exemplified the harmony of the universe and reflected it. Music was also closely linked to astronomy. An example is found in Plato's myth of the "music of the spheres". This music was produced by the revolutions of the planets, but could not be heard by men. Music was also synonymous to poetry. This is obvious in words, such as ode or hymn. These Greek words, designating different kinds of poetry, were actually musical terms. Lyric poetry meant reciting (or rather singing) poems to the accompaniment of the lyre.

Music was considered as a part of the creation; but it was also viewed as a power which could affect the creation. Aristotle writes about the power of music on the individual in his Politics. "Music directly imitates the passions or states of the soul – gentleness, anger, courage, temperance, and their opposites and other qualities; hence, when one listens to music that imitates a certain passion, one becomes imbued with the same passion; and if over a long time one habitually listens to the kind of music that rouses ignoble passions ones whole character will be shaped to an ignoble form. In short, if one listens to the wrong kind of music, one will become the wrong kind of person; but, conversely, if one listens to the right kind of music, one will tend to become the right kind of person." (Grout & Palisca, 1988, p. 7-8). Plato went a step further in accenting the power music can exert when he said, "let me make the songs of a nation and I care not who makes the laws". The translation of this saying, though, is unable to convey the humorous word-play: the word “nomos” means custom or law but also the melodic scheme of a lyric song or of an instrumental solo (Grout & Palisca, 1988, p.8).

Before Aristotle and before Plato, music had reached a high level of appreciation and had become an integral part of the life and the culture of the Greek people. The creator of Odyssey, Homer, writes of bards who sang and played on the lyre or the kithara (a larger lyre with as many as eleven strings) heroic poems at feasts. During the fifth century B.C., professional musicians emerged as modern virtuosos, chromaticism was introduced and new musical forms were developed. Most of the knowledge existing today comes from Phrynis of Mytilene (c. 450 B.C.), Euripidis (c. 480-406 B.C.) and Timotheus of Miletus (c. 450 B.C.). All above were leading proponents of chromaticism during that period. It is also known that music festivals, singing societies and music contests, along with rhetorical societies existed everywhere in ancient Greece. Obviously, this period was characterised by great involvement in the arts, which, at the time, were chiefly represented by music and poetry. Pythagoras, famous for his contribution to mathematics, also developed musical theories heavily influencing interval and scale construction. Part of his theories is still utilised today. As mentioned above, the Pythagoreans viewed music as a system of sounds and rhythms where the same mathematical laws applied, that operated in the whole world. According to them, music should not be passively enjoyed. Music was considered to be a force affecting everything that existed. Nowadays, the word “*music*” indicates “1. That one of the fine arts which is concerned with the combination of sounds with a view to beauty of form and the expression of thought or feeling; also, the science of the laws or principles by which this art is regulated. 2. Sounds in melodic or harmonic combination, whether produced by voice or instruments….” (The Oxford Universal Dictionary Illustrated, Third ed., 1965, Oxford University Press, London).

“Music” incorporated much more than it does today. Of course, the societies have changed very much during the over two millennia that separate today from ancient Greece, and so has language. Nevertheless, the original meaning of a word can often be helpful in providing an insight into the genesis, the history but also in the not always obvious connotations, perspectives, or extensions of what is hidden behind a “simple” word.

Several studies have investigated the effects of music training on children’s spatial or spatial-temporal ability by administering appropriate assessment tests but also examined performance in reading ability or improvement in the area of mathematics.

The effect of music training on spatial-temporal thinking was investigated first using the Sonata for two pianos in D Major, KV 448, by W. A. Mozart as a stimulus immediately followed by spatial-temporal testing. This attempted to demonstrate the connection between music and spatial-temporal thinking (Rauscher, Shaw & Ky, 1993). The Mozart Sonata for two pianos was a piece of choice for Einstein too, who praised it when he wrote: "The art with which the two parts are made completely equal, the play of the dialogue, the delicacy and refinement of the figuration, the feeling for sonority in the combination and exploitation of the registers of the two instruments – all these things exhibit such mastery that this apparently superficial and entertaining work is at the same time one of the most profound and most mature of all Mozart's compositions" (cited by William Kinderman, in the CD booklet of the Complete Mozart Edition: Music for 2 Pianos•Piano Duets, Philips, (1991), 422 516-2).

Based on tradition and the abstract nature of music, Peterson et al., (2000) suggest that math and music could have a connection to spatial-temporal thinking. A math software called STAR (Spatial-Temporal Animation Reasoning) was developed by Peterson, and was given to students in combination with music and math. In an invited paper for Early Childhood Connections by Bodner et al. (2002), researchers start by reviewing the history of the research attempting to establish the causal connection between music and children's innate spatial-temporal reasoning. Following investigations are listed:

1. The Mozart effect causal experiments with Rauscher et al (1993).

2. The Alzheimer-patients experiments, where after listening to the Mozart sonata, patients had enhanced short-term spatial-temporal reasoning (Johnson et al., 1998)

3. The experiments with epileptic patients, who, having been exposed to the Mozart Sonata, even in a coma, showed reduced neuropathological spiking activity (Hughes et al., 1999; Shaw, 2001)

4. The fact that long-term exposure to the Mozart Sonata enhanced learning of a maze by rats. The enhanced performance lasted more than four hours after the exposure (Rauscher et al., 1998).

5. The experiment in which EEG coherence studies gave evidence for a carryover from the Mozart Sonata listening condition to the subsequent spatial temporal task (Shaw, 2000; Sarnthein et al., 1997).

6. The fMRI studies that compared cortical blood flow activation by the Mozart Sonata versus other music (The Sonata gave striking results) (Bodner et al., 2001).

7. The temporal durations of mental rehearsals of pieces of music lasting up to a few minutes (Brothers & Shaw, 1989; cited in Leng & Shaw, 1991), that were extraordinarily reproducible and in consistency with tests of the trion model (Leng & Shaw, 1991) and the Mountcastle columnar spatial-temporal code for higher brain functions (Mountcastle, 1998).

8. Neurophysiological studies that confirmed the presence of families of spatial-temporal firing patterns related by symmetries during higher brain function (Bodner et al., 1997).

9. The fact that preschool children who received piano keyboard lessons for six months improved dramatically on an aged standardised spatial-temporal reasoning task, with the effect lasting for several days (Rauscher et al., 1997).

10. Non-verbal math games (STAR) utilise spatial-temporal abilities. These abilities are thought to be built into the structured cortex. Inner-city second graders given piano lessons along with STAR training scored significantly higher on proportional math and fractions than children given control training along with STAR. (Graziano, Peterson & Shaw, 1999)

A review of studies linking music to other domains is included in this thesis.

CHAPTER 1

COGNITIVE ABILITIES: INTELLIGENCE

A simplistic attempt to define what "being intelligent" means would necessarily overlook many issues. Intelligence is a complex subject. The abilities associated with intelligence cover a broad spectrum of human potential and activity and their expression varies among individuals or groups of individuals. Several different definitions of intelligence can be found in Table 1. Comparisons are often made between groups or gender. Research has revealed, for instance, that map reading is related to spatial ability and that men on average are better than women at these tasks. Determining who is better in orientation, though, is not as simple because women use different strategies than men do (Brannon, 2002, p.77). Statements such as the above trigger controversial discussions regarding gender differences in intelligence and mental ability. Central issues include the use of different strategies by men and women, the existence or not of mental ability variance and the origin of such differences. Research in gender difference focusing on mental ability has produced contradictory results. Hence, not only the source but also the existence itself of differences remains a controversial issue.

Intelligence may be described depending on the individual's action or function. An intelligent soccer player, for example, could predict the opponent's moves, pass the ball to his teammates and contribute to the scoring of his team. "In traditional schools…(intelligent is one who) could master classical languages and mathematics…In a business setting…(one who) could anticipate commercial opportunities, take measured risks, build up an organisation…At the beginning of the twentieth century…(one who) could be dispatched to the far corners of an empire and…execute orders completely"(Gardner, 1999, p. 1).

The variety that characterises intelligent actions, decisions, thoughts or behaviours makes the creation of an intelligence test a very demanding procedure. Nevertheless, diverse tests have been developed to assess intelligence.

1.1 Intelligence tests and IQ

It is obvious that finding a single definition to describe all skills necessary for fulfilling the role-demands in the previous examples is a demanding task. The need for, so-called, 'intelligent' individuals, however, has always existed, particularly for administrative posts. Galton (1883, in Gardner, 1999), Darwin's cousin, thought "that more intelligent persons would exhibit greater sensory acuity, and so the...measures of intelligence (he proposed) probed the ways in which individuals distinguished among sounds of different loudness, lights of different brightness, and objects of different weight" (Gardner, 1999, p.2). These beliefs, based on a deeper conviction that there exists something that presents itself as intelligence, led to the first intelligence tests.

The French ministry of education commissioned Alfred Binet and Theodore Simon around 1900 with the assignment to create an intelligence test, which they did (Binet & Simon, 1916, cited in Gardner, 1999). Later on, German psychologist Wilhelm Stern (1912, cited in Gardner, 1999) transformed the test results into a quotient and coined the term Intelligence Quotient (IQ). This was the ratio of one's mental age divided by the same person's biological age, times one hundred. Mental age was calculated utilising questions requiring answers considered being well-known beyond doubt.

Under this name, the IQ test was introduced into the United States and after initial studies (Terman, 1916, and Yerkes, 1921, in Gardner 1999) it gradually evolved to acquire the contemporary IQ test format.

1.1.1. Subgroup inequalities

Some questions that required answers which could not be considered well known had entered the IQ test during the long-lasting and extensive use of it, as early as in Binet's time. These included, for instance, what should one do with a wallet found on the street, or, how is water polo played, or, what does a certain wine taste like, and so on. The answer considered correct for the first question was to hand the wallet to the police. But that would depend on one's opinion of the police, and that, in turn, would depend on one's social background among others, especially when considered that the police did not necessarily treat all people the same way. Similarly, not everyone played water polo, not everybody consumed wine, and so on. Therefore, such questions also measure moral values and socio-cultural abilities.

Consequently, corrections were made. Despite the corrections though, issues which puzzled test administrators still existed. For example, a fifteen-point difference emerged between the mean scores of Caucasian and African-American test takers. "One could only ferret out genetic differences in intellect (if any) between black and white populations in a society that was literally colour blind (Gardner, 1999, p. 16). On the other hand, the tests had been corrected by replacing questions that required "specialised" knowledge with more complex ones. These new questions examined sensory acuity, word memory, thinking in words, thinking with numbers, evaluating the logic of certain sentences and the ability to demonstrate everyday-life's problem-solving strategies (Gardner, 1999).

Seen under this light IQ tests show a bias, even if they were constructed by well-meaning scholars. It has not been possible to eliminate all "suspicious" questions possibly sustaining discrimination between Caucasians and African-Americans or rich and poor. This can be explained through the influence of existing cultural differences of the compared groups (Steele, 1997).

All these reasons led intelligence testing "to be seen, rightly or wrongly, as a technology useful primarily in selecting people to fill academic or vocational niches" (Gardner, 1999, p. 4). Despite their declining use and despite their improvement (Sternberg, 1985), IQ tests cannot be easily replaced (Steele, 1997; Gould, 1995). The need to find a generally intelligent person still exists. Of course, there is a difference between IQ tests and intelligence per se. Hence, it might be considered as important to investigate the sources of intelligence.

1.2 Heredity and environment as sources of intelligence

Intelligence is not only inherited or only environmentally induced (Otto, 1997). It appears to be the result of a co-operation of influences both environmental and congenital (Scarr & McCartney, 1983). The influence of congenital factors has been demonstrated in identical twin studies and in autistic persons (Gardner, 1999, p. 39; and Happe, 1995). Environmental influences have been demonstrated in humans (Mithen, 1996) and in animals (Gardner, 1983, p. 37-48). A specific example is provided by Gardner. "In the cat," he writes, "there is a *critical period* in visual development from the third to the fifth week postnatally. If, during this time, one eye is deprived of form of light, then *the central connections of the eye change* and the ill-seeing eye will be suppressed from functioning. *Such interference seems to be permanent.* As a general point it seems that the most vulnerable time for an organism occurs during these sensitive periods" (1983, p. 40).

Critical periods but also sensory deprivations exist in many areas. (Nicholls et al., 2001, p. 549-571). It is therefore conceivable that environmental factors can influence heredity and produce an individual different than the one that would appear if heredity had acted alone. Environmental influences on inherited traits may appear very early in life, are of great importance and induce permanent changes. As discussed elsewhere, everyone falls somewhere within a continuum with nature on one end and nurture on the other. In order to be certain of the complex matter discussed though, a definition of intelligence should be presented.

1.3 Defining intelligence

The difficulty to clarify and organise the set of phenomena that comprise intelligence can be seen in Neisser et al., (1999): "When two dozen prominent theorists were recently asked to define intelligence, they gave two dozen somewhat different definitions" (p. 487). Dictionaries provide definitions that do not take position regarding the origin debate between inherited and acquired traits. The Oxford Universal Dictionary (1965), for instance, explains intelligence as "**1.** The faculty of understanding; Intellect **2.** Understanding as a quality admitting of degree; *spec.* superior understanding; quickness of mental apprehension, sagacity **3.** The action or fact of mentally apprehending something; understanding, knowledge, comprehension (of something), and so on. The Webster's New Collegiate Dictionary (1975) explains intelligence as: **1a** (1): the ability to learn or understand or to deal with new or trying situations: REASON. *also*: the skilled use of reason (2): the ability to apply knowledge to manipulate one's environment or to think abstractly as measured by objective criteria (as tests) **b:** *Christian Science:* the basic eternal quality of divine Mind **c:** mental acuteness: SHREWDNESS **2a:** an intelligent entity; *esp*: ANGEL **b:** intelligent minds or mind <cosmic~> **3:** the act of understanding: COMPREHENSION **4a:** INFORMATION NEWS **b:** information concerning an enemy or possible enemy or an era; *also*: an agency engaged in obtaining such information.

1.3.1 Intelligence versus multiple intelligences

Herrnstein and Murray, in their eight-hundred-page book "The Bell Curve" (1994) which includes approximately two hundred pages of statistics, indirectly support that there are no multiple intelligences as Gardner had suggested about eleven years earlier. They believe intelligence is a single ability, evenly distributed in the general population with few exceptions of individuals reaching IQs exceeding 130 (high intelligence), as few scoring in the below 70 range (low intelligence) and most people scoring between 85 and 115 (expected intelligence).

If not otherwise explained, this phenomenon would suggest a genetic background. If it were hypothesised that the DNA is responsible for the actions taken by the body that end up rendering intelligence and there is no sensory deprivation during critical developmental periods as presented (in the cat example) previously, then the neurone, or the DNA molecule responsible for the neurone's existence and characteristics, would be considered as the main contributor of intelligence.

1.3.2 Gardner's position

Gardner answers to this theoretical approach in his book "Intelligence Reframed" (1999). He defines intelligence as "*a biopsychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture*" (Gardner, 1999, p. 33-34). This definition elucidates the connection between intelligence and information processing.

It also suggests the involvement of learning procedures. Kandel's findings further support this view. Kandel was awarded the Nobel Prize for his work on a sea-worm, Aplysia (Kandel & Schwartz, 1982). Kandel considers learning primarily a matter of synaptic strength. And Gardner comments: "finally, these simple processes of *altering synaptic strengths* can be combined to explain how progressively more complex mental processes take place, and thus yield, in Kandel's phrase, a 'cellular grammar' underlying various forms of learning. That is, the same processes that explain the simplest forms of habituation serve as a kind of alphabet from which one can compose far more complex forms of learning, such as classical conditioning" (Gardner, 1983, p. 47).

In this sense, Gardner's definition of intelligence indicates that biologically, intelligences cannot be sensed or measured. They are "potentials – presumably, neural ones – that will or will not be activated, depending upon the values of a particular culture, the opportunities available in that culture, and (upon) the personal decisions made by individuals and/or their families, schoolteachers, and others" (Gardner, 1999, p. 34).

1.3.3 Other approaches

Gardner is not alone in supporting these beliefs. Other essays on intelligence also endorse a similar approach (Greeno, 1998; Perkins, 1995; and Ceci, 1990). According to their views, even if the neurone is the only element influencing intelligence, it does not by itself determine it. What really is decisive is the stimulus that "teaches" the neurone how to function. If this stimulus harms the neurone, the affected person might display physical or mental impairment. If, on the contrary, it affects the neurone in a way congruent to the cultural environment, the person will be well adjusted for the society in which he or she belongs.

Pfeifer and Scheier (1999) are inconclusive regarding a definition of intelligence. However, they do not agree with Herrnstein and Murray's position. In the glossary section of their book, they state that "no generally accepted definition exists. The term is used to describe *complete agents* (agents that are autonomous, self-sufficient, embodied and situated) that resolve the *diversity-compliance trade-off* in interesting ways. Intelligence must always be seen with respect to a *particular ecological niche*". Additionally, in their texts, they provide several definitions expressed by field experts.

Intelligence is "the ability to carry on abstract thinking" according to L. M. Terman; "having learned or ability to learn to adjust oneself to the environment" according to S. S. Colvin; "the ability to adapt oneself adequately to relatively new situations in life" according to R. Pinter; "a biological mechanism by which the effects of a complexity of stimuli are brought together and given a somewhat unified effect in behaviour" according to J. Peterson; "the capacity to acquire capacity" according to H. Woodrow; and finally "the capacity to learn or profit by experience" according to W. F. Dearborn" (Journal of Educational Psychology, 1921, cited in Pfeifer and Scheier, 2000, p. 6).

Finally, their disposition is reflected in statements such as: "...IQ is a good predictor of some kinds of success (and)...we concluded (that) intelligence originates from a highly complex interaction between genetic and environmental factors...high intellectual ability resulting in a high IQ score may well be due to a complex mix of sensory-motor abilities that in turn depend on the particular social environment" (Pfeifer & Scheier, 1999, p. 31).

1.3.4 Conclusion

From all the above, it can be sustained that intelligence is a descriptive term. It describes characteristics of individuals or of groups of individuals. Although these characteristics are evident in all people, they become more obvious when the underlying neurological elements are stimulated and activated by the environment. Table 1 summarises various definitions of intelligence as presented in the above section.

Table 1
Definitions of intelligence

Author	Definition
S. S. Colvin	having learned or ability to learn to adjust oneself to the environment
W. F. Dearborn	the capacity to learn or profit by experience
H. Gardner	a biopsychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture
The Oxford Universal Dictionary (1965)	**1.** The faculty of understanding; Intellect **2.** Understanding as a quality admitting of degree; *spec.* superior understanding; quickness of mental apprehension, sagacity **3.** The action or fact of mentally apprehending something; understanding, knowledge, comprehension (of something)
J. Peterson	a biological mechanism by which the effects of a complexity of stimuli are brought together and given a somewhat unified effect in behaviour
R. Pinter	the ability to adapt oneself adequately to relatively new situations in life
L. M. Terman	the ability to carry on abstract thinking
The Webster's New Collegiate Dictionary (1975)	**1a** (1): the ability to learn or understand or to deal with new or trying situations: REASON. *also*: the skilled use of reason (2): the ability to apply knowledge to manipulate one's environment or to think abstractly as measured by objective criteria (as tests) **b:** *Christian Science:* the basic eternal quality of divine Mind **c:** mental acuteness: SHREWDNESS **2a:** an intelligent entity; *esp*: ANGEL **b:** intelligent minds or mind <cosmic~> **3:** the act of understanding: COMPREHEN-SION **4a:** INFORMATION NEWS **b:** information concerning an enemy or possible enemy or an era; *also*: an agency engaged in obtaining such information.
H. Woodrow	the capacity to acquire capacity

Examined under this light, it would be very interesting to discuss spatio-temporal intelligence and musical intelligence, their relation to each other, as well as the environment's role in their manifestation.

1.4 Multiple intelligences

Gardner introduced a unique approach to intelligence matters. In his own words, this was a result of the "challenge and promise of examining human cognition through a number of discrete disciplinary lenses. I enjoyed investigating psychology, neurology, biology, sociology, and anthropology as well as the arts and humanities" (Gardner, 1999,

p. 33). He applied his knowledge both as a psychologist working with young children at the "Project Zero", a Harvard Graduate School of Education research group, and as a neuropsychologist, having studied aphasia near Geschwind.

He describes analytically the criteria he used to separate the human abilities, criteria which had to be met by the skills he named "intelligences".

1.4.1 Criteria for characterising abilities as intelligences

Attempting to isolate the purely hereditary elements deprived from any environmental influence, he describes two *biological* criteria (Gardner, 1999, p. 36-41; Gardner, 1983, p. 63-67):

1. The potential of isolation by brain damage. "As a neuropsychologist, I was particularly interested in evidence that one candidate intelligence could be dissociated from others. Either patients exist who have this intelligence spared despite other damaged faculties, or there are patients in whom this faculty has been impaired while others have been spared". Suggesting the distinction of linguistic intelligence, he continues: "Thus, both the separation of language from other faculties and its essential similarity in oral, aural, written, and sign forms point to a separate linguistic intelligence" (Gardner, 1983, p. 63; 1999, p. 36).

2. An evolutionary history and evolutionary plausibility. "Despite all its gaps, evidence about the evolution of our species is crucial to any discussion of the contemporary mind and brain". Suggesting the existence of spatial intelligence, he writes: "**Thus** we can infer that early hominids had to be capable spatially of finding their way around diverse terrains, and we can study the highly developed spatial capacities of other mammalian species" (Gardner, 1983, p. 65; 1999, p. 36).

Logical analysis led to two other criteria:

3. An identifiable core operation or set of operations. "In the real world, specific intelligences operate in rich environments, typically in conjunction with several other intelligences. For analytic purposes, however, it is important to tease out capacities that seem central or 'core' to an intelligence. These capacities are likely to be mediated by specific neural mechanisms and triggered by relevant internal or external types of information." Suggesting spatial and musical intelligence, it is supported that "intelligences also have their component operations or processes, such as the sensitivity to large-scale, local, three-dimensional and two dimensional spaces (spatial intelligence), or the aspects of musical processing that encompass pitch, rhythm, timbre, and harmony (musical intelligence)" (Gardner, 1983, p. 64; 1999, p. 36-37).

4. Susceptibility to encoding in a **symbol system**. Symbol systems include "...spoken and written language, mathematical systems, charts, drawings, logical equations, and so on...Historically, symbol systems seem to have arisen precisely to code those meanings to which the human intelligences are most sensitive...With respect to each... intelligence, there are both societal and personal symbol systems...And so...we have developed linguistic and pictorial symbols...Put differently, symbol systems may have been developed precisely because of their preexisting, ready fit with the relevant intelligence or intelligences" (Gardner, 1983, p. 66; 1999, p. 37-38).

If each intelligence is thought to have its own history, this history should be detectable. This need, combined with developmental psychology, led Gardner to the formulation of the next two criteria:

5. A distinct developmental history, along with a definable set of expert "end-state" performances, expressed, for example, through interpersonal intelligence. "Individuals do not exhibit their intelligences 'in a row';...In a sense, intelligences have their own developmental histories. *Thus, people...**must** develop their ...abilities in certain ways...*(and)*...we should speak of the development of a mathematician in the societal domain called mathematics...*If I were to rework this criterion today, I would speak about the development of *end-states* that harness particular intelligences... For example, both the clinician in American culture and the shaman in a tribal culture are

using their interpersonal intelligences but in different ways and for somewhat different ends" (Gardner, 1983, p. 64-65; 1999, p. 38).

6. The existence of idiot savants, prodigies, and other exceptional people.

   "In ordinary life, intelligences commingle freely, almost with abandon. Thus, it is particularly important...to take advantage of those accidents in nature... that allow...to observe the identity and operations of a particular intelligence in sharp relief...'' Nature provides with people who, without any documented signs of brain injury, have unusual profiles of intelligence. The ***savant***, for example, exhibits an area of stunning strength along with other ordinary abilities or even marked deficits. ''Autistic people may be...outstanding (in doing something)...and (at the same time) characteristically evince marked impairments...'' ''The ***prodigy***'', on the other hand, ''is the person who is outstanding in a specific performance area and talented, or at least average, in other areas" (Gardner, 1983, p. 63-64; 1999, p. 39).

The last two criteria are based on traditional *psychological* research:

7. Support from experimental psychological tasks. "Psychologists can tease out the extent to which two operations are related to each other by observing how well people can carry out two activities simultaneously...For example, most of us have no trouble walking ...while we are conversing; *the intelligences involved are separate*. On the other hand, we often find it very difficult to converse while we are working on a crossword puzzle...(because)...*two manifestations of linguistic intelligence are competing*" (Gardner, 1983, p. 65; 1999, p. 40) and

8. Support from psychometric findings, indicating that most different types of intelligence, **spatial** and **linguistic**, are weakly, if at all, correlated. "Much psychometric evidence can be read as a criticism of multiple intelligences, because (it) suggests the presence of a 'positive manifold' –a correlation in scores among various tasks. Nonetheless,...studies of *spatial* and *linguistic* intelligences...have yielded persuasive evidence that these two faculties have at best a weak *correlation*... Similarly, investigations of the new construct of emotional intelligence –roughly an amalgam of the two personal intelligences- have indicated that this phenomenon may well be *independent* of how one scores on the traditional intelligence-testing items" (Gardner, 1983, p. 66; 1999, p. 40-41).

These criteria might not be sufficient to provoke a change in everyday-language characterisations, which might have led someone to call someone else intelligent or not. However, they can serve as a basis for further discussion on musical intelligence, spatio-temporal intelligence and their presumable correlation.

1.4.2. The intelligences

Based on the above criteria, Gardner separates seven intelligences in his first book (1983) and three more in his second one (1999) on multiple intelligences. The first set of intelligences included:

- Linguistic intelligence
- Logical-mathematical intelligence
- Musical intelligence,
- Spatial intelligence,
- Bodily-kinaesthetic intelligence,
- Interpersonal intelligence, and
- Intrapersonal intelligence.

He also presented three sets of intelligences comprising of:

- **Linguistic** and **logical-mathematical** intelligences since they are typically appreciated in school,
- **Bodily-kinaesthetic** together with **musical** and **spatial** intelligence because they are more obvious in the arts, and
- **Interpersonal** and **intrapersonal** because they are focused on the individual.

These last two are roughly equivalent to emotional intelligence (Goleman, 1995).

1.4.3 Musical Intelligence

Gardner presents linguistic intelligence through the perspective of a poet. Similarly, he proceeds to describe musical intelligence through the perspective of a musician. A musician presents "an 'end-state' of musical intelligence''. Gardner describes ''some of the core abilities that underlie musical competence in ordinary individuals" and also investigates musical breakdown, touching "upon the brain organisation that makes possible musical achievement" and considers "some of the ways in which musical intelligence has – and can- interact with other human intellectual competences". A composer, he says, " constantly has "tones in his head" –that is, he is always, somewhere near the surface of his consciousness, hearing tones, rhythms, and larger musical patterns...(1983, p. 101)".

The source of these tones can be internal or external. Composers such as Aaron Copland, Richard Wagner, Camille Saint-Saens, Arnold Schönberg and others have stated that composing was not a difficult task for them, irrespective of the work necessary. The aural imagination *"is...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" according to American composer Roger Sessions (Gardner, 1983, p. 101).

Gardner introduces the chapter on musical intelligence by stating that "of all the gifts with which individuals may be endowed, none emerges earlier than musical talent" (Gardner, 1983, p. 99). During the nineteenth century, the debate between the influence of heredity and environment on musical intelligence was more intense than it is today and could not be concluded easily.

1.4.3.1. Music elements

It is generally accepted that the **structural elements of music** are **pitch, rhythm, timbre** and **harmony**, although some might object as to the validity of the last. Consequently, when investigating heredity versus environment in music, it would be appropriate to investigate all of the above-mentioned elements, possibly beginning by attempting to locate the primary cerebral areas where these features are processed. An appropriate question might be if music is processed in one brain area and analysed in four different ways or if music is processed in four or more different brain areas and experienced as one entity.

From a biological-neurological point of view, Gardner sees a link between language and music and uses several pages in his book to present it. He does not forget though to accent the dichotomy of the mechanisms involved in their processing. Philosophical-scientific approaches of the topic “music” applying a “top-down” or a “bottom-up” logic are mentioned. Gardner finds it difficult to identify a biological link between bird song and human song. He finds the variety of existing musical instruments and the neurological mechanisms which are demanded in order to produce music out of these instruments impressive. In his words, “…it is conceivable that the nervous system can offer a plurality of mechanisms for carrying out these performances.” (1983, p. 119). The issue of “talents” is examined without reaching a conclusion as to how they are transferred, if they are transferred.

The “music” chapter is completed stating the **interrelation** existing between **music** and **mathematics**, Pythagoras discoveries regarding, for instance, analogies between pitch and chord length, the course of music and mathematics throughout the centuries, to conclude: “In order to appreciate the operation of rhythms in musical work, an individual must have some basic numerical competence…When it comes to an appreciation of basic musical structures, and of how they can be repeated, transformed, embedded, or otherwise played off one against another, one encounters mathematical thought at a somewhat higher scale…(but)…In my own view, the task in which musicians are engaged differs fundamentally from that which preoccupies the pure mathematician. The mathematician is interested in forms for their own sake, in their own implications, apart from any realisation in a particular medium or from any communicative purpose…music is just another pattern. For the musician, however, the patterned elements must appear in sounds, and they are finally and firmly put together in certain ways, but not by virtue of formal consideration, but because they have expressed power and effect” (1983, p. 126-127).

It is noteworthy that scientifically valid correlation of music and mathematics is not provided.

1.4.3.2. A different perspective

Edwin E. Gordon is an important music researcher and theorist having spent a considerable amount of his professional life in structuring theoretical music assessment models. There are abundant publications displaying his tireless efforts over the years. One of the areas included in his research is the differentiation of music aptitude and music achievement (Gordon, 1998). Concerning language-music relationship, Gordon believes that "Listening to music with comprehension and listening to speech with comprehension involve a similar process" (p. 12).

Regarding heredity versus environment, he writes: "We now know that if children, regardless of their high level of potential to learn music, are not exposed to music, their potential will not be adequately developed. It might even appear that they possess little music aptitude. Yet, if one is born with a limited potential to learn music, it seems that no amount of exposure to music can raise that level of potential. If no other reason, then, a good musical environment is essential if one is to be able to realise his or her maximum innate potential, whatever that level may be." (p. 9).

1.4.3.3. Musical Aptitude

Edwin Gordon describes **musical aptitude** as "a measure of a student's potential to learn music", and music achievement as "a measure of what a student has already learned in music" (Gordon, 1998, p.5). He additionally states that aptitude cannot be defined any more certainly than intelligence, indirectly portraying music aptitude as one form of intelligence. It is possible for an individual to take a music aptitude test without having had any formal music instruction. Conversely, it is impossible to take an academic intelligence test without having learned a language and without having a minimum of academic achievement. Later in his book, Gordon (1998) gives a definition of music aptitude: "It is the impressions that we subjectively or objectively audiate[2] and associate with the sound of music that allows us to make musical inferences and judgements, thus stimulating relevant musical thought rather than thought about music. That process, though it manifests itself somewhat differently for those in the developmental and stabilised stages of music aptitude, is music aptitude" (p. 61).

He suggests that an appropriately formed music aptitude test is not influenced by race, religion and nationality and is not related to actual linguistic ability. Seen under this light, it can demonstrate a high degree of validity (Gordon, 1998). Used as a tool, the music aptitude test results may enable parents and teachers to realise the extent of a child's knowledge despite the circumstantial inability of a child to put thoughts into words.

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[2] Audiation is "hearing and comprehending in one's mind the sound of music that is not or may never have been physically present. It is neither imitation nor memorisation. There are six stages of audiation and eight types of audiation" (Gordon, 1998, p. 175)

1.4.3.4. Sources of Musical Aptitude

Similarly to many other fields, e.g. gender differences, the question of the origins of musical aptitude are centred on the nature – nurture axis. The beginning of the twentieth century found researchers supporting the notion that musical aptitude is inborn. It is crucial for music education to clarify the nature – nurture controversy. If music aptitude can be shown to be hereditary, then it would be of little (musical) value to provide students displaying little music aptitude with music instruction. And since only students with high music aptitude would be able to profit from instruction, only such individuals should be supported in studying music. If the opposite perspective were considered as true though, the "nurture" approach, all students should be taught music.

During the first decades of the twentieth century, studies were conducted investigating the source of musical aptitude through music achievement characteristics (Koch & Mj∅en, 1931; Haecker & Ziehen, 1930; Stanton, 1922; and Feis, 1910; all cited in Gordon, 1998). It was found that children were very likely to be musical when both parents were musical, children were usually musical if only one parent was musical and children were less musical than their parents were when neither parent was very musical. Another interesting finding was that males, as a group, were found to be more musical than females. Following these findings, it was believed that inherited potential was more effective than environmental influences.

Music aptitude was thought of as being fixed, stabilised at birth. Carl E. Seashore wrote regarding the sense of pitch that "the physiological limit for hearing does not improve with training" (Seashore, 1938, cited in Gordon 1998, p. 18). Numerous examples exist though of highly acclaimed musicians whose parents were not as musical as they were, for instance Toscanini, Schnabel and Gershwin. It seems that "music aptitude is a product of both innate potential and musical exposure" (Gordon, 1998, p. 7). Gordon continues describing the interplay between nature and nurture. He concludes by stating that "… the issue of whether musical aptitude is innate, not whether it is hereditary, is of primary importance in developing realistic approaches to teaching music" (Gordon, 1998, p. 7-8).

1.4.3.5. Development of musical aptitude

Research continuously produces results in most, if not in all, developmental cognitive areas indicating that there are critical periods represented by peaks in neural connectivity within the human brain from before birth to some point in childhood, depending on the skill investigated. Corresponding to the known experiment of Hubel and Wiesel (cited in Gordon, 1998) where kittens were deprived of the benefit of vision through eye occlusion during the critical period for vision, he notes: "…if a very young child has no opportunity to develop a music-listening vocabulary, the cells that would have been used to establish that hearing sense will be directed to another sense, perhaps the visual…(and)…Regardless of one's innate potential, no amount of compensatory education at a later time will be able to completely offset the handicap."(p. 9). He then proceeds to explain that the level of music aptitude is dependent on the quality of the early musical experiences received, formal and informal.

Clear implications for music aptitude are that in a child without the opportunity to develop a music-listening vocabulary, the brain pathways that would have been used for establishing that hearing sense will be irreversibly used by another sense. Based on this knowledge, Gordon believes that musical aptitude never reaches a level higher than that present at birth. It is not possible to raise this level using environmental influences. It is only possible to maintain the level of musical aptitude with which one is born. Therefore, favourable influences are necessary if one is to slow down or even stop the natural decreasing of musical aptitude postnatally. The higher the musical aptitude, the more and the diverser the experiences that are required to retain that level. After the age of nine, music aptitude becomes constant. Because of its malleable nature, music aptitude of children **under nine years of age** is called ***developmental music aptitude***. Using his research results from studies covering a time-span of over thirty years, he concludes that music aptitude ceases to develop after age nine. After it crystallises it is termed *stabilised music aptitude* (Gordon, 1998).

The great importance of exposure to musical stimuli from the earliest moment of life can be better understood when all above are taken into consideration. Irrespective of heredity, trying to "catch up" by means of intensive music training at a later time in life cannot compensate for the early losses of a poor music environment during the critical period.

1.4.3.6. Distribution of musical aptitude

Gordon constructed a test aiming at assessing musical aptitude and named it Musical Aptitude Profile (MAP). It might be expected that developmental musical aptitude is distributed in the general population similarly to other innate abilities. As it is not expected of someone to **not** have any mental abilities, it is also not expected of anyone not to have music aptitude. There are people who have more difficulty with music than others, but they too demonstrate music aptitude to some extent. According to Gordon (1998) and based on score distributions provided with proven music aptitude tests, music aptitude is average for the majority of persons (approximately sixty-eight percent, 68%), fewer persons exhibit above or below average results (approximately twenty-eight percent, 28%), and very few are exceptionally high- or low-scored (approximately four percent, 4%). Different ethnic groups, including American, European and Asian students did not score substantially different from each other. Gordon's contribution to music testing is important. Nevertheless, these tests do not directly facilitate the search for the neurological bases of music.

1.4.3.7. Musical aptitude and general intelligence

Several researchers at the beginning of the twentieth century have suggested that musicians as a group enjoy a high level of general intelligence (Cox, 1926; Stanton, 1922; cited in Gordon, 1998). Correlation between intelligence and musical creativity has not been found to be as high as anticipated. Gordon (1998) reports that his and other researchers' data suggest that there is only ten to twenty percent (10 – 20%) in common between scores of musical aptitude tests and intelligence tests. This was found to apply to all types of intelligent tests, i.e. verbal and non-verbal. In 1993, he placed this common score-area only at five to ten percent (5 – 10%). These musical aptitude test comparison results are considered as an indication that music aptitude is not composed of or dependent on general intelligence or academic achievement of any type.

CHAPTER 2

THE INFLUENCE OF MUSIC TRAINING ON OTHER MENTAL ABILITIES

2.1 Research linking music and other cognitive abilities

In 1975, a group of researchers led by Hurwitz conducted a study examining first-grade children. The treatment group received music instruction according to the Kodàly system.

2.1.1. Brief description of the Kodàly system

The Kodaly philosophy is a system of music education which has evolved from the Hungarian schools under Zoltan Kodaly's inspiration and guidance and teaches the concepts of melody and rhythm through folk songs. Despite its name, the Kodaly system itself was not invented by Zoltan Kodaly (1882-1967). Kesckemet is Kodaly's hometown, where he was born in 1882. The first "music primary" school was set up in Kesckemet, Hungary in 1950. Here singing lessons were provided every day of the school year for the first time. This teaching concept of music education and instruction, while undergoing continuous improvement, spread over the next years. The pedagogical principle applied is that of going from the known to the unknown. Hence, the total experience is offered first and only afterwards is the symbolisation of that experience offered. There are several procedural instructions when implementing the Kodaly system. The hand signals used to show tonal relationships are typical. Syllables and rhythm symbols are also used. Practice is carried out with the moveable "do", i.e. "do"(=solfège syllable used to indicate the pitch of C) does not necessarily mean C, but represents the first note of the respective tonal centre of the song studied. Musical material preferred is the folksong of the children's home country. The major instrument is singing.

Kodaly musical training aims on developing the ability of all children to:

- Sing from memory a large number of traditional singing games, chants and folk songs. These should come from the child's own heritage of folk song material and only later are expanded to include music of other cultures and countries.
- Play instruments and dance from memory.

- Listen to, perform and analyse great art music of the world.
- Be proficient in musical skills such as music reading, music writing and singing.
- Improvise and compose, using musical vocabulary appropriate to their developmental level.

One of the reasons that led the researchers to choose this over other music instruction systems was that the Kodàly system is a system aimed at training all children and not just the musically gifted. This system was chosen also because it uses hand signs and the researchers desired to provide children with a spatial and bodily sense of pitch.

The authors suggest that this music instruction program may provide valuable training in the ability to listen and pay attention, and link this to a potential influence on reading. The many-faceted perceptual and cognitive training offered in the system has led Kodàly teachers and others to suggest that the Kodàly system has implications for children's abilities not only in musical areas but in non-musical ones as well.

At the first-grade level, which is of greater interest here, rhythmical skills and their development play a central role. Children are taught folk songs from which the instructor isolates rhythmic and melodic units, emphasising the first. After making the children aware of these rhythmical units, the instructor recombines them to create new rhythmical structures. Visual symbols representing the rhythmical structures are also placed on a blackboard. Children may sing a folk song and then move their body according to the rhythmical pattern. The teacher may then "play" the rhythmical symbols by tapping on a child's shoulder. Placing the children at various distances from one another, with increased distance representing longer note duration may create a representation of combined temporal and spatial aspects, using a learned song. The child participates in these musical activities on a strong sensory and motor basis, learning to discriminate between visual symbols, to connect them with sounds and to remember auditory as well as visual symbols.

The aim of the study was to test the effect of the Kodàly method of music instruction on **sequencing skills** and **spatial abilities** and on **academic achievement** patterns of normal American children from middle class communities. Two groups of twenty children each, ten boys and ten girls, with no demonstrable deficits concerning academic performance were selected from two first grade groups in two middle class suburban schools. One group of children had received music training at the time comparisons were made. This was the treatment group. The second group of children that participated in the study served as the control group. It consisted of children matched in age, IQ, socio-economic status and for ordinal position in the family to the treatment group children, only that the control group children did not receive the Kodàly music instruction. Treatment group children received a forty-minute lesson, five days a week, for a period of seven months.

After the instruction period, the **spatial-temporal** intelligence in the treatment group was significantly higher than in the control group. The children were tested with several measures to determine sequencing skills and spatial abilities. These included a sensorimotor sequencing (tapping) and a verbal perceptual sequencing test devised by the researchers, the Beery-Buktenica Visual Motor Integration Test, the Children's Embedded Figures Test, the Raven Standard Progressive Matrices, the Graham Kendall Memory-for-Designs, and the Block Design and Object Assembly sub-tests of the Wechsler Intelligence Scale for Children (WISC). Two verbal sub-tests from the WISC were also administered, the Comprehension and Vocabulary sub-tests. There were no significant differences between experimental and control children of either sex on these two verbal sub-tests.

An important **gender difference** was reported. Boys in the treatment group were better on three of the five sensorimotor tasks controlled, on two of the three verbal sequencing tasks and on three of the four spatial tasks including the Block Design sub-test of the WISC. Girls in the treatment group though did not perform better on any of the items than girls in the control group.

Academic achievement was measured with the Metropolitan Readiness Test and the Metropolitan Achievement Test, Primary I. The Metropolitan Readiness Test was routinely administered at the start of the first grade school year for children in this study. The results of this test showed no significant difference between children of both groups at the beginning of the school year. At the end of the same year, however, the Kodàly children scored significantly higher, on average, at the eighty-eighth percentile in reading while the control group children scored at the seventy-second percentile. What is also interesting in this part of the research though is that improvement was not equal for boys and girls. Before the training, control group boys had scored higher than treatment group boys had, while girls of both groups did not differ in their scores. Following the training, girls in the treatment group scored significantly higher than their control group counterparts did while boys showed no difference. The lack of difference between the boys of the two groups during post-testing might be explained by the fact that pre-testing had showed significant control group superiority. In other words, the music program might have had a compensatory effect for the treatment group boys' initial deficit in reading readiness. Finally, a comparison of the reading scores of the Metropolitan Achievement Test, Primary II, at the end of the second grade revealed a significant difference suggesting the continuity of the possible influence of Kodàly instruction on reading skills beyond the first grade level. According to the authors, music education facilitates the process of learning to read.

In 1993, Lamb and Gregory tested a group of first grade children on reading skills and on phonic reading, i.e. the ability to vocalise nonsense syllables written on cards. Following, they were tested to evaluate ability in pitch discrimination and in note or chord comparison. Lastly, the children were asked to indicate whether words began or ended with the same sound to evaluate phonemic awareness. The ability to read standard as well as phonic material was strongly correlated to musical pitch discrimination by the researchers. They also showed that children who were capable of good discrimination of musical pitch also scored highly on tests of phonemic awareness.

A study investigating the effects of an integrated reading and music curriculum on fifth-grader's reading achievement, reading attitude, music achievement and music attitude was conducted by Laura Jean Andrews (1997) in North Carolina. Two fifth-grade classes with twenty-nine children each from one school participated. The treatment class received two twenty-minute lessons of integrated reading and music following the regular reading class. The treatment lasted eleven weeks. The control class received no special instruction during reading class time. There was a music class led by the researcher offered to both classes for thirty minutes twice a week. Pre- and post-testing was used to assess the integrated reading and music curriculum's effects. Several tests were used to measure music and reading improvement. These were the Music Attitudes Profile, the Elementary Reading Attitude Survey, the Silver Burdett Music Competency Tests, Book 5 and the Vocabulary and Reading Comprehension sub-tests taken from the Iowa Tests of Basic Skills. The results indicated that there was no significant difference found between groups in reading and music achievement. This was different for the attitude scores though. The music attitude increased for the treatment class while it decreased for the control class.

This is also a study that notes measurable gender differences. More specifically, girls were found to exhibit better attitudes towards reading than boys in both classes did, while boys demonstrated increased scores regarding music achievement.

Before proceeding, a brief description of the term meta-analysis should be included. It represents a methodology allowing for a synthesis of large numbers of existing literature in order to extract an informed generalisation from this data. It is also valuable for providing description of the relevant literature characteristics. Differences in research design or subject selection can be overcome implementing new statistical procedures. Effect sizes can be computed across studies providing insight regarding their combined significance.

Butzlaff (2000) performed a meta-analysis on thirty studies investigating the interrelation of reading and music instruction. All studies met three criteria: (1) reading was measured with a standardised measure of reading performance, (2) the reading test was administered after the music instruction and (3) the effect size could be estimated with the statistical data provided. Twenty-four studies were characterised as correlational because they lacked pre-test reading data and because experimental groups were not random. Only six studies were characterised as experimental, including pre- and post-reading tests and randomly assigned groups. Impressive is the sample size of ten correlational studies conducted by the College Board in the decade 1988 – 1998 displaying a notable link between participation in high school music performance classes and verbal Scholastic Aptitude Test (SAT) scores: over five hundred thousand students. The six experimental studies involved far fewer subjects. Their number ranges from twelve to forty-six per study. Music curriculum as well as reading tests used were different for each study.

The meta-analysis of the first group of studies, the correlational-study group, revealed a strong association – "highly significant" to cite the author – between music instruction and reading measured with standardised tests. All twenty-four studies support a dependable interrelation between the two subject areas studied. The experimental-studies group' meta-analysis also demonstrated similar correlations as the first group. Results partially supported a causal relationship between music and reading. However, Butzlaff claims evidence is insufficient to support this causal relationship. Despite the fact that the experimental studies provided a less significant positive result, this meta-analysis in its entity reinforces the often-discussed positive association between music and reading.

2.2 Research on music and mathematics

An association between music and mathematics can be followed throughout history. Many very important philosophers and scientists of the past have theorised on the connection between music and mathematics. Pythagoras' study of mathematics is well known. He and his followers used numbers to interpret everything in the physical world. Music was no exception. Its scales, for example, were analysed and explained with the use of numbers. Centuries later, Johannes Kepler used the phrase Plato had used, "music of the spheres", when referring to planetary motions. A famous composer, Johann Sebastian Bach (1685 – 1750), is known to have often composed canons and other types of highly structured music, such as fugues, similarly to solving mathematical problems. Contemporary scientists have researched in the area, producing studies exhibiting correlational as well as causal links between music and mathematics. Following is a review of recent studies in the field.

The Kodàly system was used in a study by Gardiner, Fox, Knowles and Jeffrey in 1996. The effect of a curriculum introducing music and visual-arts and at the same time emphasising skill development on visual and spatial reasoning was investigated. The subjects of this study were ninety-six children, aged between five and seven years, i.e. first- and second-grade children. They were assigned to two main groups, the experimental group and the control group. Subjects were pre- and post-tested using the First-Grade Metropolitan Achievement Test. Initially, the experimental group contained children of which less than forty percent scored at, or above the national average in post-kindergarten testing. On the other hand, seventy percent of the control group had scored marks approximately at, or above this average. After seven months of additional music classes and visual arts classes for the experimental group, this difference had disappeared. Moreover, the experimental group achieved higher standardised mathematics scores than did children of the control group who received the school's normal arts and music training. The existence of improvement for the experimental group is clear. The researchers also found that prolonged exposure to the arts program further improved mathematical learning, thus correlating the two. They reported that this arts training improved attitude towards learning. A transfer mode coined "mental stretching" involving similarities in learned mentation skills was proposed to explain larger effect of the arts training on mathematics compared to reading. Nevertheless, it remained unclear whether this improvement was due to the arts program or due to the music program or both, since both supplementary classes were offered together.

Graziano, Peterson, and Shaw (1999) conducted research investigating the effect of music on mathematical reasoning. The researchers compared the proportional reasoning abilities of one hundred and thirty-six second-grade children from the inner city 95th Street School in Los Angeles, before and after treatment. Children were assigned to four groups according to the type of instruction they received. The first group consisted of twenty-six children who received keyboard instruction together with exposure to the Spatial-Temporal Math Video Game software designed to teach fractions and proportional math. The second group consisted of twenty-nine children who were offered the above-mentioned spatial-temporal training together with English instruction. The third group included twenty-eight children who received no special treatment. The remaining children were offered spatial-temporal training only, in three sub-groups for one, two and three months respectively. The video game required children to manipulate images mentally. In a second stage it advanced to spatial presentations of fractions and proportions.

Results were measured using the companion Math Video Game Evaluation Program, and three tasks taken from the WISC-III: Object Assembly, Block Design and Picture Arrangement. Graziano et al. (1999) found that for children in the first group given 4 months of piano keyboard training along with the spatial-temporal training, scores were fifteen percent higher on proportional math and fractions than children given the English training along with the spatial-temporal training. Both above-mentioned groups scored dramatically higher than the third group, which included children who did not receive any spatial-temporal training. Children who were offered only the spatial-temporal training improved their scores on the Evaluation Program the longer they received it. From all the above, it is possible to suggest that music instruction was responsible for the enhanced proportional reasoning, as observed in the first group, reflected in abilities such as understanding fractions and ratios.

Positive benefits of music learning are also demonstrated by Vaughn's meta-analysis published in 2000. Her search of published and unpublished studies dealing with the relationship between music and mathematics initially returned four thousand references. Articles considered program descriptions or promotional material were excluded. Also excluded were articles using music as a reward following superior performance in mathematics, articles where music excerpts served as memory boosters as well as articles focusing on mathematics and music talent rather than accomplishment. The remaining forty-one studies were further categorised in three groups. The first, correlational, included twenty studies. Half of them were large studies with subject numbers in the three hundred thousand range. They compared high school students' participation in music classes with Scholastic Aptitude Test (SAT) mathematics performance. The second group, experimental involving music instruction, included just six studies. All subjects were from pre-school to elementary school children. The third and last group, experimental involving music listening, included fifteen studies. These studies compared two opposing music genres, such as classical versus rap music, predicted to enhance or decrease mathematical achievement respectively.

Separate meta-analysis was performed for each of the three described groups. Music study and mathematics achievement indicated a significant relationship in the meta-analysis of the first group. Higher scores on standardised mathematics tests were more likely for students having participated in their high school's music classes. The experimental group's analysis showed that the study of music causes an increase in mathematics achievement. Oddly, the author contradicts herself when at first she states that students who take music consequently show higher mathematical achievement, and then concludes that it has not yet been adequately proven that music training enhances performance in mathematics. The third group studies examined showed that listening to some music categories may promote performance on mathematics tests. The results of this category are mixed, maybe because of the nature of the studies included. It would be useful to separate musical selections according to their effect, for instance arousing music or relaxing music. Further, to control its effect on diverse children depending on the subjects' psychological profile, with categories such as emotionally challenged or attention-deficit children. Finally, it might be useful to state the purpose of exposure, for example academic or behavioural.

2.3 Research on music and spatial-temporal ability

Spatial-temporal reasoning is described by Gordon L. Shaw based on a definition of Johnson-Laird (1983). It "involves maintaining, transforming, and comparing mental images in space and time using symmetry operations, as, for example, in chess" (Shaw, 2001, p.611).

Rauscher, Shaw, Levine, Wright, Dennis and Newcomb (1997) conducted research comparing spatial-temporal intelligence scores before and after keyboard instruction. This research was theoretically grounded on the hypothesis that a causal connection exists between training in music and spatial ability. These theoretical grounds were proposed by Leng and Shaw (1991). Gordon Shaw was on the team of researchers working with Rauscher in the presently reviewed study. According to the above-mentioned theory, **music** training could strengthen the same neural connections that are used in **spatial-temporal** tasks. Therefore, early instruction in musical domains could possibly enhance children's capability in puzzle solving, chess playing or other tasks where spatial-temporal intelligence is necessary.

The researchers worked with a group of seventy-eight three-year-old children. The study was stretched over a period of two years; however, the children received instruction for a period of six or eight consecutive months. They provided thirty-four children with individual piano keyboard lessons from professional piano (keyboard) instructors using traditional methods. Pitch intervals, playing from memory, fingering, music notation and sight-reading were trained during these lessons. Because children visited different schools, some received eight months of one weekly lesson while the others received two weekly lessons for six months. The later group accumulated more lessons than the first group. This led the researchers to investigate for significant effects for number of lessons, which were not found. The remaining children were divided in three groups: twenty children received computer lessons, ten children belonged to the singing group and fourteen children received no lessons. The children had no prior music lessons or computer lessons.

Four tasks from the Performance sub-test of the Wechsler Preschool and Primary Scale of Intelligence – Revised (WPPSI-R) were administered to assess the children's spatial reasoning before and after the instruction period. According to the authors, the Object Assembly task measures spatial-temporal reasoning while the other three tasks, namely Geometric Design, Block Design and Animal Pegs require spatial recognition. Briefly discussed, these tasks require:

- **Object Assembly**, construction of six puzzles, two within a frame and four freestanding.
- **Geometric Design**, choice of a matching geometric design from an array of four geometric designs, and drawing geometric designs with a pencil.
- **Block Design**, construction of a white and red shape from square blocks using a picture as a model.
- **Animal Pegs**, association of coloured pegs with pictures of animals and systematical fill-in of holes, row by row.

The spatial recognition tasks revealed that no group improved significantly after the instruction period. The Object Assembly task though, the spatial-temporal task tested, showed a significant improvement for the piano keyboard group only.

The researchers suggest that "music training produces long term modifications in underlying neural circuitry in regions not primarily concerned with music" and propose that "an improvement of the magnitude reported may enhance the learning of standard curricula, such as mathematics and science, that draw heavily upon spatial-temporal reasoning" (p. 7). In fact, the results of this research support the existence of a transfer effect between music training and spatial-temporal reasoning.

In an interesting article discussing the non-musical potential of learning and listening to music, Staines (1999) poses the question: "Given that a task has been mastered, for how long will transfer persist? ... further examination of transfer should also differentiate between its many transitory effects and those consequences that are more long-term" (p. 134).

The following research provides some answers regarding long-term effects of piano instruction on cognitive development. Costa-Giomi (1999) investigated the effects of three years of piano keyboard instruction on children's cognitive development. She provided a group of forty-three nine-year-old children with individual piano lessons. A control group of thirty-five children was not offered keyboard instruction. The frequency of piano instruction for the experimental group was changed during the course of the study. In the first two years, children received one weekly thirty-minute lesson. In the third year, this was increased to one forty-five minute lesson per week. Children were tested in the beginning and at the end of each year of instruction. The Developing Cognitive Abilities Test together with four other standardised tests was administered. These tests measured verbal, quantitative, spatial, musical and fine motor ability. There were no differences found in the post-test scores of the two groups on any of the verbal or quantitative sub-tests. The spatial sub-test administered though, taken from the Developing Cognitive Abilities Test, showed significant variation in scores.

After the first and after the second year of training, a significant difference was found each time in this sub-test's scores indicating significant improvement of general cognitive and spatial abilities. At the end of the third year though, there was no significant difference found. This resulted as control-group children increased their spatial scores dramatically at the end of the third year, and was not due to stagnation of the experimental-group children. Mean scores of the experimental group compared show a regular annual increase in the three-year span. The control-group scores on the other hand remained practically unchanged for the first two years, only to match the other group's scores a year later. In an effort to explain these findings, the researcher suggested that hormonal influences on spatial ability might have played a role, considering that children were entering puberty during the third year of instruction. Furthermore, Costa-Giomi assumes that the positive effects on the cognitive abilities depended on the children's dedication to learning the piano. The later was measured calculating weekly practice time and absence frequency, and it accounted for twenty-one percent of the variance in spatial ability of the experimental group at the end of the three years piano instruction. Concluding, it was also found that students given piano instruction showed improved results regarding their self-esteem and musical skills.

2.3.1. Orff-based Music Instruction

Carl Orff, (1895-1982), German composer and pedagogue, and Gunild Keetman published "Musik für Kinder" ["Music for Children"] in 1954 after having worked towards this goal for four years. This work consists of five volumes. In the volumes, there are texts, songs and instrumental pieces that provide the prototypes for challenging children and teachers alike in music making and expressive movement. Another important method approach is reflected in its improvisation and creative work modules. Basic positions supported by the Orff Schulwerk are:

- music making and dancing are fundamental forms of human expression, requiring physical, spiritual, emotional and intellectual involvement,
- the three areas of **spoken language, dance** and **music** are realised by the children as a **single entity**, upon which they indiscriminately act,
- the playing of musical instruments should accompany singing from the start,
- traditional music and dance training curricula should be paired with creative composing and dancing activities

Orff emphasised music, movement and speech in his pedagogical structure. An important element of the Orff method is the use of percussion instruments. Typically, a set of tonebar xylophone instruments is used. These instruments resemble the piano keyboard in their visual-linear representation of the intervals between pitches. This can be seen as a direct link between pitch distribution and spatial organisation not readily offered by many instruments such as the violin. Children can learn to play these xylophones with minimal effort. They often play and sing songs at the same time or improvise their own music. When compared to playing the piano, fewer fine motor skills are required to play these instruments. Instead of fingers, mallets are used to strike the tonebars. Young children can successfully carry out this large muscle movement.

A study conducted by Persellin (1999) investigated the effect of Orff-based music instruction on spatial-temporal task performance of young children. Thirteen children aged five to six years participated. No control group was used. Participating children received Orff-based music instruction for forty-five minutes three times a week for a period of six consecutive weeks. The music lesson activities included playing hand-held percussion instruments, playing Orff tonebar instruments, singing, moving to music and orchestrating stories. Testing was conducted using the Object Assembly Test of the Wechsler Preschool and Primary Scale of Intelligence – Revised (WPPSI-R). Children received credit for accuracy and for speed. Children were tested before and after the Orff instruction program. A further post-testing took place another six weeks later in the absence of the music program, to investigate the duration of the effects caused by the music instruction.

Results revealed that the music instruction had significantly increased the children's performance on the Object Assembly Test during the first post-testing. After music instruction had ceased though, post-testing showed a retreat in test scores even though they remained higher than the pre-test scores. Comparison of the pre-test and the second post-test scores revealed no significant differences. These results show that music instruction's effect on spatial-temporal skills was only present immediately after the instruction period and was not sustained over time. The study author describes a lack of challenge reported by the children during the re-testing sessions. This might partially account for the decreasing scores trend observed. Short duration of instruction also might have played a role in this short-lived effect. The lack of a control group did not allow for comparison of Orff-instructed children after six weeks without lessons and children having received no lessons. Hence, further research is necessary to illuminate these issues.

Gromko and Poorman (1998) investigated the effect of seven months of music training on pre-schoolers' performance of five tasks taken from the Wechsler Preschool and Primary Scale of Intelligence – Revised (WPPSI-R). The five tasks were Object Assembly, Geometric Design, Block Design, Picture Completion and Animal Pegs. All tasks are previously described, except Picture Completion, which involves pointing at the missing element in a picture.

The treatment group as well as the control group consisted of seventeen three- and four-year-old children each. Hence, the total number of participating children was thirty-four. The researchers examined the connection between musical experience and performance on spatial-temporal tasks. Gromko and Poorman's "Preschoolers' Music Club" began on October 1, 1996. All children were pre-tested on the five spatial-temporal tasks in October 1996. They were then instructed in music weekly in twenty-four sessions administered over a period of seven months. A typical lesson would include a new song, music-induced movement, focus on pitch and rhythmic elements of the songs as well as exercises to increase musical memory. Parents helped their children practice at home with sets of tone bells purchased for this purpose. A tape containing songs for listening and singing was also handed to the "music club" children. Following the instruction period, the children were tested again in May 1997. The "music club" group gained significantly more in raw scores than the control group did. This was less though for older children. The authors concluded that music training can have a positive effect on the development of spatial intelligence in pre-school children.

In a more recent study, Rauscher and Zupan (2000) investigated the effects of classroom keyboard instruction on the spatial-temporal ability of kindergarten children. Sixty-two middle-income children from two elementary schools were involved in this study. They were assigned to a keyboard group or to a no music group. The keyboard group, divided in sub-groups of approximately ten children, received two twenty-minute keyboard lessons every week by a music specialist. The keyboard instruction lasted eight months. In this period, the children were tested three times: in the beginning, after four months and after eight months. Testing was done using Puzzle Solving and Pictorial Memory tasks taken from the McCarthy Scales of Children's Abilities and Block Building taken from the Learning Accomplishment Profile Standardized Assessment test (LAP-D). The Pictorial Memory task involves spatial recognition while the other two tasks require spatial-temporal processes.

Post-testing revealed a significant difference in scores with the keyboard group scoring higher on both spatial-temporal tasks after the first four months of lessons. This trend continued, producing an even greater difference after eight months. The keyboard lessons had no effect on producing differentiated post-testing scores on the Pictorial Memory task. The findings are in accord with other similar studies, despite the novel instruction setting. Concluding, the authors of the study stress implications for school administrators and educators suggesting improvement of the quality of elementary public school education that can positively contribute to the academic and social welfare of disadvantaged children.

Bilhartz, Bruhn and Olson (2000) published their study in the same year. In their research, seventy-one four- and five-year-old children from diverse economical backgrounds participated. Children were selected from various pre-schools, Head Start[3] centres and a music centre. Six sub-tests taken from the Stanford Binet Intelligence Scale were given before and after the experimental group were introduced to a music-training program. The Stanford Binet sub-tests administered included two visual tests, Bead Memory and Pattern Analysis; two verbal tests, Vocabulary and Memory for Sentences; and one mathematical test, Quantitative. Musical progress was assessed with the Young Child Music Skills Assessment (MSA). Children were randomly divided in two – experimental and control – roughly equal groups. The thirty-six children of the experimental group were offered seventy-five minutes of music instruction every week for a period of thirty weeks. The music program (Kindermusik for the Young Child) intentionally did not involve the keyboard. It consisted of the weekly school training and home assignments including singing, movement (dancing), reading and writing music, learning to recognise basic rhythms, rhythm notation, composition and playing percussion instruments. The control group, consisting of thirty-five children, received no special training.

Results indicated that the experimental group improved compared to the control group only on the Bead Memory sub-test, and this difference was not significant for the low-income children. The later might be explained by the low attendance, low parental involvement and the less completed home assignments returned by the low-income children. The Bead Memory sub-test is an abstract reasoning ability test requiring visual memory, attention, sequencing, chunking and clustering strategies, and manual dexterity. All other tests showed no significant difference. Children strongly involved in the music curriculum outperformed their music-group peers on Pattern Analysis, even though the two – experimental and control – groups showed no difference on this sub-test.

A meta-analysis was performed on studies investigating the enhancing effect on spatial skills of music instruction of pre-school and elementary school children (Hetland, 2000b). This very interesting work examined fifteen studies. These were selected from a body of published and unpublished studies centred on the discussed topic according to specific criteria. Studies were used when (1) they were in English language in the original, (2) the experimental group was taught to play a musical instrument or sing, (3) at least one control group was contained, (4) assessment tests examined mental rotation or spatial visualisation and (5) an effect size could be calculated through the statistics supplied. The subjects ranged in age from three to fifteen years. The instruction lasted from four weeks to two years.

The main core of meta-analyses yielded results, as stated by the author, which indicate that "active music instruction lasting two years or less leads to dramatic improvements" in spatial-temporal reasoning (p. 179). Individual lessons proved to be more efficient in producing an increase of spatial-temporal test scores than group

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[3] Head Start is a federal program initiated in 1964, intending to improve the skills of economically disadvantaged three- to five-year-old children in the USA, in order for them to begin schooling on an equal basis with their privileged peers

instruction. Teaching musical notation was also found to further the above-mentioned increase, as opposed to music instruction without notation. Subject variation, program and design characteristics appeared not to significantly affect the outcome. It is interesting that differences in the amount of parent involvement, the program length, the use of movement or dance, the teaching on keyboards or not or the incorporation of composition did not affect the results.

Further meta-analyses found an existent but not significant relationship between music production and Raven's Standard Progressive Matrices test. Despite the fact that few studies were available for investigating links between music and spatial tasks other than spatial-temporal performance, a causal relationship was found between music learning and spatial reasoning. The consistency of causal effects found on measures of spatial-temporal reasoning further strengthens the belief that music making leads to enhanced spatial reasoning skills. However, even though music instruction without use of notation displayed robust results, traditional music notation led to stronger effects. It is noteworthy that, according to the author, nearly seventy percent of children offered a music program similar to the ones reviewed in this study are predicted to show spatial improvement as a result of the music program.

This meta-analysis is important because it examined the validity of selected scientific research dealing with music and spatial reasoning. Known methodological threats were controlled. Ruling out the Hawthorne effect, the bias stemming from the authors' expectations, previously existing differences among the groups but also the quality flaws in the research design allowed the author to strongly support the causal effect of music instruction on spatial reasoning. Seen under this light, traditional music instruction might very well be an amplifier of the inherent spatial-temporal thinking modus operandi that takes place in the brain's neuronal circuits.

2.4 The "Mozart Effect"

Apart from the research on the connections between *making* music and spatial reasoning, there is a growing body of research investigating the effect of *listening* to music on spatial reasoning. The phenomenon of human subjects transforming mental images without a physical model subsequently producing enhanced spatial task scores when tested directly after being exposed to certain kinds of music has been called the "Mozart effect". This phenomenon was first described and published in 1993 by Rauscher, Shaw and Ky. In the original study, college students who listened to the Sonata for Two Pianos in D Major, KV. 448, by Wolfgang Amadeus Mozart had a short-term enhancement of their spatial-temporal reasoning, as measured with the paper-folding and cutting test taken from the Stanford-Binet intelligence scale. The reported research findings were broadly publicised. The media coined the term "Mozart effect" to describe the phenomenon.

This exceptional treatment by the media had diverse and unexpected consequences. While positive outcomes include a permanently growing body of research in the field, the "Mozart effect" has become an issue discussed even on television talk shows. In 1998, Gov. Zell Miller of Georgia, USA, while referring to the research proposed that his state distribute compact discs of classical music to new mothers as they leave the hospital.

Rauscher reacted to these extreme actions. She believes "one of the things we have to be careful about is jumping to conclusions that we don't have data on at all…I find that 'Mozart makes you smarter' thing is quite a bit of a leap…there is little evidence to suggest that just listening to music, as Gov. Miller would like Georgia's next generation to do, produces lasting intellectual benefits" (Viadero, 1998).

The **"Mozart effect"** has become quite a controversial issue among scientists and academics. In the meantime, hundreds of studies investigating the relationship of **music** and **spatial** skills have been conducted. A comprehensive review of relevant literature would be capacious. Conflicting results make such a review even more complicated. The following review presents a study that attempts to summarise findings related to the "Mozart effect".

Dr. Lois Hetland of Harvard's Project Zero is the author of a meta-analysis study examining research on music and spatial tasks (2000a). A thorough literature search of published and unpublished studies retrieved five hundred and fifty-three studies. Seventy-six of them presented spatial issues. Strict criteria were necessary to narrow the sample excluding even slightly divergent studies. Thus the researcher included studies that (1) used human subjects only, (2) included listening to a musical stimulus as part of one or more experimental conditions, (3) had at least one control group predicted to display non-improved spatial skills, (4) included assessment on at least one spatial task, (5) supplied adequate statistics enabling the computation of an effect size, and (6) checked the possibility of practice effects. Final selection led to the inclusion of twenty-six studies representing thirty-six experiments.

In the review section of the study, the main theories attempting to furnish a reasonable explanation of the "Mozart effect" are discussed. These include the "trion" model of the cortex, arousal and musical preference. A further theoretical explanation is suggested by the author, based on the rhythmic aspects of patterns depicted either as visual or aural stimuli. This theory appears to be related to the **"trion"** model, where **neurones** involved in processing **spatial** and **spatial-temporal** tasks, among others, are hypothetically **"primed"** by musical stimuli.

In these studies, musical selections presumed to influence spatial reasoning were presented to the subjects. Music by W. A. Mozart, F. Schubert, F. Mendelssohn-Bartholdy, and Yanni along with other melodies and rhythms alone served as treatment material. The most frequently used piece was the Sonata for Two Pianos in D Major, KV. 448, by W. A. Mozart. Incidentally, this music was used in the original "Mozart effect" study by Rauscher, Shaw, and Ky in 1993. Music used in the studies' control conditions expecting no enhancement of the exposed subjects' spatial reasoning included compositions by Philip Glass and Pearl Jam. Other control conditions were silence, noises and relaxation tapes. The researcher then compared control conditions to reassure their usage potential in the final meta-analyses. This procedure inspected connections linking (1) the Mozart Sonata KV. 448 and silence, (2) classical music and relaxation instructions, (3) silence and relaxation instructions, (4) noise and silence, (5) control music (Pearl Jam, etc.) and silence, and (6) control music and relaxation. It was indicated that studies with different control groups could be combined thus rendering meta-analyses possible.

Following this preliminary work, two meta-analyses were conducted. Firstly, the effects of music listening on enhancing spatial reasoning, as measured by all relevant tasks, were examined. It was concluded that enhancement effects are likely in future studies, since significance tests showed that it is highly unlikely that these effects were due to chance. Secondly, the researcher analysed studies controlling for music-listening effects on spatial-temporal tasks alone. A significant and generalisable effect of music on spatial-temporal performance was found. Spatial-temporal task scores were shown to increase more than non-spatial-temporal tasks. Other contrast analyses revealed that other-than-Mozart music also enhances spatial-temporal performance. No gender differences were found, while stronger effects were linked to specific laboratories though lacking a conclusive explanation pointing to the possible causes thereof.

The extensive literature search realised for Hetland's study (2000a) provides its analyses with a comprehensive and inclusive foundation. This characteristic broadly supports the clear effects of listening to Mozart, as well as some other composers' pieces. on spatial reasoning tasks. Based on these findings, controversial educational issues such as learning transfer may be re-examined. It is not that remote to imagine that there are neurological pathways enabling the "priming" of thinking modes shared by more than one discipline.

More research would be necessary to further elucidate this hypothesis. This is also suggested by Mozart effect polemicists McKelvie and Low (2002) in the conclusion of their article, even though strong language is used against the Mozart effect after failure of replication. The researchers investigated the Mozart effect with school-aged children (aged between eleven and thirteen years). They contrasted the spatial IQ scores of children who had listened to a popular dance music piece with the scores of children who had listened to the Sonata for two pianos, KV. 448, by Mozart. After failing to demonstrate significant differences, they repeated the experiment using a different methodology that had previously succeeded in replicating the Mozart effect. This design incorporated relaxation stimuli, which have been argued to inflate the Mozart effect. Even after the alterations, there was no evidence to support the Mozart effect claim of spatial IQ enhancement. The authors end their article: "Since children are still in the process of harnessing their spatial abilities, they may very well be the last hope for the Mozart effect to demonstrate robustness, or they may be the ones who hammer the final nail into the coffin of the Mozart effect…it may be worthwhile for further research to consider the effects of known learning and cognitive phenomena such as transfer-appropriate processing and arousal" (p.255-256).

2.5. Conclusion

Despite the ongoing Mozart effect controversy also reflected in the sceptical words of McKelvie and Low, the strong body of evidence based on the broad range of studies examined in the formerly reviewed research studies and meta-analyses ascertains a positive significance relationship between music and spatial-temporal reasoning, between music and mathematics and between music and reading. In other words, academic performance in the areas mentioned is likely to benefit from inclusion of music instruction in a school setting. All the above strongly hint towards the inclusion of music into the teaching subjects considered essential in basic education.

CHAPTER 3

THE HUMAN NERVOUS SYSTEM

Nervous system function always implies nervous cell or neurone (see figure 1) function and systemisation with nervous sub-system functions (Nicholls et al., 2001, p.3). In some detail, the function of the nervous system begins with a stimulus that activates special (receptor) cells found within the sensory organs. An example is the hair cells found in the ear (see figure 13). Those cells are not only capable of receiving the stimulus, but they can also convert it into electrical current. Subsequently, the electrical stimulus is transferred from one neurone to the other and the transfer is completed when muscles or glands are reached. This is how behaviour is produced. Important for coding during transfer of stimuli are sub-cellular units, especially cell membrane, dendrites, axons or fibres, neurotransmitters and their receptors, protein channels, ions and potentials – graded and action (Nicholls et al., 2001, p. 4-21).

3.1. The neurone and its function

As stated, stimulation is brought to the neurones following external action which can be recognised by the receptors. Such an action is the alteration in light intensity hitting retina cells that carry colour-pigment receptors, or the shift of air-pressure on cells that are able to sense such a shift (the hair cells), or change in mechanical pressure received by skin cells that can sense it, and so on. The energy produced by these alterations inflicts chemical changes and enters the cell in the form of electricity, as graded potential.

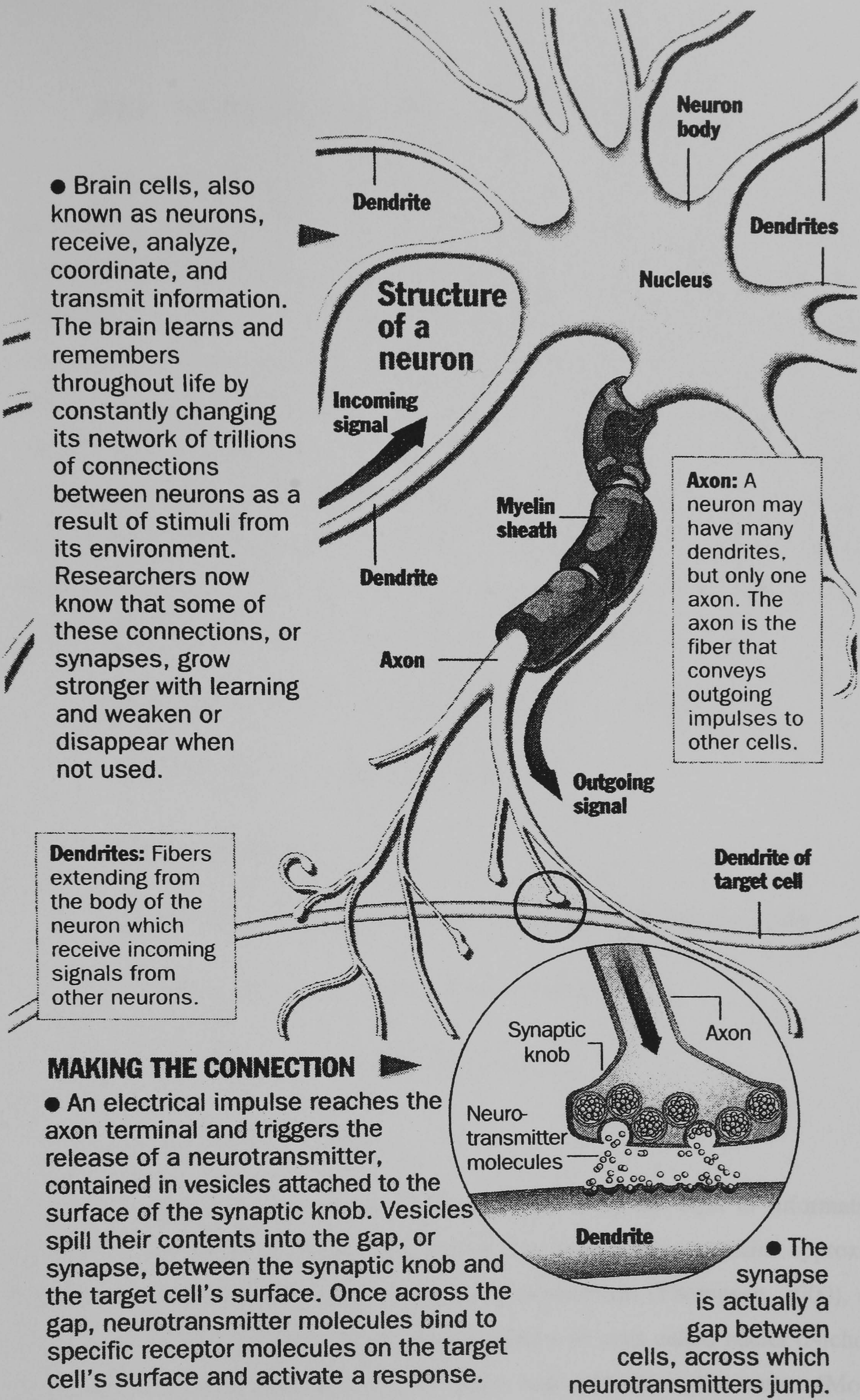


Figure 1
Structure of a neuron
(From Kotulak, 1996, p. 14)

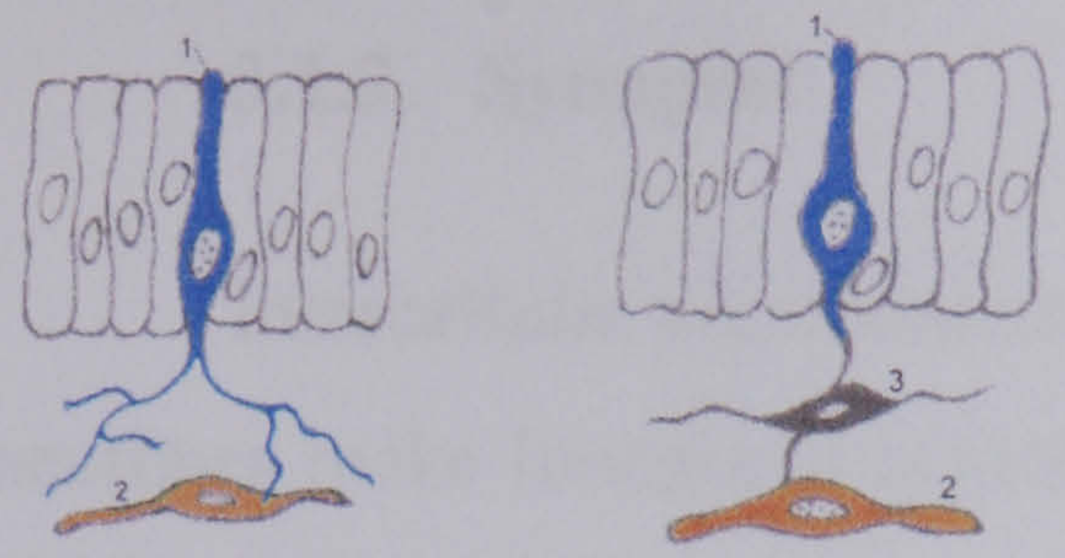
3.1.1. Graded potentials, action potentials and signalling

A graded electrical potential is what is generated in a neurone through the effect of an extrinsic stimulus. This potential is then transmitted from cell to cell as an action potential. An action potential is a "brief regenerative, all-or-nothing electrical potential" (Nicholls et al., 2001, p. G-1). In primitive forms of life the function of receiving signals was carried out by some cells named "neuroepithelial" cells (Kahle et al., 1985, p.3). Today, following millions of years of evolution, the cascade of information transferring is initiated by cells *differentiated* for every stimulus (see figure 2). These cells are found in our sensory organs while "two important conclusions about signalling in the nervous system are (1) that nerve cells act as the building blocks for *perception* and (2) that *the abstract significance of the message* can be extremely complex and "*depends on the inputs a neurone receives*" (Nicholls et al., 2001, p. 19) (see figure 2).

The abstract significance of a signal possibly has its origin

- in the number of signals a cell receives,
- in their diversity,
- in the way in which neurones are interconnected and form circuits,
- in the fact that some signals originate within the cell,
- in the complexity of the nervous system or
- in everything combined.

The validity of the above might be judged under the light of information about numbers of brain cells and their organisation. The human brain contains approximately a trillion cells (neurones) with many trillions of connections (Thompson, 2000), simple or conditioned reflexes (Nicholls et al., 2001), clusters of cells called nuclei (Nicholls et al., 2001) and clusters of cells arranged in layers and columns in the cortex (Mountcastle, 1998).

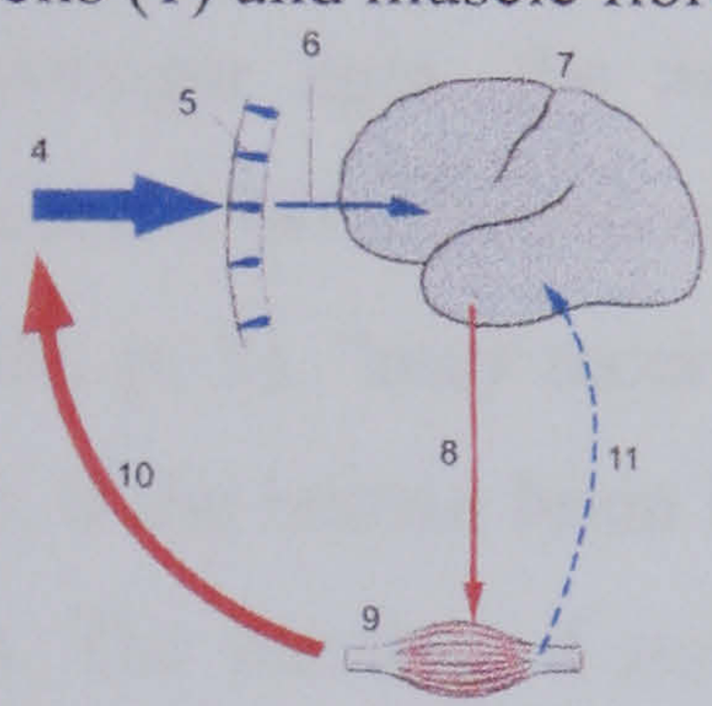


Figures A and B:
Primitive nerve cell systems
(after Parker and Bethe)

Figure C:
Figurative neuronal circuit

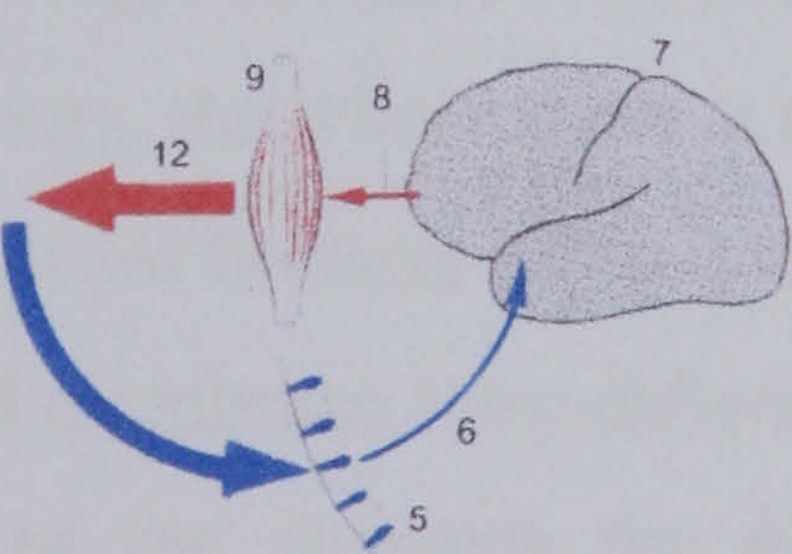
A and B.
The receptor cells are stimulated by external stimuli and transfer their stimulation to muscle fibres (directly in primitive life forms, such as the sponge, or via neurones, as in higher life forms).
C. Higher life forms include neurones (B3) and neuronal circuits (C3) which intervene between receptor cells (1) and muscle fibres (2).

Figure D:
Functional system:
Reaction of the organism to external stimuli



D. Stimuli from the environment (D4) are transmitted through receptor cells (D5) and sensory neurones (D6) into the central nervous system (D7). The central nervous system reacts by sending directions through motor neurones (D8) to the muscles (D9). The control and subsequent regulation of the degree of muscular response (D10) is carried out by receptor cells that are found in the muscles (D11) and return their message to the central nervous system.

Figure E:
Functional system:
Action/influence of the organism on the environment



Key:
1 Receptor cells (neuroepithelial cells).
2 Muscle fiber.
3 Neurone
4 Environmental stimuli
5 Receptor cell
6 Sensory neurone
7 Central nervous system
8 Motor neurone
9 Muscle
10 Muscular response
11 Receptor cell
12 Action initiated by the central nervous system

E. Self stimulation is initiated in the central nervous system and is applied to the environment (E12), passes as stimulus (E8) to the muscles (E9), which react and produce a behaviour. This behaviour is being observed by the receptor cells (E5) and transferred to the related sensory areas (E6).

Figure 2
Nervous system and neuronal functions
(From Kahle, Leonhardt, and Platzer, 1985, p. 3)

3.1.2. Synapses

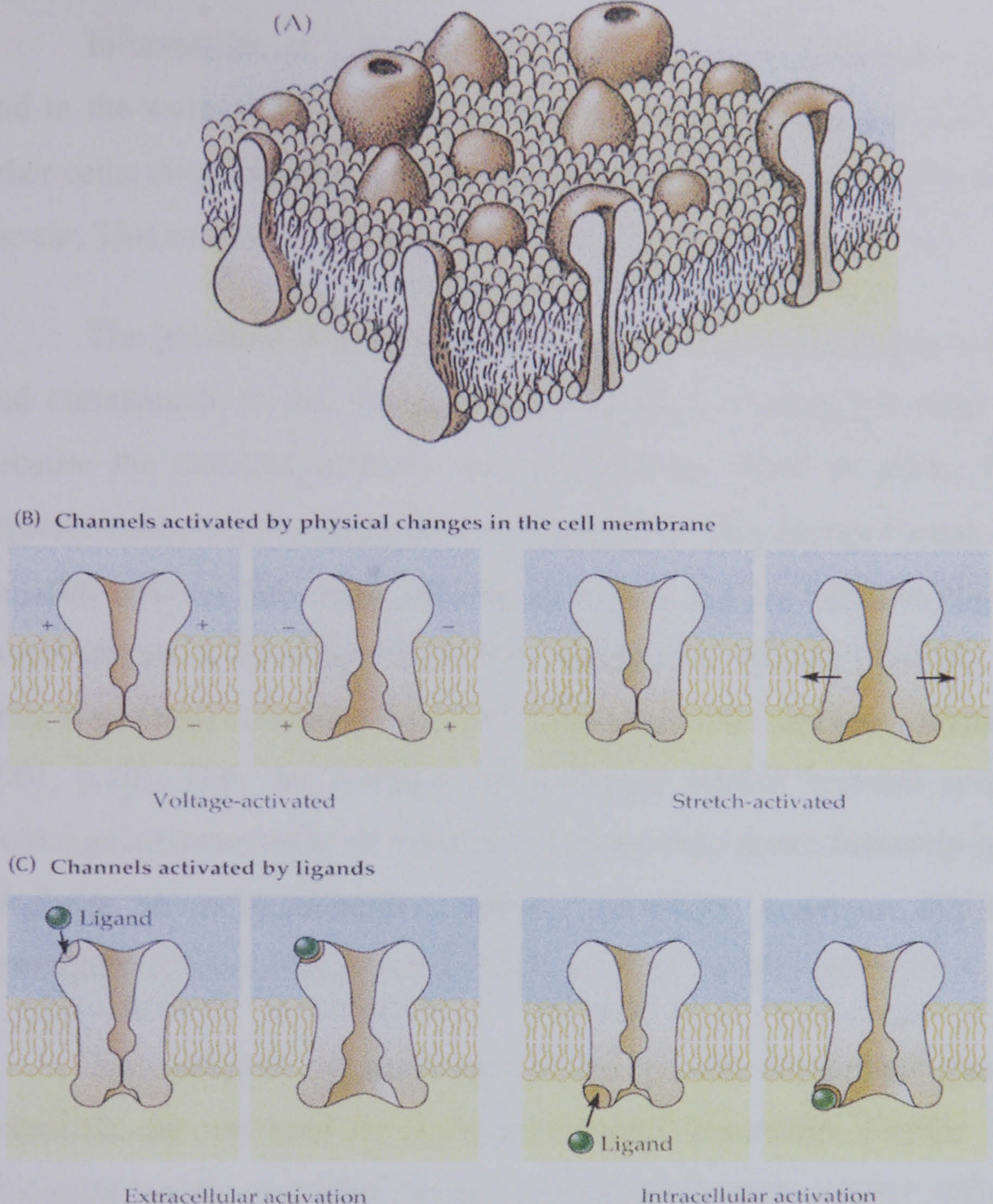
Intercellular communication is conducted through synapses, i.e. “the sites at which neurones make functional contact, a term coined by Sherrington” (Nicholls et al., 2001, p. G-7) (see figure 1).

A gap exists in the synapse between connected neurones. This gap is filled with neurotransmitters (Nicholls et al., 2001). These substances are excreted as a result of cell stimulation. To get a better idea of the number of connections existing, it is mentioned that during adult life there is an average of six thousand synapses per cell (Rosenzweig, Leiman & Breedlove, 1996). At younger ages, the number might be eighteen thousand five hundred per cell. (Huttenlocher, 1984; Huttenlocher et al., 1982). “A given neurone in the brain” says Thompson (2000, p. 3), “may receive several thousand synaptic connections from other neurones. Hence, if the human brain has 10^{12} neurones, then it has at least 10^{15} synapses, or many trillions. The number of *possible* different combinations of synaptic connections among the neurones in a single human brain is larger than the total number of atomic particles that make up the known universe…the diversity of the interconnections in a human brain seems almost without limit.”

Because of the above, it is reasonable to expect that a system formed by the neurones in the brain at a given moment is different than another system which is formed the next moment. This way, the whole brain is constantly in a *dynamic state of equilibrium*. Equilibrium can be sustained because of the action of several sub-cellular elements. Firstly, the two sides of the cell membrane have different ionic concentrations. This, together with selective permeability of the channels for different ions, creates the so-called resting potential (Nicholls et al., 2001, p. 27). At rest, the cell is in equilibrium (see figure 3).

3.2 Cell communication

All the time, also when the cell is at rest, the two sides of the membrane communicate through channels. *Trans membrane* ***proteins*** *are called ion channels* (Nicholls et al., 2001, p. 27). There are cationic and anionic channels. Protein molecules are never still. They are inherently dynamic, because of their thermal energy. Due mainly to atomic trembling, membranes display “open and closed states, with transitions between states. Such transitions can last for many milliseconds, or even seconds” (ibid), and through these transitions cell communication is achieved.



(A) The cell membrane is composed of a lipid bilayer embedded with proteins. Some of the proteins traverse the lipid layer, and some of these membrane-spanning proteins form membrane channels. At rest, the cell is in equilibrium. The probability of channel openning is influenced by a variety of stimuli.
(B) Some channels respond to changes in the physical state of the membrane, specifically changes in membrane potential (voltage-activated) and mechanical distortion (stretch-activated).
(C) Ligand-activated channels respond to chemical agonists, which attach to binding sites on the channel protein. Neurotransmitters, such as glycine and achetylcholine, act on extracellular binding sites. Included among a wide variety of intracellular ligands are calcium ions, subunits of G proteins, and cyclic nucleotides.

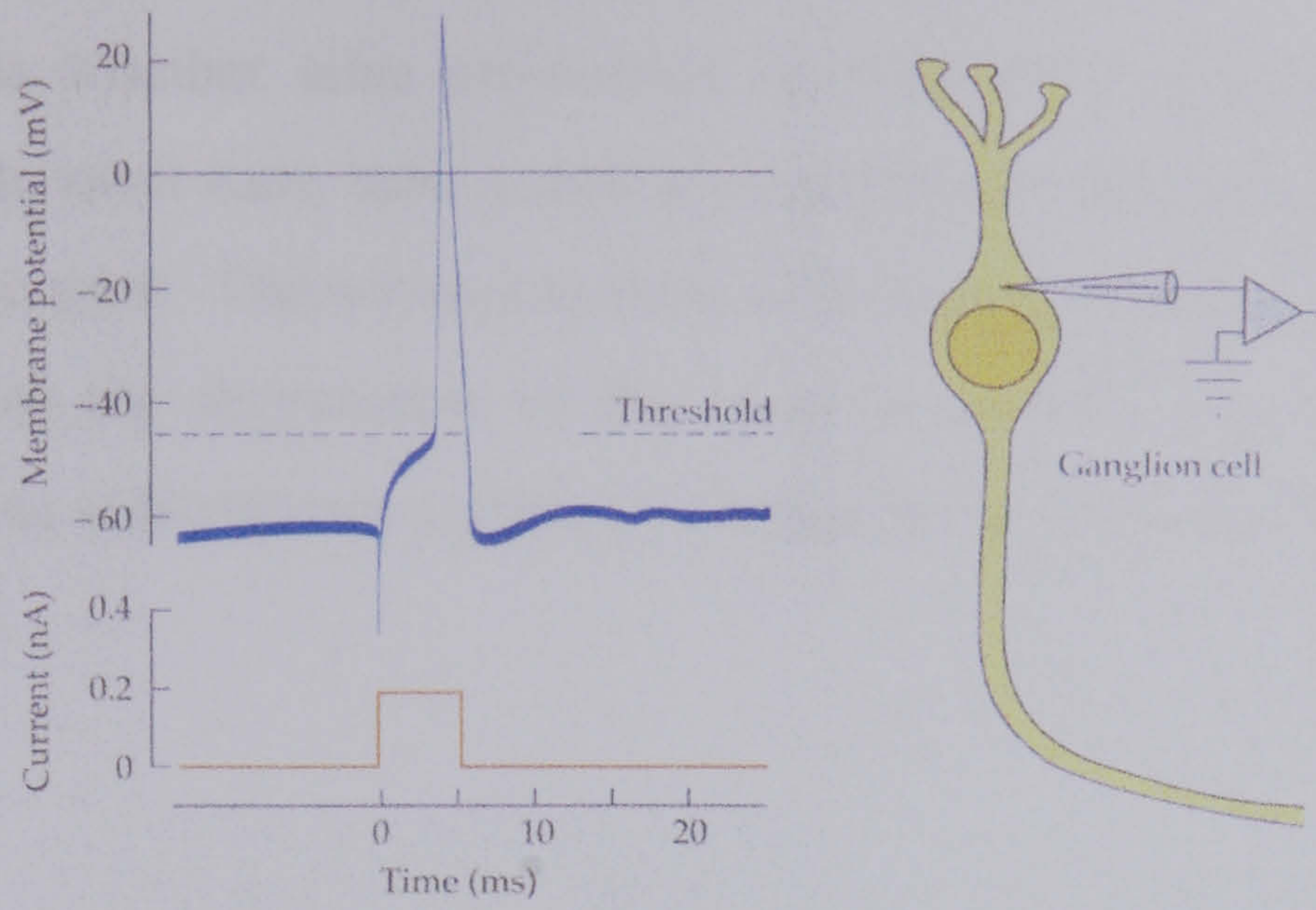
Figure 3
Cell Membrane, Ion Channel, and
Modes of Channel Activation.
(From Nicholls et al., 2001, p. 26, 28)

Information, as a stimulus, can be represented within the cell as graded potential and in the axon as action potential, that is an electric current that can be transmitted to other cells. Any stimulus, a sound for instance, begins by the deformation of a hair cell in the ear. This causes a localised graded potential within the hair cell.

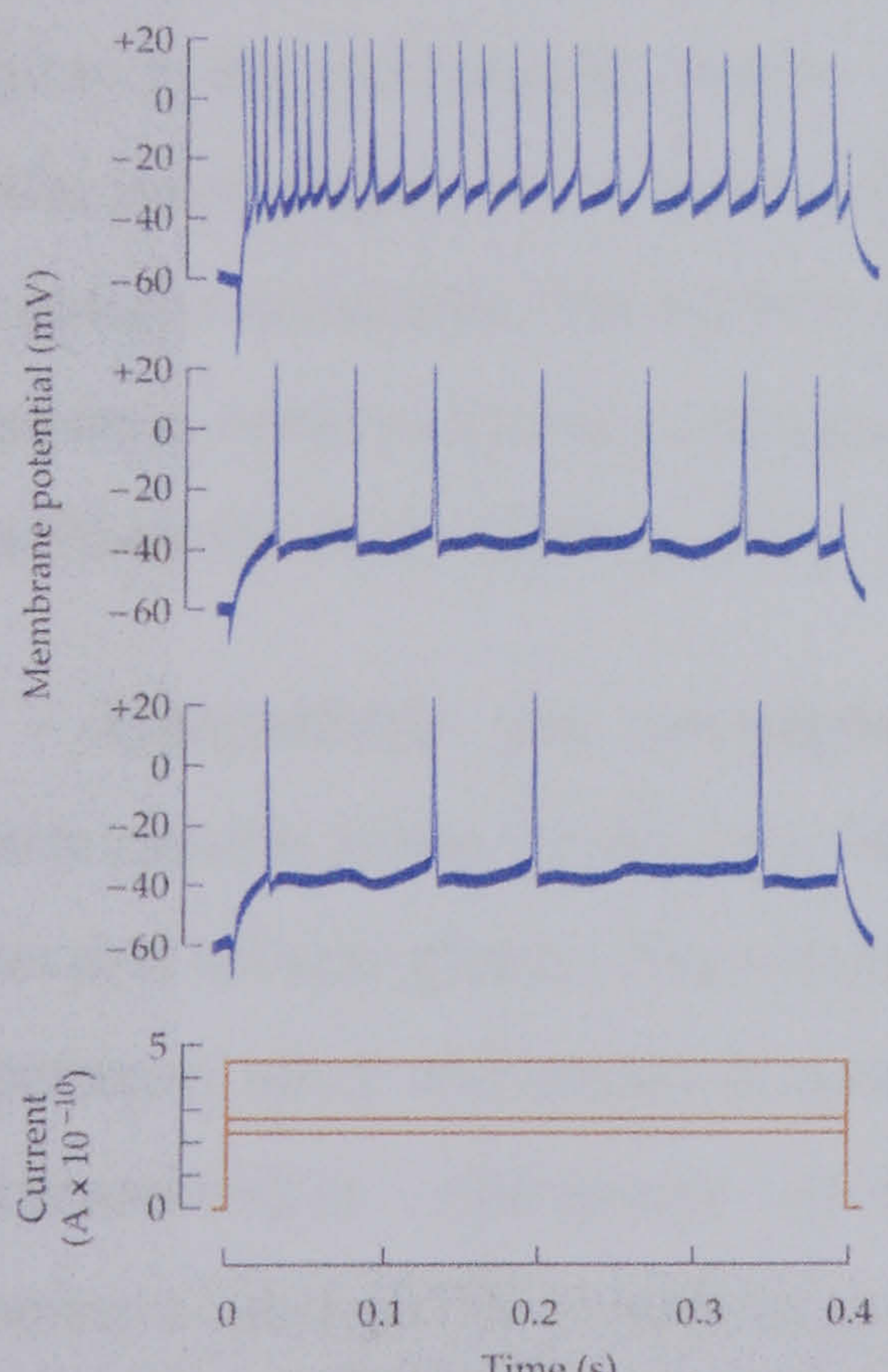
The potential is graded because its intensity differentiates it from other potentials, and corresponds to the energy that produced it. Coding has been realised analogically because the external stimulus was mechanical, visual or other. Within the cell, it is represented by another physical size, electricity. This energy though cannot be transferred to other cells in this form. Action potentials, initiated by the above-mentioned graded potentials, carry the information from cell to cell and are "virtually identical in all nerve cells in the body, whether they carry commands... or ...transmit messages" (Nicholls et al., 2001, p.10). They are found to be strikingly similar between species and are used to exchange information in all nervous systems investigated. **Intensity** is "*coded by frequency of firing*. A more effective...stimulus produces a greater depolarisation and, as a consequence, *higher frequencies of firing*..." (p. 14-15) (see figure 4).

This presents a transition of information from analogue to digital. "Action potentials are initiated by localised graded potentials. Unlike local potentials they propagate rapidly over long distances, for example from a motor cell in the spinal cord to a muscle in the leg. Again, unlike graded potentials, action potentials are fixed in amplitude and duration, like the dots in Morse code" (Nicholls et al., 2001, p.10). Action potentials carry and transfer information in a digital way. They are initiated in the cells when the signals striking the cell, having come from other cells, *reach a critical level,* in other words when they reach the cell's *threshold.* At this moment the cell fires and a neurotransmitter is formed and shed at the synapse's gap. The amount of the neurotransmitter depends on the information it codes.

At the synapse, the neurotransmitter is connected to its receptor. The result of this chemical reaction, which is analogous to the stimulus that triggered it, enters the cell as graded potential. The sum of all graded potentials formed within a cell may reach the cell's threshold. Thus, the coded information can be transferred from cell to cell with the use of both neurotransmitters and action potentials. The differentiation between stimuli depends on the origin of the action potential and the reaction provoked. This reaction is conditional. Therefore, the equilibrium can be characterised as being dynamic.



Action potential recorded from a retinal ganglion cell with an intracellular microelectrode. When the stimulus, in this case current injected into the cell through the microelectrode, causes depolarising response that exceeds the threshold, the all-or-nothing action potential is initiated. During the action potential the inside of the neurone becomes positive. The action potential propagates along the axon of the ganglion cell to its terminal, where it causes transmitter to be released.



Frequency as a Signal of Intensity in a retinal ganglion cell. Depolarising current passed through the microelectrode produces local potentials. Larger currents produce larger local potentials and higher frequencies of firing.

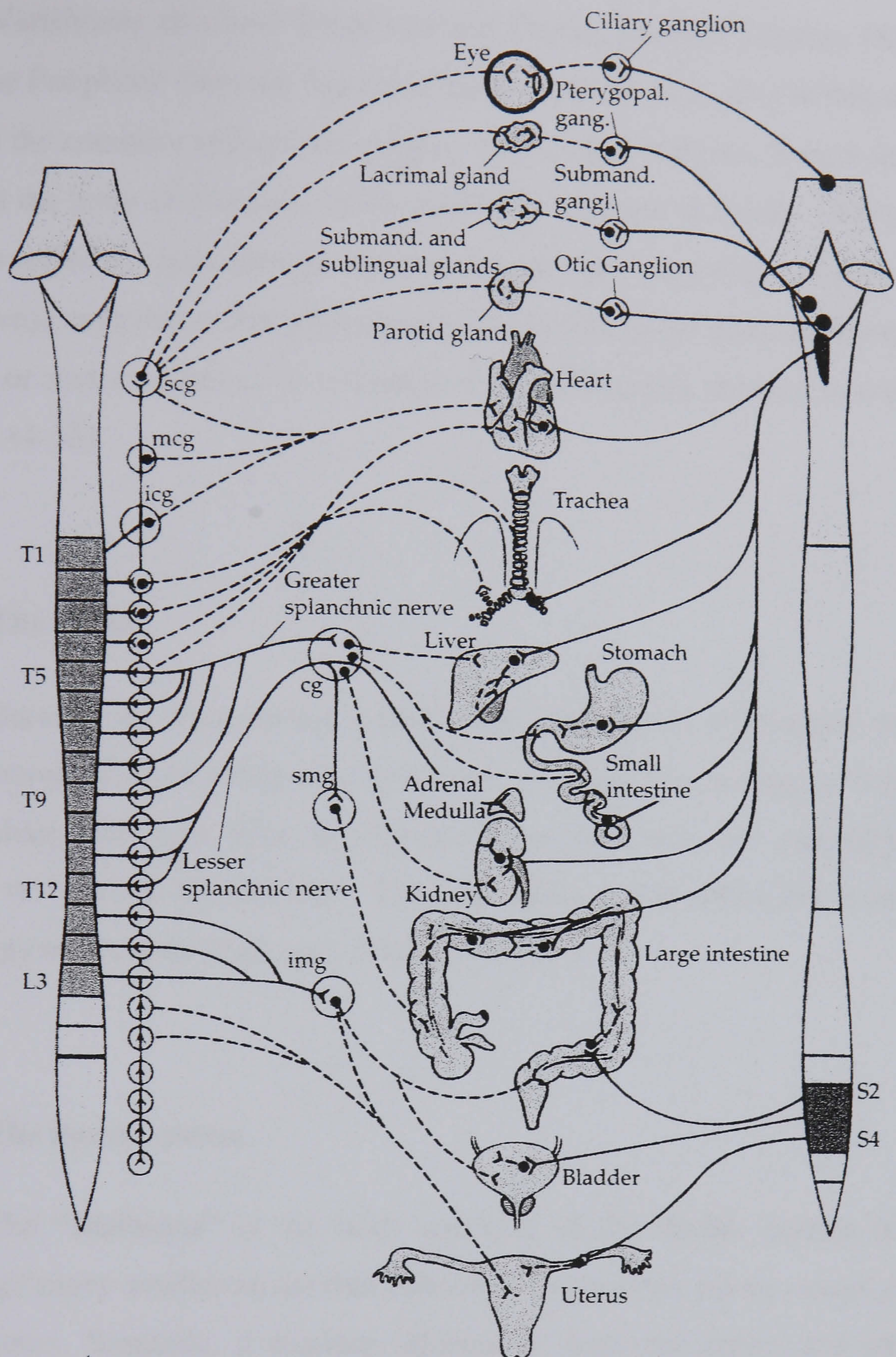
Figure 4
Action Potential and Frequency as a Signal of Intensity
(From Nicholls et al., 2001, p.14-15)

The reaction provoked by the stimulus has an aim. It is a philosophical issue to discuss whether aims pre-existed or whether they appeared during evolution. Survival though, must have been a primary intention for all creatures with brains. Other intentions may co-exist. The nervous system, with its neurones and its circuits, serves the need to co-ordinate the movements of the body in order to give rise to adaptive behaviours. Its separate sub-systems combined contribute to survival (Nicholls et al., 2001; Thompson, 2000).

3.3 The Autonomic, Peripheral, and Central Nervous System

Evolutionary speaking, the autonomic nervous system (see figure 5) was the first to develop. In humans, a series of neural axons grow out of the spinal cord, to form a series of ganglia i.e. the sympathetic system. Another series of axons that originate in the brain stem and the sacral region of the spinal cord constitute the parasympathetic system. Other axons and ganglia constitute the enteric nervous system. The fourth and last division of the **autonomic** nervous system includes neurones in the spinal cord, hypothalamus and brain stem (Nicholls et al., 2001, p. 315).

Sympathetic and **parasympathetic** systems are **antagonists**. They innervate smooth muscle fibres in the eye, lungs, intestines, vessels, urinary bladder, genitals, the uterus and several glands. They regulate gland excretion, blood pressure, pulse rate, body temperature, sleep and intake of food and liquid. Stimuli are transferred using all kinds of neurotransmitters. Autonomic nervous system neurones also secrete adenosino-tri-phosphoric acid (ATP), which is an energy agent, and peptides. With some ionic regulations, the autonomic nervous system also adapts the organism to a twenty-four hour circadian rhythm (Nicholls et al., 2001, p. 315).



Organization of the autonomic system. The sympathetic system is shown at the left, the parasympathetic system at the right. Abbreviations for the names of sympathetic ganglia are as follows (from top to bottom): scg, superior cervical ganglion; mcg, middle cervical ganglion; icg, inferior cervical ganglion; cg, celiac ganglion; smg, superior mesenteric ganglion; img, inferior mesenteric ganglion. T1–T12, segments of thoracic spinal cord; L3, third lumbar spinal segments; S2, S4, sacral spinal cord segments. III–X, cranial nerves. The diagram represents the human but applies generally to vertebrate species.

Figure 5
The Autonomic Nervous System
(From Thompson, 2000, p. 206)

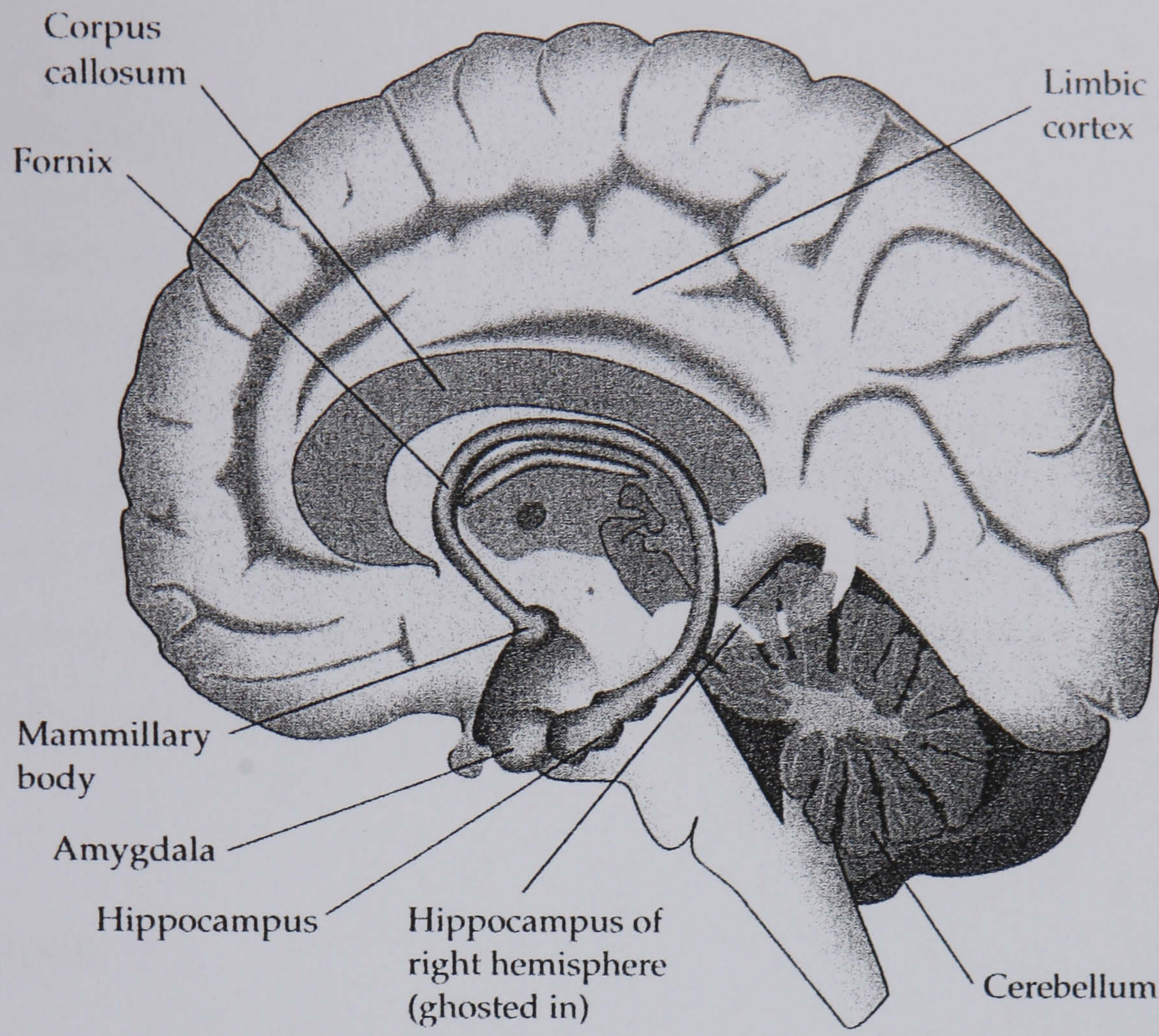
Vertebrates also have Peripheral and Central Nervous Systems (Kahle et al., 1985, p. 5). The Peripheral Nervous System is made of nerves that carry within them the axons or fibres of the neurones and several ganglia. The Central Nervous System includes the spinal cord and the brain (Thompson, 2000, p. 10-27; Adelman & Smith, 1999). The spinal cord executes reflexes, sends through the dorsal roots the "incoming" information to the brain, and conveys outgoing orders through its ventral roots to the muscles. Roots are axons from sensory or motor neurones or neurones of the autonomic nervous system. (Kahle et al., 1985, p. 44-53).

3.4. The Brain

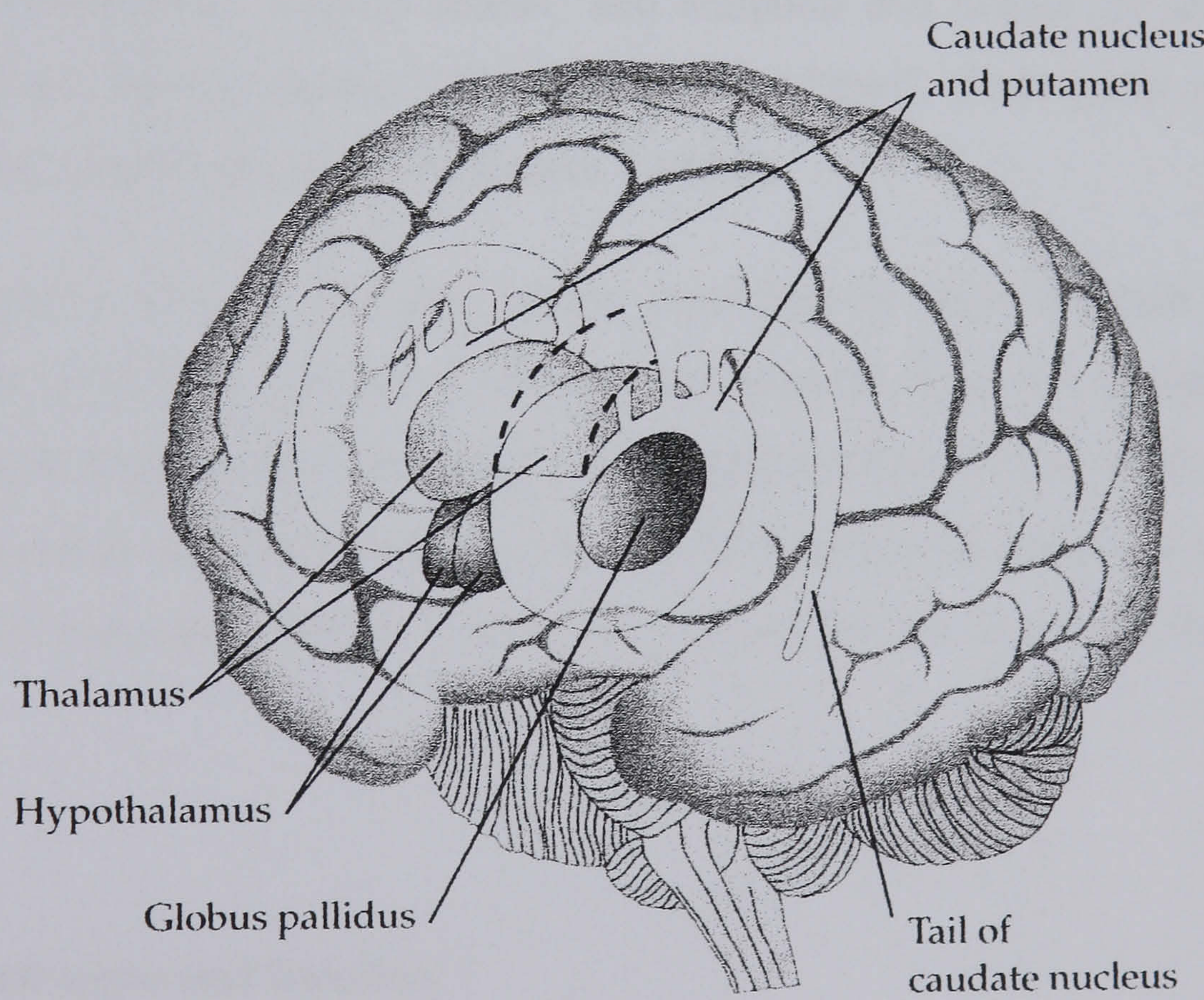
Between the brain-section called "stem" and the rest of the brain, structures exist by which answers that are going to be given are "evaluated" according to "survival values" or other values that have been developed. These structures are generally called "limbic system" or "system of emotions". The evaluations made reflect the awareness of danger and energy availability (Zafranas, 2002, p 193-205).

3.4.1. The limbic system

The **"thalamus"** is the basic structure of the **limbic** system (see figure 6). It consists of many smaller nuclei that receive *all input from senses except smell* and send it to the cortex. Similarly, it receives information from the cortex and provides feedback regarding the outcome of the action taken. The "hypothalamus" is located beneath the thalamus. It controls the activities of the autonomic nervous system but it also regulates the secretion of hormones through its connection to the pituitary gland. The hypothalamus itself is influenced by hormones and by higher centres of the central nervous system (Nicholls et al., 2001, p. 331). The "amygdala", the "hippocampus" and the "septum" also belong to this system.



The major components of the limbic system. The left hemisphere has been removed, except for the limbic system, and we are looking at the right hemisphere midline with the limbic structures of the left hemisphere extending out from the right hemisphere.



The location of the basal ganglia (caudate, putamen, and globus pallidus) together with the thalamus and hypothalamus localized in a semitransparent brain

Figure 6
Limbic System and Basal Ganglia
(From Thompson, 2000, p. 18-19)

3.4.2. Other brain parts

Brain stem is the continuation of the spinal cord upwards, and consists of the **medulla**, the **pons** and the **midbrain**. It is connected to the cerebellum by a large bundle of crossing fibres on the bottom part of the pons. The cerebellum is an important centre of motion and motion that can become automatic (reflexes). The "corpus callosum", which connects the two cerebral hemispheres, is located over the limbic structures mentioned above. Around the corpus callosum, there is white matter, and several nuclei serving motor functions called "basal ganglia" (see figures 6, 7, and 8).

3.4.3. The cortex

Above all and outlying is the **"cortex"**. The brain, when observed from above, is divided by the interhemispheric fissure into two "hemispheres". Each hemisphere has four "lobes", the "frontal", the "parietal", the "temporal" and the "occipital". Frontal and parietal are divided by the "central sulcus" and temporal and frontal are divided by the "lateral sulcus" or "Sylvian fissure". Finally, there are "gyri". Each gyrus is the cortical area between two or more fissures (see figures 7 and 8).

The specific cortex areas are named according to their location or function. Therefore, there are frontal, pre-central, post-central, parietal, temporal, occipital and other cortices. The same cortices may additionally be named auditory, visual, motor, association or primary, secondary and other cortices. Naming by function facilitates, to an extent, the understanding of brain localisation of different abilities people have (see figures 10 and 11).

3.4.4. Brain cell types and function

To complete the picture of the brain, different types of brain cells found, as well as their organisation in layers and columns should be discussed.

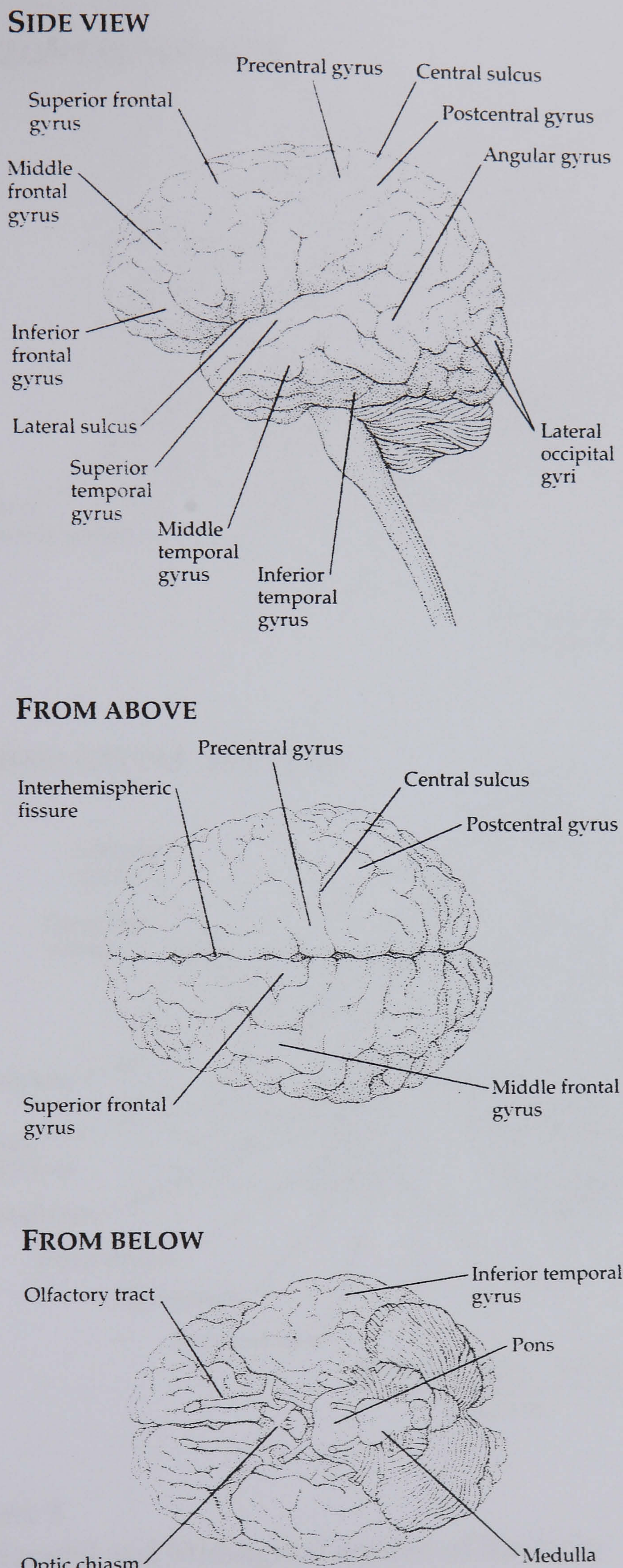
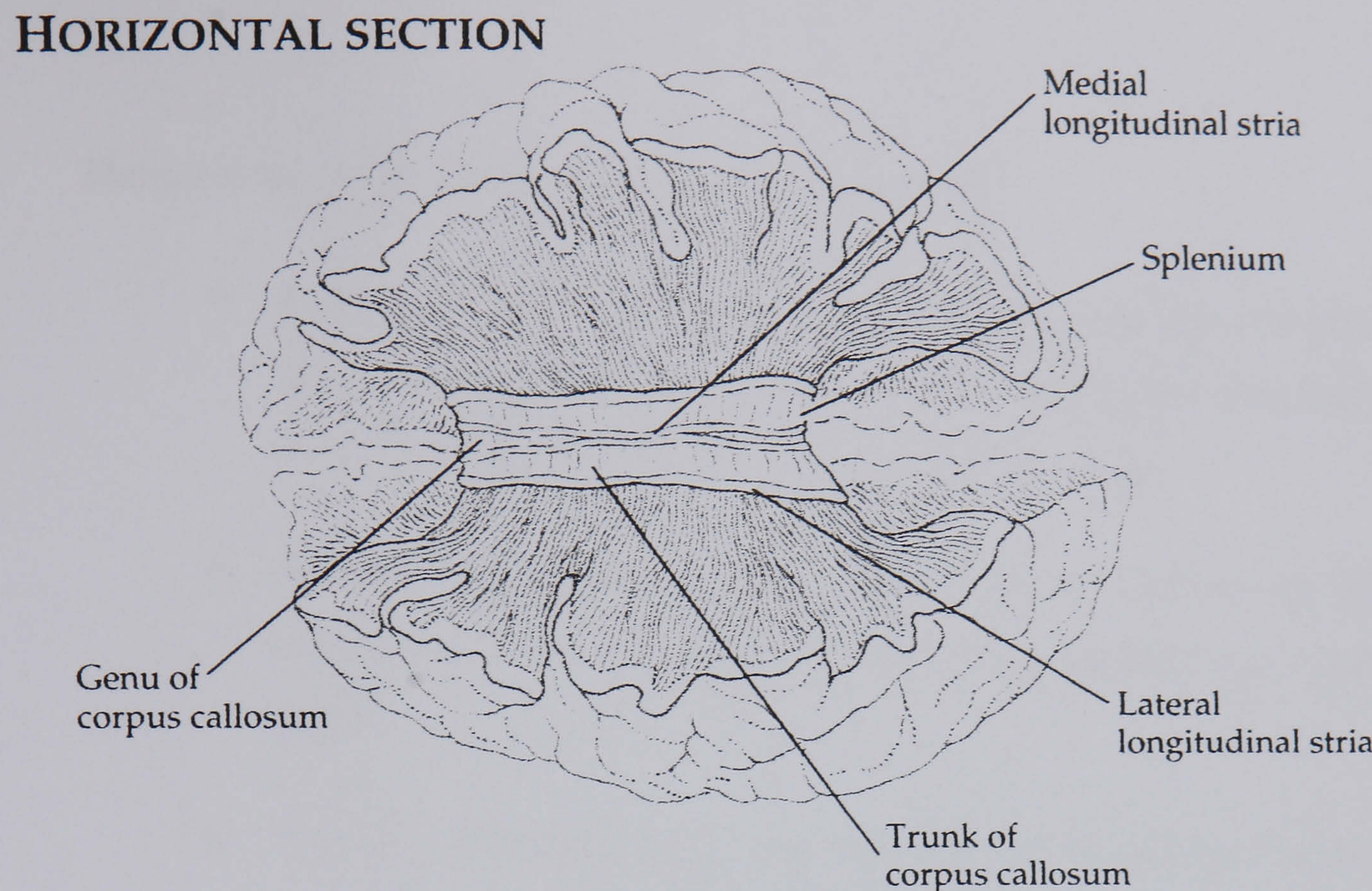


Figure 7
The Brain from different viewpoints
(From Nicholls et al., 2001, p. C-2)



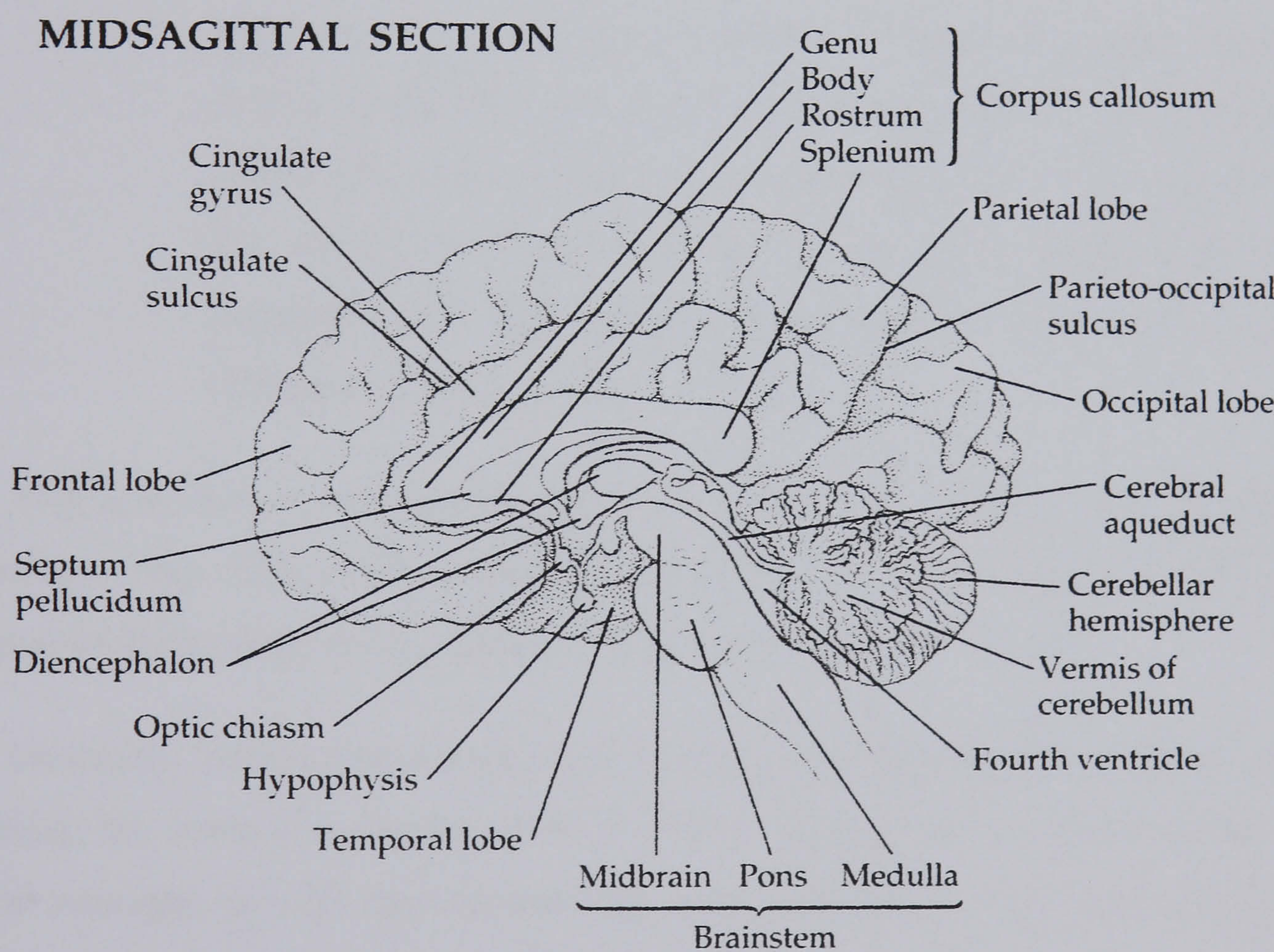


Figure 8
Horizontal and Midsagittal section of the brain
(From Nicholls et al., 2001, p. C-4, C-5)

There are four main types of neurones (see figure 9):

- *Sensory*, which extend from sensory organs into the nervous system. They carry information from the outside world but also from organs inside the body to the nervous system and the brain.

- *Motor*, which have their origin in the spinal cord or the brain and usually project their fibres out of the nervous system, into muscles and glands.

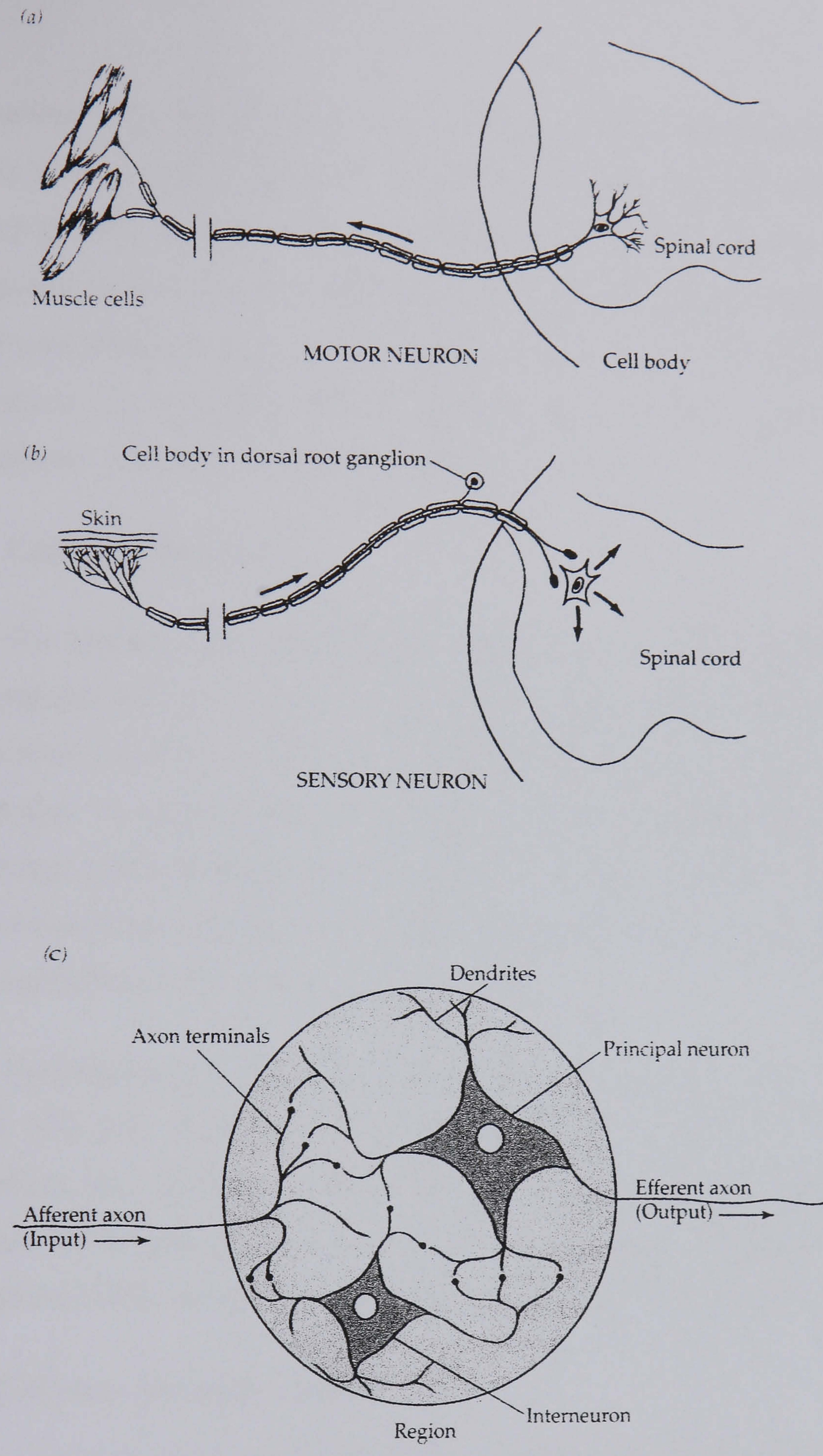
- *Principle*, which send the "final message" of the minicolumn or column into which they exist to the other regions.

- *Interneurones*, which have a variety of shapes and sizes. Their axons remain within the region where they are located. They usually convey action potentials to neurones not far from them. There are even some that do not have axons at all, but can still influence other neurone synapses. Both these last two categories are found only in the brain (Thompson, 2000, p. 43).

The first three types **communicate** with each other through **action potentials**. Interneurones may elicit action potential too, but they can also influence the route of the message even by keeping their graded potential within their own body.

Generally, information comes in through the cell body and the dendrites and goes out through the axons (Thompson, 2000, p. 40-44). Exceptionally a dendrite can receive and send messages as well. Spontaneous firings discontinued by silent intervals appear to be the mode of existence of the brain cells. Firing spikes together with silent intervals form a sort of unit. Within the brain, these units are arranged in firing groups. Spontaneous firing events are known to exist for the cells of the brain (Salmelin, 1996) and for the cells of the auditory cortex too (Lehtelä, Salmelin & Hari, 1997).

Within a structure (a minicolumn), a single type of principle neurone usually co-exists with many types of interneurones. Axons from principle neurones belonging to other regions bring information into the structure. This information is then processed by the



(a) Typical motor neuron conveying commands from the spinal cord to the muscles to move. *(b)* Sensory neuron conveying information from the skin to the spinal cord. *(c)* Example of the organisation of principal neurons and interneurons. The interneurons lie entirely within a given region (nucleus, cortex) of the brain and can modify the influence of input afferent axons on the principal neurons that project out from the region (efferent axons).

Figure 9
Neuron types
(From Thompson, 2000, p. 42-43)

interneurones. The final decision about the fate of the incoming stimulus is made within the body of the principle neurone. “Recordings of the activity of the principle neurones in other regions that send information to a particular structure or region and of the activity of the principle neurones that send information out of that structure help us to understand the kind of information processing that occurs in the structure…” (Thompson, 2000, p. 44). Since music is processed by the cortex, its structures’, principal neurones’ and interneurones’ activities are of main interest.

3.5. Cortical development

The cerebral cortex has six cell layers. The sixth is developed first. On top of it, the fifth develops, and so on up to the first layer. Consequently, minicolumns, structures that are described right below, also have six layers. Subplate neurones are responsible during development for what cells in each layer are doing. **Subplate** neurones are found in the white matter underneath the developing cortex, and they die as soon as development of the cortex is completed. Together with projections from thalamic sensory neurones, they help in the establishment of cell roles in minicolumns.

Developmentally, columns and minicolumns are secondary to layers (Thompson, 2000, p. 330-331). Neurones that carry incoming stimuli from the **thalamus** are always connected to the cells of the **fourth layer**. **Motor neurones** that send their axons outside the cortex are always located in the **fifth** and **sixth layer** (Thompson, 2000, p 23). It is observed that columnar cells are strictly organised (Mountcastle, 1998).

3.5.1. Columns and minicolumns

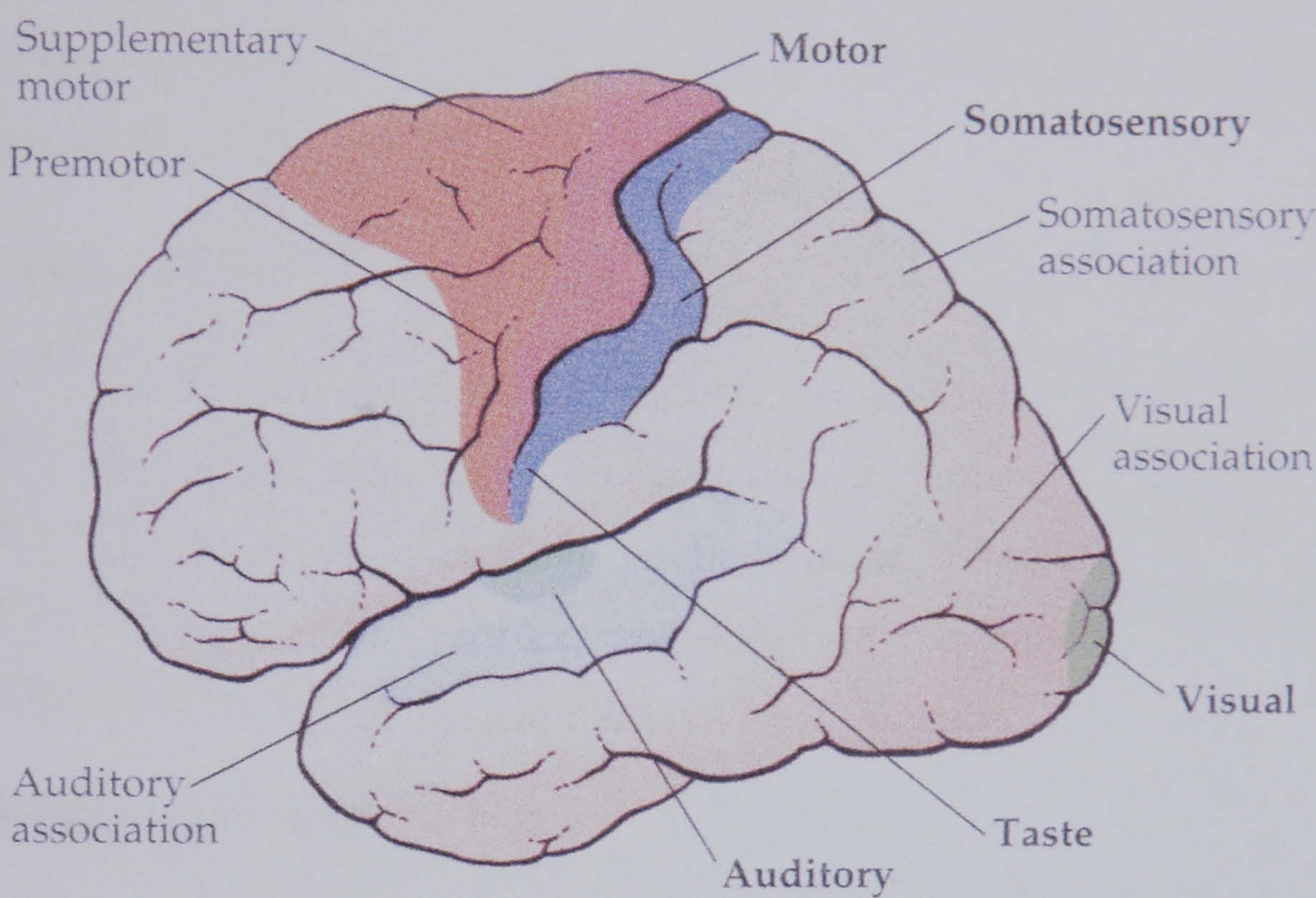
Columns are structures found everywhere in the cortex, and are constructed by minicolumns. Minicolumns contain from several to two hundred cells. It is thought that every column has concrete behaviour and Mountcastle has revealed this in the somatosensory cortex, Hubel and Wiesel in the visual cortex and Knudsen (Nicholls et al., 2001, p. 567) in the auditory cortex of the owl among others. The organisation of cells depends on their localisation.

3.5.2. Mapping of incoming information

Depending on the source of stimulus, the cortex is divided in different areas (see figure 10). When the stimuli are coming directly from the thalamus, the receptive areas are

Localisation of Motor and Sensory Functions

LATERAL VIEW



SAGITTAL VIEW

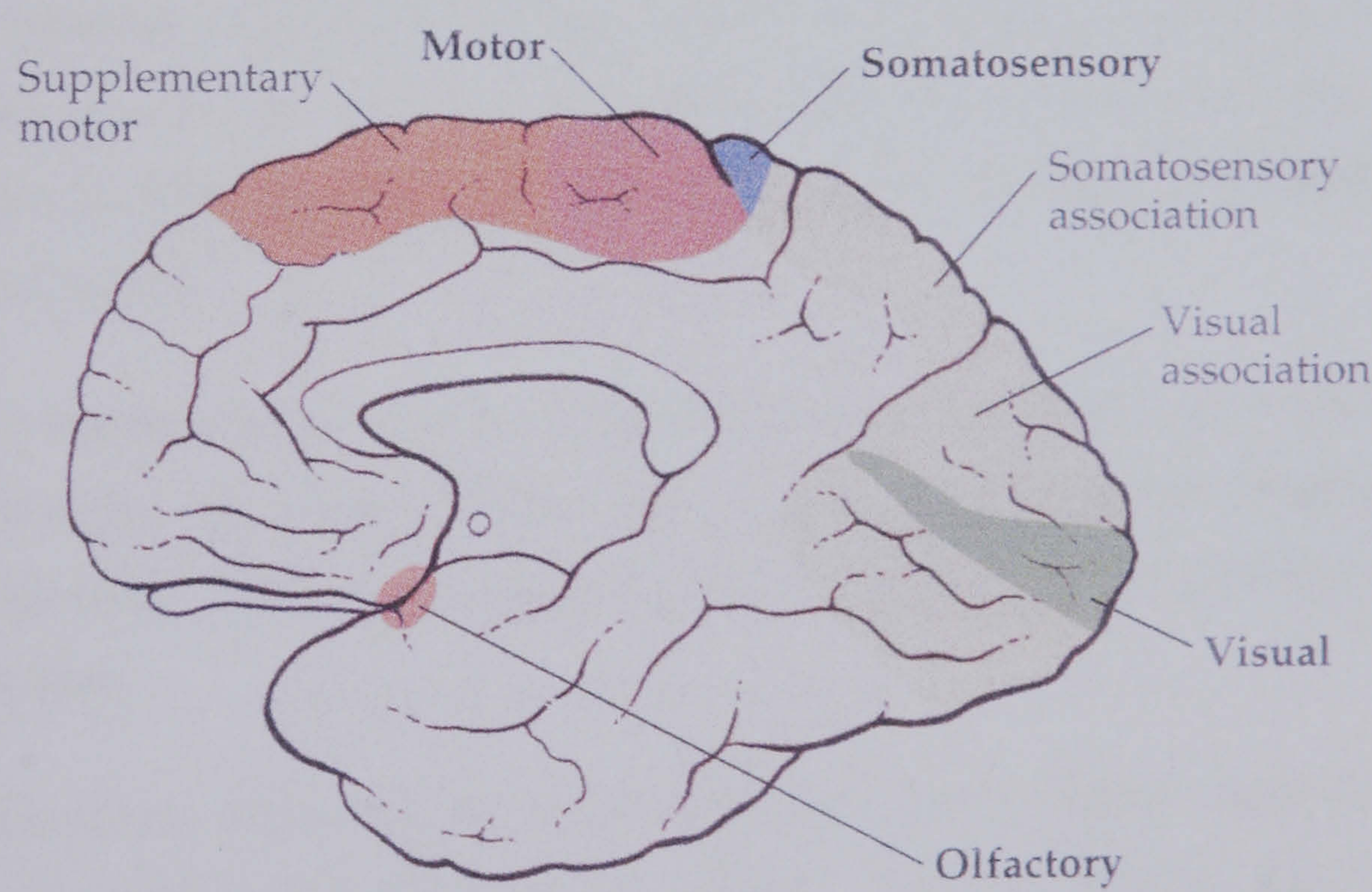


Figure 10
Localisation of Motor and Sensory Functions
(From Nicholls et al., 2001, p. C-3)

called the primary sensory areas and the stimuli are "mapped" there. Mapping means that receptive fields of the stimuli are recorded within a specific area of the primary cortex. It should be stressed that stimuli first pass through the thalamus and then continue to the corresponding cortical cells; it has been suggested that just twenty percent (20%) of the incoming information processed by the primary visual cortex originates in the retina (O'Connor & Van der Horst, 2002).

Further information processing and information interconnection combined with mapping takes place in cortical areas called secondary and/or tertiary. These areas are not discernible from areas called association areas. In humans, association areas cover a measurable section of the cerebral cortex, and they are mentioned at occasions as secondary, tertiary or higher brain function areas. Their function, though, is yet to be thoroughly explored (Thompson, 2000, p. 23).

3.5.3. Master plan and master chart

In order to perform a movement, muscle fibres must receive a stimulus. This stimulus will be realised only if other stimuli do not cancel it. Therefore, a so-called master plan is formulated for every voluntary movement performed. During this process, all the maps that exist in our brain are used and the decision for movement and of consequent behaviour is different each time. This demonstrates the need for dynamic equilibrium mentioned earlier.

A master plan is based on a master chart, which is elicited each time depending on body capacities and external events. Such a chart changes with any external and internal event (Edelman, 1992). Many opinions exist about the way the master plan for movement is formulated.

However, all accept the well-investigated primary areas, some well-investigated secondary areas and a fundamental division between sensory and motor cortices (Rosenzweig et al., 1996).

To summarise all above descriptions concerning the cortex and its columns and minicolumns, a related paragraph written by the Massachusetts Institute of Technology (MIT) professor William H. Calvin is presented:

> "The *cerebral cortex* sits atop the white matter of the brain, its 2 mm thickness subdivided into about *six layers*. Neurones with similar interests tend to cluster. *Columns* are usually subdivisions at the sub-millimetre scale, and *modules* are thought to occupy the intermediate millimetre scale, between *maps* and columns. Empirically, a column is simply a sub-millimetre region where many (but not all) neurones seem to have functional properties in common. They come in two sizes, with separate organisational principles. *Minicolumns* are about 23-65 µm across, and there are hundreds of them inside any given 0.4-1.0 mm *macrocolumn*. Each cerebral hemisphere has about 52 '*areas*' distinguished on the basis of differences between the thickness of their layers." (In the "MIT Encyclopedia of Cognitive Science"; World Wide Web, http://cognet.mit.edu/MITECS/Entry/calvin)

None of these areas is known to be specifically engaged in music or spatial-temporal reasoning.

All cortical cells from their appearance in utero until the moment at which they are substituted by the so-called secondary repertoire cells are called primary repertoire. The importance of the developmental conditions during gestation is paramount because it influences the development of both the primary and the secondary repertoire.

3.5.4. Brain plasticity

Brain plasticity refers to the property of the cells, which results from the fact that cell function is not determined before the cell settles down in a certain area. Therefore, developmental conditions may influence cells in such a way as to acquire different functions than the ones dictated by the position they occupy. An extreme example can be seen in the following research: an appropriate section had eliminated all sensory input from the forelimbs of a monkey (Thompson 2000, p.343). Twelve years later, scientists mapped the animal's sensory cortex, to discover that the forearm representation area was missing. This area had been occupied by the now expanded region of the cortex representing the face.

Secondary repertoire cells are "wired" in columns according to intrinsic factors and external stimuli, connecting to each other through synapses. The process of connecting is called *synaptogenesis*. Synaptogenesis is very intensive during the last three months of the in utero life, although apoptosis[4] (or pruning) has already begun. Through the above-described procedure, the organisation of the cells enables functionality. Secondary organisation of the cells continues after birth affected by environmental stimuli, and generally continues until the age of eleven years (Huttenlocher & de Courten, 1987).

From the moment that apoptosis, which is an integral part of the phenomenon termed "synaptic revision", becomes more frequent than synaptogenesis, the development of the area is probably completed and plasticity is decreased. Regional Cerebral Blood Flow (rCBF), when measured, represents the density of the neurones of the area and declines analogously to synaptic revision (Hirano et al., 2000). rCBF follow-up has become a powerful diagnostic tool used chiefly in research.

3.5.5. Critical periods of brain development

Until synaptic revision is completed, *critical periods* of development or *windows of opportunity* exist, during which the brain seems to be "biologically programmed" for the development of certain abilities. They are crucial for the foundation and further development of various skills (Katsiou-Zafrana, 2001). During critical periods, the brain seeks certain stimuli in order to create or stabilise some of its structures. In animal studies, critical periods have been shown, for instance, in canaries. The critical period for developing the skill of singing begins twenty-five to thirty days after hatching and ends fifty days later (Notebohm, 1991). If the canary is not exposed to the appropriate stimulus during this period, it will never sing. In humans, critical periods have been described for the development of vision, language, mathematics and other domains. Table 1 shows some abilities and the corresponding critical periods (after Katsiou-Zafrana, 2001, p. 109).

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[4] Apoptosis is the dying of certain cells while the rest of the organism continues to live

Table 1
Critical periods

Critical periods for	Age (in years)
Vision	0-4
Language	0-4
Second (foreign) language	0-6
Mathematics-logic	1-4
Music	3-10

It should be noted here that the brain has great plasticity and its structures are not static. These structures are formed during the first developmental stages, but they can be altered at any time during the life of an individual. If, however, the original "neuronal circuits" are incomplete or faulty, problems might arise since modifications will be made upon these original neuronal circuits (Katsiou-Zafrana, 2001).

Gordon (1998) writes that music aptitude does not increase after the age of nine years. Table 1 shows that for many other abilities, the critical periods end at a younger age. The capability of the brain to make permanent internal connections relative to the skill or ability easily, representing-symbolising environmental events, ceases or is greatly reduced after the respective critical period.

As can be seen above, the eleven years mentioned by Huttenlocher are not valid for all areas, since several abilities are completed before the age of eleven. Brain development continues to be considerable after the age of ten, until the age of eighteen years. Hence, other areas might "close" later. After eighteen though, the balance between synaptogenesis and apoptosis (pruning) changes in favour of the later. In the following years, the brain destroys its weak synapses, retaining only those, which, through experience, have undergone a magical metamorphosis (Katsiou-Zafrana, 2001).

CHAPTER 4

TOWARDS A NEUROLOGICAL BASIS OF MUSIC

Introduction

Russian composer Igor Stravinsky once said: "Music is by its very nature powerless to express anything at all" (Gardner, 1993a, p. 188). This quote may be understood as carrying the connotation that sounds, by themselves, are not musical. They can become emotion-inductive music after being processed in a composer's brain. "A composer works *in the embodiment of his feelings*, and, of course, it may be considered as expressing or symbolising them". An individual working with sounds is paralleled to a " craftsman whose materials of pitch and rhythm in themselves harbour no more expression than the carpenter's beams or the jeweller's stone" (ibid).

Music does not exist without life. It appears in living creatures and, among them, in humans. Music, viewed in a neurophysiological perspective, might be for sound similar to what colour is for light. Sound waves alone are only sound waves, not music. Regarding colour, we know that "colour does not exist in the world; it exists only in the eye of the beholder...Objects reflect many different wavelengths of light, but the light waves themselves have no colour." People recognise colour with the help of organised and specialised cells, "...but there is no way at all to describe colours...to a person blind from birth' (Thompson, 2000, p. 258-259). It might also be impossible to describe pitch or timbre to a person deaf from birth – not someone who has become deaf after the differentiation, specialisation and organisation of the cells necessary for hearing has occurred.

In ancient Greece, music was almost exclusively improvised, and was inseparable from a text. Music and poetry were practically synonymous. Music in its perfect form (*teleion melos*) was always associated with words or dancing or both. Music's rhythm and melody were interwoven with the rhythm and the melody of poetry. Music of the drama, of religious cults and of public contests was performed by artists who sung and moved according to prescribed dance patterns at the same time (Grout & Palisca, 1988).

In recent times, studies have been conducted on deaf children that were provided with cochlear implants. Results from these studies will be discussed. The implants were intended mainly to render the possibility to the deaf individuals to aurally perceive and to make better use of language. Hence, language becomes an issue and it will be examined here from a biological perspective beginning with differences between language sounds and other sounds.

4.1. Language properties, functions and evolution

Language is divided in semantic, phonematic, syntactic functions and pragmatic properties (Gardner, 1983, p. 89). Pragmatic properties might have facilitated the early communication between animals, especially in the cases when these animals lived in groups. Phonematic, syntactic and semantic functions are all sub-served by sounds, but retain their differences. Semantics refers to the meanings or connotations of words, and is universally considered central to language. Phonematic functions include the sounds of words, and their musical interactions upon one another. Syntactic functions are the rules governing ordering of words and their inflections (Gardner, 1983, p. 76).

Language sounds are processed in specific areas that cover a broad area of the cerebral cortex, not necessarily adjacent to primary auditory perception areas (see also figure 12). From an evolutionary perspective, this is probably a secondary development (Thompson, 2000). Communication among humans (but also among animals) can be met using other than aural stimuli, for instance visual stimuli. Researchers today accept that pragmatic language properties, "quite possibly, ...evolved from those emotional expressions and gestural capacities (pointing, beckoning) that we share with apes. There may also be certain formal or structural features that reflect or build upon musical capacities of the sort evinced by far more remote species, such as birds" (Gardner, 1983, p. 91).

Gardner further suggests that when phonological, syntactic, and certain semantic properties are brought in foreground, language might appear as an autonomous intelligence. Pragmatic functions though, when brought into the picture, make the previous hypothesis less convincing. This has been apparent in studying different aphasias where a neurological dissociation of pragmatic and other language functions was indicated. It is speculated that the evolution of a separate language faculty is not necessarily connected to the pragmatic function of language.

Decisively distinguishing between musical and linguistic intelligence, Gardner writes: "Language…remains at its core *a product of the vocal tract* and a message to the human ear…And yet I have taken care not to term this capacity as an *auditory*-oral form of intelligence. There are two reasons. First, the fact that deaf individuals can acquire natural language…(that)…serves as decisive proof that linguistic intelligence is not simply a form of auditory intelligence. Second, there is another form of intelligence… the musical intelligence…Buried far back in evolution, music and language *may have arisen from a common expressive medium*" (Gardner, 1983, p.97-98).

Chomsky's generative theory of language, which rendered human communication possible, maintains that a neurological basis exists and that language evolution was rapid and it coincided with the appearance of the Homo Sapiens (Chomsky, 1975). Researchers, more recently, though, do not fully accept either Chomsky's views or his opponents' views.

One example is Pinker (2000). In his book, he tries to demonstrate the paradox he finds in Chomsky's position. However, he does not only criticise, he also takes a position. This position might also be a hypothesis, however it is noteworthy also since many other scientists mainly from the area of developmental psychology share it (James, 1892, Marr, 1982, Symons, 1979, 1992, Sperber, 1985, 1995, Cosmides & Tooby, 1987, 1990, 1992, Jackendoff, 1987, 1992 Gazzaniga, 1992, Keil, 1989, Gallistel, 1990, Shepard, 1987, and Rosin & Schull, 1988; all cited in Pinker, 2000).

Evolution is described by this school as a bush, and not as a hierarchical scale. According to Pinker (2000), man has not evolved from chimpanzees. Instead, humans and chimpanzees have evolved from a common ancestor who has now gone extinct. That ancestor evolved from an even more ancient ancestor who has also gone extinct. Palaeontologists say that all species have gone extinct, with ninety-nine percent being the usual estimation (Pinker, 2000, p.386). Such an evolutionary perspective is more congruent to Mendel's theory, and although it obviously retains the continuation of species, it allows for conceptions presenting some element evolving rapidly, when, in reality, this is not the case.

Lieberman and colleagues (1984, 1992; cited in Pinker 2000) tried to recreate the vocal paths that had vanished. They suggest that all species preceding the Homo Sapiens including Neanderthals had an air-tract typical of mammals with limited space for loud vowels. Lieberman (1984, 1992) believes that language must have been primitive until Homo Sapiens, but it cannot be suggested that hominid language with restricted vowel space was undeveloped (Pinker, 2000, p. 399).

The evolutionary theory for language discussed here, supports the hypothesis that a larynx with appropriate space for loud vowels enabled quicker step-by-step development. Pinker believes that this type of evolution explains how "the plan that brought language about" might have emerged. This, though, might not be the only valid suggestion. Chomsky (1975) thinks that alternative to these solutions, others might exist. Not all traits must necessarily be attributed to evolution. The "S" shape of the spinal cord in humans, for example, is a consequence of standing on our two feet. At the same time, it is the main cause of lumbago. Another example is that it is possible to unintentionally let liquid or food enter the air tract while speaking.

The leading tendency in modern biology is represented by scientists such as John Maynard Smith (1988) and Ernst Mayr (1983). They are concerned chiefly with the designing of whole living organisms. These scientists unanimously accept that *natural selection* occupies an important place in evolution. The existence of alternative solutions does not mean that a biological characteristic is open to any form of explanation, depending on one's preferences (Pinker, 2000, p.405).

Natural selection can provide a basis on which various purposes are achieved. Evolutionary events are small-scale changes that provide a group of change-bearers with a *reproduction advantage* over the non-bearers. The eye can focus, it can increase or decrease depending on incoming light and can detect limits and depth. The material in the eye seems to have been formed with vision in mind. However, minor *chance*-induced changes in vision, for example, may have combined and condensed in the millennia, so that the ability of many ancestors to see a little bit better in the past led to the appearance of one organism who sees very well now (Pinker, 2000, p.406).

Chomsky (1975) believes that evolutionary processes are rapid. Only the last step of the evolution, though, can be considered rapid. Pinker states that natural selection is the only procedure through which a hereditary line of organisms can stay within a path, among an astronomical amount of possible bodies, to be led from a body without an eye to a body with an eye. Conversely, the alternatives to natural selection may rely exclusively on chance.

Focusing on the nervous system, natural selection can create instincts, or neurological sub-mechanisms, that are based on similarities. Similar inputs would result in generalisations. These generalisations, sensed by the same sensory organ, can lead to groupings of different events and objects. These groupings, after the passing of many generations, could create neuronal circuitry present at birth. Through the above-explained process, it is possible to speak about instincts. This is the context in which Pinker speaks about the language instinct.

Grouping is related to quality. Quine (1969, cited in Pinker, 2000) believes that if our "opinion" about similarities noted within different objects corresponds to a neurological structure that will be eventually linked through natural selection to a gene, then one can understand how "quality" influences our existence.

Sweetness is a quality generally preferred over bitterness, when making food choices. Dryness is preferred over moistness when trying to make a fire. Beauty is preferred over ugliness when offering a gift. Through the above, it can be assumed that frequent similar choices led to generalisations. These generalisations might have led to discernible neuronal mechanisms, instincts, or neuronal subsystems.

Biological anthropology might provide the background to search for indications that a problem of today *resembles* one that our ancestors had to solve in the environment where they evolved. Similarly, using data from psychology and ethnography one can make the following prediction: when children solve problems for which the implicated mechanism cannot be easily understood, neuroscientists should find, in the children's cerebral tissue, neuronal sub-mechanisms acting as instincts, i.e. a circuitry or a subsystem (Pinker, 2000, p.435).

4.2. Cochlear implants and brain plasticity

The validity of the above theories is questionable, as the validity of all theories might be. Study results involving cochlear implants (see figure 11) can be now seen in these theories' perspective. Hirano et al. (2000) examined six post-lingually deaf subjects and six pre-lingually deaf subjects who had undergone cochlear implantation and twelve normal subjects as controls. Regional Cerebral Blood Flow (rCBF) was measured in all subjects before and after cochlear implantation. All pre-lingually deaf subjects underwent cochlear implantation after the age of eight years. The rCBF, if synaptic revision does not

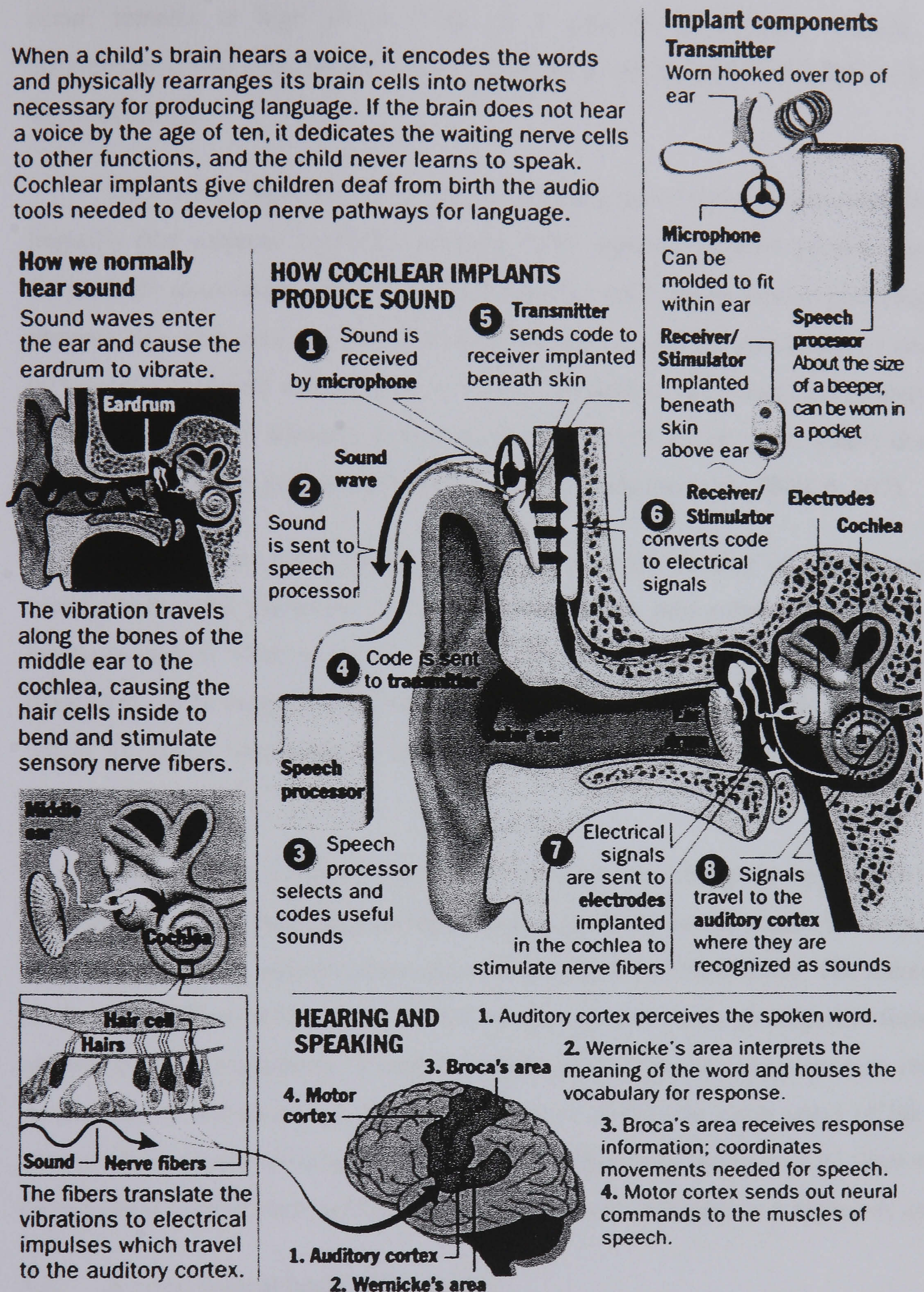

Figure 11
Cochlear implants
(From Kotulak, 1996, p. 27)

occur, remains at high levels. Thus, it is possible to evaluate whether functional differentiation had occurred by measuring rCBF at resting states. In addition, PET studies were performed.

Differences were observed when comparing post-lingually deaf subjects' and pre-lingually deaf subjects' cerebral activation. "The superior temporal gyrus is recognised as *the auditory association area* (A2) where speech sounds are processed phonologically and semantically...this area was well activated in (controls and in) post-lingually deaf subjects by listening to speech sounds with a cochlear implant, while it was inadequately activated in pre-lingually deaf subjects. It was suggested that the A2 of pre-lingually deaf subjects was undeveloped for processing speech signals…" (Hirano et al., 2000, p. 307).

On the other hand, children who had received training in sign language or lip reading before the placement of the cochlear implant, thus substituting aural with visual language stimuli (Calvert et al., 1997), did not show improvement after the implant placement. "It is suggested that functional differentiation of A2 should differ according to which of visual and auditory clue is chiefly used during critical periods for speech acquisition" (p. 593).

The example of these individuals demonstrated the great importance that brain plasticity has when occurring during critical periods of development. In cases of lack of sensory elements or sensory deprivation, brain plasticity is observed. The increased aural acuity of the blind (Röder et al., 1999), which has often been portrayed in films, may be attributed to brain plasticity. Thompson (2000) also writes that, as numerous studies have demonstrated, abundant and diverse experiences *during the early years of life* can have strong effects on the developing brain, further influencing behaviour. In other words, any environment, rich or poor, will affect the way the brain develops and organises itself.

4.3. A neurological basis of language

A neurological infrastructure serving neuronal subgroups facilitating understanding (Wernicke's area) and executing (Broca's speech area) language has been identified. A left cerebral asymmetry has been observed for language in right-handed individuals (Thompson, 2000). More specifically, Broca's speech area lies in the posterior area of the motor cortex on the left hemisphere for most right-handers. When this area is damaged, comprehension of language remains intact but speech becomes slow and strained.

Wernicke's area is located at the edge of three lobes, the parietal, the temporal and the frontal, between Heschl's gyrus and the angular gyrus, an area located between auditory and visual regions. When Wernicke's area is damaged, comprehension is lost in most cases but speech is fluent lacking content.

Ojemann, (1991) a neurosurgeon, reports that electrical stimulation of different locations measuring less than few millimetres in the brain, might de-organise one language function, for instance the repetition or the completion of a phrase. This does not concern areas around the Sylvian fissure, where primary auditory perception is located, or the areas of Broca and Wernicke. These locations were found scattered in the brain and were different for different people. Since every neurone is connected to other neurones, and there exist approximately 10^{12} neurones in each fully developed human brain, any activity attributed to the brain can be understood as an interaction of these connected neurones.

Luria (1974), concerning the localisation of language stimuli, described both dissociation and merging of the pathways of aural and visual stimuli. Nevertheless, aural stimuli do not exclusively sub-serve language. They are the foundation of music.

4.4. Music analysis and perception in the brain

Music can be analysed in various ways. One possible approach is the conception and analysis of music as a physical phenomenon. This physical approach would include examination of sound wave characteristics. Pitch, timbre and rhythm might refer to the same or different characteristics when related to the biological elements that receive the sound stimulation.

Music's perception by the ear follows a physical procedure, as do other sound forms. Sound waves travel to the ear, mostly through the air. Inside the ear, sounds are channelled through liquid to the "hair cells" and in the organ of Corti, responsible for transforming the mechanical stimulation these receive through the sound waves in electrical stimuli. From there, they are electro-chemically passed to the brain. (Thompson, 2000, p. 273-282). The cortex cells that receive these signals belong to the auditory cortex, and are organised in columns and layers similarly to all cortex areas. From there on, other areas of the brain might be activated resulting in the "awareness" of the stimulus and in some form of action. The later procedure is what transforms sounds into music.

4.4.1. Music and brain plasticity

Sounds represent various frequencies, which require specialised cells (e.g. the hair cells) to be perceived. With the function of hair cells alone though, sounds cannot be understood as music. **Musical elements** that should be examined together include **frequency** (which can be understood as the basis of human pitch perception), **timbre**, **rhythm** and **harmony**.

Music is usually produced by musical instruments. The musical instrument humans use most is their own voice. Its production requires the activation of the vocal cords, the larynx, the surrounding air tract, and the surrounding muscles. Other instruments require the participation of various body parts, such as the hands or the feet. It is apparent that the human body's resources are *sine qua non* for music. Without the human biological foundation and especially the nervous system, music would probably not exist. On the other hand, music as a stimulus can play a role in "sculpting" the brain of the developing human being.

4.5. Cortical areas and corresponding stimuli

From the above it has become apparent that when composing or when playing music, but also when listening to music, many and different sensory and motor areas of the brain are involved. Through conducted research, it might be possible to find out which brain areas are involved in music creation or perception. In order to come closer to this goal, it would be helpful to begin with a listing of areas known to host primary stimuli (see figures 10 and 12):

1. Visual stimuli or visual information are primarily projected to the back of the occipital lobe. The primary and other areas for vision have been described as V1, V2, V3 etc. in the monkey (Thompson, 2000)

2. Information from the skin and the body projects primarily to the S1 and S2 areas of the parietal lobe (Mountcastle, 1998)

3. Auditory information projects primarily to the auditory cortex, deep in the Sylvian fissure, around an area called "Roland's insula". Later, a secondary auditory association area and a tertiary auditory association area are discussed (Abbott, 2002)

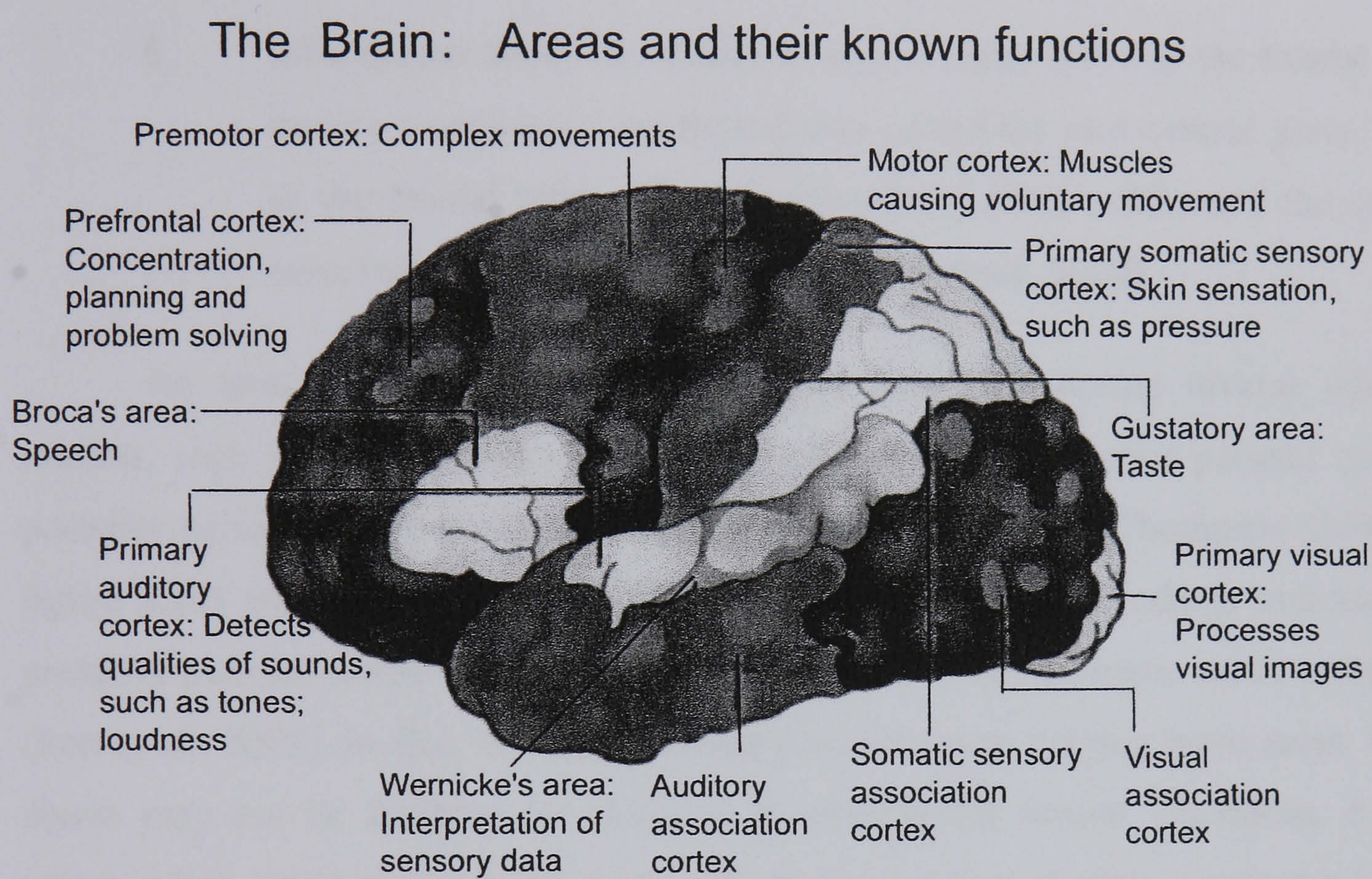

Figure 12
The Brain: Areas and their known functions
(From Kotulak, 1996, p. 10)

4. Language stimuli are mainly projected to two areas known for a long time as the areas of Wernicke and Broca. Language though is not projected exclusively to the above-mentioned areas (Pinker, 2000).

5. Olfactory sense and taste stimuli are projected to the temporal lobe, (Rosenzweig, Leiman & Breedlove, 1996) and

6. Information about movement concerns many areas of the frontal lobe, but mainly a section of the frontal lobe called the post-central gyrus, a section of the frontal lobe called inferior frontal lobule (IFL) and the cerebellum (automated common movements) (Thompson, 2000).

An area mentioned in studies of brain activation during diverse activities of interest, such as piano playing or mental rotation is the posterior parietal cortex. The posterior parietal cortex is referred to as an association cortex in Thompson (2000, p. 269, figure 8.18) without a mention of its specialisation. Research findings indicate that the posterior parietal cortex is involved in music execution and perhaps, music understanding (Itoh et al., 2001). In fact, diverse skills are projected onto varying brain areas. While the above may not be limiting for skills, it is limiting for senses. Therefore, it is worth investigating whether among all those cells in the cortex that serve a concrete function in an area, some, within limits, serve a similar but different cause to that which is known to be represented in the area. Studies have revealed, for instance, that music is processed by neuronal circuits overlapping with language (Abbott, 2002).

Tramo et al. also, (Tramo et al., 2001) investigated the "vertical dimension" of harmony through the capacity of *peripheral auditory neurones* to encode temporal regularities in acoustic fine structure and the differential tuning of many neurones throughout the auditory system to a narrow range of frequencies in the audible spectrum. They found that "neurones throughout the auditory system that are sensitive to one or more frequencies (partials) contained in the interval respond by firing action potentials". One can see the differentiation that can appear throughout the existing neuronal repertoire.

4.6. Lateralisation in music

Furthermore, there is the phenomenon of lateralisation of a skill or a function, or hemisphere asymmetry or hemisphere dominance. This implies that the brain tends to process specific information mainly or only in one of the two hemispheres. Lateralisation was described on Sperry's patients who had undergone lobotomy for medical reasons (Sperry, 1974). It has been extensively investigated and several skills were described to be or not to be lateralised. Asymmetries are addressed separately for perception and for execution resulting perception.

Music was believed to be perceived by the **right hemisphere**. This belief was based on scientific research in aphasias, where people who had suffered a stroke in the left hemisphere had difficulty in speech but had no difficulty singing (Gardner, 1993). These observations, together with clinical observations that language execution depended on the left hemisphere (Thompson, 2000), provided the foundation for the broadly accepted theory that music and language are processed in different parts of the brain. In other words, music and speech are dichotomous although both use sound as their basis. Recently, through the technologies of Positron Emission Tomography (PET) and functional Magnetic Resonance Imaging (fMRI), it has been made possible to investigate normal people in vivo. Various studies have already been conducted examining musical issues, twins, musicians, non-musicians, people who had suffered strokes, and others. Some of the results from such studies will be presented.

Anatomically, the auditory cortex areas where sound is primarily processed, i.e. the depth of the Sylvian fissure, where language sounds, music sounds or any sounds are believed to be initially processed, were not the only areas where the brain processes music and language. Alison Abbott (2002), *Nature's* senior European correspondent, is enlightening regarding related research. In the introduction of her article, Abbott supports that mental representations of the world are built up based on the information delivered by sensory organs to their own specialised areas within the cerebral cortex. She continues the introductory section discussing PET scans, fMRI, EEG (electroencephalography) and MEG (magnetoencephalography), short- and long-term memory accompanying music, emotion accompanying music, abilities required to play an instrument, and the representation of fingers in the brain.

She then states that relatively recent research indicates that "trained musicians tend to use more of the *left* half of their brains for music *processing, probably because* they have learned to process musical information more *analytically*'' (Peretz, 2001). Indeed, a body of evidence supports that there is lateralisation involved in music processing, with the left hemisphere dominating. This phenomenon probably appears because of music usage. (Schlaug, 1995; Schlaug et al., 1995; Jäncke, Schlaug, & Steinmetz, 1997; Pantev et al., 1998; Münte, Altenmüler, & Jäncke, 2002)

4.7. Music over-training effects on the cortex

Research of individuals who were over-trained in the area of music making (Elbert et al., 1998) has provided results indicating that there are limits to music training, perhaps to other training areas as well. An illness known to be caused by excessive practice in music is focal dystonia. The explanation for its appearance has been that the representation of two over-trained fingers in the primary somatosensory cortex (S1) has expanded to the extent that the areas corresponding to the two fingers had merged. This resulted in simultaneous movement of the two fingers, showing dystonic action at times i.e. the two fingers move involuntarily together.

4.8. Neuronal heredity in music

In this case, publications concerning heredity of neuronal elements that would process musical elements should be initially investigated. Drayna et al. (2001) conducted a study on one hundred thirty-six pairs of identical twins and one hundred forty-eight pairs of non-identical twins. The subjects were examined in a task of identifying melodies with an incorrect note. Within pairs, the performance of the identical twins was more closely matched than for the non-identical twins. One can suggest that there exists some kind of heredity but it is not the decisive factor in separating humans into ones that are musical and others that are not.

4.9. Development of neuronal pathways for music

Similar recent research (Schlaug et al., 1995), but also older research concerning children or musicians who had begun music training as young children and present anatomical differentiations do not answer the question of where music is perceived and how, neurologically, it is executed.

According to Kotulak (1996, cited in Stamou, 2001), "genes, the chemical blueprint of life, establish the framework of the brain, but then the environment takes over and provides the customised finishing touches" (p. 47). If accepted, the above could provide a basis for research looking for evidence of sound impact on the brain in the very early moments of life, that is in utero, and for differences between naturally occurring sounds and musical sounds. From what is known, brain development means that most cells of the primary repertoire would be dead after a while but the ones for which stimulus exists will be spared and differentiated. These new cells will be connected to each other according to information coming together with the stimulus. This information though might have, and usually has, multiple characteristics. Concerning sound, there certainly exists:

- a frequency element, which, when learned, supports pitch perception,
- a timbre element, which from a neuronal point of view would not have many differences from the pitch element except that it is connected to the pitch from which it is initiated,
- a rhythm element which is different from frequency but within the domain of sound it is connected to the temporal succession of the sound frequencies, and
- a syntax and a semantic element which are immediately connected to rhythm. Syntax is connected to the usual sound successions heard in music and semantics to the meaning that those successions usually have.

All these now form a synthesis that includes harmony and which can be processed by a different set of cells than the ones which are individually processing pitch and timbre or rhythm, syntax and meaning.

4.9.1. Music perception and emotion

Zatorre led the way in approaching emotions. Together with his colleague Blood (Blood et al., 1999) they focused firstly on "negative" emotions. It was discovered that a great diversity exists concerning patterns of brain activation in specific areas known to be involved in emotional processing in response to consonant and dissonant melodies. This was an indication that the recognition of music uses different neural pathways than the emotional appreciation of music (Abbott, 2002). Subsequently, positive emotions were investigated. This research showed activation through music of the same neuronal circuits that are also activated by reward and euphoria, as for instance by food and sex.

Altenmüller et al. (2002) investigated the "emotional valence judgements" in brain areas that were activated while listening to several kinds of music. They found a widespread bilateral fronto-temporal activation accompanied by a highly significant lateralisation effect. Positive emotional attributions were accompanied by an increase in left temporal activation while negative emotional attributions were accompanied by a more bilateral pattern with predominance of the right fronto-temporal cortex. There is no explanation, though, offered in all the studies concerning this coincidence, as to why the brain is shaped the way it is. There was no way to demonstrate that one can, for example, eat "better", more pleasurably, when listening to music than when not listening to music.

In spite of the above results, the theories of LeDoux, as presented by Goleman (1995), give a different perspective. Up-to-date investigation has demonstrated that the major part of the incoming information goes after the thalamus to the cortex. The **amygdala**, considered the centre of human **emotions**, regularly receives information from the cortex, as all other nuclei of the limbic system do. But the amygdala has an immediate connection to the thalamus too. In addition, the amygdala has the specificity to possess body connections, through which it can raise the blood pressure, increase the heart rate, contract muscles and generally prepare the organism for fight. Indeed, the amygdala will take over all other connections and embark the individual in a fight or a defence act if it is thought, using the incoming information, that the organism is in danger.

Conversely, when not in danger, behaviour will be governed by the cortex, through information lying mainly in the visual cortex. According to this hypothesis, it appears that all kinds of information is transferred to the **prefrontal** areas and these usually govern our **emotional** reactions. If and when an individual is believed not to be in danger, a "truce" is signed between the amygdala and the cortex, between brain and heart as Goleman says (1995) permitting clear thought. Under this light, it can be suggested that music (when present in the environment together with the destabilising factors) might be a selective element that will drive emotional feelings towards the truce and not towards immediate action. But this is only a remote hypothesis.

It is conceivable to attempt to discover the beginning of the interactions between the hereditary element of music and all the features of the sound stimuli mentioned previously. Stamou (2001) writes: "the ear starts developing by approximately 22 days of gestation, and by the 25th week of gestation hearing is functional" (p.47) Of course, the idea that learning begins before birth is relatively new but there already exists a body of research and information on it. Birnholz, & Benacerraf, (1983) and DeCasper & Fifer (1980) note that cochlear function, basilar response and development of inner and outer hair cells permitting transmission to the eighth cranial nerve (the first to fully develop in the foetal brain) is present by the fifth to seventh month of gestation (cited in Stamou, 2001). This implies that some of the sounds surrounding the foetal ear would be inscribed in the memory so firmly that eventually they would be as stable as the inherited characteristics. This leads to the investigation of the quality of the sounds perceived by the foetus.

4.9.2. Quality of sounds during early music development

The environment of the foetus consists of amniotic fluid, various membranes and body tissues creating an acoustic environment of low frequency level background sound above which emerge the mother's cardiovascular, intestine and placental sounds. Around the foetus, a rhythmic environment is created by the heartbeat of the foetus and the mother, by the pumping of the blood through the arteries and the oxygen through the lungs (Shetler, 1990, in Stamou, 2001). Evidence is accumulating that musical ability is present in all human beings (Fox, 1991, in Stamou, 2001). Responses to sounds begin between the twenty-fourth and the twenty-fifth week of gestation. "Newborns distinguish volume, localise a sound ten minutes after birth, prefer certain sounds to others, and acquire auditory discrimination in the first day of life." (Brand, 1985, in Stamou 2001, p. 48). The most critical period for the development of music, as Gordon (1998) ascertains after years of relative research, is between birth, if not before that, and three years of age. The second most important period extends between the third and the fifth year of life. Nevertheless, abundant information about the very neuronal structures that process perception of music and execution of music has not been available up to now making research also seek for explanations or correlations in other domains such as spatio-temporal reasoning.

4.10. Neural networks dedicated to musical processes

Music perception was investigated by Zatorre (Abbott, 2002). The findings indicate that "the primary auditory cortex is mainly thought to *identify the fundamental elements of music, such as pitch and loudness*. The secondary cortex is believed mainly to focus on *harmonic, melodic and rhythmic* patterns, and the tertiary auditory cortex is thought to *integrate these patterns into an overall perception of the music*" (p. 13).

Isabelle Peretz and colleagues, (2002) on the other hand, (Peretz et al., 2002; Ayotte, Peretz, & Hyde, 2002) has studied individuals with congenital amusia. Amusia is a term coined in 1888 by August Knoblauch. The term "amusia", a standard term in neurology and neuropsychology today, became a standard term designating a general impairment in music abilities after brain damage. Subsequent authors have used the term to denote a general impairment in music abilities. (Johnson & Graziano, 2003). Peretz supports that special pathways exist within the primary cortex defined to the processing of music. Her subjects did not notice that a note in a melody was altered by a semitone. They were indifferent to dissonance in music. Memorising a melody or tapping in time were difficult tasks for them. However, the difference in pitch indicating a statement or a question, for instance "He speaks French" or "He speaks French?" was perceived by all of them. From all the above, Peretz concludes that amusia is an extraordinarily specific disorder confined to the musical domain. Further research would be necessary to associate neural circuits with music only.

Platel (2002) writes that only if such research were successful in indicating neural networks dedicated exclusively to musical processes could the hypothesis that all deficits observed by Peretz's results are due to an initial misfunction of the system of pitch perception be verified. Although tonotopic representation of sounds has been described in animal studies and in man (Pantev et al., 1989), as Platel (2002) mentions, there exist only very few fMRI studies directly investigating musical processes. Music perception was characterised as a complex and composite process (Platel et al., 1997).

4.10.1. Interdependence between language and music sounds

Functional independence between language and music is an issue requiring additional research. The nature of both skills remains ambiguous, as does their source. An attempt to shed some light in this area was carried out by Engelien and colleagues (1995, in Platel, 2002) studying patients presenting central auditory disorders characterised by selective disturbances of musical functions and absence of an established neurological pathology. The above research did not come to a clear-cut conclusion.

Koelsch et al. (2002) sustain that the brain responds to musical chord sequences in a similar but not identical way to language perception, both in musicians and non-musicians. This is also supported by other research conducted in musicians and in non-musicians (cited in Koelsch, 2002). The aim of Koelsch and colleagues was to investigate the neural correlates of music processing with fMRI. The researchers exposed the subjects to sequences of chords, which contained some unexpected musical events. During the unexpected events, the areas of Broca and Wernicke, the superior temporal sulcus, Heschl's gyrus, both planum polare and planum temporale, as well as the anterior superior insular cortices were activated. Concisely, the areas activated were the inferior fronto-lateral and the anterior as well as the posterior temporal lobe structures in both hemispheres (Koelsch et al., 2002). The cortical network that comprises all the above structures belongs to the domain of language.

Since the investigation described shows that the brain uses the same network for language and musical harmony, it can be suggested that either it uses exactly the same cells and pathways for both, or that two separate sub-networks exist within the same network. The brain is excited when the harmony of music is unexpectedly modified. Therefore, it can be hypothesised that the common function that Koelsch et al. (2002) measured concerns the syntax of both language and music, since in both cases the function concerns the way the sounds are arranged in time, that is the way musical elements relate to each other in time. This relation is probably affected by the "meaning" of the musical sounds, if it is admitted that those sounds have their own meaning as well. Thus, music, according to Koelsch, has a syntactic and a semantic dimension.

In any case, the findings provide functional neuroanatomical support for the notion that musical elements of speech play a crucial role in the acquisition of language. The participants in the study of Koelsch et al. (2002) were non-musicians and distinct activities were elicited by events which could only be differentiated from in key sequences "by the application of implicit knowledge about music theoretical principles of harmonic relatedness" (p. 964)

All the above might lead to the investigation of the hypothesis that an instinct exists for music as well as for language. Nevertheless, if such instincts exist (Pinker, 2000), where in the brain would their niche be? Perhaps a separate niche for music and a separate niche for language might not really be necessary. It can be hypothesised that concerning concrete functions as, for instance, melody, rhythm or harmony, these may be processed by areas already known, such as Wernicke's and Broca's areas, while the so called association areas or tertiary areas or areas of Higher Brain Function (HBF) "select" the pieces from the concrete function areas and make a whole that is realised as music or as language.

If this were the case, a lot would depend evolutionarily on the conditions under which the above entities (music and language) were selected. For instance, neuronal sub-networks that have developed into the so-called instincts would be divided into some that are older and more permanent appearing in both, language and music (specialising in e.g. rhythm and syntax), than others that have developed more recently (specialising in e.g. music listening and comprehension or music executing). Furthermore, two other functions might be connected to language and music: spatial recognition and spatial-temporal reasoning. Of course, the above is purely hypothetical. But if things developed this way, Pinker (2000) would be right in his suggestion that music is a by-product of the way the human auditory system analyses sounds combined with our tool-making skills (Abbott, 2002). Also, the notion of Shinichi Suzuki (1981) that everyone should be acquainted with music since music could be learned similarly to the mother tongue should have been given more attention. Finally, all findings could have been explained, i.e. the findings of Zatorre et al. (Abbott, 2002) for the initial processing of the frequencies in the primary auditory area, the ones by Koelsch et al. (2002) for the processing of syntax and meaning in the secondary auditory areas (through evolution) and the ones of Ojemann (1991) for finding different isolated areas in different people processing only one, isolated feature of the language (through brain plasticity)

4.11. Impact of music on cortical activation patterns

Altenmüller et al. (1997) conducted a study where the impact of musical stimulus on cortical activation patterns was also explored. According to prior findings indicated in the study, trained musicians processed music analytically, primarily using the left hemisphere. Conversely, untrained listeners processed sounds more globally, with a right hemispheric preference (Bernsteiner et al., 1994; Peretz, 1990). EEG measurement was used attempted to determine if the cortical activation patterns of an individual taught musical concepts verbally would differ from those of an individual taught musical concepts musically. In their words, the researchers suggested that different pathways of musical learning would cause different mental representations in the memory of the learner (possibly different neuronal pathways). If the above were true, then the EEGs would indicate different cortical activation patterns.

Participants in the study were nine right-handed students, four males and five females, with the same general educational level. Their mean age was 13.8 and, in school, they were in the seventh and the eighth grade. According to the scores of musical aptitude tests (conducted with Gordon Advanced Measures of Music Audiation), all subjects were found to be comparable. Each participant focused on the task of increasing the ability to accurately identify a properly structured musical period[5]. Three groups, A, B, and C, of three subjects each were formed. In the pre-test, subjects were controlled on sixty short melodies, with a length of eight bars each. Thirty melodies were correct, while the other thirty were incorrect ones. The question posed to the participants was whether the melodies sounded "well balanced" and "closed". All groups answered comparably [A (n = 40), B (n = 41), and C (n = 41)]. The treatment phase was different for each group. Students in group A were instructed on the structure of a musical period verbally. Their answers were also provided verbally. Group B received musical instruction on the same topic, only that here clapping, singing, and improvising were used. Students of this group were required to give their answers in the form of a musical response, without using any isolated verbal communication. The last group (C) was a control group that received no instruction. The instruction lasted five weeks. Next, the subjects were post-tested using the same procedure as in pre-testing. As expected, taught groups A and B showed improvement. Group C did

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[5] musical period was defined as a short symmetrical melody with rhythmically and melodically corresponding parts

not show improvement. Analytically, the results for each group were group A (n= 50), group B (n= 51), group C (n= 41.6).

While responding to the questions, both in pre- and in post-testing, subjects were monitored on an EEG instrument. Despite the fact that no significant difference appeared in test scores of instructed groups A and B, the EEG measured clearly different cortical activation patterns. During pre-testing, the EEG reports indicated that melody processing produced widespread activation of all brain areas, especially in the frontal lobes, in all three groups. No hemispheric dominance was reported. During post-testing though, activation patterns differed significantly ($p < .001$). Great activity increases over the left and right frontal cortex were reported in groups A and B. Hemispheric dominance was different for the two groups though. Group A showed a notable increase over the left frontal region while group B showed a clear increase over the right frontal region. Control group C exhibited a general decrease in cortical activity.

Researchers suggest that while music learning procedures did produce changes in cortical activation patterns, distinct cortical activation patterns reflected different mental representations of music. This variance was produced by the different teaching procedures. One year later, group B participants showed better retention of knowledge than group A participants.

An implication of the study, as suggested by its authors, hints to transfer of musical training into other areas. They suggest the exploration of musical learning not only for music itself, but also as a powerful tool to develop various neuronal networks and, possibly, facilitate other learning. They also indicate that verbal knowledge lasted longer when processed with the aid of music.

4.12. Posterior parietal cortex and music execution

Itoh et al. (2001) conducted an interesting investigation. His team recruited eight pianists, seven females and one male. Their task was to play a given score first with one hand alone, then with the other hand alone and finally using both hands together. This was a sight-reading task, meaning that the score was not studied before. At the same time, fMRI recordings of the subjects' brains were made. It was found that activation which correlated to playing with left hand only and with right hand only mapped chiefly onto the corresponding contralateral (opposite) primary sensorimotor area SM1, that is onto the precentral and postcentral gyri. Activation which correlated to playing with both hands together mapped chiefly onto the posterior parietal cortex, more specifically onto the superior and inferior parietal lobules. Subjects also executed a non-specific hand-grasping task.

Both-hand piano playing demonstrated that movement is initiated by orders produced not only in the motor areas, which are the areas of the frontal lobe and the cerebellum. It made clear that somatosensory association cortex, as mentioned by Rijntjes et al. (1999) which is the same as posterior parietal cortex, can also be considered as motor cortex since purposeful movement, that is piano playing, was produced while the association areas were activated.

At the same time, during the non-specific hand-grasping task activation was observed in the SM1 but not in the posterior parietal cortex. In other words, the posterior parietal cortex was activated only by music played on the piano. Itoh et al. proceeded to further analyse their results and found that "activation in the PPC (posterior parietal cortex) was found to correlate to piano performance irrespective of hand movement modality" (Itoh et al., 2001, p.43).

A widely accepted left parietal functional asymmetry was also found to exist. Commenting on that, Itoh et al. present clinical studies suggesting that the perceptual component of three-dimensional spatial processing is principally sub-served by the right posterior parietal cortex (Kwee et al., 1999) while the executive component of three-dimensional spatial processing is sub-served predominantly by the left posterior parietal cortex (Heilman & Rothi, 1993). Piano performance initially requires two-dimensional visual perception of the music score. Then, sensorimotor three-dimensional spatial processing is required for organising finger movements. The authors then write that the left hemisphere dominant activation in the posterior parietal cortex is compatible with known lateralisation of function for that area.

The transition from the reading of the two-dimensional music score to the three-dimensional organisation of the finger movements makes it imperative that the piano player is capable of processing a series of mental images. The process involves processing of images in a spatial-temporal manner in the mind. An interesting hypothesis would be that the parietal association cortex (posterior parietal cortex in Itoh et al., somatosensory association area in Rijntjes) activated motor cortices when complex movement such as piano playing was produced.

4.13. Spatial-temporal processes in the brain

In addition to the definition of spatial-temporal processes provided earlier, before birth, spatio-temporal processes might involve all kinds of sensory stimuli except visual. After birth, visual stimuli are also processed in the brain. Actually, they are processed to the point where vision dominates. Humans belong to the category of animals that can be classified as "beholders" (Thompson, 2000). Language-analytic reasoning, a way of thinking that uses words, is linked to vision.

In language, every word can be regarded as a stabilised "time-slice", similar to an isolated personal visual memory. Memory is central to any kind of understanding of the ways by which people incorporate the world. "Specific temporal phase differences must exist between the same inherent spatial-temporal *memory* patterns in connected columns" in order for the dramatic enhancements in reliability in the firing of connected columns to occur, by introducing Hebb intercolumnar couplings (Sardesai et al., 2001). After Sardesai et al. achieved this reliability, they generalised the criteria of large enhancements and "the spatial rotations as well as the temporal phases (became) crucial. Only certain combinations of inherent memory patterns meet these criteria" (p.173). The importance of memory is greatly emphasised.

Another important issue can be seen in the following examples. A person blind from birth has never seen the objects he refers to and to overcome this handicap he imagines them. This is accomplished through cell connections within the brain. Someone blind from birth who can hear, therefore, might create "images" representing words based mainly on aural stimuli. These images, apart from their auditory character, would have a strong *temporal component* too, because of the temporal nature of sound perception. If the individual is unlucky enough to be blind *and* deaf from birth, object representations will be based on tactile, olfactory and taste sense stimuli, since other senses will not be available. These images would have a stronger *tactile component* than the previous ones. What it is important to stress here is that when referring to a *component,* one refers to a function of memory. Indeed, all the substances of which an object is formed of, are its components. In order to speak about it, one must remember its components. All that one is able to remember, is all one was able to sense and bring back to mind.

This rough analysis shows the great importance and the role of the senses and of memory in understanding the world. In order now to find out and understand how spatio-temporal reasoning works, it would be better to search for in vivo studies demonstrating where in the brain spatio-temporal reasoning is installed.

4.14. Cortical areas involved in spatial-temporal reasoning and in music processing

Bodner et al. (2001) demonstrated in an fMRI study that the regions of the brain that were activated when subjects listened to the music of the Sonata for two pianos, KV 448, by W. A. Mozart, which, as stated (p. 683) "have given evidence for music causally enhancing spatial-temporal reasoning", were the dorsolateral prefrontal cortex, the occipital cortex and the cerebellum. An EEG coherence study provided evidence for a carryover from the Mozart Sonata listening condition to the subsequent spatial-temporal task. Therefore, according to the team led by Bodner (2001), spatial-temporal reasoning is processed in the above-mentioned areas. Rijntjes et al. (1999), though, demonstrated that the premotor cortex, the somatosensory association cortex and a region of the lateral cerebellum were activated by movements and they consider these areas as belonging to the motor system. Pre-motor and cerebellar regions in Rijntjes et al. (1999) study are the same as prefrontal cortex and the cerebellum of the Bodner et al. (2001) study, even though they studied movement and music perception respectively. This fact raises the question of whether it is possible that these regions are both spatio-temporal and motor areas at the same time.

Jordan et al. (2002) summarise previous studies and also perform their own fMRI studies on males and females who did not differ in overall level of performance on three mental rotation tasks. Their equal level of performance was chosen to eliminate any confounding influences of overall performance levels. Despite the fact that they do not refer to music, it is interesting that they attribute their findings to the hypothesis that the sexes use different strategies in solving mental rotation tasks (see figure 13). They propose that it may be an interesting question for future research to explore whether different strategies and their accompanying cortical activations might be altered by experience in solving mental rotation problems. Women showed bilateral activations in the intraparietal sulcus (IPS), the superior and inferior parietal lobule, the inferior temporal gyrus (ITG) and the premotor areas. Men exhibited significant activation in the right parieto-occipital sulcus (POS), the left intraparietal sulcus and the left superior parietal lobule. Both sexes showed activation of the premotor areas, but men showed an additional significant activation of the left motor cortex.

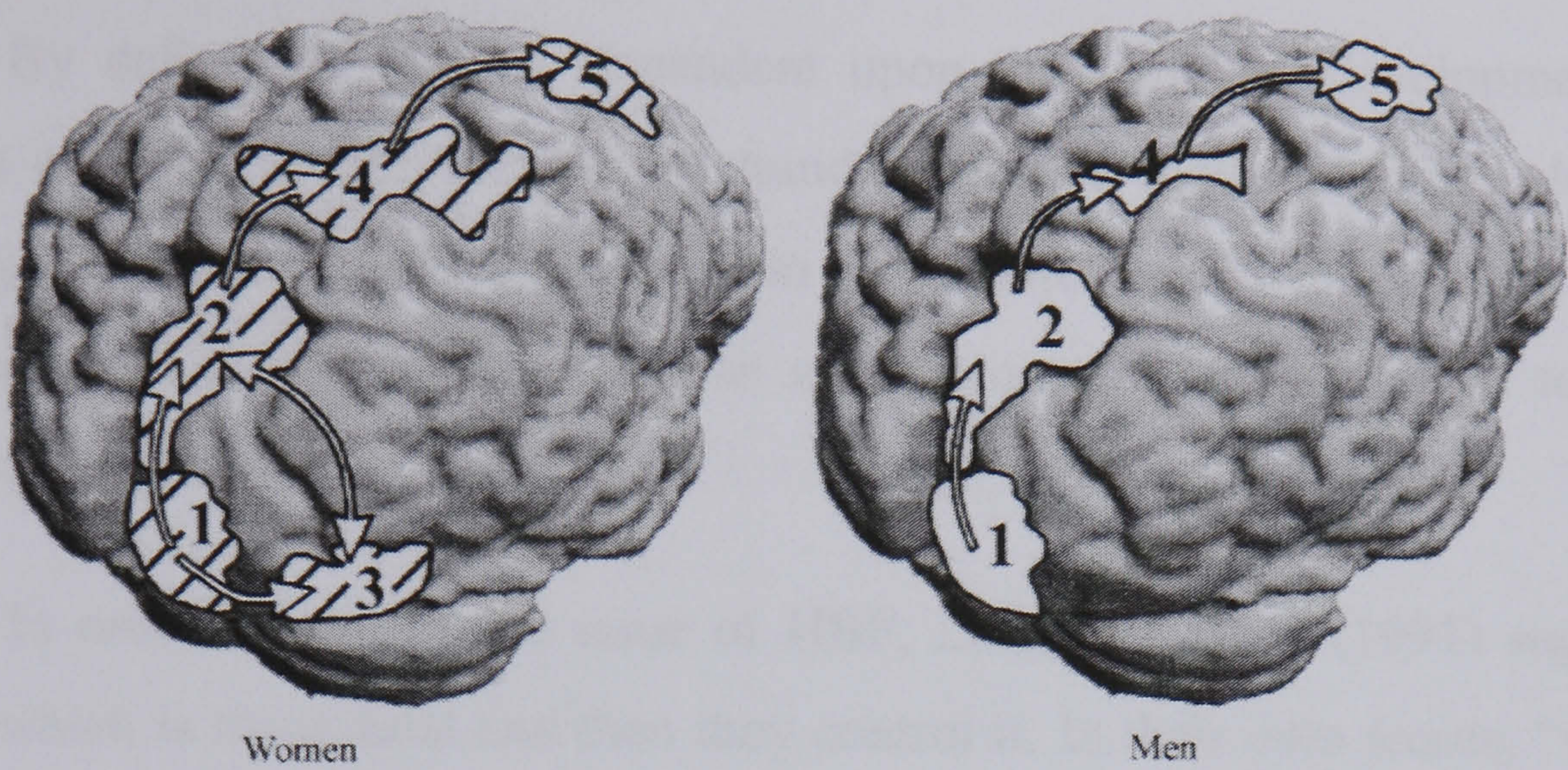


Figure 13
Hypothetical pathways for solving mental rotation tasks in women and men:
(1) primary visual area, (2) extrastriate cortex, (3) inferior temporal/inferior occipital regions, (4) parietal regions (intraparietal sulcus), (5) premotor cortex.
(From Jordan et al., 2002, p. 2406)

The conclusions of Nair et al. (2003) are also interesting. The researchers observed use of an intricate neuronal network consisting of sensorimotor cortex, supplementary motor area (SMA), superior parietal lobule and cerebellum when tasks involving both planning and execution were performed. An apparent decoupling of sensorimotor cortical and cerebellar areas was observed when activity was practically absent and only imagined. The authors explain their findings implementing the notion that "the brain engages multiple cortical and cerebellar structures to varying degrees for planned sequential action" and that "more and more evidence points to the brain as a highly interconnected spatiotemporal dynamical system that uses distributed representational schemes " (p.259). To their support, they mention Edelman and Tononi (2000), Jirsa and Kelso (2000) and many others. These studies though, did not concern music.

4.15. Higher brain function (HBF)

In Itoh et al. (2001), when both hands played, both the SM1 areas showed activation. For movement to exist, activation of the motor neurones of the fifth and the sixth layers of the SM1 is necessary. Since the posterior parietal cortex is activated, this implies that the posterior parietal cortex and the SM1 are connected. Furthermore, some believe that certain brain areas are involved in higher brain function (HBF) while others call these areas association areas. The fact is that these areas represent large sections of the cortex, which act in synchronisation for fragments of seconds up to a minute without necessarily requiring sensory input (Leng & Shaw, 1991).

By definition, HBF is dependent upon the temporal development of firings of billions of neurones for factors one hundred or one thousand times slower than cases needing "recognition and answer" and do not require sensory input (Leng & Shaw, 1991). The posterior parietal cortex, being an association area, might appear to execute higher brain functions.

In order to discuss the issue of HBF, Leng and Shaw (1991) suggest a neuronal model which is theoretical and then they control it. In their own words, "we will base our discussion of HBF on generalizations of results from the trion model, which is a highly structured mathematical realization of the Mountcastle organizational principle in which the cortical column is the basic neural network…and is comprised of subunit minicolumns, our idealized trions" (p. 229).

4.15.1. Trion model

According to Leng and Shaw (1991), trions are synonymous to minicolumns. It should be repeated that minicolumns contain from several to two hundred cells each. They have receptor cells for extrinsic stimuli in the fourth layer, cells in their fifth and sixth layers transmitting impulses out of the brain and principle neurones and interneurones found in the other three layers. These last two cell categories organise the minicolumn intrinsically and may be found in all layers. The interneurones' role is not clear; it is believed though that the interneurones can influence other neurones at their synapses. "A columnar network of trions", the authors continue, "has a large repertoire of quasi-stable, periodic spatial-temporal firing patterns, ...which can be excited. These (firing patterns) can be readily enhanced by only a small change in connection strengths via a Hebb learning rule and evolve in natural sequences (related by certain symmetries) from one to another in probabilistic evolutions" (p. 229).

A small difference therefore is needed in the strength to connect so that connections are realised. This difference might appear at the time when the stimulus runs through the cell and the postsynaptic connection is realised. Within a minicolumn, this difference might be provided by the interneurones after the minicolumn is aroused. This arousal may also be achieved through a two-way influence: coming as a stimulus from the thalamus to the fourth layer of the minicolumn and then disperse within it, or, transferred between principle neurones in appropriately ordered minicolumns on the verge of macrocolumns forming cortical areas.

Through Mountcastle's principal for columnar organisation, it becomes clear that minicolumns act as units. Countless years of evolution produced a number of fundamental principles, in addition to learning rules, which are integrated into the function and organisation of the higher cortex. These principles and rules are built into a layer of cells which are interconnected in the cortex. These cells form the minicolumn in a way that allows for synchronisation and stimulation-firings.

A consequence of this organisation is that the columns can become excited into complex spatio-temporal firing patterns of the minicolumns. This is the code for HBF. This code " involves the creation and transformation of ...complex patterns among columns over large regions of the cortex" (p. 238). Therefore two spatial scales greater than the neurone must be considered: the column (scale of 700 μ) and the minicolumn (scale of 100 μ).

Considering the above, several codes might exist. These would depend on the urgency of information being processed and its complexity. Concerning the urgency, the role of the amygdala in case of danger is crucial. In those cases, as seen in other sections of the thesis, the amygdala can "take over" and produce behaviours. In non-urgent situations, the cortical code used is such that both spatial and temporal measures are used (100 μ and 25 milliseconds respectively). Brothers and Shaw (1989, cited in Leng & Shaw, 1991) measured the reproducibility of mental rehearsals of musical pieces. The precision observed in the musical rehearsals, characterised as "incredible" by them, led the researchers to introduce a series of new neuronal time scales, in HBF, from seconds to minutes in order to "reset" the phases of the sophisticated spatial-temporal firing patterns. Based on the above, they proposed a series of temporal scales from the single neurone time scale of one millisecond to the HBF time scale of up to several hundreds of seconds.

Meanwhile, the trion model had been proposed in prior publications (e.g. Shaw, Silverman & Pearson, 1985; cited in Leng & Shaw, 1991). In this model, the minicolumns or trions had hypothetically three firing levels: average, above average and below average. Trions were proposed to be highly structured in time and in spatial connections. They were thought to form a network and to have a repertoire of a great number of quasi-stable, periodic spatial-temporal firing patterns. Trions displayed the qualities of being easily enhanced and selected out by only a small change in connection strengths using a Hebb learning rule (Shenoy et al., 1993). According to Leng and Shaw (1991), the trions were also involved in natural sequences (related by certain symmetries) from one to another in the probabilistic or Monte Carlo evolutions.

Two types of Monte Carlo evolutions exist: the *analytic mode* and the *creative mode*. Leng and Shaw (1991) were impressed by the results of Monte Carlo evolutions of the creative mode mapped onto pitches and instruments to produce music. Different simple mappings of the same evolution gave music reminiscent of a minuet, a waltz, certain folk music, or styles of specific periods of Western music. A theme could *be learned* so that evolutions using this theme would produce recurring "variations" (Leng & Shaw, 1991, p. 235).

Brothers and Shaw (1989) argued that standard laboratory paradigms would not probe the code for HBF. "To study the sound producing characteristics of an exquisite violin, one must play the sorts of musical sequences that the instrument is designed to beautifully produce rather than scrape the bow…Extending this analogy to HBF, we focused on the high end of the range of the cognitive tasks by examining the performance of professionals in highly trained, demanding tasks" (Leng & Shaw, 1991, p. 236). They recruited an orchestra conductor, a solo flutist, and several experienced dance students and asked them to mentally rehearse musical pieces with durations reaching the magnitude of minutes. Error in reproduction duration was less than two percent. These results, according to the researchers, revealed the importance of ruling out the strictly spatial code for representing information in HBF. Seeking for the temporal codes, they argued that there are two quite different ways in which neural coding has been treated in the temporal domain, one that is intrinsic to the code and highly constrained and the second that is unstructured and not highly constrained. Based on this, there is no way to account for such a high degree of synchronisation over large regions of the cortex. To solve this problem, Leng and Shaw (1991) proposed "a general principle of HBF, i.e., that all higher brain functions of sufficient difficulty, lasting for periods of tens of seconds or more, require extremely accurate timing for the organized firing of groups of neurons over large regions of the cortex" (p. 237).

Based on their findings, Leng & Shaw (1991) maintain that it is certainly not necessary nor expected that each minicolumn has the same number of neurones, for the minicolumn to be a "useful" concept. The structured connectivity permits the diverse cortical "units" to function co-operatively in a dynamic processing sense. The strongest connections are formed vertically, and through them, the minicolumn is formed. Weaker connections are formed horizontally, connecting neighbouring minicolumns. Columns are interconnected in an even weaker manner, while distant columns are connected in a highly specific manner and yet, still weaker. Three spatial scales arise from this perspective, outlining minicolumns, columns and cortical areas.

A basic time-step is employed in the calculations of Leng & Shaw (1991), which they name *r*. They estimate that if *r* were equal to twenty-five milliseconds, four minutes of music would roughly equal ten thousand *r*. If a single neurone fires every twenty-five milliseconds, every minicolumn contains one hundred neurones, every column contains ten thousand neurones and the entire cortex around ten billion neurones, then a series of time scales is produced ranging between twenty-five and two hundred fifty milliseconds. This series is familiar and reproducible. To reach the ten thousand *r* necessary for HBF, time scales between twenty-five and two hundred fifty milliseconds would be used "*to reset and co-ordinate sophisticated spatio-temporal firing patterns over large areas of the entire cortex*". (Leng & Shaw, 1991, p. 242).

Based on the trion model, Shaw collaborated with several researchers and produced studies concerning the relation of the "trion" to learning (Shenoy et al., 1993), to memory and to higher brain function (Leng & Shaw, 1991).

All in all, Shaw proposes that humans start off with some basic cellular structure in the brain around the time of birth, giving rise to a huge repertoire of inherent spatio-temporal firing patterns. These patterns can be excited or inhibited. They evolve from one to another in natural sequences, which are related to each other by certain symmetries, and they can be easily learned in a selective manner. He suggests that these features correspond to a model, the "trion". They lead to an understanding of several characteristics. These include the symmetry that exists in this model which could account for the remarkable similarity found by Bonhoeffer and Grinvald (1991, cited in Leng & Shaw, 1991) between the iso-orientation minicolumns in area 18 of the visual cortex of the cat which are precisely arranged in pinwheel-like structures. Arguments over whether all minicolumns or all columns need to have the same number of neurones are irrelevant for understanding the dynamics involved in the Mountcastle columnar organisational principle. In this model there should be room for the biological realisations that structure competing connections among groups of neurones in space and time, leading to large repertoires of inherent spatio-temporal patterns which, related by certain symmetries in probabilistic evolutions, form the basis of the model of HBF.

Music listening, performing and composing involve development of the above-mentioned inherent repertoire of spatio-temporal patterns. It is demonstrated that different mappings of the same Monte Carlo probabilistic evolutions give different recognisable human styles of music (in Leng & Shaw, 1991). In addition, according to several researchers, this is consistent with the universal appreciation of music (Malm, 1977; Shippen and Seidlova, 1980; Headington, 1980; Grout & Palisca, 1988). The assumption that this inherent repertoire of patterns is essentially present at birth is perhaps a necessary condition to understand the appreciation of music by infants (Fox, 1991; Brand, 1985; Stamou, 2001). It might be proposed that there is an inherent structure in the brain devoted to music just as there is such a structure for language. This structure is accessible for use from birth without any prior learning. From a biological perspective, individuals may be placed on a normal distribution curve, exceptions existing at both ends of the curve. Therefore, one could probably speak of a talents and amusics. According to brain plasticity, the mass of cells that innately exists in the brain and concerns musical sounds will develop to the extent that external stimulation will be available, through cultural activities. Finally, the development of this structure may probably help in the development of other functions using spatial-temporal reasoning, for instance mathematics.

CHAPTER 5

GENDER DIFFERENCES IN THE BRAIN AND IN COGNITIVE ABILITIES

Introduction

The human race is innately dimorphic. Mankind consists of female and male humans. There has never been any doubt regarding the differences in physique between men and women. A difference in genes has been proven to account for sex differences in humans. The human genome contains twenty-three pairs of chromosomes. The pair number twenty-three determines chromosomal sex. There are two normal possibilities for chromosome combination in pair twenty-three: two X shaped chromosomes or one X-shaped and one Y-shaped chromosome. A person inheriting the XY chromosome pair will most probably be male, while an individual inheriting an XX pair will be female.

Behavioural aspects also present variance according to gender. The cause of these behavioural differences though remains controversial. Some suggest that there are biological influences while others support social influences during the developmental phase. Both approaches overlook the power of the other approach to alter neural development or psychological development respectively. Hormonal level changes or neuronal morphology that support gender-centred behavioural differences in diverse areas are often reported by researchers in the field of biology.

A psychologist examining the same subjects, given that above-mentioned hormonal secretion or neuronal morphology variation is adequate, would detect and describe the same differences but would most probably provide an explanation using behavioural tools. Research conducted by psychologists often reports behavioural changes following educational procedures or strong experiences. As is now known, also through the findings of neuroscience as described in the present dissertation, such experience will induce physical changes within the organism, and most probably in the brain. As previously stated, social and biological factors are in constant interaction during human development and should be separated only to clarify matters on a theoretical basis.

5.1. Steroid hormone effects and human anatomy

Hormones are chemical substances produced and released by endocrine glands. They circulate throughout the body and affect various regions of the body. The body contains many endocrine glands that secrete many different hormones. A specific group of hormones, steroid hormones, is typically associated with differences between the sexes and reproduction.

Steroid hormones include gonadal hormones. These are in turn classified in androgens such as testosterone and estrogens such as estradiol. Each sex produces both types of hormones. It has been shown through the study of various developmental anomalies that the human body will develop a male external phenotype when androgens are in greater proportion and a female external phenotype when estrogens are in greater proportion. The gonads, i.e. the reproductive organs, the ovaries and testes, also secrete the progestins, a third type of gonadal hormones. Progesterone, the most common progestine, plays a role in preparing a woman's body for pregnancy. Through the above examples, it can be realised that gonadal hormones play a central role in human development (Brannon, 2002).

Each human body is constructed from numerous cells that can be divided in many types. Not all cell types though can be affected by all hormones. Only cells possessing suitable receptors respond. Receptors are specialised proteins, which recognise and bind to specific hormones. Neurones are one of many cell types that do respond to steroids. Breedlove (1992) reports that neurones may make new synapses, discard old synapses, remain alive or even die with the appropriate steroid hormone influence. The secretion of androgens and estrogens begins prenatally. It is therefore logical to assume that since the nervous system develops under the influence of different levels of androgens in males and in females, gender differences in neural structures might be observed. Such differences have been observed and are briefly discussed below.

5.2. Sexual dimorphism of the human brain

The only known to-date nervous system difference between men and women already present at birth is a small difference in absolute brain weight. When brain weight though is correlated with body size, this difference is reduced or even reversed depending on body size measures. There is much controversy on this issue, but the trend seems to be in favour of the male advantage (Breedlove, 1994). It is important to distinguish this difference from all others. As mentioned in the introductory paragraph, other differences could equally be the result of social experience as well as the influence of genetic material. Only differences present before or at birth can be considered least affected or practically unaffected by social stimulation and experience.

5.2.1. The Corpus Callosum

As previously described, the corpus callosum is the main structure connecting the two brain hemispheres. It consists of approximately 200 million nerve fibres crossing the midline and is crucial for the proper co-ordination of the left and right cerebral function since it is the primary pathway for communication between the cerebral hemispheres (Breedlove 1994). The important role of the corpus callosum makes the findings of any sex difference interesting. Reports (in Breedlove, 1994) though have been contradictory. Some found the maximum width and area of the posterior portion of the corpus callosum known as the splenium to vary between women and men, indicating larger and more bulbous splenium in women. Others failed to reveal sex-related differences.

Several reasons for these mixed results are suggested. These include differences in the protocols used to define sub-regions of the corpus callosum, subjects uncontrolled for handedness, age-inflicted changes and imaging-measurement techniques and equipment. Studies agree that differences in corpus callosum are by themselves not capable of characterising a brain as male or female. Regarding the appearance of these differences, it is not grounded that dimorphism in this brain region is congenital. Apart from the above, difference in the midsagittal area of the corpus callosum might be independent of the number of axons, meaning that men might have more axons than women despite the overall trend in size favouring women (Breedlove, 1994).

5.2.2. The Hypothalamus

Several studies report sexual dimorphism in the region of the hypothalamus. Allen & Gorski (1990; cited in Breedlove, 1994) found that after age ten, the 'bed nucleus of the stria terminalis' (BNST) is two to three times larger in males than in females. Unfortunately, the function and ontogeny of the BNST is largely unknown. Based on findings in other species, sexual dimorphism in the human hypothalamus was searched and found in the area responding to the sexually dimorphic nucleus of the pre-optic area (SDN-

POA) in rats. In 1985, Swaab & Fliers first named the hypothalamus region of the brain showing sex difference SDN-POA of humans, because of the analogies to the SDN-POA of rats in location and histological appearance (Breedlove, 1994).

This nucleus' development is strongly influenced by the presence of testosterone and oestrogen. In the first two to four years of life, the cells in this structure multiply rapidly. Afterwards, girls show a decrease in cell numbers while boys do not. Sexual dimorphism favouring males was first detected after the age of ten, peaking in young adulthood and middle age. Hence, it could be suggested that social influences upon gender development appear to play an important role in forming this difference. There is, of course, also the possibility that the sex difference in the SDN-POA is reflected in cell number at a later age but is present even before birth. During the human life-span, the SDN-POA appears initially monomorphic, then doubles in men during young adulthood, retreats to modest differentiation between sixty and eighty years of age and returns to the young adulthood situation after the age of eighty (Breedlove, 1994). In another study, the SDN-POA was not found to be sexually dimorphic, while two other nuclei in the region of the medial pre-optic area, the interstitial nuclei of the anterior hypothalamus (INAH) , namely INAH-2 and INAH-3 were reported to be larger in men than in women (Breedlove, 1994).

5.2.3. Lateralisation differences

The two hemispheres are not mirror images of each other, as previously discussed. They also appear to direct different mental abilities. Research and theory has investigated differences in the lateralisation of the two hemispheres in men and women. Results present a modified picture for men and women. Men appear to have language processes located mainly in the left hemisphere and spatial abilities in the right. Women tend to have both functions more equally represented in both hemispheres, presenting less lateralised cerebral function. According to research reported in Brannon (2002, p. 54) gender differences are small, accounting for only one to two percent of the variation in lateralisation.

Breedlove (1994) is rather certain that sexual dimorphism exists in the human nervous system. Considering that animal literature has shown that perinatal environment factors and social stimuli during the development of rats can measurably alter adult sexual neural dimorphism, "it is likely that such influences could leave their mark upon our neural structure and consequently our behaviour".

5.3. Gender differences in cognitive abilities

In spite of the fact that men and women are not different cultural or ethnic groups, there is an old debate concerning differences in cognitive abilities still unresolved. One of the structural ideas behind most standard intelligence tests is that women and men should not achieve different mean scores. In an early example, the Stanford-Binet IQ test showed already in the first half of the 20th century that no average differences exist between scores of men and women. This lack of difference by itself does not imply equivalent mean performance of women and men in individual tasks. In intelligence tests such as Wechsler's Tests of Intelligence, women score higher on verbal sub-tests while men score higher on the performance sub-tests. Only when examined combined the scores of men and women do not show gender differences, as the sub-tests do (Lichtenberger, Broadbooks & Kaufman, 2000).

5.3.1. Differences in verbal abilities

Several different tasks have been used by researchers to study verbal ability. These include the verbal sub-tests from the Wechsler tests, verbal fluency, synonym and antonym tests, anagram tests, reading comprehension, sentence structure, reading and writing tests but also vocabulary, punctuation, reading and spelling sub-tests from other achievement tests. There are certain verbal tasks, which display substantial mean differences between men and women in favour of the later. Women perform better than men, for instance, when asked to name words that start with a given letter or when asked to generate synonyms of given words. Reading and spelling are also better carried out by females. Their average scores on college achievement tests in literature, English composition and Spanish reflect the above (Neisser et al., 1996). In a study by Lawson et al., (1987) with over two thousand children participating, there were no overall IQ sex differences but verbal sub-tests revealed a strong female advantage. On the other hand, spatial sub-tests showed a strong male advantage.

Males are over-represented within groups of subjects diagnosed with dyslexia and reading disabilities and are populous among stutterers (Neisser et. al., 1996, p. 512). When referring to dyslexia though, it is useful to note that terms can be misinterpreted and that is often the cause of ambiguity and controversy. According to Pavlidis (1990), dyslexia is one of the most misunderstood syndromes in the fields of neurology, psychiatry, psychology, ophthalmology, optometry and education. Among contradictory data, theories that surround its aetiology and the lack of accurate and unequivocal methods of diagnosis, the incomplete definition of the syndrome of dyslexia causes misunderstanding. Hence, it is important at this point to attempt to define "dyslexia" and "learning disabilities".

The British Dyslexia Association (cited in Pumfrey & Reason, 1991) defines dyslexia as: "a specific difficulty in learning, constitutional in origin, in one or more of reading, writing, spelling and written language, which may be accompanied by difficulty in number work. It is particularly related to mastering and using written language (alphabetic, numerical and musical notation) although often affecting oral language to some degree".

The National Joint Committee on Learning Disabilities offers a definition of learning disabilities which reads: "Learning disabilities is a generic term that refers to a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning, or mathematical abilities. These disorders are intrinsic to the individual and presumed to be due to central nervous system dysfunction, and may appear across the life span. Problems in self-regulatory behaviours, social perception, and social interaction may exist with learning disabilities but do not themselves constitute a learning disability. Although learning disabilities may occur concomitantly with other handicapping conditions (for example, sensory impairment, mental retardation, serious emotional disturbance) or with extrinsic influences (such as cultural differences, insufficient or inappropriate instruction), they are not the result of these conditions or influences" (National Joint Committee on Learning Disabilities, 1989, p.1).

Maccoby & Jacklin (1974) report that from the pre-school and early school years, girls achieve better results in most verbal tasks. They are quicker in saying the first word, in articulating more clearly and in learning to read. They are also more fluent, they use longer sentences and get better scores on tests of spelling, grammar and word fluency. Similar differences in verbal ability were found by many other researchers as well.

McGuiness (1976) found that young girls aged from one to five years were more proficient that their age-matched boys. A longitudinal study investigating sex differences in educational achievement, after following over nine thousand children for six years showed that girls constantly score better on spelling, punctuation, language use, reading and comprehension. In 1997, researchers (Kramer et al.) administered the children's version of the "California Verbal Learning Test" to four hundred one boys and four hundred ten girls aged five to sixteen years. The test presents groups of fifteen semantically related words, which have to be recalled and recognised. As expected, girls recalled and recognised significantly more words than boys did. The explanation provided was that girls grouped related words together and this strategy facilitated their memory. Even though performance improved with age, gender difference remained essentially invariable.

All above-discussed research supports a strong female advantage in verbal abilities. Opposite opinions though also exist. In 1981, Janet Hyde completed a meta-analysis of the research findings taken from Maccoby & Jacklin's literature review. She found that the gender related differences in verbal performance accounts for only one percent of the total, leaving ninety-nine percent related to other factors. A later comprehensive meta-analysis (Hyde & Linn, 1988) of one hundred sixty-five studies assessing gender-based variations in verbal ability concluded that little evidence exists for demonstrating a clear gender difference in verbal ability. Women were found to have an advantage in some verbal abilities while men had the advantage in others. All the differences found were small and no difference in the magnitude of gender differences was shown when analysis by age was performed. Additionally, a decreasing trend in size of reported gender-related differences with time was indicated. As mentioned above, researchers have defined a variety of widely diverse tests as verbal. This could be one of the reasons research on verbal performance occasionally produces contrasting results.

5.3.2. Differences in quantitative and visual-spatial abilities

In most areas, comparison of skills or potential among members of the two genders has led to controversy. This is the case also with visual-spatial and quantitative abilities, although many studies favour males in this area. It is generally recognised that differences in these abilities do exist between men and women. There are conflicting reports though as to the extent, the age of appearance as well as the type of tasks that reveal these differences.

5.3.2.1. Quantitative-mathematical abilities

Females appear superior in quantitative abilities beginning from the early years of school until sometime before puberty. This is then reversed favouring males and remains so. Around the age of thirteen, boys begin to excel in many of the assessments of mathematical performance compared to girls (Brannon, 2002). The mathematical section of the Scholastic Aptitude Test (SAT) shows a considerable advantage for males, as do tests of proportional and mechanical reasoning (Neisser et al., 1996). Hyde's meta-analysis though (1981) showed that only one percent of the difference in mathematical performance was related to gender.

Later studies showed a small, non-significant advantage for women in the general population (Hyde, Fennema & Lamon, 1990). The researchers performed a meta-analysis of one hundred studies. In total, the combined number of subjects represented in the analysis was 3175188. The study shows a complex pattern of gender-related differences in quantitative abilities, depending on specific skill and age. Problem solving showed no gender differences in elementary or middle school. Beginning in high school and continuing into university, differences favouring men appeared. Girls showed a small superiority in computation until the end of middle school. In samples of the general population gender differences were very small and favoured females. The authors of the meta-analysis also indicated that the magnitude of the gender difference has declined over the years.

It is therefore shown that while mathematical performance produces differences apparent in particular groups, large gender-related differences do not appear in the general population. There is a stereotype that women perform poorly and dislike mathematics. It seems though that the small differences in mathematics performance do not support such a position. On the contrary, when social factors are considered, women do not perform in accordance with the differentiated treatment they experience. As Koehler (1990) writes: "When one considers that females endure remarks from teachers or texts indicating that mathematics is not a female domain, are involved in far fewer interactions with their teachers involving mathematics, are rarely asked high-cognitive-level questions in mathematics, are encouraged to be dependent rather than independent thinkers, spend more time helping their peers and not getting helped in return, and are often not placed in groups that are appropriate to their level, it is amazing that the gap [in mathematics achievement] is not considerably larger." (p. 145).

5.3.2.2. Spatial abilities

A study by Linn & Petersen (1985) sheds some light on sex differences in spatial ability. Spatial ability is defined as a "skill in representing, transforming, generating, and recalling symbolic, non-linguistic information"(Linn & Petersen, 1985, p. 1482). The authors of this meta-analysis focused on three questions concerning spatial ability and sex differences: (1) What is the magnitude of sex differences in spatial ability? (2) On which aspects of spatial ability are sex differences found? and (3) When, in the life span, are sex differences in spatial ability first detected? Before answering these questions, the authors stated their position on issues relative to the investigated subject. They agreed that spatial ability is an important component of intellectual ability.

5.3.2.2.1. Spatial Ability Categories

Spatial ability involves multiple processes. Several approaches have been published, proposing various categorisations ranging from three to sixteen categories (Brannon, 2002, p. 87). No consensus though exists for categorisation of measures of spatial ability. The approach of Linn & Petersen (1985) has been widely accepted and will be followed here. They sorted the above-mentioned measures into homogenous categories. This was achieved by comparing correlations between different spatial tasks outlining "factors" in spatial ability and by identifying processes used to solve a particular spatial task. Three categories were formed, labelled spatial perception, mental rotation and spatial visualisation. The one hundred and seventy-two effect sizes that were used in their meta-analysis were accordingly distributed.

- The first category, **spatial perception**, requires exact judgement of spatial relationships despite distracting information. An example is the water level task, where the subject must draw or identify a horizontal water line in a tilted bottle. Sixty-two effect sizes fit the above criteria. The results revealed sex differences in performance on spatial perception favouring males. Effect size for those over eighteen years of age was found to be larger than for others, with the earliest reported findings referring to seven- and eight-year-old children.

- The second category, **mental rotation**, asks for the rotation of a two- or three-dimensional figure rapidly and accurately. During this process, the viewer must predict what any array of objects will look like when rotated on its axis. A typical example is the Shepard-Metzler Mental Rotation Test. Respondents are expected to locate two instances of a rotated stimulus figure quickly. Twenty-nine effect sizes were included in this analysis. The largest effects at all ages were found for the Vandenberg and Kuse version of the Shepard-Metzler Mental Rotation Test. Results indicate that males tend to outperform females on mental rotation at any age. One study (Kail et al., 1979 in Linn & Petersen, 1985) even showed that thirty percent of females were slower than all the males. However, it is important to state that gender difference is observed primarily on speed and not as much on accuracy of mental rotation.

- **Spatial visualisation** category, the last of three categories by Linn and Petersen (1985), involves complicated, multi-step manipulations of spatially presented information. Examples include Paper Folding tasks and Hidden Figures. Eighty-one effect estimators, the most in a single category, were selected for analysis here. Results showed a lack of significant sex differences in spatial visualisation, with a slight tendency in favour of males.

The authors concluding report that spatial perception and mental rotation is easier for males than females while spatial visualisation is about equally difficult for the two sexes. Noting the absence of a strong body of research investigating younger children at the time, it is maintained that these trends are detected at about eight years of age, and, where applicable, persist through the life span.

Gender differences in three-dimensional block problems were reported in studies on sex and ethnic differences in African and Scottish children by Jahoda (1980). The gender difference remained across the two ethnic groups examined. Boys in both the native African and the Scottish populations performed better than girls on a three-dimensional block construction task. Similar findings were reported by Widiger, Kundson, and Rorer (1980). Boys performed better than girls by age 6 on three-dimensional WISC block tasks.

The earliest gender differences in this area were reported by McGuinness and Morley (1991). They found gender differences in 4- to 5-year-old children on a large block construction task. It required subjects to construct a model identical to one shown using large Lego blocks. The choice of large blocks resulted from an attempt to compensate for girls' more developed fine motor skills. Boys were approximately 1 year in advance of girls in construction times. Yet another study favouring boys was conducted by Livesy and Intili (1996). After studying eighty four-year-old children and comparing their achievement on a three-dimensional block design test and on a kinaesthetic acuity task, they found that there was a significant gender difference in performance on the block-design test and a strong correlation between the two tests' performance for both sexes. A significant difference in favour of boys on the kinaesthetic acuity test was found only in the presence of extra cues. The authors accredit differential use of cues rather than gender differences for explaining the difference found in the kinaesthetic acuity test. Since the cues provided were visual though, it might also be hypothesised that boys were better in visuospatial transforming than girls.

Researchers at the University of Chicago conducted research studying the mental rotation abilities of two hundred eighty-eight pre-school children (Levine at al., 1999). As noted above, mental rotation produces significant gender differences favouring males. The researchers divided the children, aged approximately between four and seven years, in six age groups. Each group contained twenty-four boys and twenty-four girls. Testing involved pointing to one of four shapes the children thought could be made by two pieces of complex geometric shape that had been previously presented to them. Results indicated that by age four and a half, boys outperformed girls. The authors did not conclusively provide the origins of this difference but claim that they might be found in the way children are reared, in biological factors or in both. Hassler (1992), after measuring sex hormones of various groups discussed, as elsewhere in detail, supports that "physically androgynous persons in both sexes tend to attain higher scores on spatial measures than do either masculine men or feminine women" (p. 56).

Apart from the research already commented on, there are other findings that question the existence of gender differences in spatial abilities altogether. There is a test for instance, called the rod-and frame test introduced by Witkin in 1949. This is a spatial perception task in which men typically outperform women. The subject is placed in a darkened room and, with the help of an experimenter, must place a luminous rod vertically while viewing a (luminous) frame oriented at twenty-two degrees. The gender difference disappeared though when the rod was replaced by a human figure and the task was presented as a measure of empathy. In fact, the gender difference was reversed in favour of women even though the task essence remained judging relative position in space (Caplan et al., 1985).

5.3.3. Gender difference in musical abilities

The existence or not of a gender difference in musical ability has been addressed in past research. Brannon (2002) reports of several studies that fail to show gender-related differences in the field of musical ability. In one of the studies, a musical expert was called to rate the compositions of male and female composers. The expert rated the compositions equal in possessing musical creativity (Hassler et al., 1990; in Brannon, 2002). Men were found to be more creative, when creativity is measured through achievement. Halpern found that musical ability tests show minimal differences between genders. Therefore, gender differences cannot easily be derived from the fact that the number of male prominent musicians is greater than that of women prominent musicians. This might reflect dissimilar access to training, different degree of support from family and society, or even, in some cases, limited acceptance of women in creative fields (Brannon, 2002). Even though to date there is no strong evidence showing gender differences in musical ability, the previously described sex differences in spatial ability combined with the close relationship between spatial ability and musical ability might provide a foundation for future correlations between music and gender.

5.3.3.1. Summary

Summarising, recent research inspecting gender differences on verbal, mathematical and spatial tasks has shown that the patterns of difference are smaller and more complex than previously suggested (Weiss, 2003; Brannon, 2002, p.79). One of the factors leading to the above-mentioned complexity is the emphasis tests give to achievement versus potential. This implies that any score difference found does not necessarily reflect biological differences. It could indicate social influences or parental motivation, to mention but a few. In anticipation of the completion of mapping of the human genome, it might become possible to correlate the influence of the Y-carrying gene to other areas of human activity, thus elucidating the origins of biology-based gender differences.

5.4. Theories addressing gender differences

Several theories have been suggested in various attempts to explain the differences in cognitive abilities found between women and men. Factors such as social stereotypes and expectations have been discussed and proposed together with the sexually varied biological influences. While some researchers support environmentally oriented causes, for instance social factors, as being responsible for sex variance in cognitive abilities, others have stressed the importance of biological or genetic factors. This dichotomy is also known as the "nature" versus "nurture" debate. The simplicity a pure biological explanation would provide makes it an attractive choice compared to complex sociological approaches. Only few contemporary psychologists though expect any complex human behaviour to be exclusively explainable by either "nature" or "nurture". Most explanations fall somewhere along a continuum with "nature" at one end and "nurture" on the other.

Many researchers have focused their work on investigating the exact role of gonadal hormone variation on the dimorphic development and later function of humans. Most attention is given to the role of testosterone. It has been linked to diverse conditions affecting both genders. Following is a presentation of representative studies.

5.4.1. The Geschwind-Behan-Galaburda model of cerebral lateralisation

Geschwind and Behan (1982), Galaburda (1986, in Pavlidis & Fisher, 1986), Geschwind (1986, in Pavlidis & Fisher, 1986) and Geschwind and Galaburda (1987) have proposed a theory explaining gender differences in cognitive abilities based on biological premises. It attempts to make links among gender, laterality, learning disorders and health problems. Three basic assumptions are presented:

- those who manifest developmental language disturbances should show increased evidence of altered immune function,
- left-handers are expected to report more immune disorders and
- those who demonstrate language disorders should be more often left-handed.

This lateralisation theory focuses on differences between the two hemispheres of the brain. It emphasises the role of the gonadal hormone testosterone on the development of the brain. According to this theory, the exposure of the foetus to testosterone prenatally affects the lateralisation process. Enhanced levels of testosterone would slow growth in certain areas of the left hemisphere while promoting enlargement of other regions in the right cerebral hemisphere. This process would lead to the development of "anomalous dominance", i.e. to individuals non-right-handed and non-left-side lateralised for language, with increased immune, and autoimmune system disorders. That, in turn, would affect subsequent mental abilities. The theory authors hypothesise that the prenatal growth of the right hemisphere in boys gives them the superiority in spatial tasks, while, for the same reason, girls excel in verbal abilities. In an example they write: "The less strongly lateralised pattern of motor skill would help to account in part for the elevated rate of nonrighthandedness among athletes, in contrast to the common view that this is entirely the result of an advantage in competing against righthanded opponents." (Geschwind & Galaburda, 1987, p.79)

In 1990, Hassler worked with a group of musical composers, instrumentalists, but also painters and non-musicians from student and junior-high school population. She investigated the relative participation of right- and left- hemisphere functions in verbal and spatial processing. According to the results, spatial orientation, spatial visualisation, tactile-visual discrimination and verbal fluency were related to hemispheric lateralisation. Males, as expected, were found to be more lateralised than females. Language lateralisation was different between males and females only of the non-musicians group. Female left-handers were found to have a tendency for reversed language lateralisation whereas male lefthanders did not. In a following report, Hassler & Nieschlag (1991) published that "musicians are less left-lateralised than non-musicians for language functions"(p.518). Regarding handedness, the authors state that it "proved to be an important variable with respect to musical talent in boys. Male left-handers attained significantly higher mean test scores than male right-handers on Wing's Standardized Tests of Musical Intelligence at each stage of the study" (p. 504).

In studies published in 1993 (Hassler, 1993; Hassler & Gupta, 1993) groups of male and female subjects in late adolescence were investigated. The Geschwind and Galaburda model of cerebral lateralisation was tested by examining the relationship of anomalous dominance and spatial parameters to spatial abilities. Researchers controlled for asthma/allergies, migraine, myopia and IgE and Ig total in blood serum. Atypical visuospatial, language and handedness dominance were associated to spatial giftedness, and immune vulnerability was related to atypical handedness in males. The above outcomes partially supported the tested model in men. Women provided different results though. Spatial giftedness and musical talent were related to immune vulnerability. Giftedness or immune parameters though failed to relate to indicators of anomalous dominance. Musical talent was related to left-handedness and to anomalous dominance. Still, the data did not completely support the Geschwind-Galaburda model in females, since spatial giftedness and immune vulnerability could not be connected to anomalous dominance hypothesised to be a product of elevated prenatal testosterone levels.

The theory of Geschwind, Behan and Galaburda has received much criticism and has been found to be flawed by many scientists (e.g., Bryden, McManus, & Bulman-Fleming, 1994; Obrzut, 1994) but it has also promoted research investigating connections among biological characteristics, diverse skills and gender. Critique claims that the majority of the numerous citations of the articles during the 1980's were generally uncritical, accepting the broad principles of the theory. The Geschwind-Behan-Galaburda theory was found to lack specific definitions of the accurate use of concepts such as developmental language disturbances, learning disorders, or even anomalous dominance. It also fails to determine the severity of predicted health-related symptoms (Obrzut, 1994). Bryden et al. (1994) evaluated the associations between handedness and intellectual ability, immune and neural crest disorders to conclude that the empirical data either does not support the original theory or that the evidence is inconsistent with the theory. Obrzut (1994) is also negative when he reaches a conclusion: "there is enough equivocal evidence to reject the GBG theory as it is proposed in its general form" (p. 273).

A commentary by Halpern (1994) on the meta-analysis of the Geschwind-Behan-Galaburda (GBG) theory by Bryden, McManus and Bulman-Fleming (1994) shows a different perspective. She comments that the GBG model of cerebral lateralisation is "an ambitious attempt to causally link levels of testosterone to a wide range of psychological and biological phenomena". It is unrealistic, she writes, to expect that any model has identified the "true" and complete explanation of the origin of the diverse array of variables it seeks to explain because brain-behaviour relationships are not yet understood clearly enough. According to Halpern though, the GBG model is an imaginative theory based on a combination of perceptive empirical observation and creativity that has revealed surprising relationships, difficult to understand without presenting some common causal elements. But the quality of the model is found in its role as a stimulus for further research and theory development and not in its ultimate truth or modifiability, she supports. "I believe that it (the GBG model) has passed this test with flying colours" (Halpern, 1994, p.190). To further aid to the controversy, the findings of a magnetic resonance imaging study (Habib et al., 1995) showed reduced leftward (but not inverted) planum temporale asymmetry in normal adult left-handers compared to right-handers. These results further indicate that planum temporale asymmetry covaries with functional lateralisation, supporting the GBG model.

The relationship between left- or right-handedness and individual differences in intelligence was investigated in a study by Halpern et al. (1998). Medical College Admission Test (MCAT) scores of 174547 highly select adults who took the test between 1992 and 1995 were compared. Information about age, sex and writing hand was also available. Subjects' age ranged between nineteen and forty years, with the eighty percent in the range under twenty-five years of age. The MCAT consists of four separate tests: Verbal Reasoning, Biological Sciences, Physical Sciences and Writing Sample.

Results indicated that 12.6% of the men and 10.4% of the women tested were left-handed. Substantially more than proportionally expected left-handed individuals were accepted for medical school. 14.6% of the accepted males for medical school were left-handed as were 12.1% of the accepted females. The higher acceptance rate can be translated in higher MCAT scores for left-handers as compared with right-handers. The distribution of high-scorers was not even either. The top-scoring group included twenty-one percent more than proportionately predicted left-handers in the Verbal Reasoning test results. The same was true for male versus female test-takers. Contrary to the above, the Writing Sample top-scoring group included forty-four percent more right-handers than would be predicted according to their representation in the population. Here males achieved the higher average score again. In the two remaining tests, Biological Sciences and Physical Sciences, handedness provided very small mean differences. Sex differences though were much larger favouring males.

Halpern et al. (1998) suggest that these findings show that the most intellectually gifted adults are more often than would be expected right hemisphere dominant (left-handed) and that verbal reasoning and writing may have different optimal brain organisations, at least for the group of highly gifted adults, such as the one examined. The article closes with the designation that "converging evidence across studies of sex differences, laterality, cerebral activity and morphology, and cognitive abilities suggests that structural and organizational differences in the brains of males and females and right- and left-handers are systematically related to different patterns of cognitive abilities, with the largest differences occurring in the extreme tails of the distributions (i.e., retarded and intellectually gifted portions of the intelligence range)" (p. 99).

5.4.2. Studies representing other approaches based on gonadal hormone influences

An interesting study conducted by Hausmann et al., (2000) investigated the sex hormone effects on spatial abilities during the menstrual cycle. Twelve young women with a regular menstrual cycle participated. Blood samples were collected every three days over six weeks. During the same time, the performance on three spatial tests was measured. The tests were the Revised Vandenberg & Kuse Mental Rotation Test, the Mirror Pictures Test (taken from the WILDE-Intelligenz-Test) and the Hidden Figures Test taken from the Differentieller Fähigkeitstest. The Mental Rotation Test revealed a significant difference in spatial ability between the menstrual and the midluteal phase with high scores during the first and low scores during the second phase. According to the researchers, this indicates that testosterone had a strong and positive influence on mental rotation performance whereas estradiol had a negative one.

Another study also studying cognitive sex differences investigated the relationship between menstrual phase via serum estradiol and progesterone levels and cognitive abilities and cognitive performance in a sample of medical students in eastern Turkey (Halpern & Tan, 2001). The researchers administered a Turkish language version of the "Finding A's" Test, a test that is classified as "feminine", the Vandenberg and Kuse Mental Rotation Test, a test that is classified as "masculine", and the Cattell Nonverbal Test of Intelligence, a test that is classified as "neutral". Women participants indicated their menstrual cycle day when the cognitive tests were administered to assess the relationship between test performance and fluctuations in hormone levels. To further examine hormonal levels, blood samples were taken from all students.

Results for the Cattell Test indicated no differences between men and women. Secondly, moderate levels of serum estradiol and lower concentrations of progesterone for the women were associated with the highest scores. As was expected, in the Finding A's Test the females scored significantly higher than the males. The Vandenberg and Kuse mental rotation test showed a medium-to-large male advantage. Hormonal influence was recorded in relation to cognitive performance. It correlated with the rise in estradiol in the preovulatory portion of the menstrual cycle and the rise in both estradiol and progesterone in the midluteal phase of the cycle. It should be noted though that the effects on cognitive performance across the normal cycle were quite small. The researchers concluded that hormones play a role in cognitive performance, but the exact nature of that role remains elusive.

Contrary results were attained by a group of researchers led by Liben (2002). They reported the outcomes of an experimental investigation involving adolescents being treated for delayed puberty. Fifty-five subjects received sex steroids or placebos alternately for twenty-one months while spatial tests were administered every three months. Although expected differences in spatial performance between boys and girls were found, the level of achievement did not vary according to the levels of the actively circulating sex steroids suggesting an organisational and not a functional steroid role.

These findings seem contradictory to those of Janowsky, Oviatt and Orwoll (1994). They support that steroidal hormones influence performance on tests of cognitive abilities throughout the adult years and well into old age. Their conclusion is based on observations of normal ageing men who were given testosterone to enhance sexual functioning. These men also showed improved performance on visual–spatial tests relative to a matched placebo control group. The pre-treatment endogenous testosterone levels were presumably below the level at which spatial ability is optimised. Oestrogen levels were also measured and were found to relate conversely to performance on the visual-spatial task.

Kimura (1996) suggested that there might be an "optimal" level of testosterone for certain spatial abilities. Women were found to perform better on visuospatial tests during the low-oestrogen phase of their menstrual cycle, than during the phase when oestrogen is much higher. Oppositely, verbal and fine manual skills performance was higher during the high-oestrogen phases of their cycle.

In a study by Neave, Menaged and Weightman (1999) thirty-four heterosexual and homosexual males and twenty-eight heterosexual and homosexual females were compared on performance on four cognitive tasks, which have been shown to reveal evidence of sexual dimorphism. Subjects were given two spatial tests, specifically a Mental Rotation and a Water-Level Test, and two verbal tests, a Verbal Fluency and a Verbal Association Test. Saliva samples were collected for determination of testosterone concentrations. The group of heterosexual males obtained the highest average scores in the Mental Rotation

Test, while the same group performed worse than all other groups and significantly worse than the homosexual male group on the Verbal Association Test. No other group differences were reported. A significant association was apparent between testosterone levels and performance on the Mental Rotation Test. Variations in circulating testosterone concentrations accounted for eighteen percent of the variance of performance on this task. In addition, higher levels of testosterone were associated with better performance on the Water Level Test. Testosterone levels tended to be higher in both homosexual groups than in their heterosexual counterparts. The authors of the study suggest this might explain the poorer performance of the homosexual male group on the Mental Rotation Test. In other words, it is suggested that circulating levels of testosterone, especially when over and above organisational differences, may be crucial for performance on some spatial tasks. Even though their performance was better than that of the heterosexual females, the homosexual female group's higher testosterone level was considered to be insufficient to significantly influence their cognitive performance. The conclusion states that moderately high levels of testosterone are associated with optimal performance on a mental rotation task. Verbal tasks and circulating testosterone levels were not linked.

Another study revealed phase and task dependent variations in functional cerebral asymmetry across the menstrual cycle in verbal and music dichotic listening tasks (Sanders & Wenmoth, 1998). Verbal and music tasks were presented sequentially to the same female subjects. The verbal task indicated a right ear advantage and greater asymmetry during the midluteal phase as compared to menses. The opposite was true of the musical task. It indicated a left ear advantage and greater asymmetry during menses. Based on these results and on other studies, the authors concluded that "whatever hard-wiring occurs in the foetus the human brain retains a degree of plasticity and remains susceptible to the activational effects of oestrogen and testosterone in adult life"(p.873). In her review article, Kimura (1996) supports that early exposure to sex hormones has lasting effects on problem-solving behaviour. Additionally, changes in cognitive patterns are associated with sex hormone fluctuations both in men and in women.

Correlation between testosterone levels and spatial ability has been the investigation subject of several studies. Silverman et al. (1999) measured testosterone levels of fifty-nine males in saliva the same time in the morning and in the evening when the androgen's level was expected to be highest and lowest respectively. Parallelly they administered a Mental Rotation Test to evaluate the relationship between the measured hormonal levels and the test scores. They reported that mental rotation test scores revealed a significant positive relationship with mean testosterone levels but not with changes in it. Another very interesting study examined the activating effects of cross-sex hormones (Van Goozen et al., 1995). The effects of exogenously provided testosterone on women and oestrogen together with anti-androgens in men were analysed. Experimental research on human behaviour in this case would have been impossible. Hence, researchers administered a large battery of tests on aggression, sexual motivation and cognitive functioning twice to two groups: a group of female-to-male transsexuals and to a group of male-to-female transsexuals. The first time the tests were administered was exactly before any cross-sex hormone treatment had begun, while the second testing session was held three months into the hormonal treatment.

Results showed that the female-to-male group increased its sexual motivation and arousabilty, visuospatial ability, aggressive tendencies and angry readiness while decreasing its indirect angry behaviour and verbal fluency competence after the hormonal treatment. The male-to-female group oppositely improved performance on aspects of verbal fluency and increased tendency to indirect angry behaviour, while visuospatial ability dropped marginally, aggressive tendencies were reduced and sexual interest and behaviour almost ceased. Regarding the source of these changes, the researchers concluded that most likely the hormone therapy and not unconscious or deliberate move in the direction of the desired sex bringing forth stereotypical ideas about personality characteristics and behaviours of the opposite sex was responsible. Another conclusion described the opposite-direction effect caused on different cognitive functions within an individual due to the hormonal treatment. In other words, as one function improved, the other worsened. All above manifest an impressive effect on psychological functions after cross-sex hormone treatment. The activational effect of androgen administration to females and androgen deprivation of males appears to overwhelm the organisational effects these hormones exercised in previous periods of the subjects' lives.

5.4.3. The Psychobiological Model

Halpern & Tan (2001) proposed a model in which cause and effect are circular to explain differences among members of the opposite gender. They used the term "psychobiosocial model" (see figure 14). This model reflects an attempt to unify biological, psychological as well as social influences in one common theory. It is based on the premise that biological and psychosocial influences cannot be separated and divided into distinct categories. Such divisions are impossible. The example noted by the theory creators discusses the differences and similarities in female and male brains. (Halpern & Tan 2001). These differences as well as the similarities in brain structures could have been induced, magnified or minimised following appropriate environmental stimulation. Hence, the human brain is sexually dimorphic due to environmental (nurture) as well as genetic (nature) factors. Research indicates that the brain's structures and size remain malleable during the whole life span (Stefan, Kunesch, Cohen, Benecke, & Classen, 2000). Changes in cortical representations following specific experiences have been investigated and found to exist using brain imaging techniques (Ungerleider, 1995).

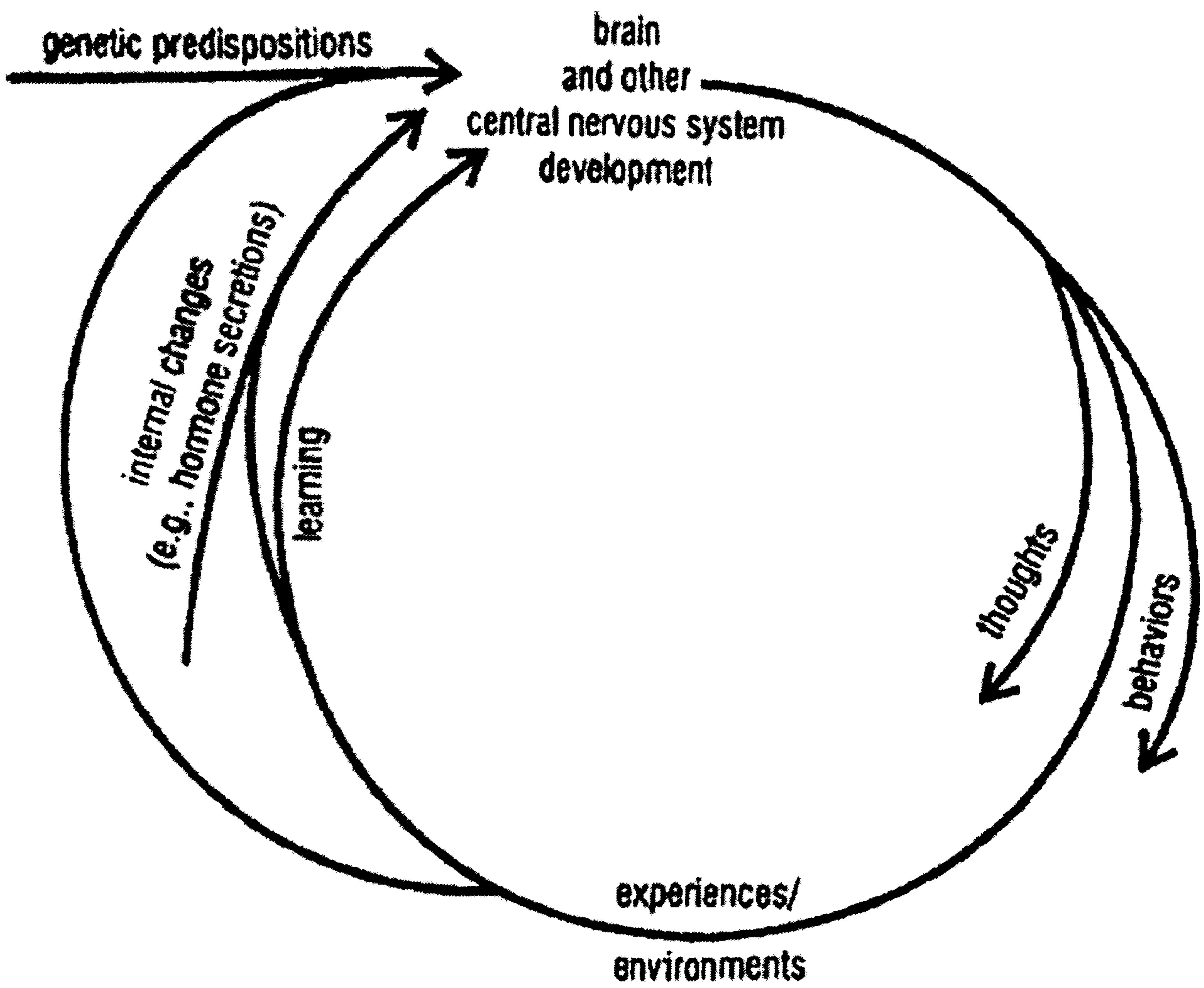


Figure 14
The Psychobiosocial model (a schematic diagram)
(From Halpern and Tan, 2001, p. 396)

Knowledge accumulated through life directly influences neural structures in the brain, such as connections between dendrites and cell size. The differentiated structural pattern thus created in the brain via experience will influence, through its acquired characteristics, future selections of activity. Environment and biology seen under this perspective appear to be in constant interaction. Attempting to separate them seems pointless. Rather, a uniting theoretical model would be more pragmatic. It could provide a way of addressing the complex processes managing brain structures and behaviours. Genetic predisposition might account for a tendency to learn some skills instead of others. The "appropriate" behaviour of males and females, according to one's prior knowledge, necessarily influences their selection of experiences. At the same time, when males and females are observed or investigated as groups they do show differences. Just as these groups influence their individuals, individuals might themselves be contributing to these differences when consciously or not selecting to belong to either group.

5.4.4. Music and steroid hormones

Several researchers have investigated the relationship of music and steroids, particularly testosterone. Some of their theories and findings are discussed here.

One of the leading researchers in this area with numerous relative publications is Marianne Hassler. Some of her findings are presented in this section. In 1989, Hassler & Nieschlag assessed salivary testosterone levels in composers, instrumentalists and non-musicians. The aim of the study was to relate musical capacities and spatial ability to physiological and psychological masculinity and femininity. Testosterone levels served as the marker of the later characteristic. All groups were found to have above-average spatial ability. Musicians surpassed non-musicians on spatial visualisation. Male composers had lower testosterone levels than the other male groups. Female composers were found to have higher testosterone levels than the other female groups.

Similar to the previously described study, researchers (Hassler 1991a, 1991b, 1992; Hassler & Nieschlag, 1991; Hassler, Gupta & Wollmann, 1992) compared salivary testosterone levels from composers, instrumentalists, painters and non-musicians. Male composers, as above, had significantly lower testosterone levels than the other male groups. Respectively, female composers had higher testosterone levels than all other female groups. Painters were found to be similar to the control group. In a comment on musical development, the authors write that "most of those boys and girls who demonstrated creative musical behaviour at the beginning of our study lost the ability to compose and improvise in the course of adolescence...It seems possible that an optimal testosterone range exists for the expression of creative musical behaviour and that exceeding this optimal range in the course of puberty may contribute to a stop of musical production in boys"(Hassler & Nieschlag, 1991, p. 504, 518). Significant differences in spatial test performance were not related to the testosterone level. Hassler concludes writing that "musical composers of both sexes were physiologically highly "androgynous". Creative musical behaviour was associated with testosterone levels that minimised sex differences" (Hassler, 1991a, p.25). Musical talent was related to spatial ability in the above-average range before and during puberty. In a very biologically biased statement, Hassler states that musicians are androgynous persons. Since there is a relationship between music capacities and spatial ability, sex hormones and particularly testosterone "may contribute to the development of both musical talent and spatial ability"(Hassler, 1992, p.56).

Fukui (2001) formulated a new hypothesis for the origin and function of music. It is stated that the reason a sex hormone such as testosterone is so closely related to music is still unknown, even though there are many reports of music affecting the human endocrine system. This study investigated whether listening to music affects testosterone levels in females and how this compares with relative findings for males. Seventy college students aged from nineteen to twenty-five years participated. Depending on their group assignment, subjects listened to any of the following music: their favourite music, Gregorian chant, Mozart's Sonata for two pianos, KV. 448, jazz music or popular music. One group did not listen to any music at all. Saliva samples were collected prior to and immediately after listening to thirty minutes of music or silence in order to assess subjects' testosterone levels.

Results revealed significant sex differences. Testosterone levels decreased for males under all music conditions while testosterone levels increased in females under all music conditions. Testosterone and behaviour are correlated in both directions, i.e. testosterone influences behaviour at the same time that behaviour potentially alters the hormone's levels. Considering that testosterone has been linked to libido, activity level, aggressiveness, sensation seeking and dominance, it is proposed that music has a biological and evolutionary function.

It is hypothesised that music developed not only as a signal of courtship, but also to control human love in a complicated way. As humans formed and lived together in larger groups and in societies, the need to control sexual, aggressive and dominant behaviour due to excessive testosterone grew stronger. Libido correlates to testosterone differently for men and women. In studies reported by Fukui, men with lower testosterone had low libido while women with high levels of the hormone, while having a higher libidinal potential, had lower rates of intercourse. This combination would drive males less frequently to confrontation and would suppress women's sexual behaviour. People have empirically used music-induced effects whenever the need existed: in ceremonies, in funerals, in wars and in so many other situations. The author closes the article reminding that music in all possible settings, even in the animal world, serves as a tension relief, bonds, brings pleasure and harmony among people.

CHAPTER 6

DEFINITION, SELECTION AND COMPARISON OF PIANO METHODS

6.1. Definition of "Piano Method"

6.1.1. Introduction

The great popularity of piano playing – and consequently the increase of the number of people receiving piano instruction – has led to a production of numerous method books and other teaching materials over the years. There are many different approaches to piano teaching making the amount of materials and books so great that anyone attempting to become knowledgeable on the subject could easily be confused. Consequently, the main aim of this chapter is to systemise the most frequently used piano methods by sorting them into groups and briefly discussing their content.

6.1.2. Definition

The word "method" is defined by Merriam-Webster as a "systematic plan followed in presenting material for instruction." It comes from the Greek word *methodos*, from *meta- (=after)* + *hodos (=way)*. "Method" implies "an orderly logical effective arrangement usually in steps." In addition, the word indicates a plan which develops one integrated system of learning. Hence, a piano method would refer to a procedure specifically designed to instruct the art of piano playing.

6.2. Brief History of Piano Methods

The oldest publication of a special method developed for a keyboard instrument (an ancestor of the modern piano) is "Il Transilvano" by Girolamo Diruta, which appeared in 1593 in Venice, Italy. Many pieces in the seventeenth century with titles such as "Studii", "Essercizi", "Toccaten", "Lessons", and "Preludes" indicate that these pieces, long before Bach, were most probably intended for teaching (Schwarting & Schwarting, 1994). Piano methods are present since the appearance of the piano itself (beginning of the eighteenth century). The integrity of the musical culture of the time is reflected through the practice of teaching and learning to play keyboard instruments using high quality musical examples. Many major composers composed or gathered pieces suitable for teaching the keyboard beginner.

It is logical to assume that these composers, besides being performers, were also teachers that composed the practice pieces for their students themselves (Bastien, 1977). A well-known and representative example is that of Johan Sebastian Bach's (1685-1750) collection of pieces for his second wife, Anna Magdalena. The "Büchlein für Anna Magdalena" is still used today as piano teaching material, even though the instrument J. S. Bach played and composed for was the harpsichord, piano's predecessor. Another example is that of Carl Czerny's exercises. Viennese composer Carl Czerny (1791–1857), a contemporary and pupil of Ludwig van Beethoven (1770–1827) and the teacher of Franz Liszt (1811-1886), is best known today for his series of piano exercises composed to forward the development of piano playing at all levels. More organised piano methods appeared in the twentieth century, e.g. the "Mikrokosmos" (1940) series by Hungarian composer Bela Bartok (1881-1945). The study of the piano is a very time-consuming procedure during which many methods may be followed at various instances.

Methods that are more modern have replaced most of the methods used in the past centuries for piano instruction. It is of interest to this research though to examine only methods still in use specifically designed for piano beginners and suitable for the first year of their training. In order to comprehend the basic concepts behind the construction of these piano methods, it is necessary to focus on their educational principles and goals.

6.3. Teaching objectives

Each piano method has specific goals and suggests a learning program for step-by-step progression. In other words, there is a scheme according to which the various elements of piano playing are introduced. The specific goals set by each method are unique but there are distinct similarities and differences discernible. Any set of goals could be representative of a group of methods. Following is an attempt to give a list of some general goals likely to be found in most beginners' first year piano books.

1. Become familiar with the entire keyboard
2. Identify notes without hesitation (including ledger line notes) and find them on the keyboard
3. Read and locate on the keyboard sharps and flats
4. Recognise note duration and be able to play correct note values

5. Understand meter signatures and differences in tempo

6. Follow dynamic markings

7. Memorise selected pieces

6.4. Educational approaches

The manner in which piano lessons are taught has changed markedly over the past century. This is a result partly due to the fact that overall educational philosophy has changed over the above-mentioned period of time. In many cases, elementary training in all fields had an autarchic character. Teaching was centred on the teacher, his/her as well as societies needs and expectations. Students' feelings and emotional involvement were not considered important issues. Learning was often connected to forced memorisation, copying and practising uninteresting pieces just to learn rules and to demonstrate respect for the teacher.

In a typical initial piano lesson, the child would learn how to sit straight on the piano bench keeping his arms and wrists in a certain position. Next, the child would be demanded to shape his fingers "as if it were holding a golf ball" retaining its wrists so that a coin placed on top of its hand would not fall while playing. Students surviving these fundamentals were then introduced to exercises and scales. The amount of time between the first piano lesson and the first musical composition played was considerable. The result was that most beginners would discontinue after some time. Those who made it through this ordeal were then seen as worthy of receiving a musical training.

Things today are quite different, fortunately. The whole approach is centred on the student. In a typical first piano lesson, the teacher will try to attract the student's attention by presenting the selected material in a fascinating way. Establishing rapport between student and teacher is essential. The emotional outcome of this first meeting should be a positive one for the child. It is of great importance to teach the child to enjoy music making while keeping track of ongoing personal progress. Student and teacher together seek a natural playing position that, in spite of conforming to certain rules, does not require the student to take an uncomfortable rigid position in front of the piano. Every student may be successful regardless of individual differences in achievement and pace.

Student-centred approaches are not confined to the recent past. Hetty Bolton, a British pedagogue, writes as soon as 1954:"the principal thing is that we are getting to know a person, and that this person is beginning to form an impression of us. This personal contact is the most important thing in the first lesson." (Bolton, 1954, p.18; cited in Bastien, 1977)

The transition from the "old" to the "new" approach though was not an easy one-step procedure. James L. Kuethe writes

"The forces of tradition make it quite difficult to introduce new teaching methods. Besides the inertia of existing methods, there is the problem of avoiding threat to teachers using the traditional approach. It is understandable that experienced teachers will resist change if they are made to feel that the way they have been teaching is inferior or that they must learn new skills. They will insist that the old way is the best way and find fault with the innovation.

Techniques that are now traditional were, of course, at one time new. And, naturally, no teaching method has failed to undergo subtle changes in response to changing values of the culture." (Kuethe, 1968, p.141; cited in Bastien, 1977)

Europe has always had a strong tie with tradition, often making the transition towards new ideas and approaches rough and lengthy. This is the case with piano teaching as well. There are piano methods still in print that reflect old educational approaches, such as "Die Klavier Fibel" by Willy Schneider (Heinrichshafen Verlag, 1960). Some teachers might prefer to employ such a piano method merely because they were taught with this method themselves. It is of importance for piano instructors to attempt to reflect the needs of today's students and modify their presentation technique and educational material accordingly.

6.5. Description of Piano Methods

6.5.1. Introduction

As previously noted, the number of universally available piano methods is great. For that reason, only representative methods of special interest for this research which fulfil certain criteria are examined in the following pages.

6.5.2. Selection Criteria

•*Location* played an important role here. The research and the teaching took place entirely in Greece making a basic criterion the availability of the method books in Greek music stores. For the same reason, only in-print methods actually used and accepted by the majority of Greek music educators are considered. Another criterion is the targeted

•*Age group*. Methods discussed are aimed towards young children. Any methods specifically intended for older beginners were not considered. Children taught were all in the kindergarten. For that reason

•*Language* issues were intentionally overlooked. It was not a prerequisite for the method books to be translated in the Greek language because it is not required or expected of kindergarten children to read. This allowed for a greater selection list.

•*Pacing*. All students do not have the same aptness to advance in music instruction. Therefore, in the attempt to provide a more beneficial instruction plan, the method should allow for adaptation according to students' needs, thus taking into account individual differences. When the pacing issue is not addressed, students with below average musical inclination might feel frustrated, or, at the other end, gifted students might become bored with the music training they are receiving.

•*Educational Approach.* Only student-centred piano methods were actually considered as educational material for this study. Autarchic old-fashioned methods were avoided, since they are known to bore or even annoy most contemporary children. One of the educational goals of the study was to teach every participating child basic rules and practices of piano playing.

6.5.3. Listing of popular Method Books

A practical approach to determine popular piano methods in the city of Thessaloniki was to visit the major sheet music and piano score shops and to find out which methods were their best sellers. "Do Re Mi" and "Nakas" (both publishers and retailers) provided useful relative information. The results indicating the five best-selling methods are:

•Giannis & Anthoula Papadopoulou, "*Τα πρώτα βήματα στο πιάνο*" – [The first steps on the piano] – Piano Method, Nakas Editions, Athens, (s.d.)

•*Thompson's Easiest Piano Course*, (1955) John Thompson, Greek translation by Anna Fanourgaki, Nakas Editions, Athens, (Greek Edition 2002).

•*Alfred's Basic Piano Library*, (1981), Willard A. Palmer, Morton Manus and Amanda Vick Lethco, Greek translation by Evdokia Korakianiti, Nakas Editions, Athens, (Greek edition 2001).

•*Hal Leonard Student Piano Library*, Piano Lessons – Book 1, Barbara Kreader, Fred Kern, Phillip Keveren and Mona Rejino, Hal Leonard Corporation, 1998

•*The Bastien Piano Library*, Piano Lessons – Primer Level, James and Jane Smisor Bastien, Kjos Publishing, 1985

6.6. Comparison of the methods

Methods can be directly compared on educational approaches, introduction of new rhythm and theory elements, musicality elements, layout, and other specific areas. In this section, the above-mentioned five piano methods will be compared based on several focus points.

A major concern and one of the goals common to all piano methods for beginners is the approach to reading music. There are three main approaches termed: "middle C", "multiple key" and "landmark". A middle C approach would teach facts one at a time and would begin by requiring the student to place hands with both thumbs on middle C and start playing. This is a traditional approach, which was most likely used to teach most of today's piano teachers. The multiple key approach has gained popularity more recently even though the oldest multi-key course, namely the Oxford Piano Course written by Ernest Schelling, Gail Martin Haake, Charles J. Haake, and Osbourne McConathy, dates from 1928 (Bastien, 1977). It differentiates itself from the traditional middle C approach in several ways. A multi-key method would present whole concepts and then break them down instead of building up from single facts. All twelve major five-finger positions are presented during the first months of instruction, while the importance given to intervals and intervallic relationships enable directional reading and movement independence on the keyboard. The third approach is the landmark-intervallic approach. As an alternative to middle C and multi-key approach, this introduces reading through the use of given landmarks: bass clef F, middle C and treble clef G. This approach was first introduced in 1955 in the Frances Clark Library for Piano Students (Summy-Birchard). Intervallic reading then enables the student to expand the range of notes read and played.

A second concern is the introduction of rhythm and counting. Two major tendencies here are the durational and the experiential. In the first case, the student would count aloud "one, one, one-two" for example whereas in the second the child would "clap, clap, clap-hold" instead. Awareness of own pulse is also used by many methods and is a helpful subjective and direct means of introducing stability in rhythm. Theoretical elements can be presented with or without experiential processes, the later usually being aided by other supplementary material. Other points of interest include the technique sequence (first placement of fingers on the keyboard), the page layout, the introduction of dynamic and tempo markings. A direct comparison is possible in the following tables. After each table, a brief discussion provides information on the evaluation of the methods according to the specific criterion.

Table 1
Comparison of reading approach

	The first steps on the piano	***Thompson's Easiest Piano Course***	***Alfred's Basic Piano Library***	***Hal Leonard Student Piano Library***	***The Bastien Piano Library***
Reading Approach	Middle C. Does not include pre-reading material	Middle C. Does not include pre-reading material	Combination of middle C, multi-key, and landmark. Includes pre-reading material	Combines multi-key and landmark. Includes pre-reading material	Multi-key and intervallic. Includes pre-reading material

The middle C approach requires the child to begin to play short melodies while simultaneously learning notation and rhythm. When considered that the child has no previous experience, it is to be expected that most children will be overwhelmed. A negative experience right at the start of the instruction program might have caused effects such as low participation or refusal to co-operate. Hence, the first two methods were not considered. Of the remaining three, Hal Leonard method is the most recently written (1998) method. Its combination of intervallic multi-key and landmark approaches makes it preferable to the Bastien method. A clear choice between Hal Leonard and Alfred's method based on this criterion alone would be difficult.

Table 2
Comparison of rhythm approach

	The first steps on the piano	*Thompson's Easiest Piano Course*	*Alfred's Basic Piano Library*	*Hal Leonard Student Piano Library*	*The Bastien Piano Library*
Rhythm Approach	Durational (counting aloud) and clapping, though not experiential	Durational (counting aloud)	Durational (counting), including rhythm chanting (e.g., quarter, quarter, half note).	Durational (counting and chanting) and experiential (clapping). Awareness of pulse	Durational (counting and chanting).

While all methods apply the "counting aloud" technique, Hal Leonard is unique in its experiential approach. By introducing various clapping patterns, the child is able to learn the difference between note durations practically, not just theoretically. Children do not necessarily automatically connect counting aloud with longer or shorter note values. Additionally, the awareness of pulse is a welcome inclusion for reasons discussed above.

Table 3
Comparison of initial finger placement

	The first steps on the piano	*Thompson's Easiest Piano Course*	*Alfred's Basic Piano Library*	*Hal Leonard Student Piano Library*	*The Bastien Piano Library*
Initial finger placement	Middle C position. Fingering included.	Middle C position. Fingering included	On black keys with fingers 2-3-4, also middle C position. Fingering included only when necessary (beginning of piece and at position shifts)	Middle finger supported by thumb. On black keys with fingers 2-3, then 2-3-4. Fingering included, later only when necessary (beginning of piece and at position shifts)	On black keys with fingers 2-3-4, then C position. Fingering included.

In the above table, it is clear that most methods include the fingering. This, combined with a fixed position such as the middle C position, usually leads to a fixed association of finger numbers with specific keys. The students do not learn to read the notes; instead, they learn the above association. If asked to play in a different position, these children cannot perform. It is of value, therefore, to include fingering only when necessary. Beginning with the black keys and frequent key changes aids independence on the keyboard and, possibly, facilitates the spatial association of keys and written notes. This later characteristic was considered of value for this research. The unique element found in the Hal Leonard method here is the first playing experience: it uses the third (middle) finger supported by the thumb. While this lasts for just one lesson, it is important to compensate for the finger weakness of most five-year-old children. This ensures a positive start and, combined with the rest, makes this method preferable.

Table 4
Comparison of page-layout

	The first steps on the piano	*Thompson's Easiest Piano Course*	*Alfred's Basic Piano Library*	*Hal Leonard Student Piano Library*	*The Bastien Piano Library*
Page Layout	➢ In colour ➢ Normal size notes. ➢ Drawings in single colour ➢ Keyboard picture and association with written notes.	➢ Full colour ➢ Normal size notes. ➢ Illustrations ➢ Keyboard picture and association with written notes.	➢ Full colour. ➢ Large notes. ➢ Illustrations ➢ New elements presented in special box. ➢ Teacher accompaniments at the lower part of the page.	➢ Full colour. ➢ Large notes. ➢ Original illustrations. ➢ Focus on music. ➢ New elements presented in special box. ➢ Teacher accompaniments at the lower part of the page. ➢ Keyboard graphics for finger placement.	➢ Full colour. ➢ Large notes. ➢ Illustrations. ➢ New elements displayed in upper part of the page. ➢ Focus on music. ➢ Teacher accompaniments at the lower part of the page.

Pre-school children are easily distracted and therefore require captivating material for prolonged attention. An attractive, colourful page can be proven a valuable ally of the teacher. Of the above methods, only "the first steps" were not as satisfying, while the Hal Leonard method had the best quality paper and intense contrast through the combination of bright colours and very white paper.

Table 5
Comparison of sequencing of musicality elements

	The first steps on the piano	*Thompson's Easiest Piano Course*	*Alfred's Basic Piano Library*	*Hal Leonard Student Piano Library*	*The Bastien Piano Library*
Musicality Elements	Dynamic markings *f*, *p*, *pp*. Legato and staccato Repeat sign Anacrusis Fermata and Tie Accent	Dynamic markings *f*, *p*, *pp*. Legato and staccato Repeat sign	Dynamic markings *f*, *p*, *mf* Legato and staccato Repeat sign Crescendo and diminuendo	Dynamic markings *f*, *p*, *mf*, *mp* Repeat sign D.C. al Fine	Dynamic markings *f* and *p*. Legato and staccato

Dynamic markings are essential and are included in all methods. All methods except for the Hal Leonard method then proceed with the introduction of articulation, i.e.

legato or staccato playing. The Hal Leonard method introduces articulation in the second book. While this might be considered a disadvantage of the method, it helps some slow-paced children follow the group by requiring less at one time. Many children find it difficult to play the correct note, to use the right finger, to apply the correct amount of pressure (dynamics) **and** to connect (legato) or detach (staccato) the notes. The "first steps" definitely includes many new concepts in a short time-span which might overwhelm some pre-school children.

It is clear that the method that shows the most advantages for use in this study is the Hal Leonard method. Apart from the above-mentioned reasons, it has teacher accompaniments throughout the first book making every song possibly more pleasurable for the children. It is the only method to include regular creative improvisation pieces, which help the children discover by themselves the possibilities of their keyboards. The songs included reflect a variety of moods, not just the typically "happy" pieces, appealing to children with diverse characters and musical tastes.

CHAPTER 7

THE GREEK EDUCATIONAL SYSTEM

This research was conducted with children that were all enrolled in a Greek, public, experimental kindergarten. Therefore, a brief description of the Greek educational system was considered useful.

The public educational system in Greece is organised in a manner similar to some and different to other European countries. Following is an overview of the educational system. (All information found in the following section was extracted from the web site of the Greek Ministry of National Education and Religious Affairs at www.ypepth.gr).

7.1. The structure of the educational system

Greece has compulsory education for all children aged between six and fifteen years old. This includes Primary (*Dimotiko*) and Lower Secondary (*Gymnasio*) Education. Children, however, can attend from the age of two and a half years (pre-school education) in institutions (private and public) called "*Vrefonipiakoi Paidikoi Stathmi*" (crèches) followed by the *Nipiagogeia* (kindergartens). The *Dimotiko* (Primary Education) provides a six-year program, and children are admitted at the age of 6. Along with the *Nipiagogeia* (regular kindergartens) and the *Dimotika*, there are all-day primary schools, with a prolonged schedule and a broader spectrum of activities in their curriculum.

According to the reform of 1997, non-compulsory secondary education consists of two school types: *Eniaia Lykeia* (Unified Upper Secondary Schools) and the *TEE* (Technical Vocational Educational Schools). The *Eniaia Lykeia* (EL) offer educational programs with a duration of three years while the *TEE* (Technical Vocational Educational Schools) provide a two-year (a' level) or three-year (b' level) program.

For students with special educational needs, special *Nipagogeia* (kindergartens), *Dimotika*, *Gymnasia*, *Lykeia* and upper secondary classes are in operation. Other specialised schools include Musical, Ecclesiastical and Physical Education *Gymnasia* and *Lykeia*.

The Vocational Training Institutes (*IEK*) provide formal education but are not classified since they accept both *Gymnasio* (lower secondary school) and *Lykeio* (upper secondary school) graduates. They accept students according to the relevant specialisation as provided.

Universities and Technological Education Institutes (*TEI*) comprise public higher education. Students' performance at national level examinations during the second and third grade of *Lykeio* is considered for admittance to these institutions. The Hellenic Open University admits students twenty-two years old or older by drawing lots.

In formal education, although classes can be repeated when necessary, the length of study is fixed. Upon completion of a level, students are awarded a formal school-leaving certificate, which is the official authorisation. Each educational level requires the completion of the previous level, proven by the possession of an appropriate title (school-leaving certificate, degree etc.). The following table gives an overview of the educational system.

Table 1
Overview of the Greek educational system

Primary Education		
Nipiagogeio [Kindergarten] Ages 4-6 (mainstream, All-day, Experimental, Special) ***Dimotiko*** [Elementary School] Ages 6-12 (mainstream, All-day, Experimental, Special)		
Secondary Education		
Gymnasio: Ages 12-15 (General, Musical, Ecclesiastical, Physical Education, Special) compulsory education		
Lykeia: Ages 15-18 – Musical – Ecclesiastical (self sufficient and autonomous) – Physical Education Schools B' grade – Special A' grade	***TEE***: (Technical Vocational Educational Schools) B and A Level C and B Level	***IEK*** (Vocational Training Institutes)
Higher Education		
Conventional – Technological Education Institutes (***TEI***) Universities (***AEI***) Postgraduate studies (Universities, ***TEI***- Hellenic Open University) – Hellenic Open University		

7.2. Pre-school education

Education in general is provided by the Greek State free of charge. Private schools also exist, but are not free of charge. The same applies to pre-school education. It is a part of primary education, consisting of kindergarten and primary school. Being a part of primary education, pre-school is generally governed by the same legislative framework as that which applies to primary schools.

7.2.1. Historical view

Pre-school education was not addressed by the modern Hellenic State until 1895, when citizens were permitted to establish *nipiagogeia* (kindergartens) for children from three to six years old. Timetable and activities of these new educational facilities were determined the following year (April 30, 1896) when a relevant Royal Decree was issued. It was not until 1929 that kindergartens were first included in primary education.

A 1985 law still in effect today, passed in the Parliament of the Hellenes, provides the structural and operational details of the primary and secondary education. Pre-school education is to be provided in kindergartens. These kindergartens may either operate independently or together with *paidikoi stathmoi* (nursery schools). The duration of attendance at kindergarten is two years. It is gradually being made compulsory throughout the country by region.

Especially concerning experimental kindergartens, organisational and operational matters are regulated by decision of the Minister of National Education and Religious Affairs. The first experimental schools in Greece were established in 1929 (by Law 4376/1929) at the universities of Athens and Thessaloniki. Forty-seven years later, another experimental school was opened at the University of Patras (Law 309/76). Model schools with similar objectives operating at the Pedagogical Academies, as the one where this study was conducted, were renamed “experimental” (Law 1566/85). The supervisory council of the relevant Pedagogical Department for primary school and kindergarten teachers supervises the experimental schools in this category. The School Advisor of the region visits the experimental schools, monitors the teaching work and links the pedagogical department and experimental schools with the other schools in the region.

The objective of the experimental schools, as stated in the decision of the Minister of Education (No. Φ27/148/Γ1/160/14-2-95) is: "to promote psycho-pedagogical and educational research as well as to provide practice for the students in the Pedagogical Departments of the universities and for the teaching staff in the regions to which they belong."

7.2.2. Types of kindergartens

Depending on the number of children attending, kindergartens may have either one or two teachers. One-position (*monothesio*) and two-position (*dithesio*) kindergartens are attended by at least seven but less than thirty and by at least thirty-one but less than sixty children respectively. Kindergartens may also have more positions.

In implementation of L. 2525/97 and beginning during 1997-1998 school year, 160 all-day kindergartens were opened on a trial basis with an extended timetable. These kindergartens were intended to engage the children in creative activities for approximately eight hours per day. In the following school year 1998-1999, all-day public kindergartens were increased to 350. The goal being for all kindergartens to operate all day, this number was doubled for the school year 1999-2000 and has continued to increase.

The last type of kindergartens, experimental kindergartens, is described in the previous section.

7.2.3. Eligibility

Children must be at least four years old on 31st December of the year of registration to be eligible for enrolment in kindergarten. Requirements for parents to register a child in kindergarten are as follows:

- The family must reside in the kindergarten school district.
- The child must be of the required age.

Health matters are also important. Parents must present the child's health booklet certifying that the child has had the required inoculations upon registration. A lottery is held if the number of children applying exceeds the number provided for in the Presidential Decree. Children for all-day nursery schools are selected based on social and financial criteria.

Special regulations concerning experimental kindergartens are of interest. Under law 1566/85, but also by virtue of ministerial decision Φ27/148/Γ1/160/14-2-95, children who have their permanent residence in a town where there is an experimental kindergarten may be registered in it after a lottery is held. To participate in the lottery, the following steps must be made by the children's parents:

- an application submission during the last ten days of May of the previous school year,
- a signed solemn statement that the child is not participating in the lottery for any other experimental school,
- certification of the child's age.

The number of children in each class must not exceed twenty-five.

7.2.4. Objectives

The objective of kindergarten is to help young children develop physically, emotionally, mentally and socially. This effort is made taking into account the framework originating from the broader purpose of primary and secondary education. Kindergarten should help children:

- cultivate their senses and organise their mental and physical acts.
- enrich and organise their experiences deriving from the physical, social, and cultural environment and acquire the ability to distinguish relationships and interactions in this environment.
- develop the ability to understand and express themselves through symbols generally and in the realms of language, mathematics and aesthetics in particular.
- create interpersonal relations which will assist their gradual and harmonious integration into the life of the community, and

- develop initiatives freely and effortlessly and, within the framework of the organised environment, become accustomed to the give-and-take relationship between the individual and the group.

The operation of the all-day kindergarten (L. 2525/97) additionally served the following objectives:

- The upgrading of early childhood education and the all-round preparation of the child for primary school,
- Reinforcement of the role of state care with a view to reducing educational and social discrimination and
- Service to working parents.

The Pedagogical Institute's instructions for carrying out the educational task include:

i. Clearly formulated goals for every course (within the framework of the general and special objectives of education for each level).

ii. Subject matter selected in accordance with the objective of the course at each level,

iii. Subject matter selected in accordance with the timetable requirements and the assimilative ability of the pupils,

iv. Subject matter structured into individual units and topics, and

v. Indicative directions as to the method and means of teaching every unit and topic.

As stated by the Ministry of National Education and Religious Affairs, curricula are constantly formulated, experimentally tested, evaluated and reviewed. This procedure aims in reflecting developments in knowledge, social needs and advances in the educational sciences.

According to Presidential Decree, curricula for kindergarten aim at the following:

- education and psychomotor development of small children,

- social, emotional, moral and religious development on both the individual and collective level,
- cultivation of aesthetic sense within the framework of more general development,
- mental development and finally
- cultivation of motor and mental skills.

Detailed instructions and practical recommendations on how to organise and conduct each class are also contained in an activity book for kindergarten teachers. According to this activity book, the child is encouraged to anticipate, to investigate, to experiment, to compare, to discover relations, to classify and to grow mentally. The basic principle of the curriculum is to obtain the child's active participation. A picture of the class in its entirety but also of each child individually is important when constant adaptation of educational activities to the pace of every pupil is an objective.

7.2.5. Timetables and daily activities

According to the above Presidential Decree, the total hours of daily creative engagement of children in public kindergartens are three and one-half. These hours are from 9:00 a.m. to 12:30 p.m.

As determined by Presidential Decree, the school year for kindergarten teachers begins on 1 September and ends on 21 June the following year. Classes do not begin until 11 September and end on 15 June the following year.

Finally, the program for the all-day kindergarten employing two teachers between 7:45 and 16:00 is as follows:

- Timetable for first teacher 07:45 - 12:00 (4h 15')
- Timetable for second teacher 11:45 - 16:00 (4h 15')
- Time children are engaged: 8:00 - 15:45 (7h 45')

The daily work programme includes:

- The engagement of the children in "activity corners" without the direct involvement of the teacher.

- Activities targeted either on goals pre-selected by the teacher, or on those arising from unplanned or planned activities.

For unplanned activities, teachers follow the procedure below:

- They select one or more goals from one or more fields of development,

- They select and organise activities correlating with the general objectives

- They help and animate the children to become involved in activities

- They evaluate the results of the learning effort

7.2.6. Class separation and teachers

One-position kindergartens have children from both age groups together in a single classroom. In these cases, effort is made to differentiate activities in pacing and in level of difficulty. This is needed in order to cover the special needs arising from the characteristic features of each age group. The teacher normally works with the same class for at least one school year.

In two-position kindergartens, classes are created on the grounds of age (children 4-5 years old and children 5-6 years old).

As described in law 2525/97, two kindergarten teachers are employed in every all-day kindergarten.

CHAPTER 8

METHODOLOGY

Introduction

In Chapter two, several studies which link music to other mental abilities are reviewed. Music instruction and ability appears to influence reading, mathematics and spatial-temporal ability. Of all areas, the most consistent extra-musical effect of music instruction was found on spatial-temporal tasks. Although not all studies present significant differences of treatment groups versus control groups, all studies (Hurwitz et al., 1975; Rauscher et al., 1997; Gromko and Poorman, 1998; Costa-Giomi, 1999; Persellin, 1999; Rauscher and Zupan, 2000; Bilhartz, Bruhn and Olson, 2000; Hetland, 2000b) report enhancement to some extent of spatial-temporal task performance in children who received music instruction. According to these findings, it could be expected that a group of children, after receiving music instruction, would demonstrate an increase in mean spatial-temporal test scores. No relevant study was conducted in Greece or had used a Greek population. Therefore, this study would investigate the extra-musical effects of piano-keyboard instruction in a Greek setting, using a Greek population. The above served as the foundation of the first hypothesis upon which this study was based: "If children show some improvement in their scaled cognitive test scores, between the pre-test and the post-test, then, the piano-keyboard instruction was effective in improving cognitive test scores of kindergarten children".

The cognitive tasks which were expected to show the greatest improvement were the spatial tasks. Spatial intelligence involves "the capacities to perceive the visual world accurately, to perform transformations and modifications upon one's initial perceptions, and to be able to recreate aspects of one's visual experience, even in the absence of relevant physical stimuli" (Gardner, 1983, p. 173). This is closely related to the definition of spatial-temporal processes by Johnson-Laird (1983), provided in Chapter two of the present thesis. Gardner also believes that music and spatial intelligence may be interrelated. "The localization of musical capacities in the right hemisphere has suggested that certain musical abilities may be closely tied to spatial capacities" (Gardner, 1983, p. 123). The findings of Bodner et al. (2001) support the hypothesis that music can enhance spatial-temporal reasoning, since music was found to be processed in the same areas as spatial-temporal tasks. Additionally, physiological reasons, based mainly on cerebral cortex organisation and function models such as the trion model, support that music listening, performing and composing involve development of the inherent repertoire of spatio-temporal patterns (Leng and Shaw, 1991). Mathematical improvement was expected, but the conclusion of Vaughn (2000) that it has not yet been proven that music training enhances performance in mathematics, did not suggest expectation of striking results. Finally, the non-significant relationship between music production and Raven's Standard Progressive Matrices test (Hetland, 2000b), upon which the Matrix Analogies test of the K-ABC is based, suggested a small or no increase. All the above led to the formation of the second hypothesis: "certain cognitive tasks such as the spatial tasks will show greater improvement, while others, such as analogy tasks should remain practically unchanged".

Several gender differences in humans have been reported. Studies have shown nervous system differentiations (Breedlove, 1994) as well as cognitive ability inequalities (e.g., Branon, 2002). Spatial ability is an area where research has revealed male superiority, already at the age of four and a half (Levine et al., 1999). Despite the close link between music and spatial tasks discussed earlier though, only Hurwitz et al. (1975) reported significant gender differences after music instruction. None of the studies investigating the effect of piano lessons on spatial-temporal ability (Rauscher et al., 1997; Costa-Giomi, 1999; Rauscher and Zupan, 2000) found gender differences. In an fMRI study, Jordan et al. (2002) found that the two sexes use different strategies when solving mental rotation problems. The above led to the formation of the last hypothesis: "if improvement of spatial tasks performance is different for boys than for girls, despite equal treatment and instruction, then, this will show that the effects of piano-keyboard training on spatial tasks are gender dependent".

8.1. Design

The educational part of this study took place during the academic year 2001-2002. The piano-keyboard instruction began after all necessary procedures were completed. These included obtaining official approval (described in detail in 8.2.4.) and acquaintance Children participating in the study were offered piano-keyboard instruction, twice weekly. Before and after the instruction period, participants were administered six sub-tests from the K-ABC. The two testing-evaluation procedures (pre-training and post-training) as well as the piano-keyboard program were carried out in the facilities of the Kindergarten where the research took place. The study was **non-reactive**, since the participants were not aware that they were part of the study in any way. The independent variables here were the keyboard training and gender and the dependant variable was the K-ABC score difference between the pre-testing and post-testing assessment.

The present experimental design was a Repeated Measures Design. The measure (i.e. the Kaufman Assessment Battery for Children) was repeated on each participant under two conditions, before (pre-training) and after (post-training) following the piano-keyboard instruction program. The **data** were **related**, because when results were presented, a value in one condition was directly related to a value in the other condition.

The hypotheses were:

1. If children show some improvement in their scaled cognitive test scores, between the pre-test and the post-test, then, the piano-keyboard instruction was effective in improving cognitive test scores of kindergarten children.

2. If it was effective in that, then, certain cognitive tasks more closely related to music instruction such as the spatial tasks will show greater improvement, while others, such as analogy tasks should remain practically unchanged.

3. If the improvement of spatial tasks affects boys' achievement differently than girls', despite equal treatment and instruction, then, it shows that the effects of piano-keyboard training on spatial tasks are gender dependent.

The Null hypotheses were:

1. Children's cognitive test scores will not improve by the piano-keyboard instruction program.

2. All cognitive tasks will show similar improvement following the music instruction.

3. There will be no difference between the spatial scores of boys and girls.

The Null Hypotheses for this test were rejected only when the significance level was less than 0,05. Such values ($p<0.05$) indicate that the two variables compared (pre-treatment versus post-treatment) differ in distribution.

8.2. Participants

All participants of this study came from the Experimental Kindergarten of the Aristotle University of Thessaloniki (Πειραματικό Νηπιαγωγείο Αριστοτελείου Πανεπιστημίου Θεσσαλονίκης), Thessaloniki, Greece. The age of the individuals in this educational facility ranges between four and six years. Children are divided in two age groups: four to five years old (pre-kindergarten) and five to six years old (kindergarten). Approximately half the children belong to the pre-kindergarten age group and the other half are five to six years old and belong to the kindergarten age group. Apart from the special keyboard-training course, the educational program followed comprised of all activities habitually performed in all Greek Experimental Kindergartens as required by the Greek Ministry of National Education and Religious Affairs, including a physical workout program offered twice weekly. About one hundred twenty pupils in total attended in the year 2001/2002.

8.2.1. The School

There is a total of six classrooms, one gymnastics hall, one dinning area, one kitchen, two staff offices and one resting area in the two-story building. This lastly noted resting area, a large room located on the lower level of the building, also served as the keyboard lesson classroom for the purposes of this research. In the front of the building is a parking lot for employees and parents/visitors. In the back there is a spacious garden with a playground appropriately equipped for the school's pupils. This is a public facility, which does not require any payment from the parents of the children attending. Children are accepted following the completion of a written request form by the parents/guardians and following a procedure described above. In this sense, its pupils represent a self-selected population. There are no discriminative social, economical or other criteria excluding children from attending this kindergarten. Sixty-three children were between five and six years old (kindergarten) and sixty children were between four and five years old (pre-kindergarten). This school does not separate children to form classes according to age. Instead, it mixes the two age groups creating six classes of approximately half kindergarten and half pre-kindergarten aged children in each.

8.2.2. Subjects' Selection Criteria

Sixty-one individuals attending the above-described kindergarten meeting the following criteria were finally selected for this study:

i. Age between five and six years at the beginning of the study

   The reasons for the choice of this age group are presented in chapter 8.2.3.

ii. One year of attendance at the same kindergarten prior to the study

   This was controlled to rule out possible effects, positive or negative, adjusting to a new environment might have on the music instruction program and on the K-ABC test results.

iii. Normal or corrected vision and hearing

   This was controlled to ensure that all children were equally able, regarding the two senses, to participate in the instruction program. It is logical that a child with a visual or aural impairment could not participate in the same way as other, non-impaired, children in the program.

iv. No prior music instrument instruction or experience and no other form of prior musical training

   This was necessary, because the aim of this study was to control effects observed after music training. Children with prior musical training would possibly exhibit effects of music instruction already at pre-testing, making a comparison between pre- and post-training pointless.

v. Average or above average socio-economic background

   Children from low-income families have been reported to improve less and to participate less in similar music instruction programs offered (Bilhartz, Bruhn and Olson, 2000). The above socio-economic backgrounds were selected to avoid a diminution of gain scores after music training due to lack of participation.

vi. Greek being the native language

All teaching was provided in Greek. Therefore, it was important that all children could understand, follow and participate in the program without encountering language problems.

vii. No overt emotional problems prior to commencing school

For practical reasons, children participating in the piano-keyboard instruction program were divided into groups different (smaller) than their class. Children with emotional problems might have found this difficult, and would possibly refuse to actively participate in the music group.

viii. No overt physical handicaps

Physical handicaps could directly interfere with participation. A low post-test score of such a child might be attributed to these reasons, making it very difficult to assess the net effect of music training. Therefore, children with such handicaps were not considered.

Out of the sixty-one participants thirty-three were females and twenty-eight males (ratio 1.18 females to 1 male), their age ranged between 58-70 months at the beginning of the study (Mean 65.08, S.D. 3.34). Detailed information is provided in Table 1.

Table 1
Participants' Demographic Information

1. **Characteristic**	**Data**
2. **Gender**	
Male	28
Female	33
3. **Age**	
M	65.08 months
S.D.	3.34
Range	58-70 months
4. **K-ABC Nonverbal Scale score**	
M	106,98
S.D.	11,75
Range	86-138

8.2.3. Choice of age

The age of five years and the kindergarten level was chosen because of several reasons:

- Children are often overwhelmed by the demands of the first grade of elementary school. The age of six was therefore intentionally avoided.

- Many parents decide not to send their children to school very early. They try to avoid early pre-school programs for many reasons, keeping the children at home near them, when possible. Even this category of parents though usually sends their children to kindergarten to help them socialise and be better prepared for first grade elementary school, which is compulsory for all. In this sense, a group of five-year-olds taken from a public kindergarten is a more representative sample of the general population than a group of four-year-olds taken from the same facility would be.

- The educational program for the first grade of the elementary school is very demanding. That means that there is practically no time left at school to implement novel courses, making the integration of a music-training program a difficult organisational task. Kindergartens, on the other hand, do not have such intense educational programs, making the integration of a music-instruction program rather simple. This was a practical reason for which to prefer the kindergarten from the elementary school.

- Five-year-old children as a group are more mature than four-year-old children. Music instruction, being quite complex, requires a minimum of concentration and involvement.

- According to Gordon (1993), "the informal guidance that a child receives in the home and preschool and the formal instruction that she receives in kindergarten will influence her level of developmental music aptitude much more than will the formal music instruction that she receives in elementary, middle, and high school"(p. 3).

- The majority of children who enter kindergarten have not yet emerged from the music babble stage. If guided through the music babble stage, the children will be able to learn to be more musical. Any kindergarten child who has the benefit of music instruction will emerge from the music babble stage sooner than any other child who has not received similar instruction (Gordon, 1993).

8.2.4. School director's/supervisor's approval

A written approval by both the director and the supervisor of the educational facility was obtained allowing for this research to take place. The keyboard-training program was integrated in the school's schedule of regular activities. All parents were informed about the school's activities by its authorities. Therefore, the collection of signed forms of informed consent from the children's parents was redundant.

8.3. Psychological measures

8.3.1. Introduction

There are ethical issues that relate to the objectivity and the accuracy of IQ testing. The American Psychological Association (APA) publishes an ethics code, which provides ethical guidelines, developed empirically. This code has been under periodical revision since its first publication in 1953. In the 1992 revision, the ethics code included a set of six general principles and 102 standards grouped in eight general categories. The second category is "Evaluation, assessment, or intervention". This category deals with the construction of tests, among others. The importance the APA gives to test development is partly due to the fact that many important decisions might be made based on psychological test results. For this and for other reasons stated below, the choice of the test used in this research was not a simple one.

8.3.2. Historical view

Psychologists have tried to portray and measure intelligence for over 100 years (see also chapter one). A milestone in this effort is the creation of the intelligence test in 1905. Alfred Binet, Victor Henri and Thèodore Simon, the test creators, measured memory, attention, comprehension, vocabulary and imagination (Brannon, 2002, p.78). Lewis Terman adapted the Binet-Simon test into the Stanford-Binet, which appeared in the United States in 1916 (Brannon, 2002).

The development of improved intelligence tests led to the division of abilities in verbal and performance skills. Verbal sub-tests include tasks directing the subject to answer diverse questions aiming in assessment of general knowledge, vocabulary, arithmetic, memory and comprehension. In the performance sub-tests, subjects are required among other things to arrange pictures in a logical manner, construct structures using building blocks, complete pictures that lack some section, assemble objects and associate symbols to digits.

The tests most commonly used today to measure children's IQ are the Stanford-Binet IQ test and the Wechsler Intelligence Scale for Children (WISC). In 1983, however, a new test was introduced; the Kaufman Assessment Battery for Children (K-ABC). The

K-ABC has become increasingly popular among psychologists and others that utilise intelligence tests.

8.3.3. Reasons for selecting the K-ABC

The Kaufmans developed multiple tests having extensive experience in the field of intelligence testing. Alan Kaufman was a researcher and assistant director at The Psychological Corporation from 1968 to 1974. While in that position, he was project director for the development and standardisation of the Wechsler Intelligence Scale for Children-Revised (WISC-R) and the McCarthy Scales of Children's Abilities. Nadeen Kaufman, a specialist in neuroscience and learning disabilities, contributed with her training in the field of special education and with her clinical skills. Alan and Nadeen Kaufman authored together the book *Clinical Evaluation of Young Children with McCarthy Scales* in 1977. Alan Kaufman's conversations with David Weschler in the nineteen-seventies served as a basis for a varied approach to intelligence test interpretation. Having such a strong background in the field and the wish to provide supplemental material in the field of tests of intelligence and related abilities, the Kaufmans have continuously produced relative work ever since.

Their first test in 1983 was the K-ABC. It is a test based on a theoretical framework different from other tests available at the time. Unlike other tests, its manual includes several validity studies. The K-ABC manual is also sensitive to minority assessment, which resulted in reduced ethnic differences. The K-ABC reflects its authors' process-based approach to intelligence. In their own words: "If we know how a child best learns, we have a much better idea of how to teach that child. The K-ABC is predicated on a model of **how we learn**. An integral part for this model is, once you get the results, what do you do with them?" (Lichtenberger, Broadbooks & Kaufman, 2000, p. 9). The educational approach of the test is obvious in the following citation: "one of the motivations for constructing the K-ABC was to have a test that was educationally relevant, that did more than just pin a number on somebody or help place them in some room or category. But instead, what have I learned about this child that I can now use to help this child learn better, function better?" (p. 9). One other goal of the K-ABC was " to be sensitive to the diverse needs of pre-school, minority group, and exceptional children" (Kaufman, & Kaufman, 1983a, p.5). Telzrow (1984) supports that the K-ABC is useful for asserting pre-school children with language disorders since it does not have the heavy language requirements most intelligence batteries do.

Since the population of children tested for the purposes of this research was of pre-school age, the special needs of this age group had to be considered. Teaching items to ensure the subject understands what was required and considering attention span were characteristics that made the K-ABC more reasonable for use with pre-schoolers. Another factor suggesting the choice of K-ABC was the non-verbal nature of the Mental Processing Scale, which minimised the effect of language when testing Greek-speaking children. The abundance of research using the K-ABC in several different countries and cultures (Egypt France, Germany, Israel, Japan, Korea, Mexico, the Netherlands and Zaire) also supported this choice. (Lichtenberger, Broadbooks & Kaufman, 2000, p. 30-31)

8.3.4. Theoretical foundation of the K-ABC

The combination of a variety of theories led to the "sequential and simultaneous processing theory", which serves as the theoretical framework used in the K-ABC. It focuses on how children solve problems rather than focusing on the problems themselves. It presents, therefore, an explanation of behaviour derived from the process rather than from the product (Lichtenberger, Broadbooks & Kaufman, 2000, p. 13). Sequential processing indicates the capability to organise stimuli in sequential or serial order. The stimuli are interrelated, creating a form of dependence within the set of stimuli. "Sequential processing places a premium on the serial or temporal order of stimuli when solving problems" (Kaufman & Kaufman, 1983a, p. 2). Simultaneous processing often implicates spatial, analogic, or organisational abilities (Kaufman & Kaufman, 1983a, 1983b). "Simultaneous processing demands a gestalt-like, frequently spatial integration of stimuli to solve problems with maximum efficiency" (Kaufman & Kaufman, 1983a, p. 2). A typical example of simultaneous processing is found in the Triangles sub-test of the K-ABC.

Of particular importance for this study were the following constructor intentions: "The K-ABC Mental Processing (i.e. Sequential plus Simultaneous) subtests were deliberately designed to **minimize** the **role of language** and verbal skills for successful performance, and to include stimuli that are **as fair as possible** for **boys** and **girls** from **diverse backgrounds**" (Kaufman & Kaufman, 1983a, p. 2).

8.3.5. Description of K-ABC

The K-ABC is a battery of tests that are administrated individually. It is a comprehensive test that assesses intelligence and achievement of children aged 2 ½ to 12 ½ years. There is a total of sixteen sub-tests which are grouped in four scales (Sequential Processing, Simultaneous Processing, Mental Processing Composite, and Achievement). The number of sub-tests administrated as well as their combination depends on the child's age. A maximum of thirteen sub-tests might be administrated to any one child.

An important feature is the combination of nonverbal sub-tests. These sub-tests produce a Nonverbal Scale. As implied, these sub-tests can be administered gesturally and responded to motorically (not available for children under four years of age). The combination of the Sequential and Simultaneous Processing Scales gives the Mental Processing Composite and represents a global measure of intelligence.

The Nonverbal Scale produces a standard score (Mean=100, S.D.=15) and is suggested by the test constructors in cases of "deaf, hearing-impaired, speech- or language-disordered, autistic, and **non-English speaking** children" (Kaufman & Kaufman, 1983a, p. 35). The tasks constituting the Nonverbal Scale are different for different age groups. According to the test authors, "the scale cannot be administered reliably below age four" (Kaufman & Kaufman, 1983a, p. 35). The above are shown in Table 2.

Table 2
Nonverbal Scale tasks for different age groups

Age **4** Years	Age **5** years	Ages **6** to **12 ½** Years
➢ Face Recognition	➢ Hand Movements	➢ Hand Movements
➢ Hand Movements	➢ Triangles	➢ Triangles
➢ Triangles	➢ Matrix Analogies	➢ Matrix Analogies
	➢ Spatial Memory	➢ Spatial Memory
		➢ Photo Series

The administration of the K-ABC takes from thirty-five minutes (e.g., for 2 ½-year-old children, where seven sub-tests are administered) to eighty-five minutes (e.g., for 12 ½-year-olds, where thirteen sub-tests are administered). Following is a table (Table 3) listing all sub-tests of the K-ABC.

Table 3
K-ABC categories

Sequential Processing Scale *Problem solving done step-by-step*	**Simultaneous Processing Scale** *Process of many stimuli parallelly*	**Achievement Scale** *Factual and academic knowledge*
• Hand Movements • Number Recall • Word Order	• Magic Window • Face Recognition • Gestalt Closure • Triangles • Matrix Analogies • Spatial Memory • Photo Series	• Expressive Vocabulary • Faces and Places • Arithmetic • Riddles • Reading/Decoding • Reading Understanding

8.3.6. The sub-tests

Each one of the K-ABC sub-tests is briefly described below. Only the sub-tests administered in this study (in bold letters) are more extensively described.

Sequential Processing Scale

- ***Hand Movements***: (for ages 2 ½ through 12 $^{5}/_{12}$) The **Hand Movements** measures aspects of motor functioning through the child's ability to copy the precise sequence of taps on the table with the fist, palm, or side of the hand performed by the examiner. It is a visual-motor sequential processing task. Its constructor notes that a better score would be achieved by a good attention span and concentration. An example can be seen in the following figure 15.

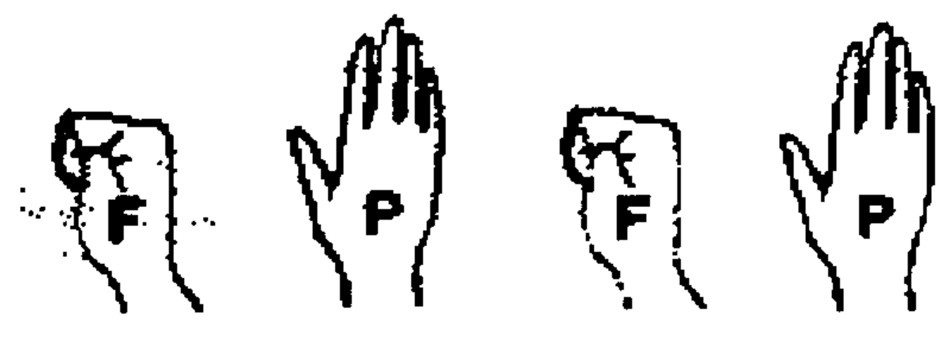


Figure 15
A Hand Movement task example.

- *Number Recall*: (for ages 2 ½ through 12 $^5/_{12}$) The child is asked to repeat a series of digits in the same sequence as the examiner has said them.

- *Word Order*: (for ages 4 through 12 $^5/_{12}$) This sub-test requires touching a series of silhouettes of common objects in the same sequence as the examiner said the names of the objects.

Simultaneous Processing Scale

- *Magic Window*: (for ages 2 ½ through 4 $^{11}/_{12}$) Requires identification of a picture which is exposed by the examiner by slowly moving it behind a narrow window. This exposure mode makes the picture only partially visible at any one time.

- *Face Recognition*: (for ages 2 ½ through 4 $^{11}/_{12}$) Here the subject selects the one or two faces that were exposed briefly, from a group photograph on the following page.

- ***Gestalt Closure***: (for ages 2 ½ through 12 $^5/_{12}$) The child here is required to convert an abstract visual stimulus into a concrete object and describe that verbally. The **Gestalt Closure** is a simultaneous processing visual-vocal communication task. It measures the child's ability to mentally "fill in the gaps" in a partially completed ink drawing, and to name or describe that drawing. An example can be seen in the following figure 16.

Figure 16
A Gestalt Closure task example

- ***Triangles***: (for ages 4 through 12 $^5/_{12}$) The **Triangles** sub-test is a simultaneous processing non-verbal concept formation task. It measures the child's ability to assemble several identical rubber triangles (blue on one side, yellow on he other) to match a picture of an abstract design. This is a spatial visualisation task, which might involve mental rotation. An example can be seen in the following figure 17.

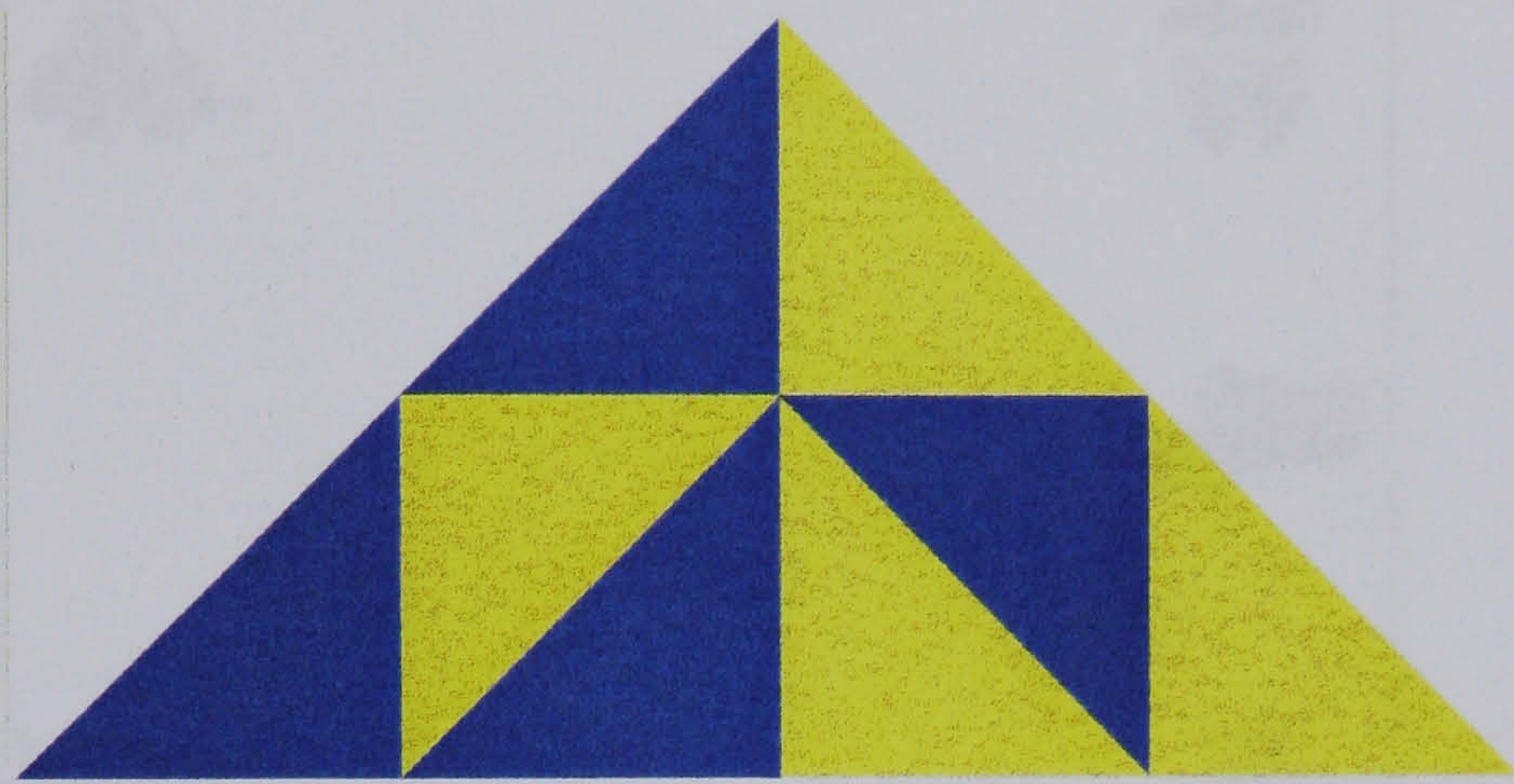


Figure 17
A Triangles task example

- ***Matrix Analogies***: (for ages 5 through 12 $^5/_{12}$) The **Matrix Analogies** sub-test measures the child's ability to select the picture or design that best completes a two-by-two visual analogy. It is an analogic thinking task and is included in the K-ABC as an adaptation of Raven's Progressive Matrices Test. An example can be seen in the following figure 18.

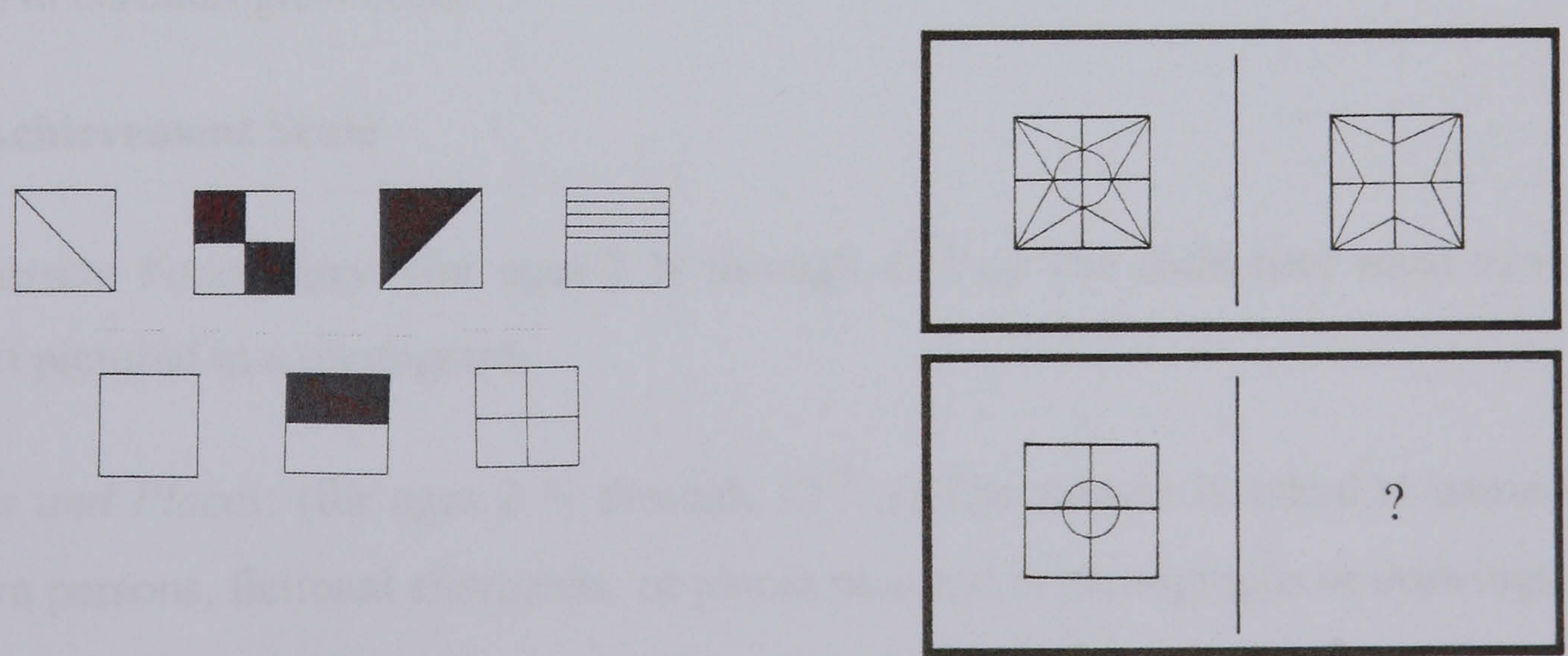


Figure 18
A Matrix Analogies task example

- ***Spatial Memory***: (for ages 5 through 12 $^{5}/_{12}$) The **Spatial Memory** sub-test is a spatial localisation task. It measures the child's ability to recall the locations of pictures arranged randomly on a page. As its name implies, it measures short-term memory. An example can be seen in the following figure 19.

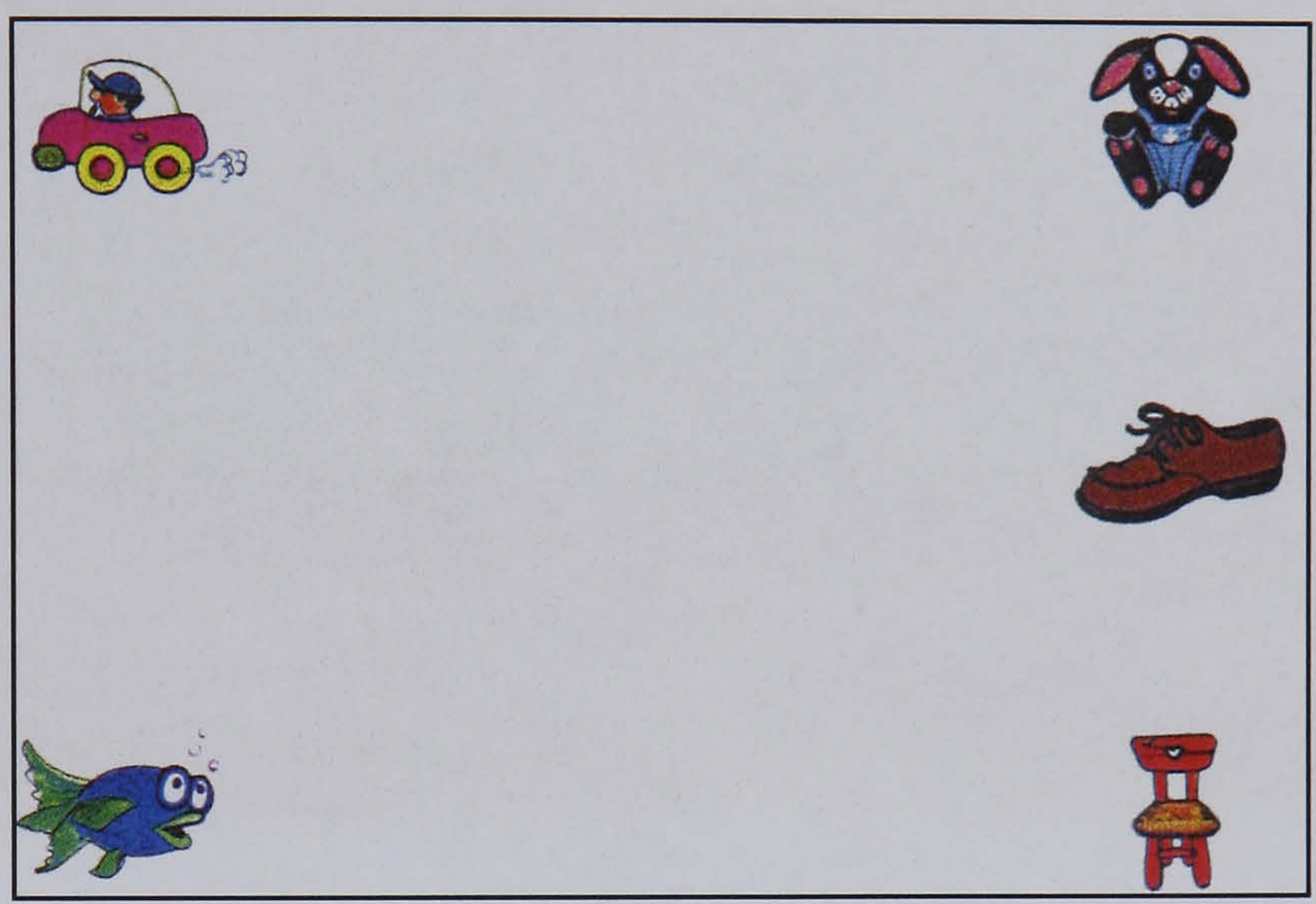


Figure 19
A Spatial Memory task example

- *Photo Series*: (for ages 6 through 12 $^{5}/_{12}$) This task involves placing photographs of an event in chronological order.

Achievement Scale

- *Expressive Vocabulary*: (for ages 2 ½ through 4 $^{11}/_{12}$) The child here must name the object pictured in a photograph.

- *Faces and Places*: (for ages 2 ½ through 12 $^{5}/_{12}$) The subject is asked to name well-known persons, fictional characters, or places pictured in photographs or drawings.

- ***Arithmetic***: (for ages 3 through 12 $^{5}/_{12}$) The **Arithmetic** sub-test measures the child's ability to identify numbers, count, compute, and demonstrate understanding of mathematical concepts. It is a mathematical concept and computational skill task. An example can be seen in the following figure 20.

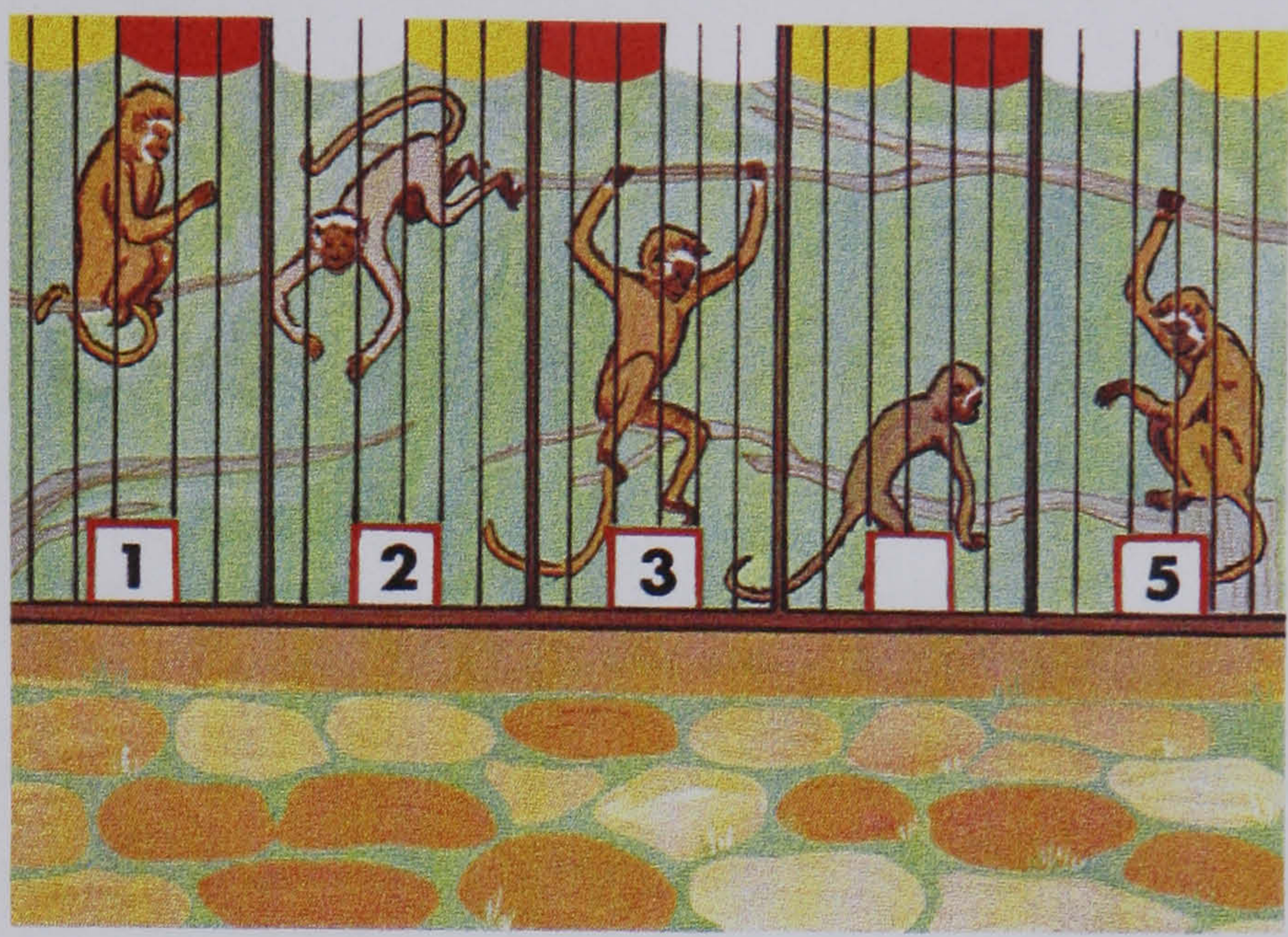


Figure 20
An Arithmetic task example

- *Riddles*: (for ages 3 through 12 $^{5}/_{12}$) The child is provided a list of characteristics and is asked to infer the name of the concrete or abstract concept they belong to.
- *Reading/Decoding*: (for ages 5 through 12 $^{5}/_{12}$) As implied by its name, here the child identifies letters and reads words.
- *Reading Understanding*: (for ages 7 through 12 $^{5}/_{12}$) The subject demonstrates reading comprehension by following commands that are provided in sentences.

8.3.7. Other researchers who used the K-ABC

As reported by Dr. Rauscher and LeMieux (Rauscher, 1999b), the K-ABC was used among other age-standardised tests to assess spatial ability and it's variation in a group of Head Start children receiving keyboard lessons, computer lessons or no special training. At the time of the article's publication, the first two years of a five-year study conducted at ten Head Start sites located throughout north-east Wisconsin, USA had been completed. Dr. Frances H. Rauscher is one of the pioneers in research conducted on music and cognitive development with numerous publications in the field. Her decision to utilise the K-ABC in her latest research reinforces the choice of this psychometric test as being highly appropriate for the type of research conducted within the field of this thesis.

8.4. Procedure

The K-ABC Test was administered exactly before the keyboard training started and immediately after the training ended. The purpose of the re-administration of the K-ABC was to assess the effects of the keyboard training provided

The two testing - evaluation procedures (pre-training and post-training) as well as the keyboard training program were carried out in the facilities of the Experimental Kindergarten of the Aristotle University of Thessaloniki. In addition, the study was *Non-Reactive*, as the participants were not aware that they were part of the study in any way. The *Independent Variables* here were the keyboard training and gender, and the *Dependent Variable* was the difference in scoring and its standardised age equivalence between pre-training and post-training assessment.

The pupils selected for this study came from the prefecture of Thessaloniki. They came from middle and upper socio-economic backgrounds, according to the subjects' selection criteria.

The present experimental design was *a Repeated Measures* Design, as the measure (i.e. the K-ABC test) was repeated on each person under two conditions, **before (pre-**training) and **after (post**-training) the keyboard program. The data were ***Related***, because when results were presented, a value in one condition was directly related to a value in the other condition.

8.4.1. Testing

All pupils participated in the testing mentioned above. A professional psychologist with adequate experience in psychological testing administered all the tests. The testing took place in the resting area of the school. This room provided for satisfactory testing conditions. During the pre- and post-testing periods, children were tested every weekday only between 9am and noon. Due to this time constriction, both pre- and post-testing lasted more than twelve workdays each.

8.4.2. Training procedure

8.4.2.1. Training Session Frequency

The keyboard lessons were administered twice every week for each group of children individually. The duration of each lesson was thirty minutes.

8.4.2.2. Instructor

All teaching was conducted by the writer of the thesis, a professionally trained musician with experience in the field of piano instruction. He holds the Piano Diploma of the National Conservatory of music, Athens, Greece, the Diploma and the MA (Magister Artium or Master of Arts) in Piano Performance from the University for Music and Drama in Graz, Austria, which qualify him to teach piano in Greece.

8.4.2.3. Place

Instruction took place in the resting area of the kindergarten because there is no room intended specifically for music. A good proportion of the children leaves the school at half past noon. Many parents though choose to leave their children at school until 4pm. The resting area meets the needs of this second group of children. After lunch at approximately one o' clock, children still at school who wish to rest might do so in the above-mentioned room. There are six mattresses located in one room section that occupy about one third of the space. There are two closets containing blankets for the children and one chair. Three quarters of the wall are covered by windows, making this a very bright room. Therefore, drapes are hung in front of all windows so that darkening and sleeping is possible during mid-day and afternoon hours. The keyboards were in the opposite side of the mattresses. The six keyboards were placed to form a circle. There were no chairs in front of the keyboards as one might have expected. Instead, the keyboard bases were adjusted so that their height would enable the children to play while standing.

8.4.2.4. Keyboard arrangement conception.

Usually a child that goes to a music lesson is either self-motivated or has been sent there by conscious parents who will support their child at all times. These children though had not chosen to learn to play keyboards. Neither had their parents made that choice. It was a mater of coincidence that this training program was taking place at their school. For this reason, the researcher did not expect the children to be specifically interested in musical activities or keyboard playing. Having the above in mind, every effort was made to attract, inspire and keep these children interested during the entire instruction period. Five-year-old children get very easily frustrated if they have to sit still in a chair for thirty minutes. To avoid that, they were allowed to stand in front of their keyboard and even some moving around was tolerated.

Placing the keyboards in a circle had also similar grounds. There were two main options for keyboard placement in the room available: in a row (against the wall) or in a circle. If the keyboards were in the first position, the children would be facing the wall most of the time. This might have enhanced individual concentration but would have created other problems such as the awkward teacher's positioning. If standing in a row, the children would have to look backwards or to the side in order to pay attention to the teacher. This additional effort could make some children lose interest or get easily tired. It is also more difficult to keep track of what the others are doing if they are not directly visible. The sense of belonging to the group is then decreased. The keyboards were placed in a circle because of all the above reasons. Teaching experience proved the above observations valid.

8.4.3. Groups

The children were divided in twelve fixed groups. Ten groups contained five children and two groups contained six.

8.4.3.1. Criteria of group selection

The children were assigned to different groups depending on which class they attended. As previously mentioned, there were six different classrooms in which the children were evenly distributed. For organisational purposes, keyboard groups consisted of children all attending the same class.

8.4.4. Educational Materials

8.4.4.1. Keyboards

The keyboards used were six Yamaha keyboards, model "Portatone" PSR-260

8.4.4.2. Piano Method

The method used for teaching was "Piano Lessons – Book 1" taken from the "Hal Leonard Student Piano Library", by Barbara Kreader, Fred Kern, Phillip Keveren and Mona Rejino, Hal Leonard Corporation, 1998. Also "Piano Solos – Book 1", "Piano Theory Workbook" and the "Music flashcards – Set A" of the same series were used.

8.4.5. Lessons

The keyboard lessons were administered twice weekly during the period between November 2001 and May 2002.

8.4.5.1. Detailed lesson flow and planning

Lessons started immediately after the pre-testing with the K-ABC was completed.

One or two students enrolled in the Department of Pre-school Education of the Aristotle University of Thessaloniki were also present in the classroom. They were introduced to and greeted by the children and remained seated during the course of each lesson. The students' role was predominantly observatory. They kept one observation sheet for each pupil in the program recording the child's interest, behaviour and participation.

All absences were also recorded. Pre-school children are frequently absent from kindergarten. It was therefore necessary to ensure sufficient presence in the classroom for the piano-keyboard instruction period. This ruled out the possibility of misinterpreting a child's poor performance due to missed lessons.

Each group received a total of forty-one lessons. Teaching was possible in the morning from nine o' clock until half-past twelve, providing enough time for six groups per day with five minute breaks in between. As previously noted, each group received two half-hour lessons weekly. The two lessons were well spaced during the week, with half the groups meeting Mondays and Thursdays and the other half of the groups meeting Tuesdays and Fridays. This helped reduce the number of absences from the keyboard lessons for each child. It was common for a child to miss school for one or two days but not as common to be absent for three or more days. Therefore, the children usually appeared for the next keyboard lesson after having missed one.

8.4.5.2. Lesson content

The "Piano Lessons – Book 1" taken from the "Hal Leonard Student Piano Library" (Kreader, Kern, Keveren, and Rejino, 1998) served as the organisational basis of instruction. It is divided into an introductory unit and five teaching units. During the lessons, the introductory unit and the first four units were covered. "Piano Solos", "Piano Theory Workbook" and "Music Flash Cards – Set A" were used correspondingly.

8.4.5.3. Introductory Unit

The first few lessons were used for a variety of non keyboard-centred purposes, as would be expected. Establishing good contact in the beginning of a program is advantageous for any successful educational program. That is why effort was made in the initial group meetings for the children to be acquainted to the teacher and vice versa. Activities included individual introduction, exploring the keyboards' capabilities and games. Being as young as five years old, these children also needed some time to adjust themselves in the newly formed keyboard group before they could begin feeling comfortable and become active. Luckily, this time-period was limited since the children all belonged to the same class and knew each other already.

The aim of this study was chiefly to investigate the training's extra-musical benefits and not just to teach these children to play keyboards correctly. This explains why some traditionally important issues of keyboard and piano teaching were not emphasised. Sitting correctly, for instance, was not discussed at all because the children were standing and not sitting in front of the keyboards. On the other side, hand position was explained to enable all participants to keep their hands relaxed and their fingers curved when playing. The children were asked to let their arms hang free at the sides. Then they were told to walk around slowly to get a relaxed and natural hand and arm position. They were then made conscious of the relaxation in their hands and asked to maintain that feeling for as long as they could. Lastly, standing in front of their keyboard, they placed their hands in position several times to ensure they would be able to do this easily alone.

Following hand position, the importance of rhythm in music was stressed. Children were made aware of the analogy of rhythm in music and heartbeat, using the concept of "musical pulse". This experiential approach generated immediate response and quick comprehension. Understanding of rhythmic importance is crucial, rhythm being music's backbone, making this lesson essential. Introducing and exploring the keyboard was the next goal. Concepts of high and low keys on the keyboard were explained. Finger numbers were presented to the children, assisted by the use of the clear illustrations found in the "Lessons" book, p. 6. All children could recognise numbers 1 through 5, so no extra training was required in number reading. Realising the division of the keyboard in sets of two and three black keys and orientation on the keyboard were next.

All the above were drilled with the exercises of the "Piano Theory Workbook – Book 1" (p. 2-5) in an amusing but simultaneously constructive manner. Many children could not distinguish left from right hand. It was therefore necessary to train them before issues that were more complex could be raised. This was done gradually. Special plastic bracelets were given to each child and were worn on the right wrist. It was easy then to improvise activities and games for the children to learn which hand was which. For instance, all children were asked to raise the hand with the bracelet. Then they were told that this was the right hand. Then they were asked to raise their right hands. Most children responded very well to these activities. Furthermore, the exercise asking for the sorting of mixed left and right hand outlines, taken from the "Piano Theory Workbook – Book 1", p. 10, was helpful.

All but four songs taught to the children had English lyrics. The instructor translated these in the Greek language, which made singing and memorisation easier and increased attractiveness. Translation was not literal. Instead, it was attempted to produce rhyming Greek lyrics with meanings close to the original English text or, when not possible, close to the illustration on the corresponding book page.

8.4.5.4. Unit One

After this preliminary work, keyboard playing started in the second week of lessons. The first song was a simple two-note song with clear rhythm ("climbing up/climbing down", Piano lessons, p. 8-9). Quarter notes are presented and explained as "pictures of sound". This piece calls for continuous hand alteration within a steady pulse. Distinguishing **which** hand plays **when** was the key issue involved in playing this song well. A simple code is used in the method: when the note-stems are directed down, the note shall be played with the left hand and when the note-stems are directed up, that note shall be played with the right hand. A useful exercise helped the children practice this before playing (Theory Workbook, p.11).

The middle (third) finger of each hand was used to play on two groups of two black keys. The third finger was used in a non-typical position for the piano, with the thumb placed behind the first joint of the third finger for support. This being the first guided contact with the keyboard, a positive first experience was of great importance. It is possible that the above described third finger use is proposed by the Hal Leonard Piano Method in order to ensure that all children, even those with the weakest fingers, will succeed in this first effort.

Improvisation on the newly taught two black keys was next. The accompaniment played by the teacher had a flowing character, differing greatly from the accompaniment of the first song that was rather sturdy. The student was asked to use the same alternating hand pattern learned, on a new basis. This was an important and, for most, difficult step for the children. They were asked to be flexible in a creative manner with only one constriction: they had to follow the accompaniment's steady pulse. Most children needed encouragement to play freely, while the teacher had the opportunity to observe the students' impulsive tendencies. From an empirical point of view, this was an important point as well. Each student combined all information given up to that point in a unique way. This personalised the learning experience for each child, contributing to individual self-paced learning within the group.

The set of three black keys served as the playing material of the next song, "My Dog, Spike". Simple mathematical thought was called for through questions like "how many sets of two black keys are there on your keyboard?", "how many sets of three black keys are there on your keyboard?" and also "are there more two black key sets or more three black key sets on your keyboard?". In the whole book, every time new elements are introduced, a brief description or explanation of them can be found in a shaded focus box on top of the page. Here the duration of the quarter (crotchet) note and the corresponding rest are displayed in two light-blue shaded boxes in the upper right-hand corner of the page.

After the new elements were explained and exercised, clapping and counting the new song was the new activity. Independent movement of the second (index), third (middle) and fourth (ring) left hand fingers was necessary for this song's performance. The introduction of rests was also a new element. All children were asked to gather around one keyboard where the teacher played the piece. After listening to the piece once, each child was asked to follow the music in the book with the index finger as the teacher repeated the music. This procedure was intended for establishing a temporal correlation between the written music text (visual stimulus) and the actual music progression (aural stimulus). It is a spatial-temporal procedure creating strong links between the visual (spatial) and the aural (temporal) stimulus. *The above exercise*, considered by the teacher to be of great importance, *was repeated for every new piece taught in the entire program.* Other exercises related to the above and also repeated for all subsequent pieces were singing the lyrics and pointing to the notes, tapping the rhythm while listening and counting aloud (one-one-one-rest-etc.) as the teacher played.

After this preparation, the children played the song quite easily, and most corrected themselves perfecting their performance within the time span of their lesson. The difference between moving up or down (stepping) and repeating a note was discussed. If the same finger played twice, it was "repetition". If the fingers played only once at a time, it was "stepping". This provided the children with a sense of direction and movement on the keyboard together with its representation on paper. To facilitate orientation, beginning with this song a keyboard graphic for finger placement can be found in the right-hand upper corner of every song-page in the book.

The next song, "Sorry, Spike", contains the exact musical contents as "My Dog, Spike" does. The only difference is that all in "Sorry, Spike" is played by the right hand alone as opposed to the left hand alone in "My Dog, Spike". Moving the three middle right-hand fingers independently proved not to be as demanding as following the finger numbering over each note. A possible reason might be that finger numbering is not left-to-right or right-to-left but from the centre outwards with the thumb being the first to count. A different (numbered) finger plays the "parallel" note. For example, the upper note should now be played with the fourth (right-hand) finger instead of the second (left-hand) finger previously.

Upon completion of both "Spike" songs, the pieces were performed as one song. Children played the song one by one and all together. This mini review served as a concentration duration test, which all children passed variously. Few were in position to play correctly the first time keeping pulse steady as they continued with the right hand on the second page. By the end of the lesson though, all had achieved this goal.

A new note value, the whole (semibreve) note, was the new rhythmic element of "Merrily We're Off To School". To emphasise the difference in size between the quarter and the whole note, children were asked to clap four quarters and then clap a whole note (four beats count). The equation is graphically shown in the shaded "new element" box of the page (p. 14). Flash cards of a quarter note, a quarter rest, a whole note and three cards containing combinations of the above were used to create and play games repeating the taught material (Hal Leonard Student Piano Library, Music flash cards-Set A, yellow number 2, 3, 4, 11, and 12).

Note clusters were explained as two or more notes played all together using the fingers indicated. The obvious intention of the method writers using clusters here was to mimic the horn sound of a school bus, which is pictured directly above the music. The children's response to the cluster sound was very positive, inducing laughter and making this one of their favourite pieces. Some children also liked this piece because they recognised the tune it is based on: "Mary had a little lamb".

"My Best Friend" was the next song of the method. Here the half (minim) note is presented in an analogous way to the whole note previously introduced. The song contains three different note values, making it a possible basis for arithmetic games. Quarter notes, half notes and whole notes were counted and their totals compared. The music was then practised in a manner similar to the previous songs adding flash card – yellow number 6 (depicting the half note). The inclusion of two lines of music on one page separated by a coloured line was also new.

The following song, "I Can Do It!" offers a first explanation of bars in music. According to the method, a bar is any "group of beats between two bar lines" while a "double bar line means the end of the piece" (Piano Lessons – Book 1, Hal Leonard Student Piano Library, p.17). The last new element of the first unit is the half note (minim) rest, shown in the shaded box of "Let's Get Silly!". Two new songs, "Water Lily" and "Mister Machine", taken from the "Piano Solos", Theory workbook's p. 12-13 and flash cards – yellow number 7, 13, and 14 were used together with the previously used flash cards to exercise acquired knowledge.

Closing the first unit, the songs "Night Shadows" and "Walking The Dog" were practised and theoretical review was concluded by composing rhythms (Theory workbook, p.14).

8.4.5.5. Unit Two

The second unit begins with the introduction of note names (white keys only) in English. Music borrows the first seven letters of the English alphabet to name its notes (A, B, C, D, E, F and G). Note names in Greek though are derived from the Italian solfegio singing practice and are named do, re mi, fa, sol, la and si. Hence, this lesson could not be taught precisely as printed. Certain adjustments were made in order to proceed. The music was used but the notes were sung with their Greek names. The children were pleased to discover where the notes, whose names they learned, were, and to play on the white keys. The third finger supported by the thumb was used again, and the upward and downward movement in steps (playing the nearest white key up or down respectively) was reviewed.

Improvisation using the C-D-E note-group helped the children become comfortable with the white keys. The thumb was used for the first time provoking complaints from many children. After repeated demonstration though, all children placed their thumbs and played in a correct manner. In consecutive lessons of unit 2, the dynamic signs *p* (piano = soft) and *f* (forte = loud), the repeat sign *:II* and the rest of the white keys (F-G-A-B note-group) were introduced as found in the lesson book. Theory book exercises (p. 16, 18, 22) and flashcards (pink number 2, 3, 4 and yellow number 15 and 16) aided to the above.

8.4.5.6. Unit Three

This is the shortest teaching unit. With just five songs, this unit attempts a smooth transition from pre-notation-reading in previous units to decoding and reading the grand staff in the next unit. In this unit, all songs are written in pre-notation, the only difference from before being that the English note name is written **inside** the note. The Greek children were not taught to read in English, so the note names in Greek were written in by hand in the lesson books despite the fact that many children did not read yet. The 4/4 time signature was explained beginning the third unit. All children responded well to this new concept. It should be noted though that all songs from the start had been in 4/4 meter, so the children were familiar to the division in 4/4 bars. One new symbol was introduced: that of a quarter note with an "x" instead of the normal filled circle connected to the note stem. This percussion symbol (meaning to knock on the piano cabinet or stomp) amused the children without troubling them.

Instead of presenting new symbols, this unit focused on preparing the children to read regular notes on the staff. While all previously learned material was put to practice, establishing a correlation between the notes' movement direction and the finger-movement direction was emphasised. That is most probably why the authors chose to leave the "Sea (C) Song" without lyrics, something encountered for the first time in this book. The "Sea (C) Song" was sung using the note names instead. As was intended, this helped the children recognise patterns and movement direction.

The three corresponding songs from the Piano Solos together with the four remaining songs from the lesson book were then practised in this unit. All techniques described above were used together with new flashcards (yellow number 9 and 17) and theory book exercises (p. 23,24).

8.4.5.7. Unit Four

Learning to read the musical staff was the issue of the fourth teaching unit. Line notes and space notes are depicted before the explanation of the structure and note placement on the staff. As suggested in the Teacher's Guide, children traced the pictures of the large line note and the large space note on this page with their index finger. Next, the staff's structure and note placement on the staff were explained. Direction of note movement already familiar through the previous songs was now presented on the staff. "My Dog, Spike" was played on white keys (F-G-A) but the title was not given. Most of the children recognised the tune and expressed their enthusiasm without being provoked, as the lesson book suggests. Exercises and games (theory book p.29 and flashcards, white, numbers 35-38) proved very useful to train all children adequately as to avoid confusion before continuing to the practical application of this knowledge.

The Bass clef sign was introduced first. The fourth line was named the "F" line. It was easy to detect this line because of two facts: it passes between the two dots of the Bass clef sign and it is coloured blue (the other four being black) in the book. Finding note names was then centred on the note's distance from the fourth (F) line. The note "F" served as a reading guide for the Bass clef. Luckily, the Bass clef's Greek name is "F clef", making this approach seem quite logical.

A symbol, the magnifying glass, was introduced. The note name was to be filled in every time it appeared in the book. The placement of the magnifying glasses proved to be strategic. They were at the spots where most children needed more time to think and stumbled. Hence, when filled in before playing they helped the children move on keeping a steady tempo.

The Treble clef sign was shown next. Most children recognised it. A similar approach was used, as explained above. The reading guide here was the second (G) line. Similar to the Bass clef example, the Treble clef's Greek name is "G clef", exactly because it indicates the position of the note "G".

After reading notes on each clef separately, the Grand Staff was presented as a "Musical Map" that tells which key to play. It was explained as the combination of the Bass and the Treble staff and middle C was shown and used as an auxiliary reading guide for the Grand Staff. A keyboard graphic in the lesson book (p. 42) helped children find the notes' position on their keyboards.

Until the end of the unit ten new songs, taken from both lesson and solos books, were played. This helped all children practice and improve note reading. Two dynamic symbols, *mf* (mezzo forte = moderately loud) and *mp* (mezzo piano = moderately soft), were the last taught symbols. All applicable drilling techniques described in previous units were used together with exercises (theory book, p. 31, 33 and 37) and flashcard (white 11-19, pink 5-8, yellow 18-21) games to improve children's comprehension.

8.4.6. Re-testing

Following the completion of the keyboard instruction program, all participating children were given the K-ABC for the second time. The post-testing procedure was identical to the pre-testing procedure described in detail above.

CHAPTER 9

RESULTS AND STATISTICAL ANALYSIS

Introduction

The main aim of this statistical analysis was to compare the children's scores before and after the piano-keyboard treatment. The age difference between the two testing sessions was approximately equal to six months. Hence, it was of special interest to measure the difference in the sub-test scores as reflected through their age equivalents. The later were calculated by converting the raw scores according to the relevant table provided together with the K-ABC materials (Table 6, p. 232, K-ABC Administration and Scoring Manual, Kaufman &Kaufman, 1983b).

The Kolmogorov-Smirnov test was used to compare the observed cumulative distribution function for a variable with normal distribution. This is a procedure which enables the testing of the assumption of normality of distribution, by comparing the observed distribution versus normal distribution. According to the histogram, the sample was **not** drawn from **normal distribution**. The significance level for all the tests was set below 0,05. Therefore, if a test shows a significance level greater than 0,05 the Null Hypothesis is accepted. Otherwise, it is rejected.

This chapter contains a series of tables and graphs which display in detail all findings produced by this study. The first section presents the analysis of the data gathered from the observation sheets completed individually for each child. This is followed by an analysis of absenteeism effect on improvement and an analysis according to class. In the final section, the K-ABC results are presented and analysed for improvement and according to gender.

9.1. Statistical analysis of the observation sheet data

During the piano-keyboard lessons, a non-participating observer (a musician, last-year university student in pre-school education) was present in the classroom who recorded student behaviours on pre-printed observation sheets. There were nine questions included on the observation sheet:

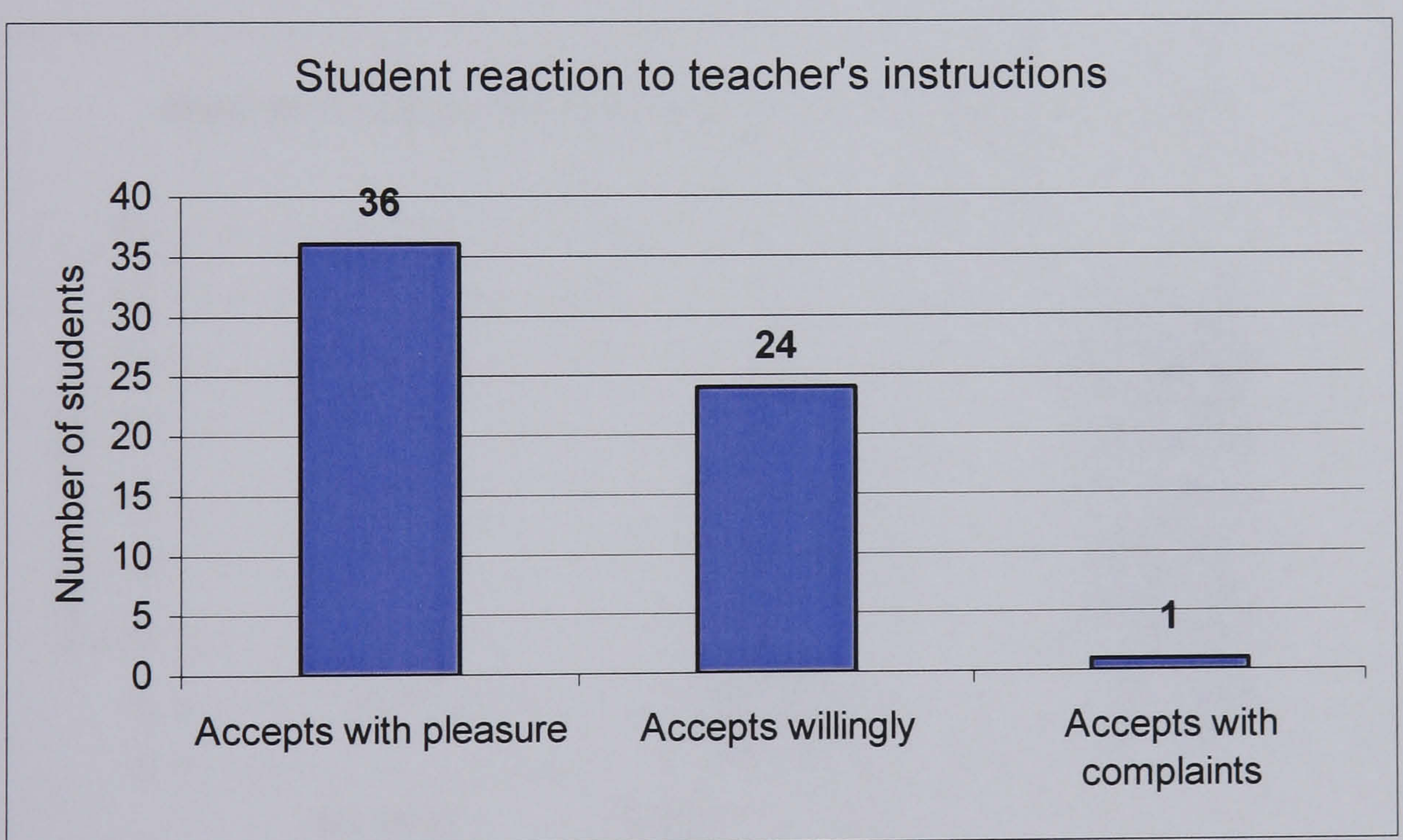
1. When the teacher began the activity, how did the student react?
2. Does the child take the initiative to engage in the activity alone?
3. How serious is the child towards the activity?
4. Which abilities can be observed:
   a. Counting of rhythmic values
   b. Ability to move fingers on the keyboard
   c. Co-ordination of note-reading and keyboard playing
   d. Playing with right and left hand (together)
   e. Improvisation
   f. Ability to read non-instructed musical text
5. Does the child seem to want to function independently?
6. How does the child behave within the group?
7. External factors that might have influenced the children's behaviour.
8. Does the child wait for the instructor's assistance to get involved in the activity?
9. How much attention does the child pay to the specific activity in which it is involved?

One observation sheet was completed for each child. All results were analysed except for answers to question 7, because the answers required speculation by the observer and therefore did not provide useful information on the children. Analysed results are presented in tables and graphs.

Results from the analysis of observations regarding the student' reaction to teacher's instructions (question 1) are presented in the following table and graph. Each student was placed in the category in which the student had attained the most positive marks during the entire training period. Following, simple percentages of children per category were calculated.

Table 1
Question 1:
Student reaction to teacher's instructions

	N	%
Accepts with pleasure	36	59,0
Accepts willingly	24	39,3
Accepts with complaints	1	1,6
Total	61	100,0

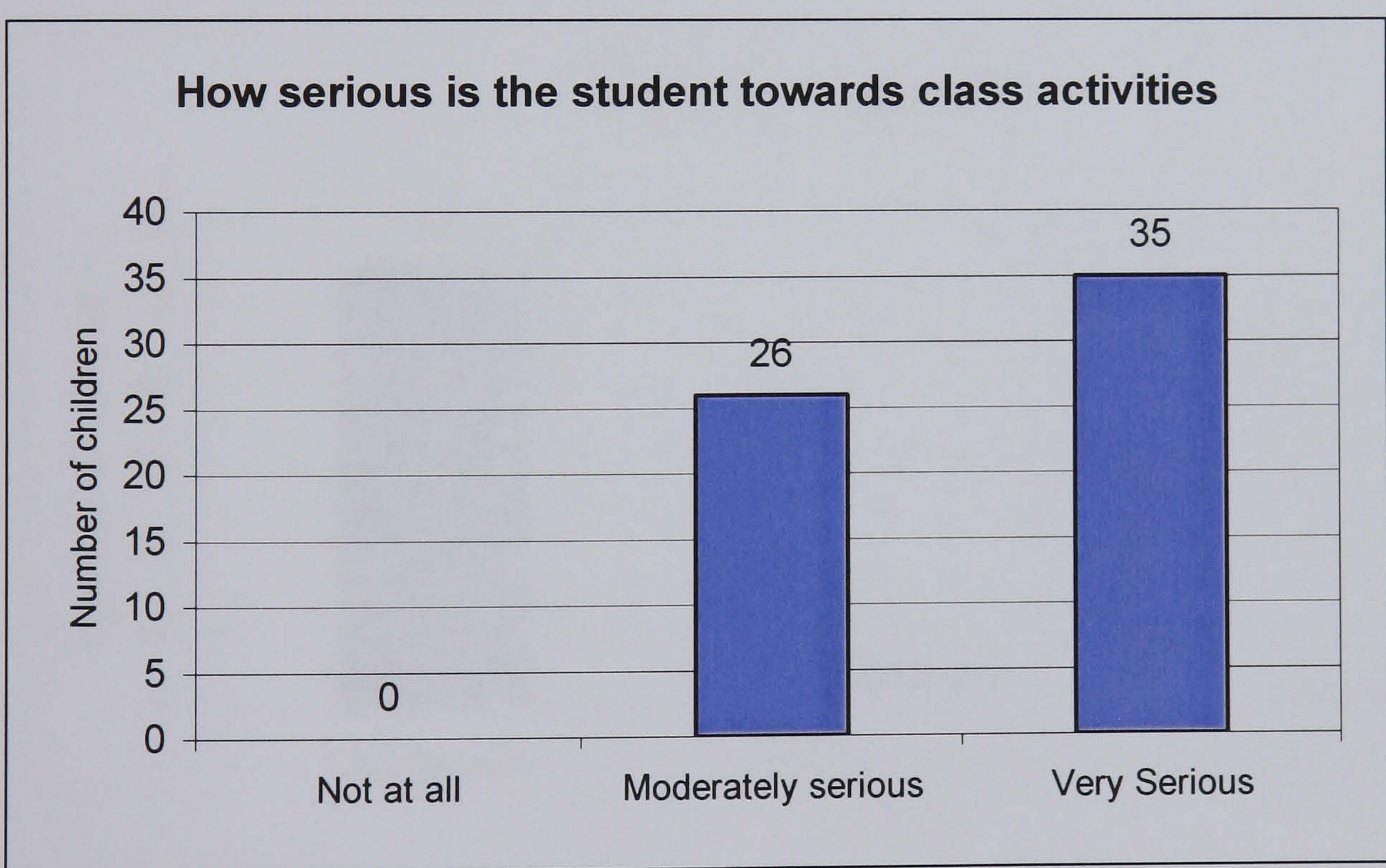


Graph 1
Student Reaction

Results from the analysis of observations regarding the student' seriousness towards class activities (question 3) are presented in the following table and graph. Each student was placed in the category in which the student had attained the most positive marks during the entire training period. Following, simple percentages of children per category were calculated.

Table 2
Question 3:
How serious is the child towards class activities

	N	%
Not at all	0	0
Moderately serious	26	42,6
Very serious	35	57,4
Total	61	100,0

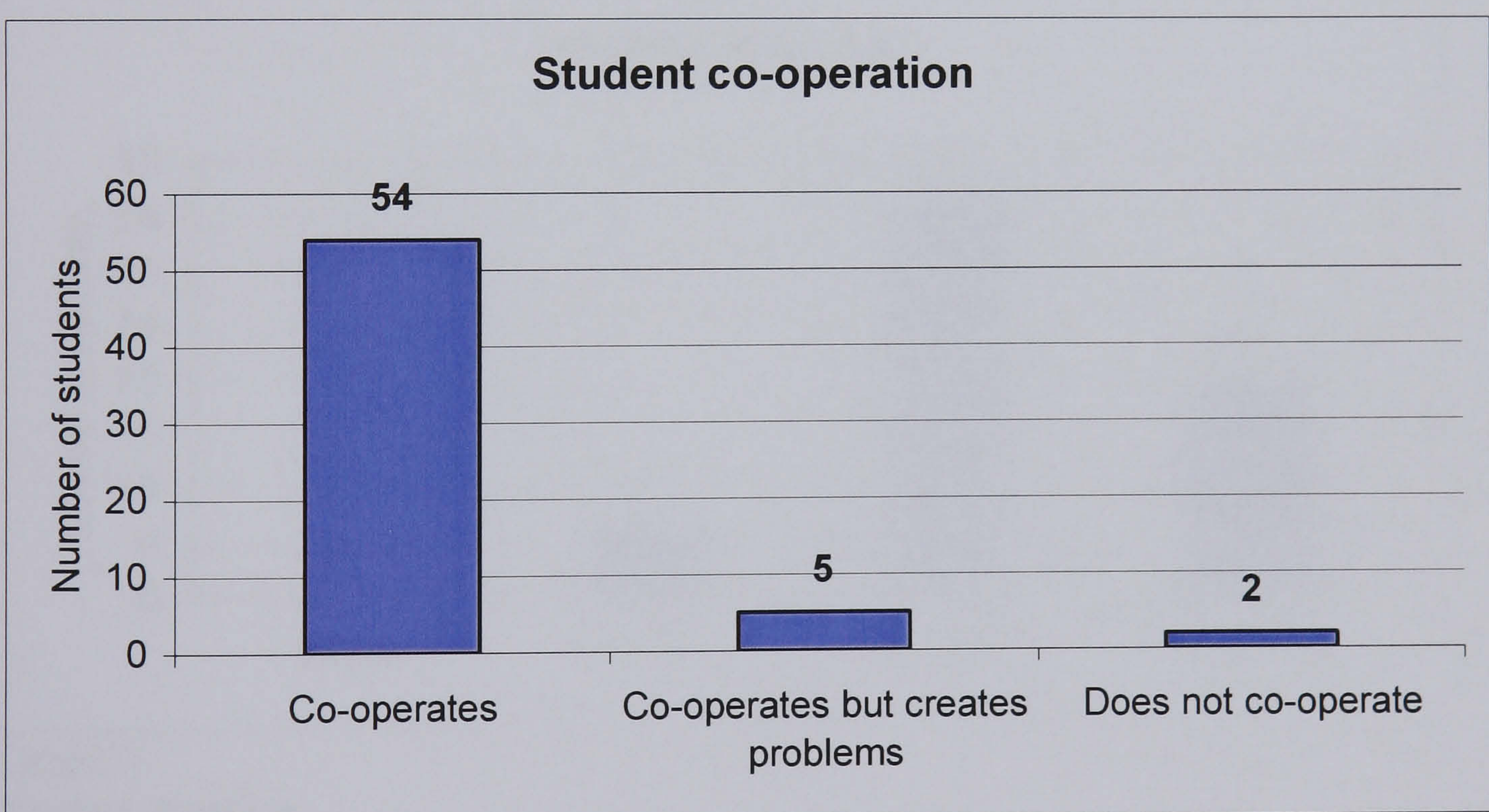


Graph 2
Child seriousness in class

Results from the analysis of observations regarding the student' co-operation and behaviour in the group (question 6) are presented in the following table and graph. Each student was placed in the category in which the student had attained the most positive marks during the entire training period. Following, simple percentages of children per category were calculated.

Table 3
Question 6:
Student co-operation

	N	%
Co-operates	54	88,5
Co-operates but creates problems	5	8,2
Does not co-operate	2	3,3
Total	61	100,0

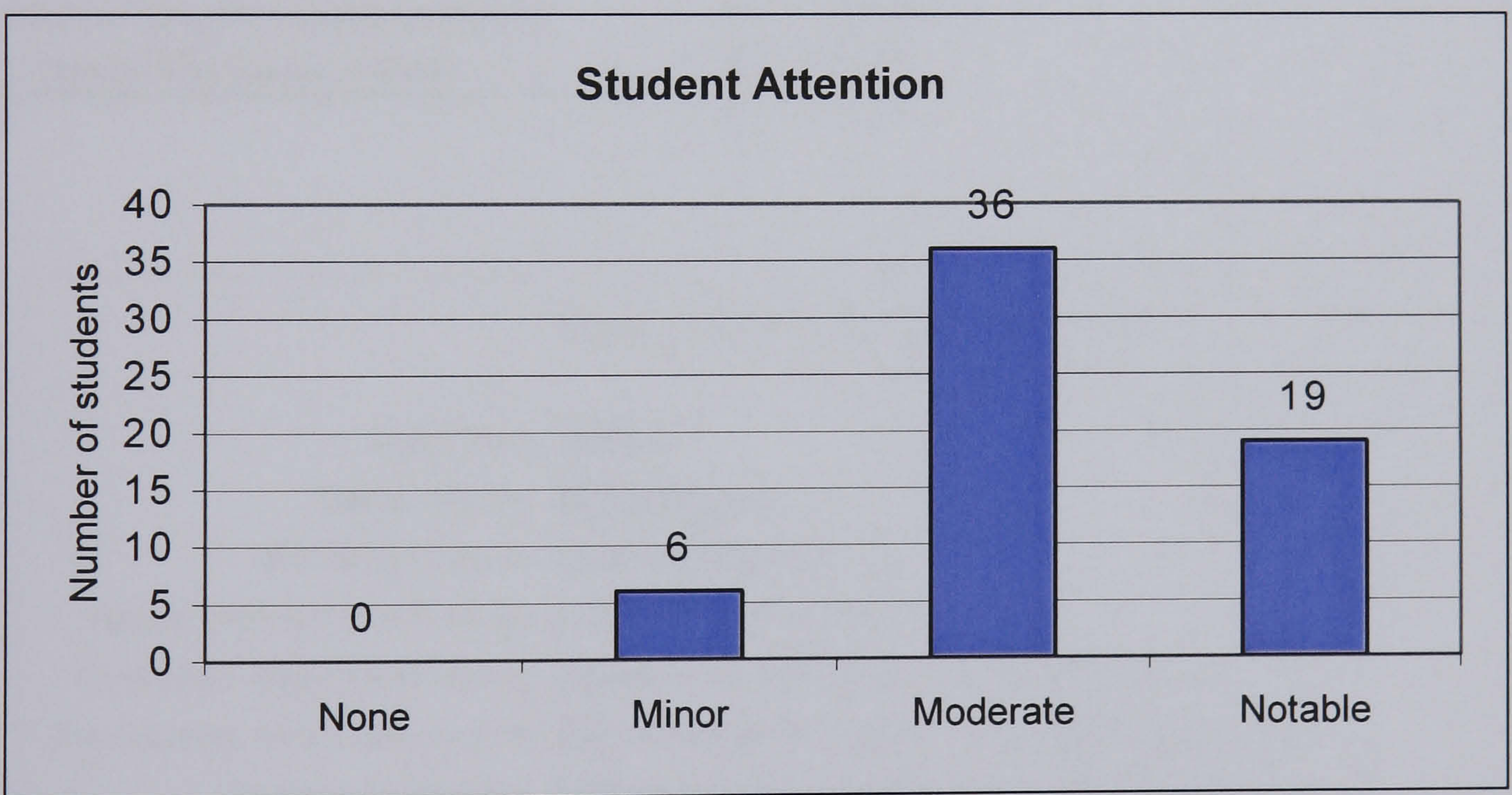


Graph 3
Student co-operation and behaviour within the group

Results from the analysis of observations regarding the student' attention (question 9) are presented in the following table and graph. Each student was placed in the category in which the student had attained the most positive marks during the entire training period. Following, simple percentages of children per category were calculated.

Table 4
Question 9:
How much attention does the child pay to the specific activity in which it is involved

	N	%
None at all	0	0
Minor	6	9,84
Moderate	36	59,01
Notable	19	31,15
Total	61	100,00

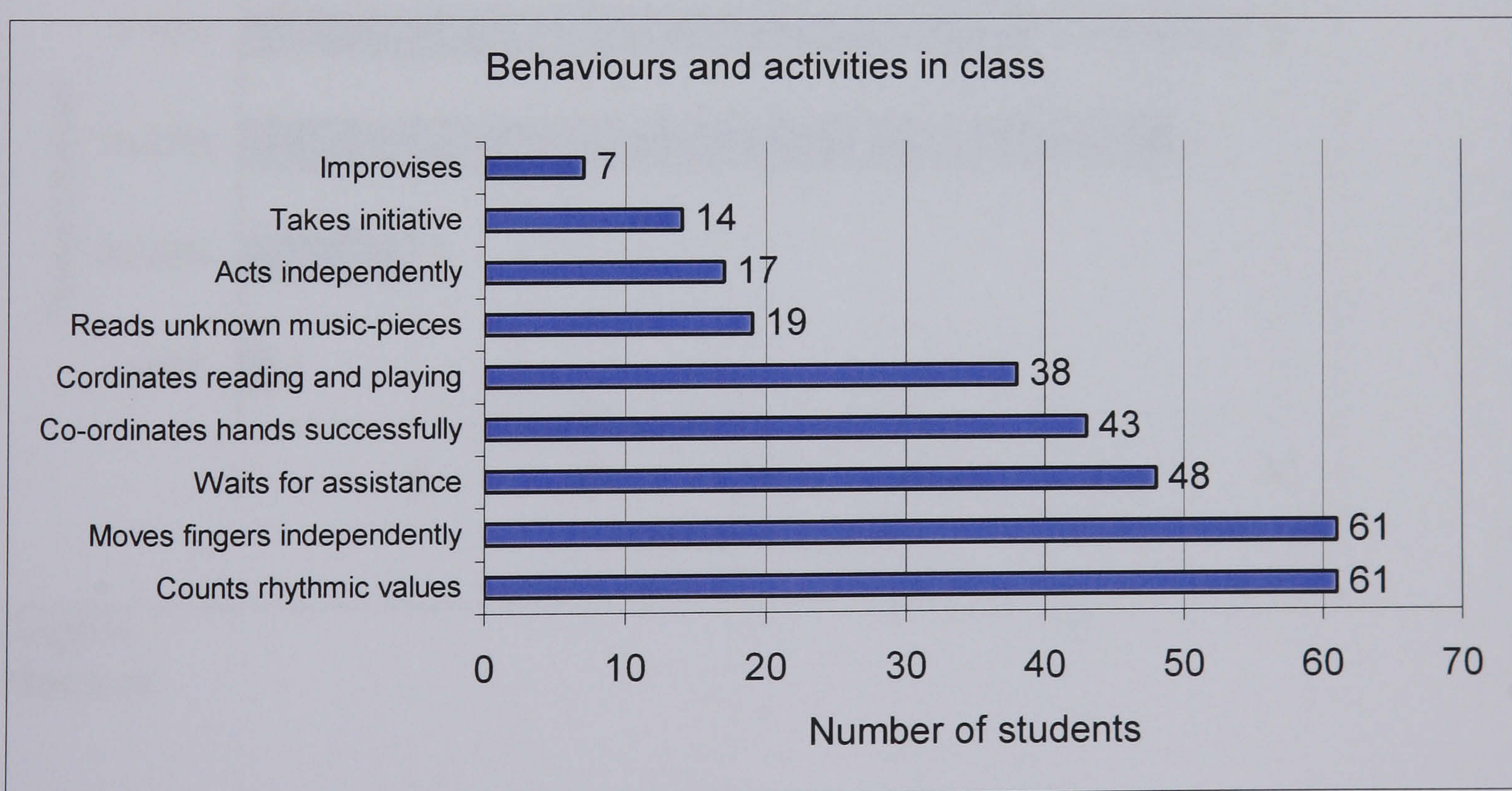


Graph 4
Student attention

Results from the analysis of observations regarding the student' improvisation, initiative, independence in class, music reading, hand co-ordination, need for assistance, independent finger movement and rhythmic value comprehension (questions 2, 4, 5, and 8) are presented in the following table and graph. Each student was placed in the category in which the student had attained the most positive marks during the entire training period. Following, simple percentages of children per category were calculated.

Table 5
Questions 2, 4, 5, and 8:
Behaviours and activities children engaged in during piano-keyboard instruction.

	N	%
Improvises	7	11,5
Takes initiative	14	23,0
Acts independently	17	27,9
Reads unknown music-pieces	19	31,1
Co-ordinates reading and playing	38	62,3
Co-ordinates hands successfully	43	70,5
Waits for assistance	48	78,7
Moves fingers independently	61	100,0
Counts Rhythmic values	61	100,0



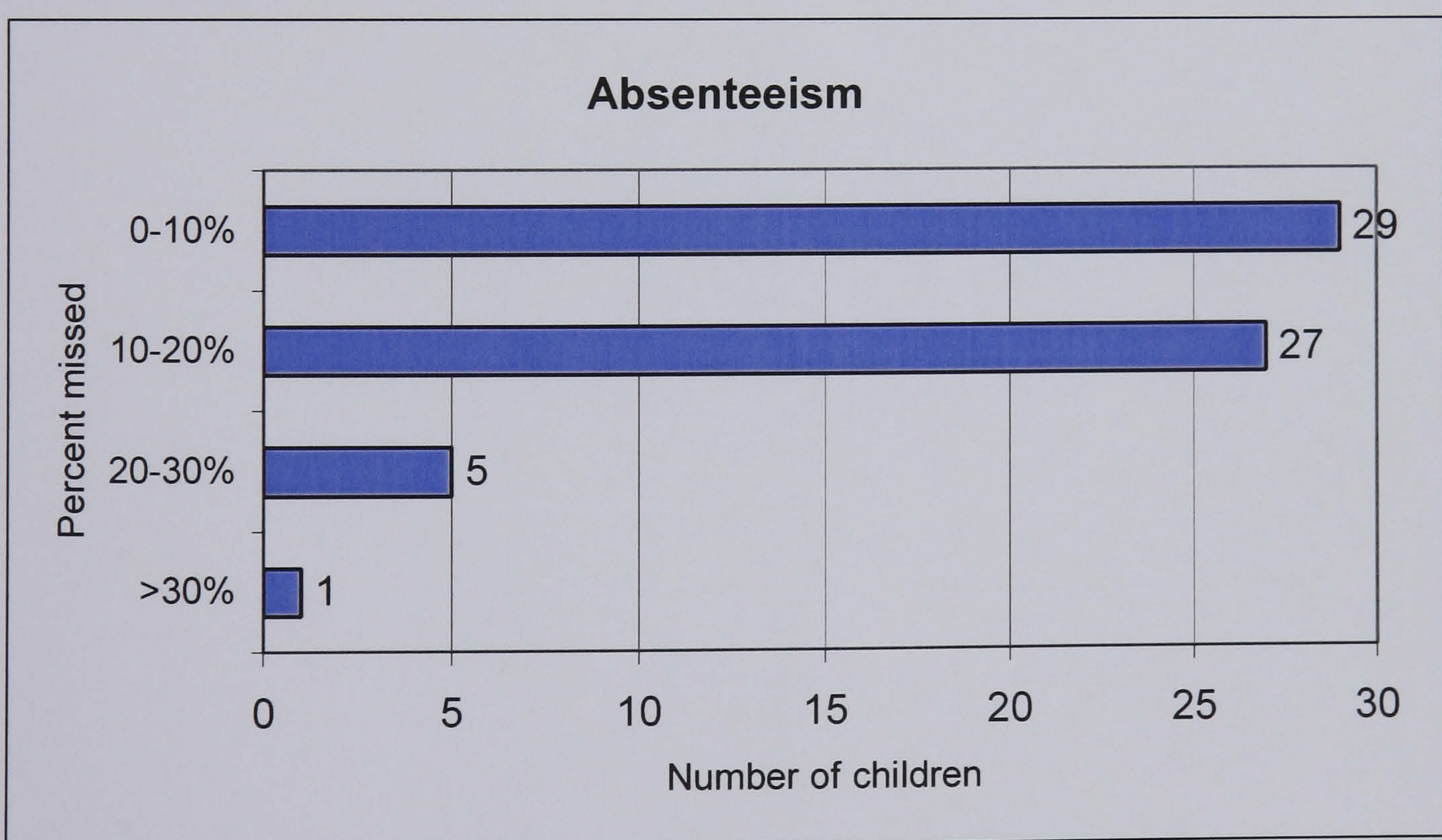
Graph 5
Children's behaviours and activities

9.2. Statistical analysis of significance for absenteeism

Kindergarten children are frequently absent from school because of illness or other reasons. Of those participating in this study, one child was absent for approximately thirty percent of the time. Five children did not attend twenty to thirty percent of the piano lessons and twenty-seven children missed between ten and twenty percent of the lessons. The above can be seen in table 21. Therefore, it was necessary to control for a possible effect of absenteeism on test scores.

Table 6
Absences

Percent of absences	Number of children
>30%	1
20-30%	5
10-20%	27
0-10%	29



Graph 6
Absences

For each age equivalent difference variable, the correlation coefficient with the variable of absences was calculated. Results are presented in table 22. All the correlation coefficients were not significant (p>0,05); i.e. there is no significant linear relationship between the variable of absences paired with any of the age equivalent difference variables.

Table 7
Pearson Correlation of age equivalent difference variables and absences

	Coefficient	Sig. (2-tailed)
Hand Movements age equivalent	-,166	,200
Gestalt Closure age equivalent	,004	,974
Triangles age equivalent	,109	,405
Matrix Analogies age equivalent	-,128	,324
Spatial Memory age equivalent	,175	,178
Arithmetic age equivalent	-,098	,453

9.3 Pre-test data

The following two tables 8a and 8b present the pre-test data for each sub-test and for each child individually.

Table 8a
Pre-test data (1)

Code	Sex	Age in months	Hand Movements age equivalent	Gestalt Closure age equivalent.	Triangles age equivalent	Matrix Analogies age equivalent	Spatial Memory age equivalent	Arithmetic age equivalent
1	M	68	72	81	90	72	75	75
2	F	60	66	45	75	66	81	60
3	F	60	66	51	54	48	60	51
4	F	67	60	48	72	72	69	63
5	M	70	72	75	66	78	99	78
6	F	61	60	48	90	72	81	69
7	M	68	81	60	96	66	75	69
8	M	63	72	48	75	54	81	54
9	M	69	54	42	48	66	60	57
10	M	70	66	39	66	66	66	75
11	M	63	99	96	96	87	87	78
12	M	66	99	45	78	66	75	75
13	M	66	66	57	54	72	63	75
14	F	65	54	45	54	48	66	57
15	M	61	72	51	96	78	69	72
16	M	61	81	51	75	72	63	69
17	F	68	72	48	90	72	93	63
18	M	61	60	57	54	66	87	57
19	M	61	48	48	63	48	51	48
20	M	66	90	69	78	87	81	84
21	F	58	66	60	75	66	75	66
22	F	58	60	57	66	87	93	66
23	F	61	54	69	96	66	81	57
24	M	67	81	48	66	78	81	75
25	F	68	81	66	90	78	93	72
26	F	59	90	51	90	78	66	66
27	F	60	60	66	111	60	75	63
28	F	66	90	48	78	78	81	69
29	F	62	90	39	66	66	66	81
30	M	69	66	42	57	66	48	66

Table 8b
Pre-test data (2)

Code	Sex	**Age** in months	**Hand Movements** age equivalent	**Gestalt Closure** age equivalent	**Triangles** age equivalent	**Matrix Analogies** age equivalent	**Spatial Memory** age equivalent	**Arithmetic** age equivalent
31	F	63	66	45	72	72	57	48
32	M	65	54	42	48	78	87	54
33	M	67	66	87	75	66	81	69
34	M	69	81	51	90	66	81	102
35	F	66	54	66	57	66	69	66
36	F	66	72	48	75	78	60	69
37	M	67	72	45	72	72	69	57
38	F	64	81	57	66	48	60	66
39	M	66	66	60	63	60	60	69
40	F	62	81	81	90	66	69	81
41	M	64	48	57	48	72	63	66
42	M	70	72	66	63	87	57	69
43	F	67	66	60	78	78	87	69
44	F	66	48	60	72	87	69	69
45	F	61	60	42	66	48	69	66
46	F	70	60	66	54	66	66	57
47	F	65	72	75	111	78	66	69
48	M	64	54	60	48	72	57	57
49	F	64	60	51	72	72	63	72
50	F	63	66	69	72	72	57	78
51	M	68	71	57	90	66	81	72
52	M	68	81	87	96	102	66	78
53	F	67	66	48	72	54	66	69
54	M	66	60	81	72	54	60	63
55	F	63	66	45	63	66	69	63
56	F	70	60	66	84	78	48	72
57	F	69	72	60	90	102	93	90
58	M	69	45	99	90	96	63	54
59	F	69	54	39	66	78	57	72
60	F	65	72	66	75	87	81	63
61	F	65	66	48	84	72	75	51

9.3.1. Nonverbal Scale scores

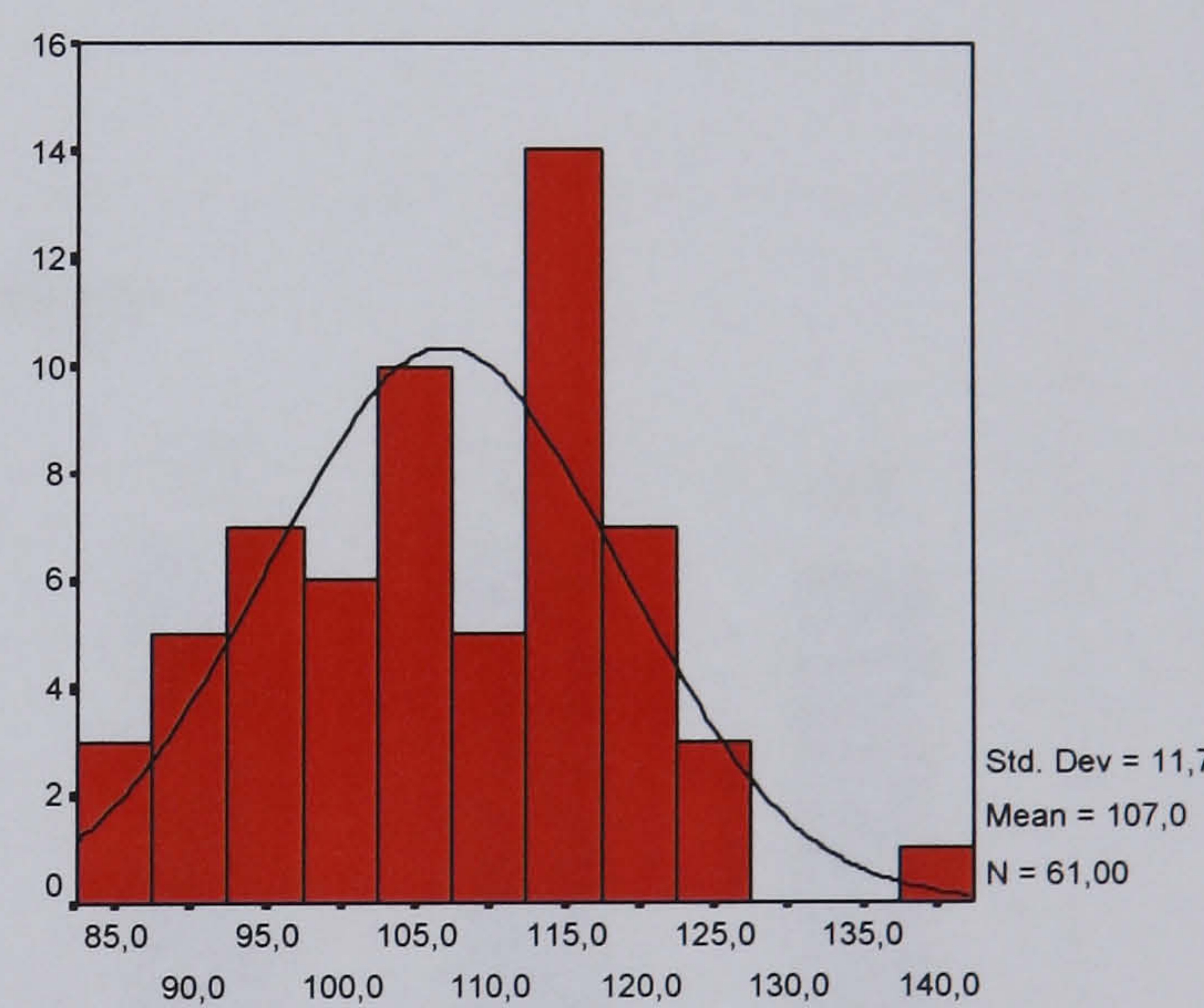
The Nonverbal Scale standard score (as described in section 8.3.5.) was computed for each child during pre-testing. Results are shown in tables 9 and 10 and graph 10.

Table 9
Descriptive Statistics for Nonverbal Scale scores

N	Minimum	Maximum	Mean	Std. Deviation
61	86,00	138,00	106,98	11,75

Table 10
Nonverbal Scale scores

	Frequency	Percent
86,00	1	1,6
87,00	2	3,3
89,00	4	6,6
91,00	1	1,6
93,00	1	1,6
94,00	1	1,6
96,00	4	6,6
97,00	1	1,6
98,00	4	6,6
101,00	2	3,3
103,00	4	6,6
105,00	3	4,9
106,00	3	4,9
110,00	3	4,9
112,00	2	3,3
113,00	7	11,5
115,00	3	4,9
117,00	4	6,6
119,00	2	3,3
121,00	5	8,2
123,00	2	3,3
127,00	1	1,6
138,00	1	1,6
Total	61	100,0



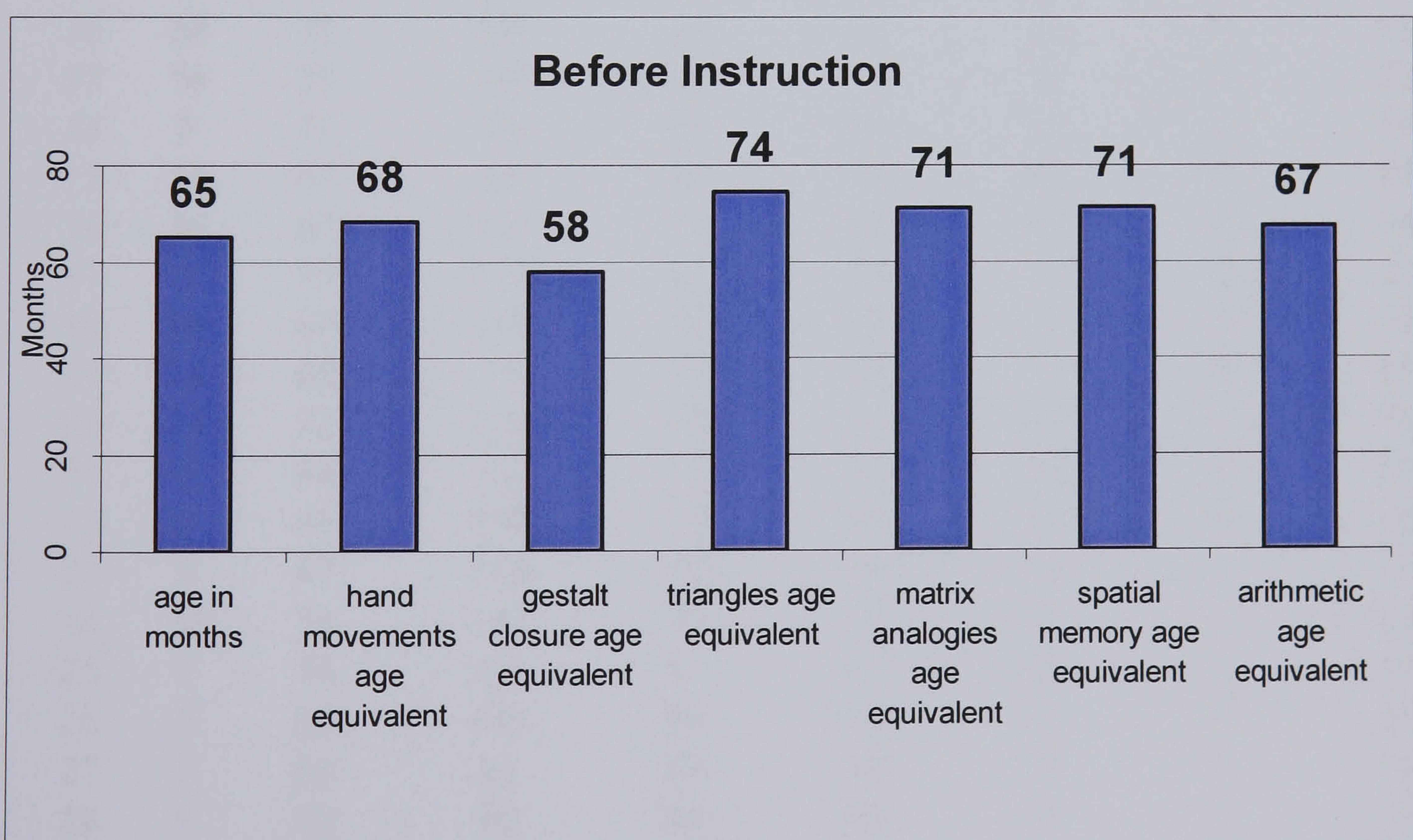
Graph 10
Nonverbal Scale standard scores

9.4. Descriptive Statistics of the pre-test data

The Descriptive Statistics table provides summary statistics for continuous, numeric variables. Summary statistics include measures of central tendency such as the mean, measures of dispersion (spread of the distribution) such as the standard deviation (S.D.) and the minimum and maximum values for each variable.

Table 11
Descriptive statistics of the pre-test data

	N	Min	Max	Mean	S.D.
Age in months	61	58	70	65,08	3,34
Hand movements age equivalent (in months)	61	45	99	68,20	12,38
Gestalt closure age equivalent (in months)	61	39	99	57,93	14,28
Triangles age equivalent (in months)	61	48	111	74,41	15,43
Matrix analogies age equivalent (in months)	61	48	102	71,11	12,15
Spatial memory age equivalent (in months)	61	48	99	71,26	12,01
Arithmetic age equivalent (in months)	61	48	102	67,38	10,02



Graph 11
Descriptive Statistics (before instruction)

9.5 Post-test data

The following two tables 12a and 12b present the post-test data for each sub-test and for each child individually.

Table 12a
Post-test data (1)

Code	Sex	Age in months	Hand Movements age equivalent	Gestalt Closure age equivalent	Triangles age equivalent	Matrix Analogies age equivalent	Spatial Memory age equivalent	Arithmetic age equivalent
1	M	73	114	105	150	102	99	105
2	F	66	99	57	90	72	87	90
3	F	67	72	60	84	78	75	57
4	F	73	81	48	90	78	75	81
5	M	76	141	105	90	78	123	75
6	F	67	72	57	96	96	111	81
7	M	74	150	87	96	78	93	93
8	M	68	114	81	96	78	87	72
9	M	75	99	69	90	72	75	66
10	M	76	150	39	90	60	75	78
11	M	69	99	105	111	87	99	93
12	M	72	141	60	90	72	75	81
13	M	71	90	60	84	78	69	72
14	F	71	72	69	90	72	63	69
15	M	67	87	66	90	87	99	84
16	M	67	150	51	96	87	75	69
17	F	75	114	81	90	72	93	93
18	M	66	114	69	78	78	75	72
19	M	68	72	57	72	72	66	69
20	M	72	150	102	90	87	111	99
21	F	64	72	75	72	66	93	69
22	F	65	150	75	96	87	87	75
23	F	67	114	105	90	78	111	75
24	M	74	141	75	90	102	87	84
25	F	74	66	81	90	96	111	90
26	F	66	141	96	90	78	87	69
27	F	66	81	69	90	78	81	84
28	F	73	90	69	90	78	93	75
29	F	68	72	69	90	60	81	81
30	M	75	90	57	90	87	69	78

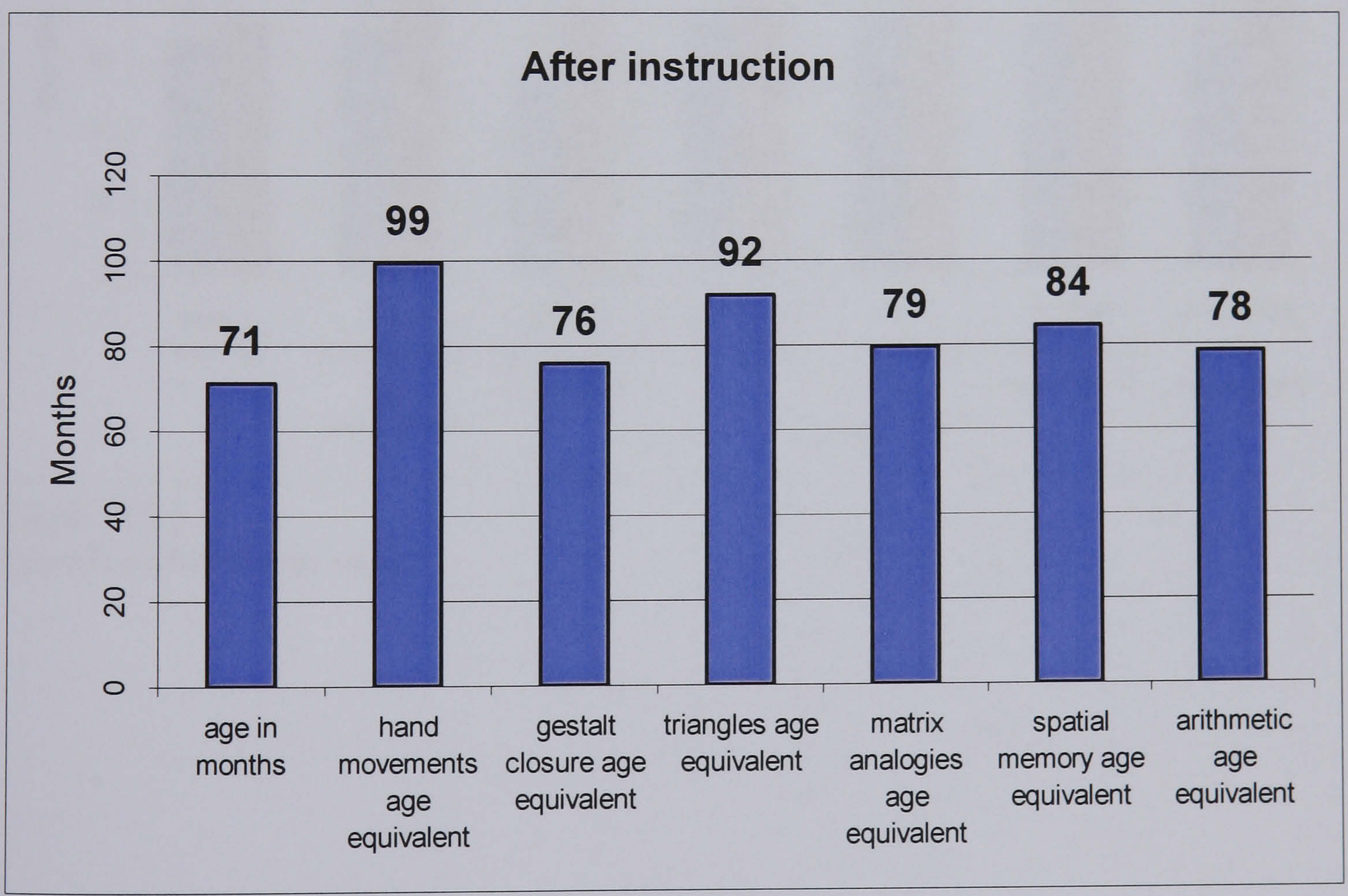
Table 12b
Post-test data (2)

Code	Sex	**Age** in months	**Hand Movements** age equivalent	**Gestalt Closure** age equivalent	**Triangles** age equivalent	**Matrix Analogies** age equivalent	**Spatial Memory** age equivalent	**Arithmetic** age equivalent
31	F	69	72	69	75	72	69	63
32	M	71	90	60	72	72	75	63
33	M	73	114	69	90	78	105	90
34	M	75	150	66	111	72	111	126
35	F	72	114	84	90	96	81	78
36	F	71	72	75	75	78	99	69
37	M	73	90	96	84	72	81	66
38	F	70	66	81	75	54	69	63
39	M	72	66	66	72	78	81	90
40	F	68	114	96	90	102	81	90
41	M	70	81	75	72	78	99	84
42	M	76	90	81	126	96	87	69
43	F	72	90	66	129	66	87	102
44	F	72	150	96	96	72	81	81
45	F	66	81	51	78	72	81	72
46	F	76	60	69	90	72	66	60
47	F	71	150	75	111	87	93	84
48	M	70	90	75	96	78	75	54
49	F	70	81	69	90	87	75	81
50	F	70	90	81	75	60	66	81
51	M	75	72	75	96	72	75	90
52	M	75	99	141	144	96	93	84
53	F	73	99	57	84	66	75	81
54	M	72	72	96	96	60	69	69
55	F	69	81	66	72	87	69	57
56	F	76	114	96	90	78	75	81
57	F	75	150	96	90	102	93	105
58	M	75	72	105	96	78	63	66
59	F	76	72	60	90	78	63	72
60	F	72	60	69	96	102	93	72
61	F	71	60	60	96	87	93	63

9.6. Descriptive Statistics of the post-test data

Table 13
Descriptive statistics of the post-test data

	N	Min	Max	Mean	S.D.
Age in months	61	64	76	71,16	3,36
Hand movements age equivalent (in months)	61	60	150	99,34	29,40
Gestalt closure age equivalent (in months)	61	39	141	75,74	18,27
Triangles age equivalent (in months)	61	72	150	91,77	15,37
Matrix analogies age equivalent (in months)	61	54	102	79,38	11,55
Spatial memory age equivalent (in months)	61	63	123	84,39	14,31
Arithmetic age equivalent (in months)	61	54	126	78,44	13,30

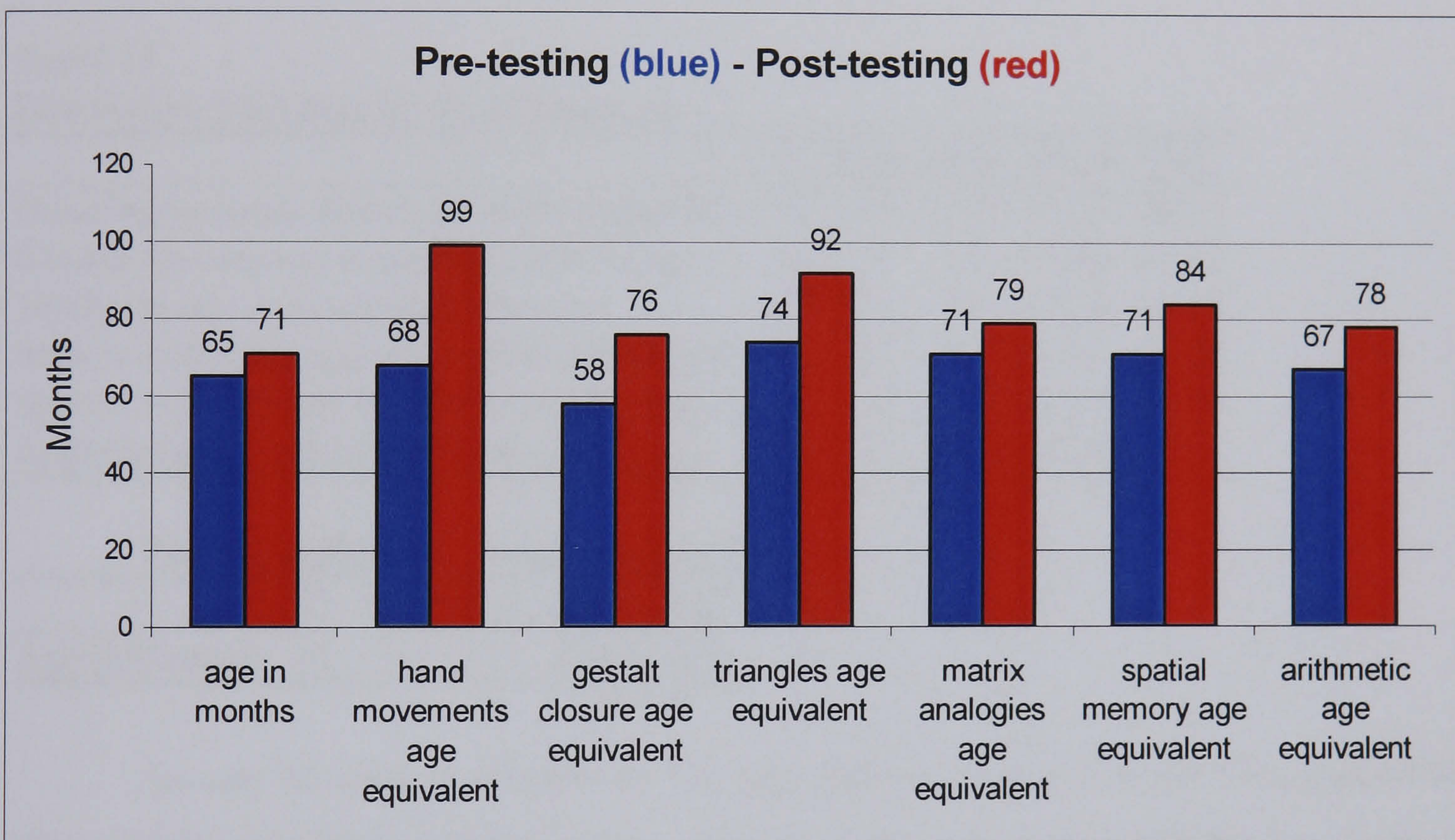


Graph 13
Descriptive statistics (after instruction)

9.7. Comparison of pre-instruction data and post-instruction data

Mean values for all variables increased between the two measurements. This increase though was not equal for all variables. The exact amount of increase, as well as its statistical significance, is presented in the following sections.

A direct comparison of the value of each variable at pre-testing and at post-testing is possible in Graph 11/13.



Graph 11/13
Pre-test and Post-test values

9.8. Descriptive Statistics of the differences

In order to directly measure the difference between pre- and post-test scores, the following procedure was necessary. Let X be the age equivalent variable with the values before treatment and let Y be the age equivalent variable with the values after the treatment:

Each value of the variable Z=Y-X equals to the difference observed between the values before and after the treatment. The descriptive statistics for these age equivalent difference variables are presented in Table 14.

Table 14
Descriptive Statistics of the differences

	N	Min	Max	Mean	S.D.
Hand movements age equivalent difference	61	-18	102	31,15	28,15
Gestalt closure age equivalent difference	61	-18	54	17,80	13,12
Triangles age equivalent difference	61	-21	63	17,36	16,58
Matrix analogies age equivalent difference	61	-18	36	8,26	11,84
Spatial memory age equivalent difference	61	-12	39	13,13	11,60
Arithmetic age equivalent difference	61	-6	33	11,07	9,03

The age difference is also presented:

	N	Min	Max	Mean	S.D.
Age difference	61	5	7	6,08	0,56

As can be seen in the above, the age difference between the two measurements does not exceed seven months and the smallest difference is five months. The mean value of age difference is 6,08 months with a standard deviation of 0,56. It is obvious that the greatest difference is observed for the variable "hand movements age equivalent difference" with a mean value of 31,15 months, while the smallest difference is observed for the variable "matrix analogies age equivalent difference" with a mean value of 8,26 months.

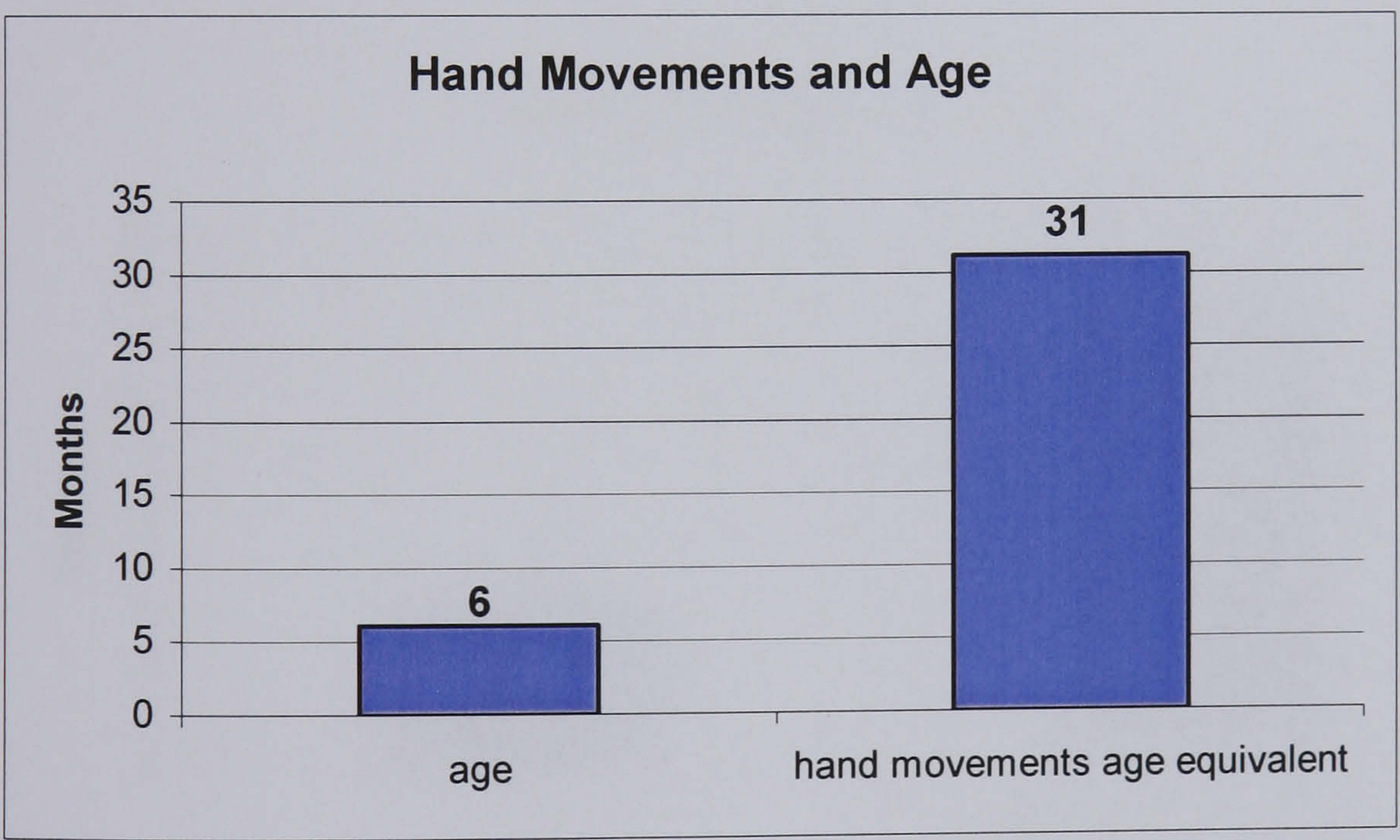
Following, the age equivalent difference variables with the age difference were compared. The variables were not normally distributed. Therefore, non-parametric tests were used. The Wilcoxon Signed-Rank is a non-parametric test that is used to detect differences in the distributions of two related variables. Each age equivalent difference variable was compared with the age difference using this test.

9.8.1. Hand Movements and age difference

The *Wilcoxon signed-rank test* was used. The difference between pre- and post-training scores for Hand Movements was significant (p<0,001) (Table 15). It was concluded that for Hand Movements there was a significant improvement for the mean values of the difference between the Pre-training and Post-training test scores and the age difference mean value.

Table 15
Age difference and Hand Movements age equivalent

Age in months			Hand movements age equivalent			
N	Mean	S.D.	N	Mean	S.D.	p
61	6,08	0,56	61	31,15	28,15	<0,001



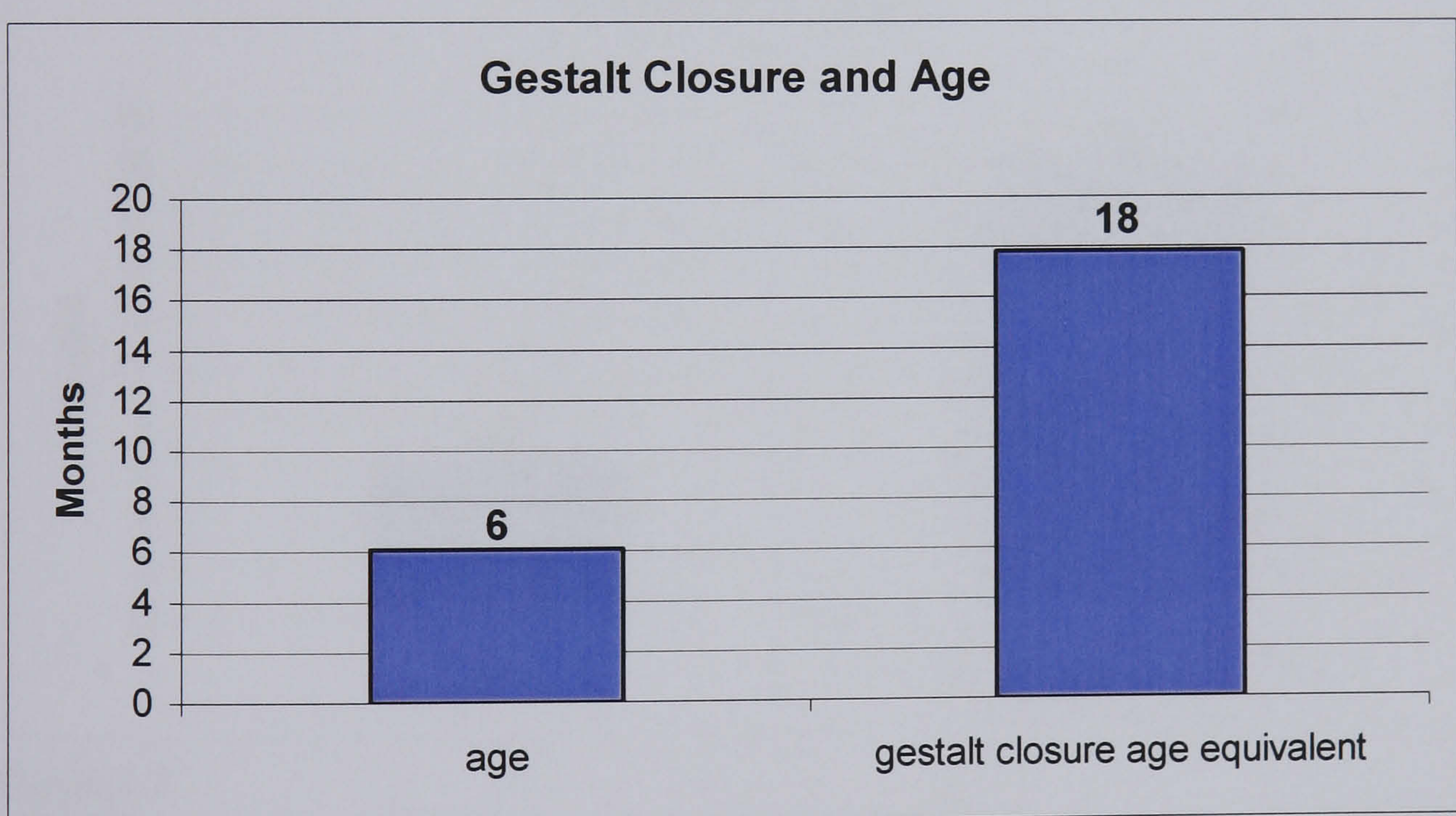
Graph 15
Comparison of the difference values of age and of the Hand Movements age equivalent

9.8.2. Gestalt Closure and age difference

The *Wilcoxon signed-rank test* was used. The difference between pre- and post-training scores for Gestalt Closure was significant (p<0,001) (Table 16). It was concluded that for Gestalt Closure there was a significant improvement for the mean values of the difference between the Pre-training and Post-training test scores and the age difference mean value.

Table 16
Age difference and Gestalt Closure age equivalent

Age in months			Gestalt closure age equivalent			
N	Mean	S.D.	N	Mean	S.D.	P
61	6,08	0,56	61	17,80	13,12	<0,001



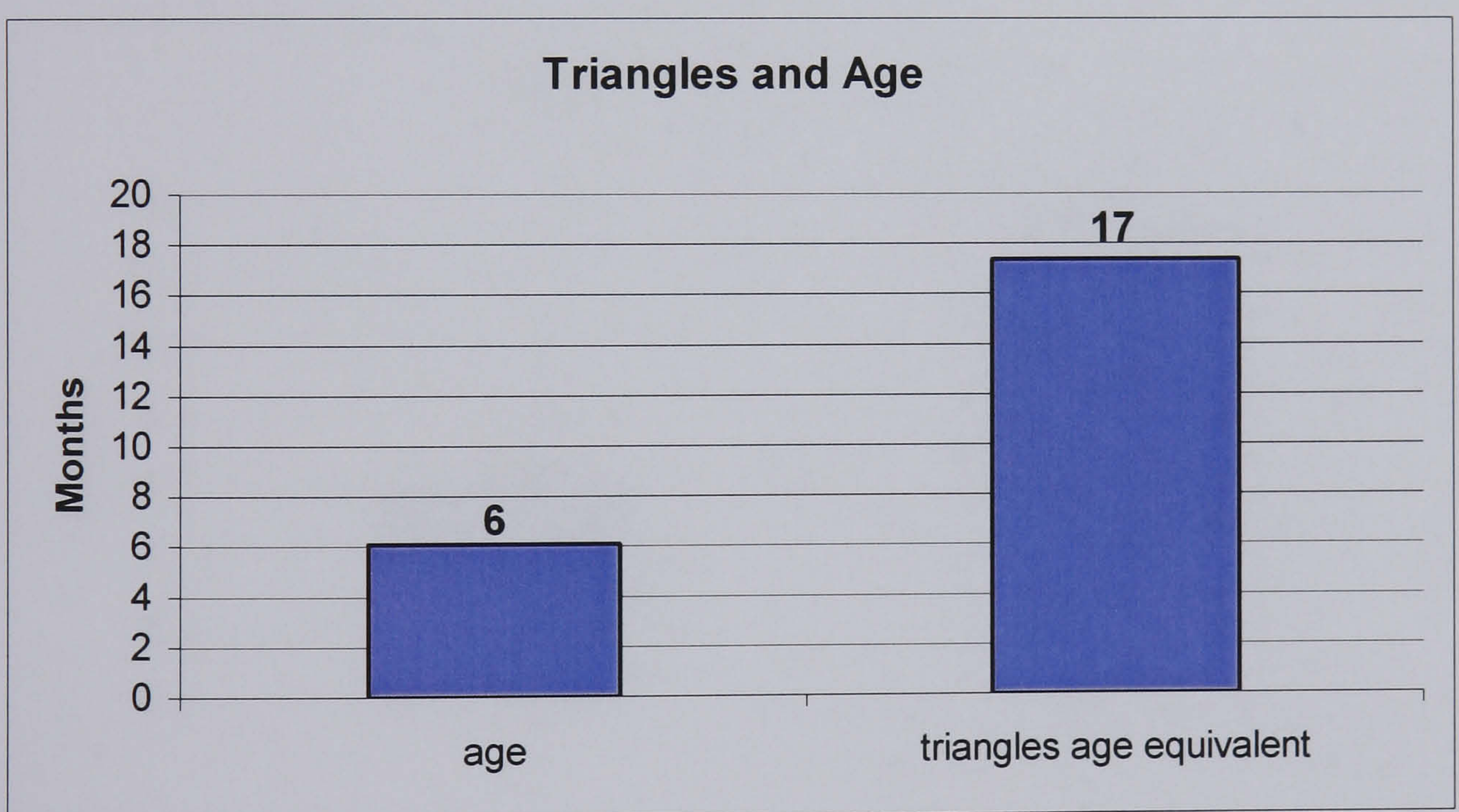
Graph 16
Comparison of the difference values of age and of the Gestalt Closure age equivalent

9.8.3. Triangles and age difference

The *Wilcoxon signed-rank test* was used. The difference between pre- and post-training scores for Triangles was significant (p<0,001) (Table 17). It was concluded that for Triangles there was a significant improvement for the mean values of the difference between the Pre-training and Post-training test scores and the age difference mean value.

Table 17
Age difference and Triangles age equivalent

Age in months			Triangles age equivalent			
N	Mean	S.D.	N	Mean	S.D.	P
61	6,08	0,56	61	17,36	16,58	<0,001



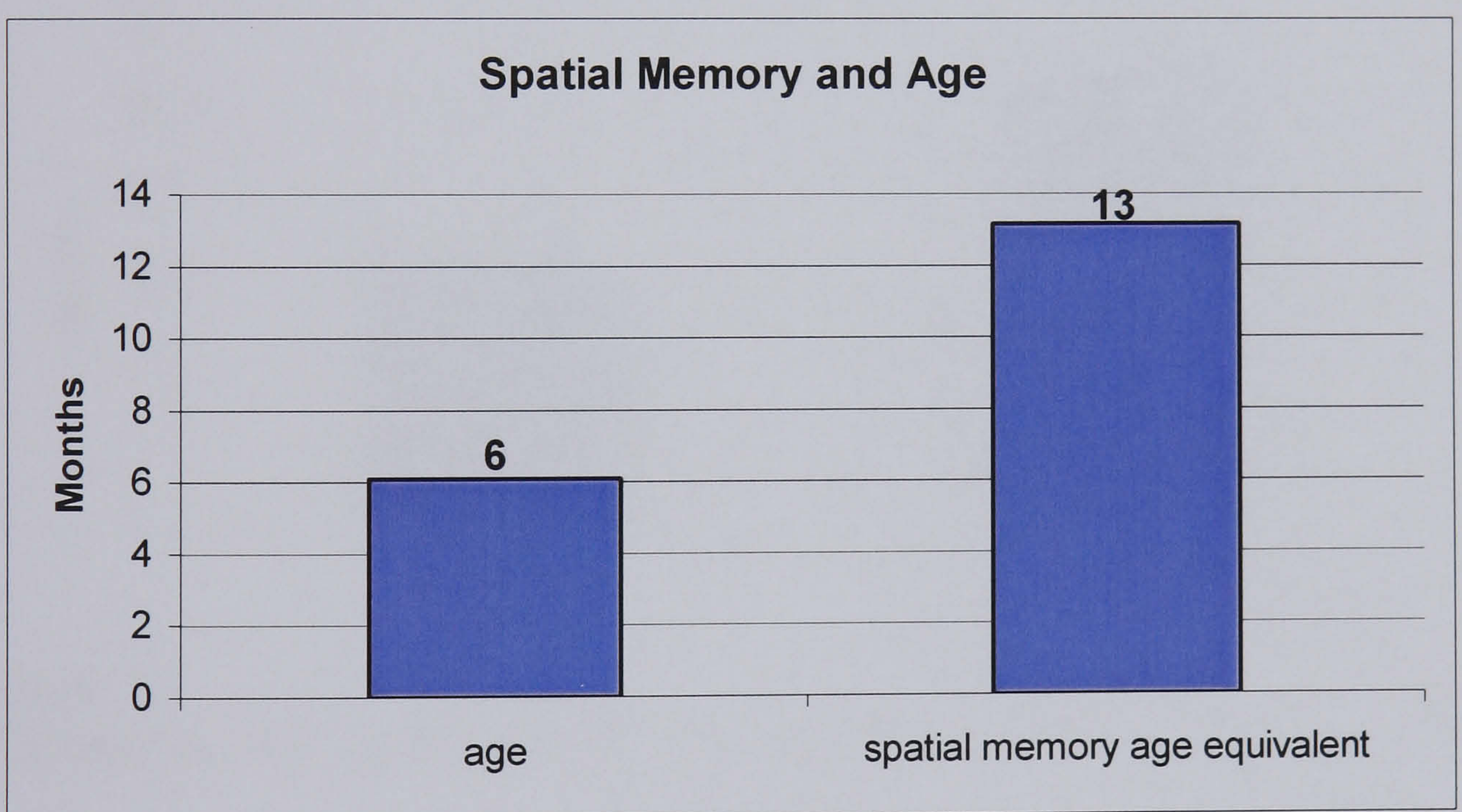
Graph 17
Comparison of the difference values of age and of the Triangles age equivalent

9.8.4. Spatial Memory and age difference

The *Wilcoxon signed-rank test* was used. The difference between pre- and post-training scores for Spatial Memory was significant ($p<0,001$) (Table 18). It was concluded that for Spatial Memory there was a significant improvement for the mean values of the difference between the Pre-training and Post-training test scores and the age difference mean value.

Table 18
Age difference and Spatial Memory age equivalent

Age in months			Spatial memory age equivalent			
N	Mean	S.D.	N	Mean	S.D.	p
61	6,08	0,56	61	13,13	11,60	<0,001



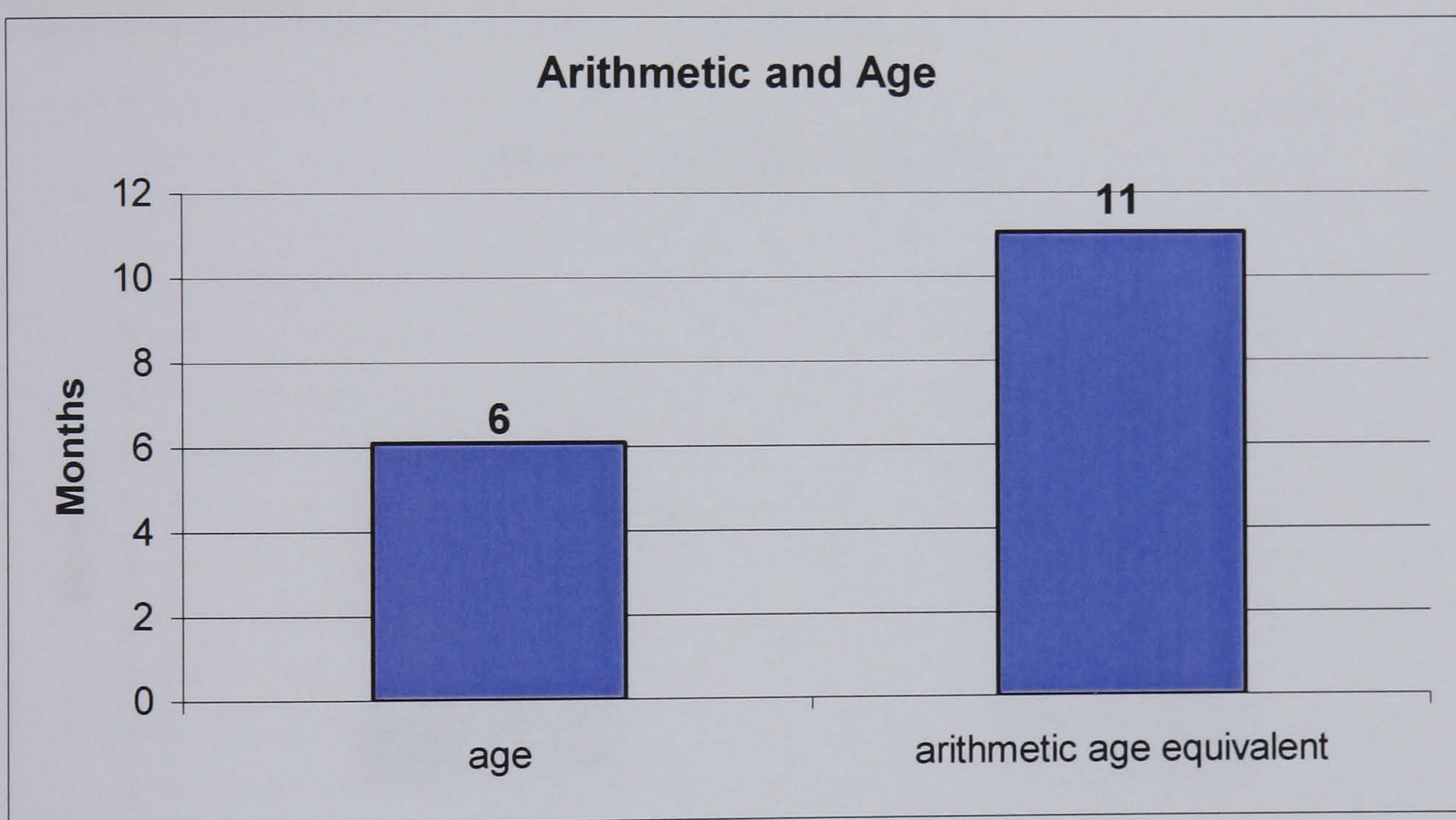
Graph 18
Comparison of the difference values of age and of the Spatial Memory age equivalent

9.8.5. Arithmetic and age difference

The *Wilcoxon signed-rank test* was used. The difference between pre- and post-training scores for Arithmetic was significant ($p<0,001$) (Table 19). It was concluded that for Arithmetic there was a significant improvement for the mean values of the difference between the Pre-training and Post-training test scores and the age difference mean value.

Table 19
Age difference and Arithmetic age equivalent

Age in months			Arithmetic age equivalent			
N	Mean	S.D.	N	Mean	S.D.	p
61	6,08	0,56	61	11,07	9,03	<0,001



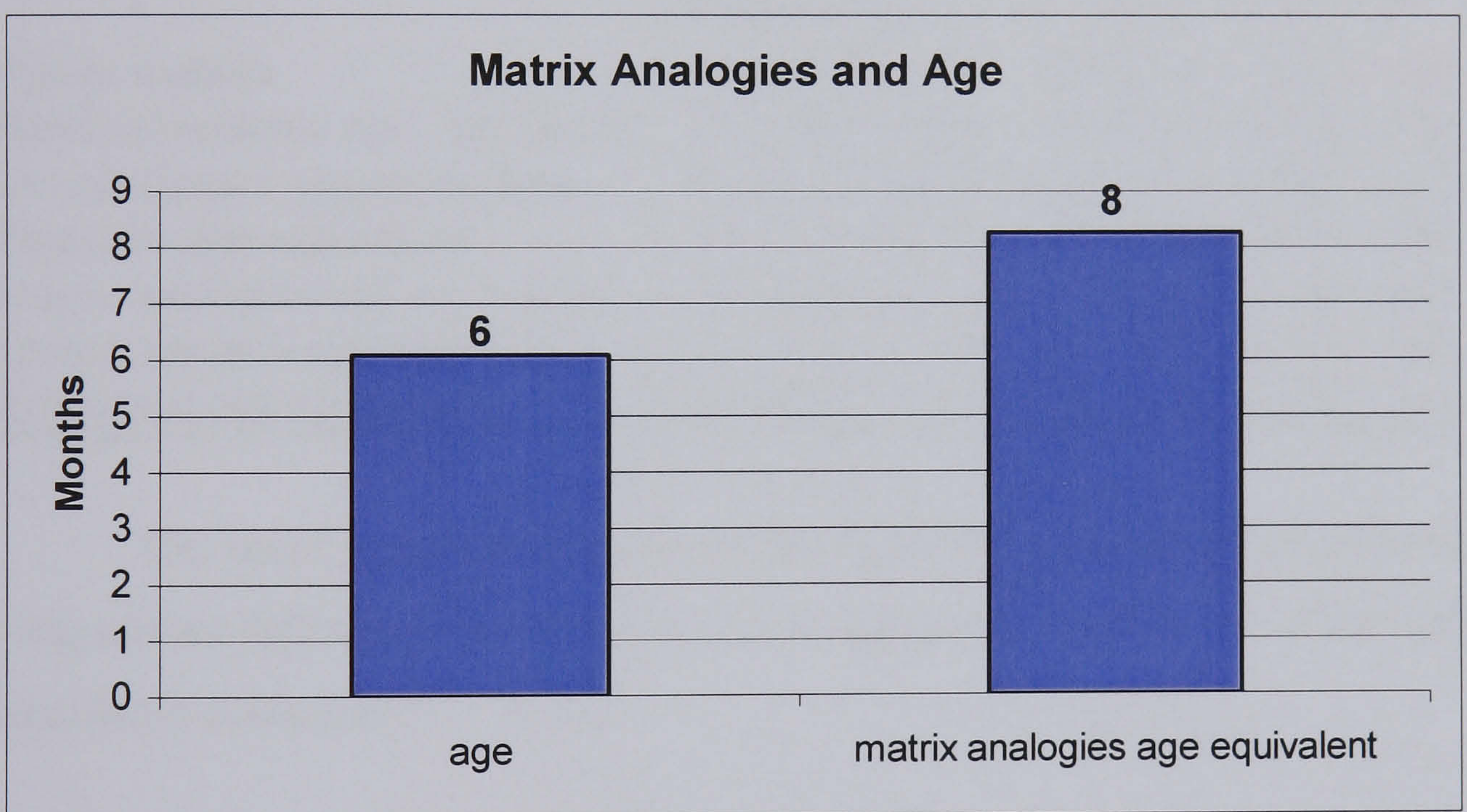
Graph 19
Comparison of the difference values of age and of the Arithmetic age equivalent

9.8.6. Matrix Analogies and age difference

The *Wilcoxon signed-rank test* was used. The difference between pre- and post-training scores for Matrix Analogies was **not** significant (p>0,05) (Table 20). It was concluded that for Matrix Analogies there was no significant improvement for the mean values of the difference between the Pre-training and Post-training test scores and the age difference mean value.

Table 20
Age difference and Matrix Analogies age equivalent

Age in months			Matrix analogies age equivalent			
N	Mean	S.D.	N	Mean	S.D.	p
61	6,08	0,56	61	8,26	11,84	0,185



Graph 20
Comparison of the difference values of age and of the Matrix Analogies age equivalent

Small significance values (less than 0,05) for the Wilcoxon test indicate that the two variables differ in distribution. The above results indicate that only the Matrix Analogies age equivalent difference does not differ significantly from the age difference.

9.9. Statistical analysis according to gender

Among the aims of this study was also to investigate possible gender differences. Therefore, all test results were also analysed for variation according to gender. Male and female groups were compared before treatment and after treatment. Additionally, the difference of the pre- and post-testing values was compared for the two genders.

The non-parametric Mann-Whitney test is used to compare two independent samples. Small significance values (less than 0,05) indicate that the two groups have different locations. Results are shown in tables 21a and 21b through table 29.

Table 21a
Statistical analysis according to gender before treatment

Before Treatment	Female			Male			
	N	Mean	S. D.	N	Mean	S. D.	P
Age in months	33	64,18	3,46	28	66,14	2,92	,024
Hand movements age equivalent	33	67,00	10,81	28	69,61	14,07	,359
Gestalt closure age equivalent	33	55,55	10,85	28	60,75	17,27	,432
Triangles age equivalent	33	76,55	14,51	28	71,89	16,36	,326
Matrix analogies age equivalent	33	70,45	12,30	28	71,89	12,15	,935
Spatial memory age equivalent	33	71,55	11,79	28	70,93	12,47	,804
Arithmetic age equivalent	33	66,45	8,78	28	68,46	11,37	,343

The small significance value ($p<0,05$) for the variable of age indicates that there is a significant difference between the age of males and females. No other variable shows significant difference.

Table 21b
Statistical analysis according to gender after treatment

After Treatment	Female			Male			
	N	Mean	S. D.	N	Mean	S. D.	P
Age in months	33	70,33	3,44	28	72,14	3,04	,039
Hand movements age equivalent	33	93,09	28,82	28	106,71	28,86	,045
Gestalt closure age equivalent	33	73,55	14,43	28	78,32	21,96	,522
Triangles age equivalent	33	89,09	11,01	28	94,93	19,03	,212
Matrix analogies age equivalent	33	79,00	12,47	28	79,82	10,56	,700
Spatial memory age equivalent	33	83,55	13,31	28	85,39	15,59	,776
Arithmetic age equivalent	33	77,09	11,75	28	80,04	14,99	,537

The small significance values ($p<0,05$) for the variables of age and of "Hand Movements age equivalent" indicate that there is a significant difference between males and females for these variables. No other variable shows significant difference.

9.9.1. Gender differences in improvement

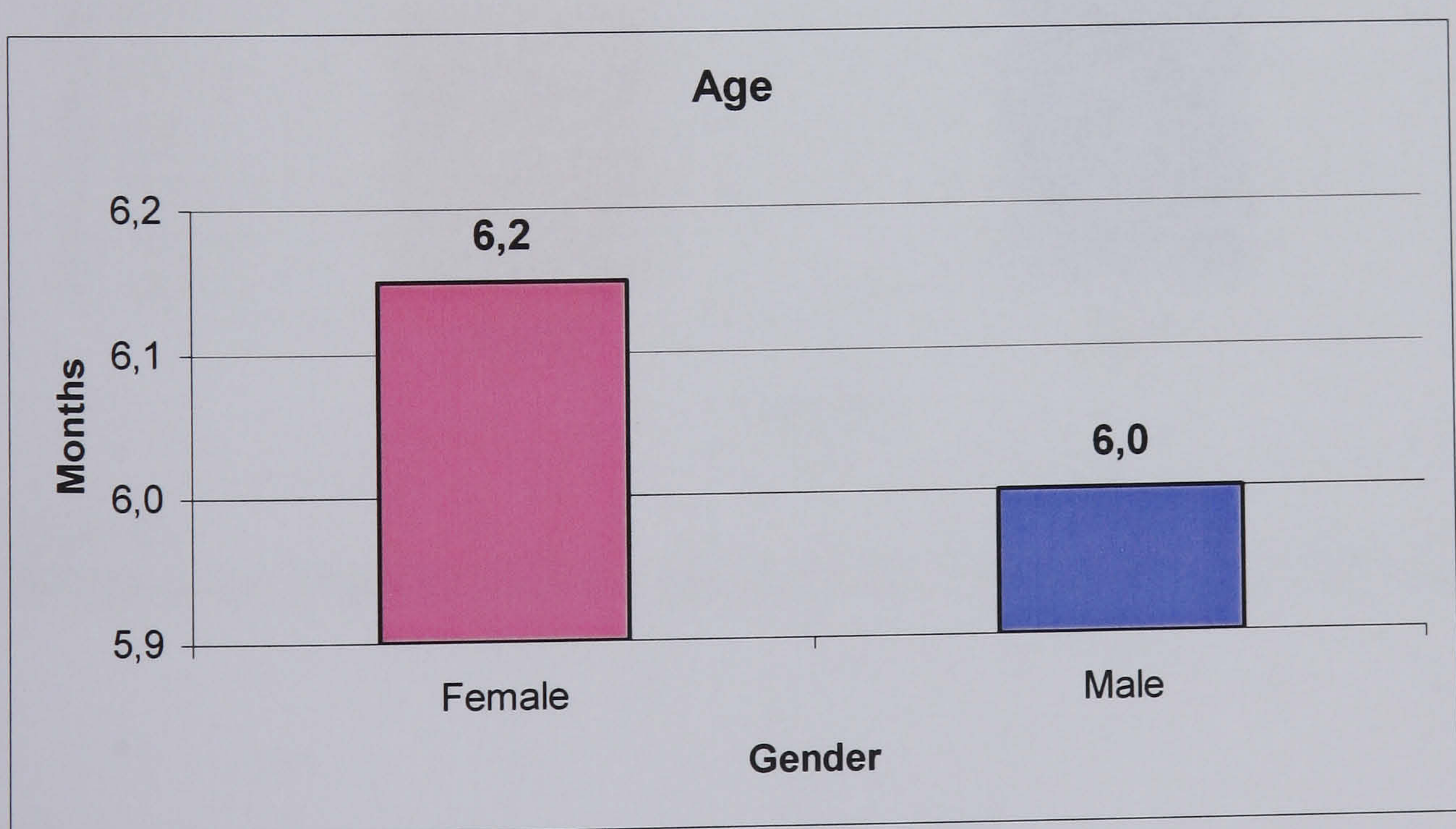
Gender differences in improvement were examined by comparing variation in boys' and girls' test scores after the music instruction, for each skill separately.

9.9.1.1. Gender differences in Age

The *Mann-Whitney test* was used. The difference between pre- and post-training for Age was not significant (p>0,05) (Table 22). It was concluded that for Age there was no significant difference between boys and girls for the mean values of the difference between the Pre-training and Post-training testing periods.

Table 22
Gain values in age

Gender	Female			Male			
	N	Mean	S. D.	N	Mean	S. D.	P
Age in months	33	6,15	,57	28	6,00	,54	,287



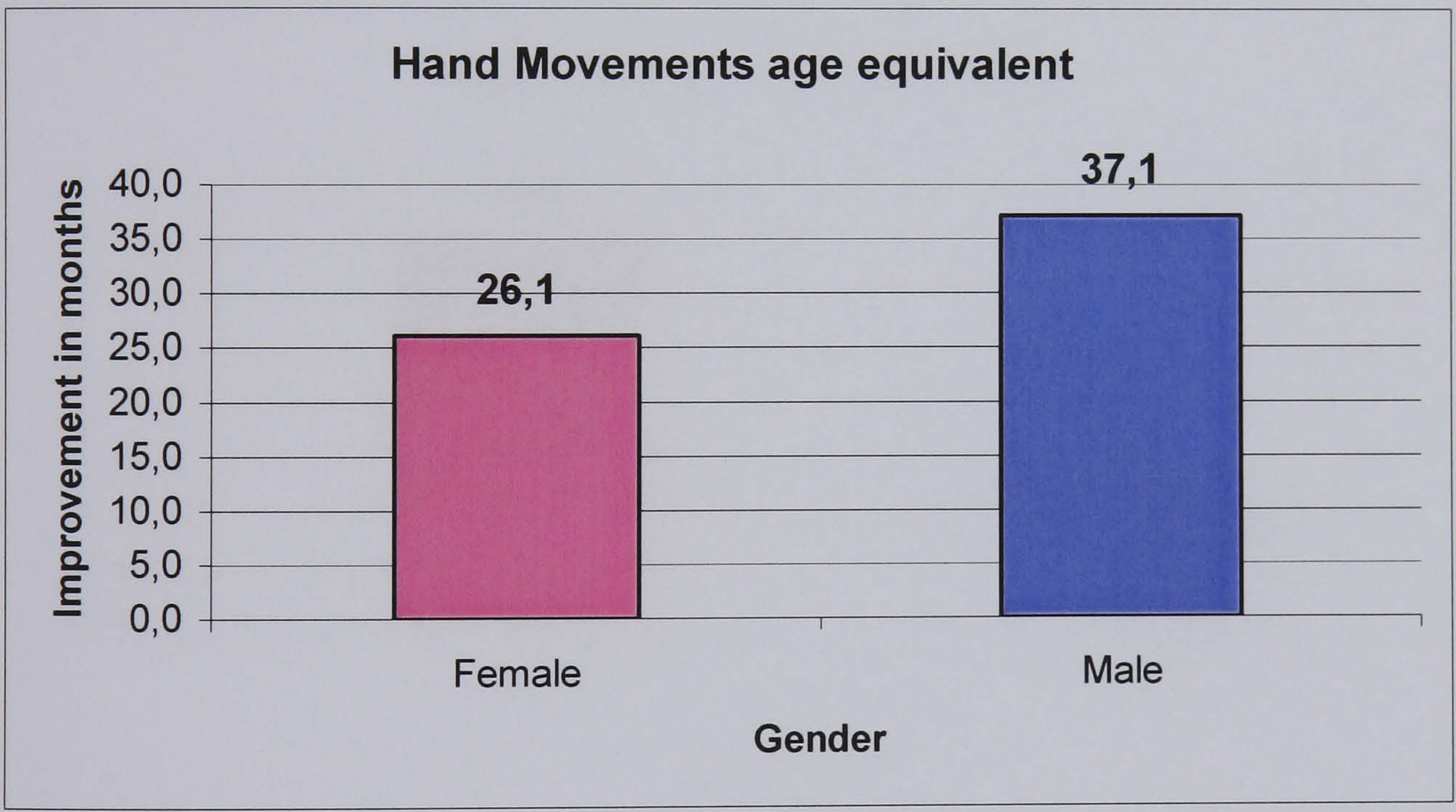
Graph 22
Difference for "Age" between boys and girls (in months)

9.9.1.2. Gender differences in Hand Movements

The *Mann-Whitney test* was used. The difference between pre- and post-training scores for Hand Movements was not significant ($p>0,05$) (Table 23). It was concluded that for Hand Movements there was no significant difference between boys and girls for the mean values of the difference between the Pre-training and Post-training testing periods.

Table 23
Gain values in Hand Movements

Gender	Female			Male			
	N	Mean	S. D.	N	Mean	S. D.	P
Hand Movements age equivalent	33	26,09	31,10	28	37,11	23,38	,060



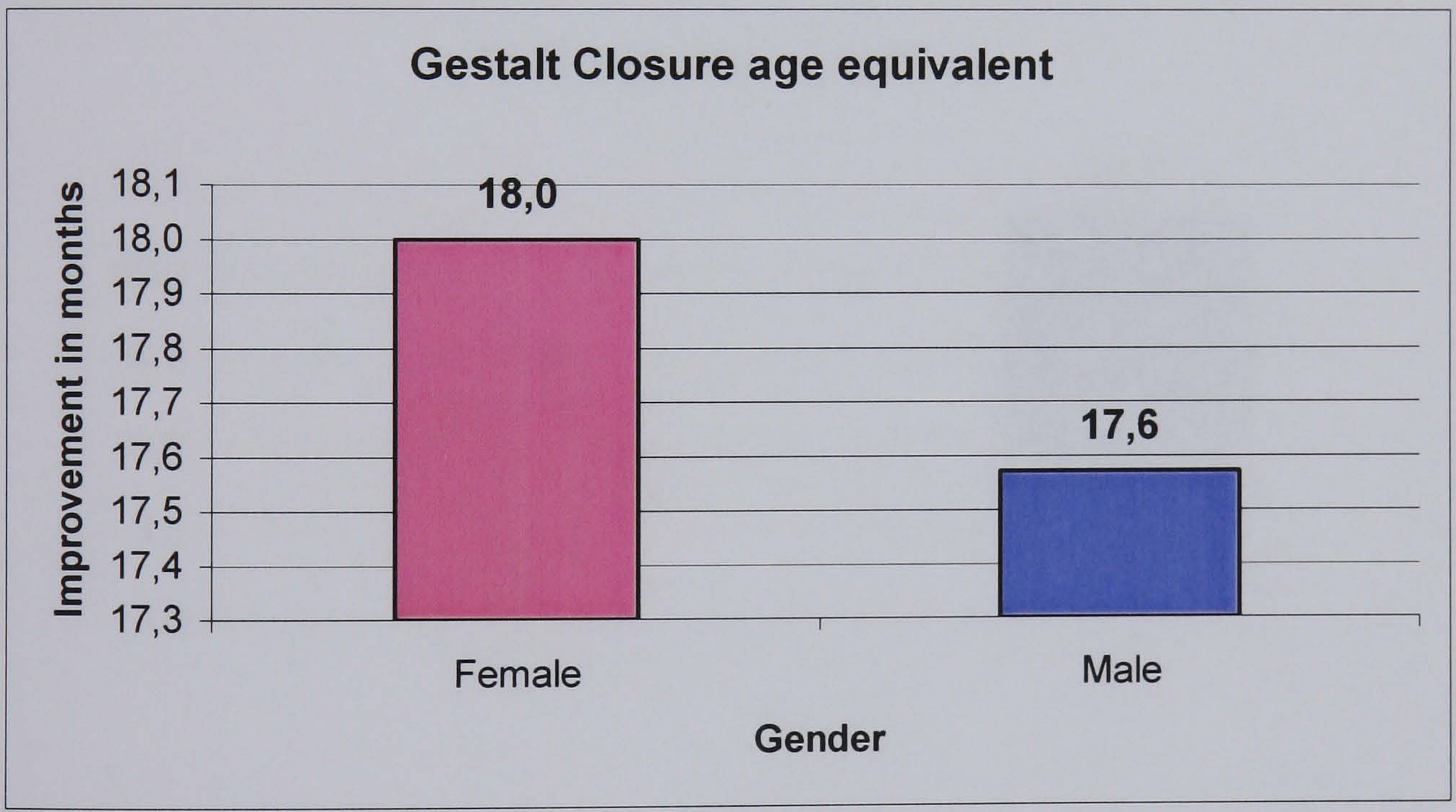
Graph 23
Difference for "Hand Movements age equivalent" between boys and girls (in months)

9.9.1.3. Gender differences in Gestalt Closure

The *Mann-Whitney test* was used. The difference between pre- and post-training scores for Hand Movements was not significant (p>0,05) (Table 24). It was concluded that for Gestalt Closure there was no significant difference between boys and girls for the mean values of the difference between the Pre-training and Post-training testing periods.

Table 24
Gain values in Gestalt Closure

Gender	Female			Male			
	N	Mean	S. D.	N	Mean	S. D.	P
Gestalt Closure age equivalent	33	18,00	11,67	28	17,57	14,87	,839



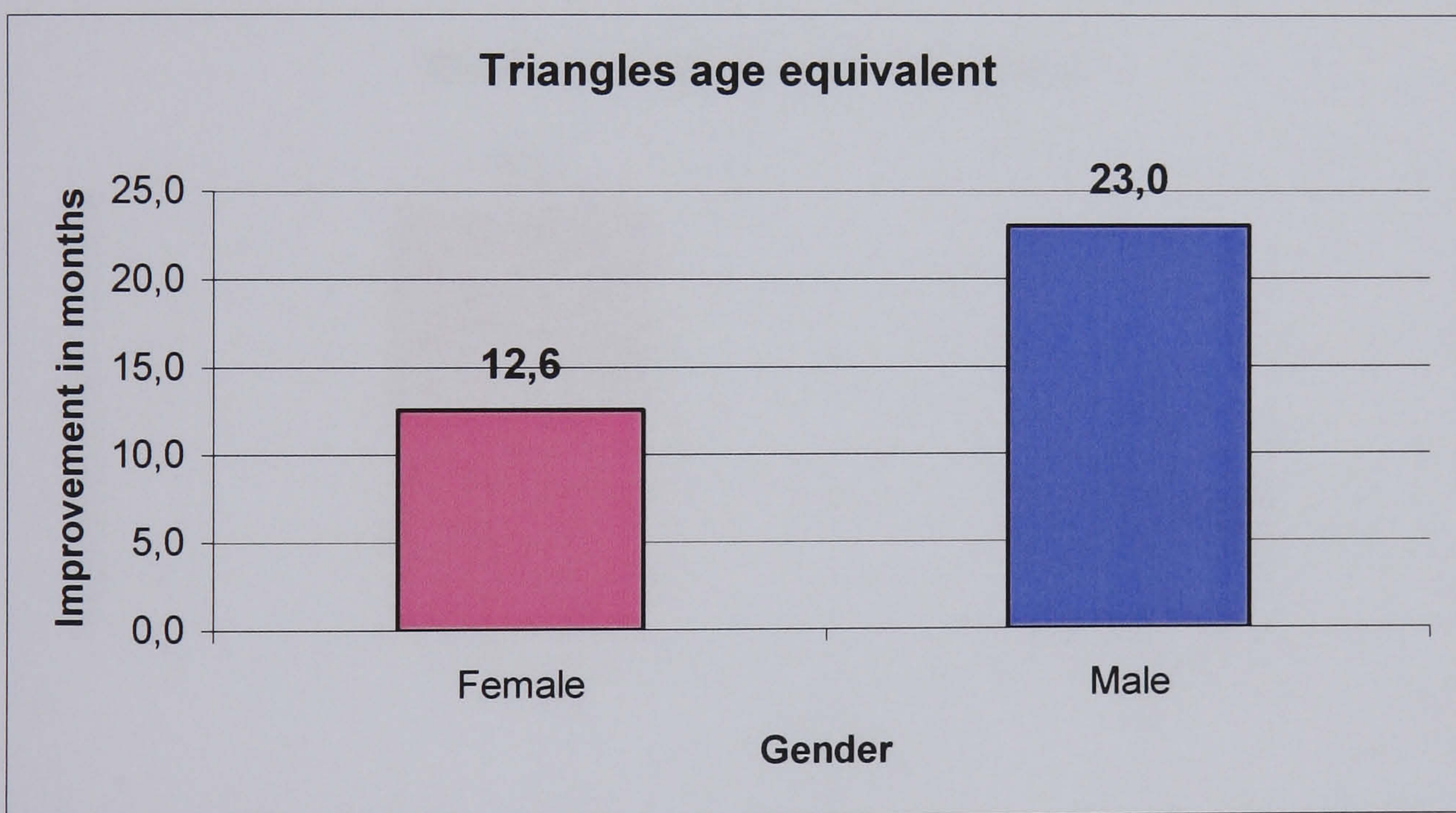
Graph 24
Difference for “Gestalt Closure age equivalent” between boys and girls (in months)

9.9.1.4. Gender differences in Triangles

The *Mann-Whitney test* was used. The difference between pre- and post-training scores for Triangles was **significant** ($p<0,02$) (Table 25). It was concluded that for Triangles there was a significant difference between boys and girls for the mean values of the difference between the Pre-training and Post-training testing periods.

Table 25
Gain values in Triangles

Gender	Female			Male			
	N	Mean	S. D.	N	Mean	S. D.	P
Triangles age equivalent	33	12,55	15,05	28	23,04	16,75	,016



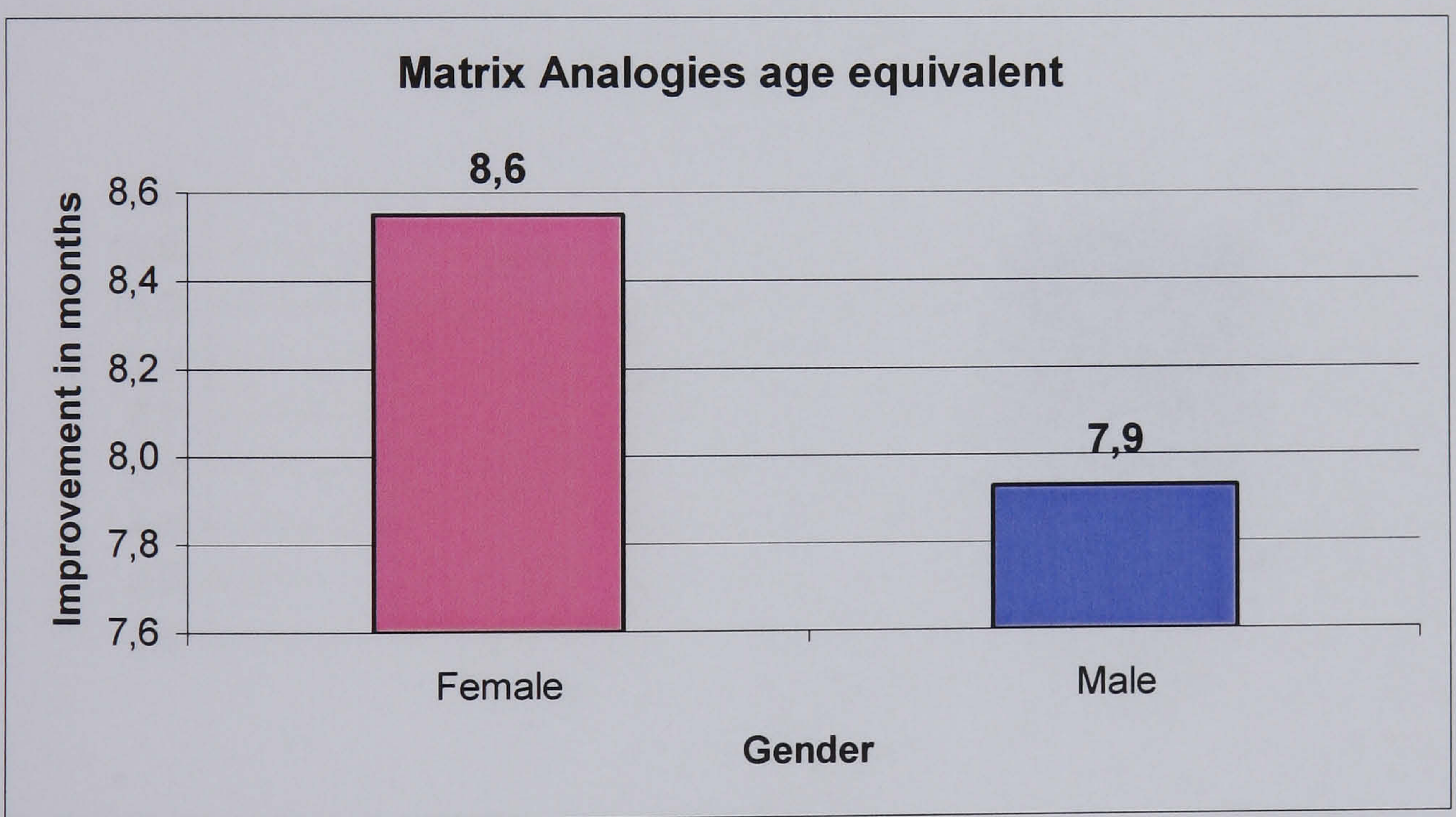
Graph 25
Difference for "Triangles age equivalent" between boys and girls (in months)

9.9.1.5. Gender differences in Matrix Analogies

The *Mann-Whitney test* was used. The difference between pre- and post-training scores for Matrix Analogies was not significant (p>0,05) (Table 26). It was concluded that for Matrix Analogies there was no significant difference between boys and girls for the mean values of the difference between the Pre-training and Post-training testing periods.

Table 26
Gain values in Matrix Analogies

Gender	Female			Male			
	N	Mean	S. D.	N	Mean	S. D.	P
Matrix Analogies age equivalent	33	8,55	12,80	28	7,93	10,84	1,000



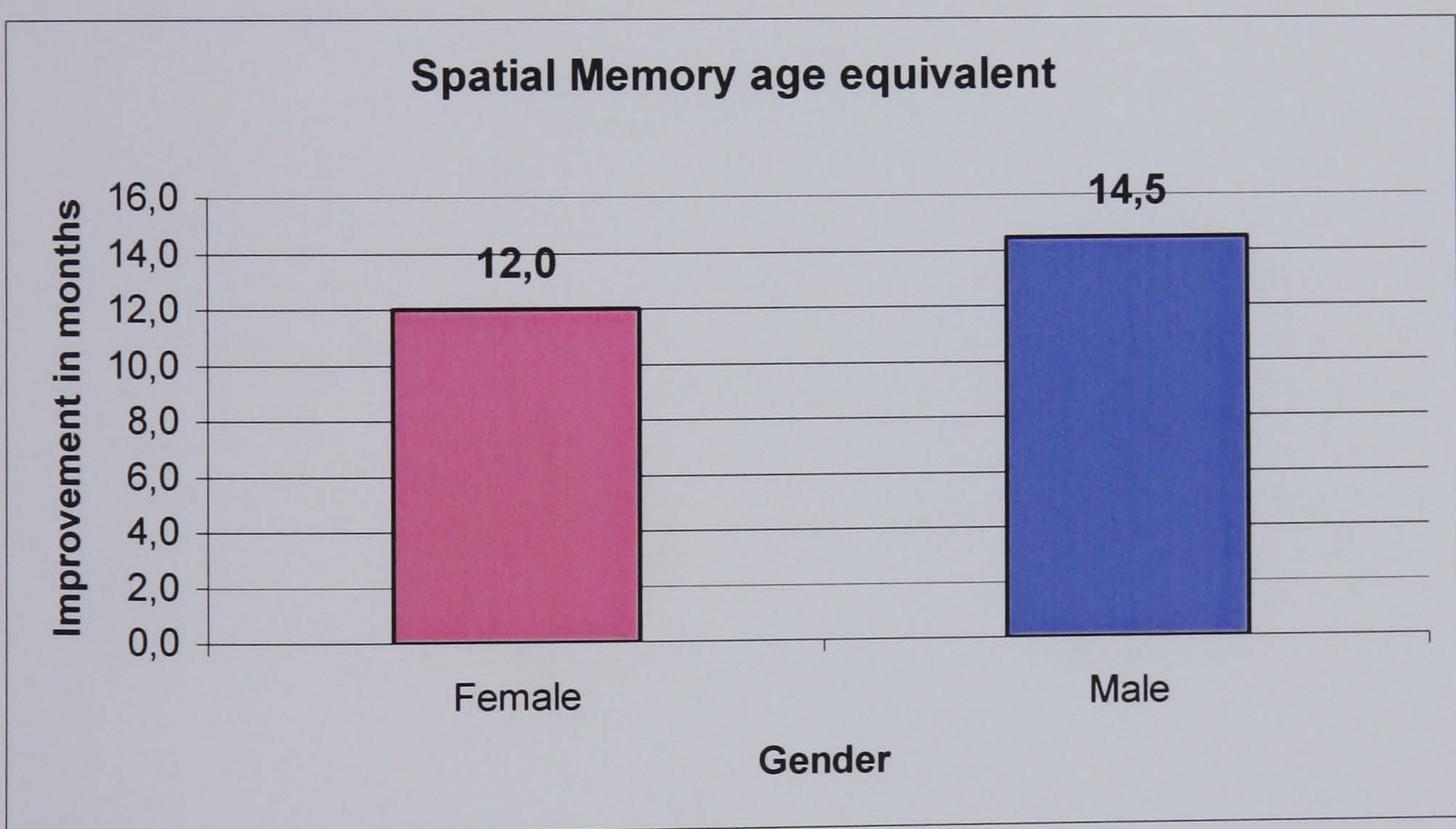
Graph 26
Difference for "Matrix Analogies age equivalent" between boys and girls (in months)

9.9.1.6. Gender differences in Spatial Memory

The *Mann-Whitney test* was used. The difference between pre- and post-training scores for Spatial Memory was not significant (p>0,05) (Table 27). It was concluded that for Spatial Memory there was no significant difference between boys and girls for the mean values of the difference between the Pre-training and Post-training testing periods.

Table 27
Gain values in Spatial Memory

Gender	Female			Male			
	N	Mean	S. D.	N	Mean	S. D.	P
Spatial Memory age equivalent	33	12,00	10,42	28	14,46	12,91	,278



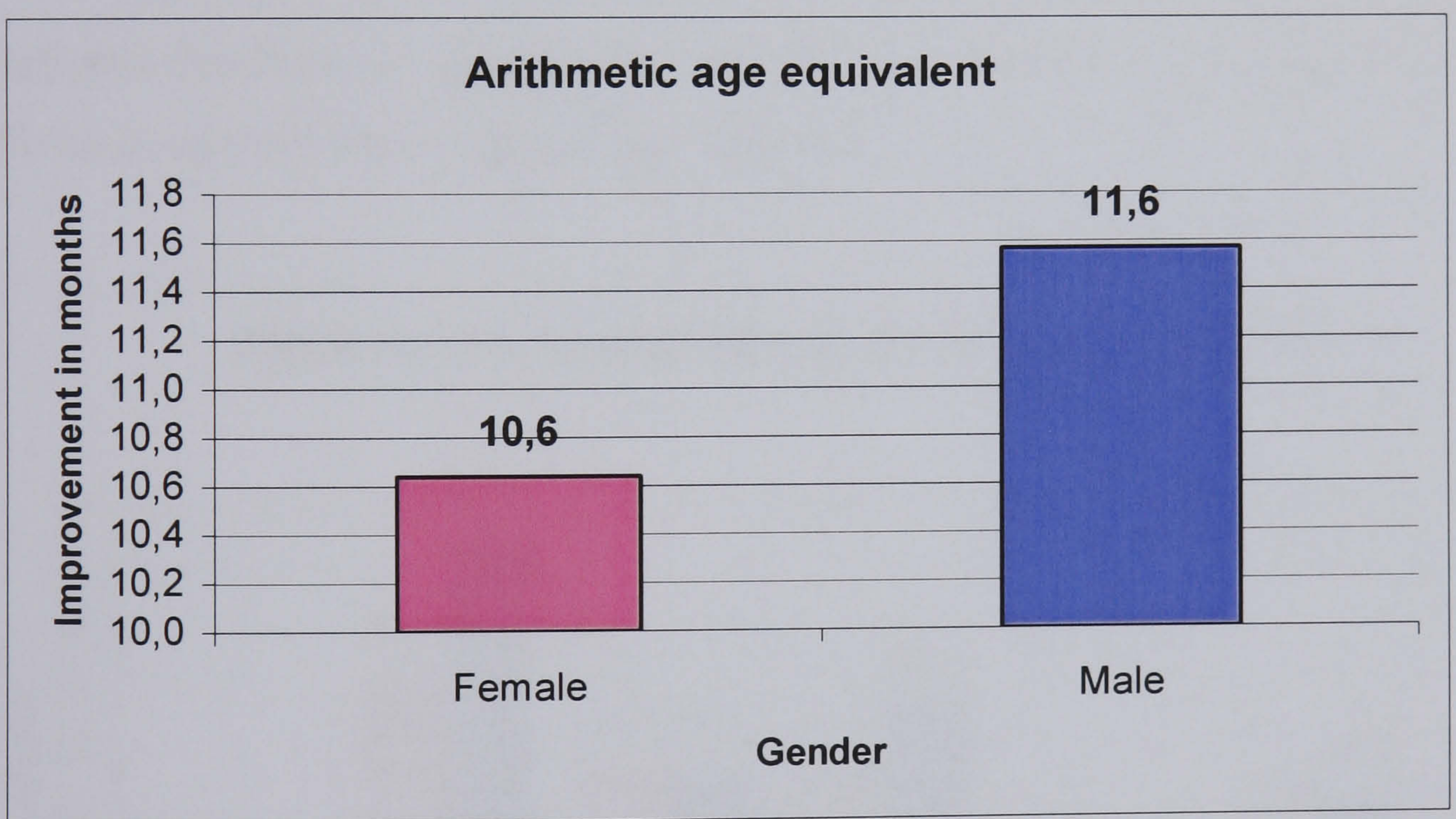
Graph 27
Difference for "Spatial Memory age equivalent" between boys and girls (in months)

9.9.1.7. Gender differences in Arithmetic

The *Mann-Whitney test* was used. The difference between pre- and post-training scores for Arithmetic was not significant (p>0,05) (Table 28). It was concluded that for Arithmetic there was no significant difference between boys and girls for the mean values of the difference between the Pre-training and Post-training testing periods.

Table 28
Gain values in Arithmetic

Gender	Female			Male			
	N	Mean	S. D.	N	Mean	S. D.	P
Arithmetic age equivalent	33	10,64	9,19	28	11,57	8,97	,546



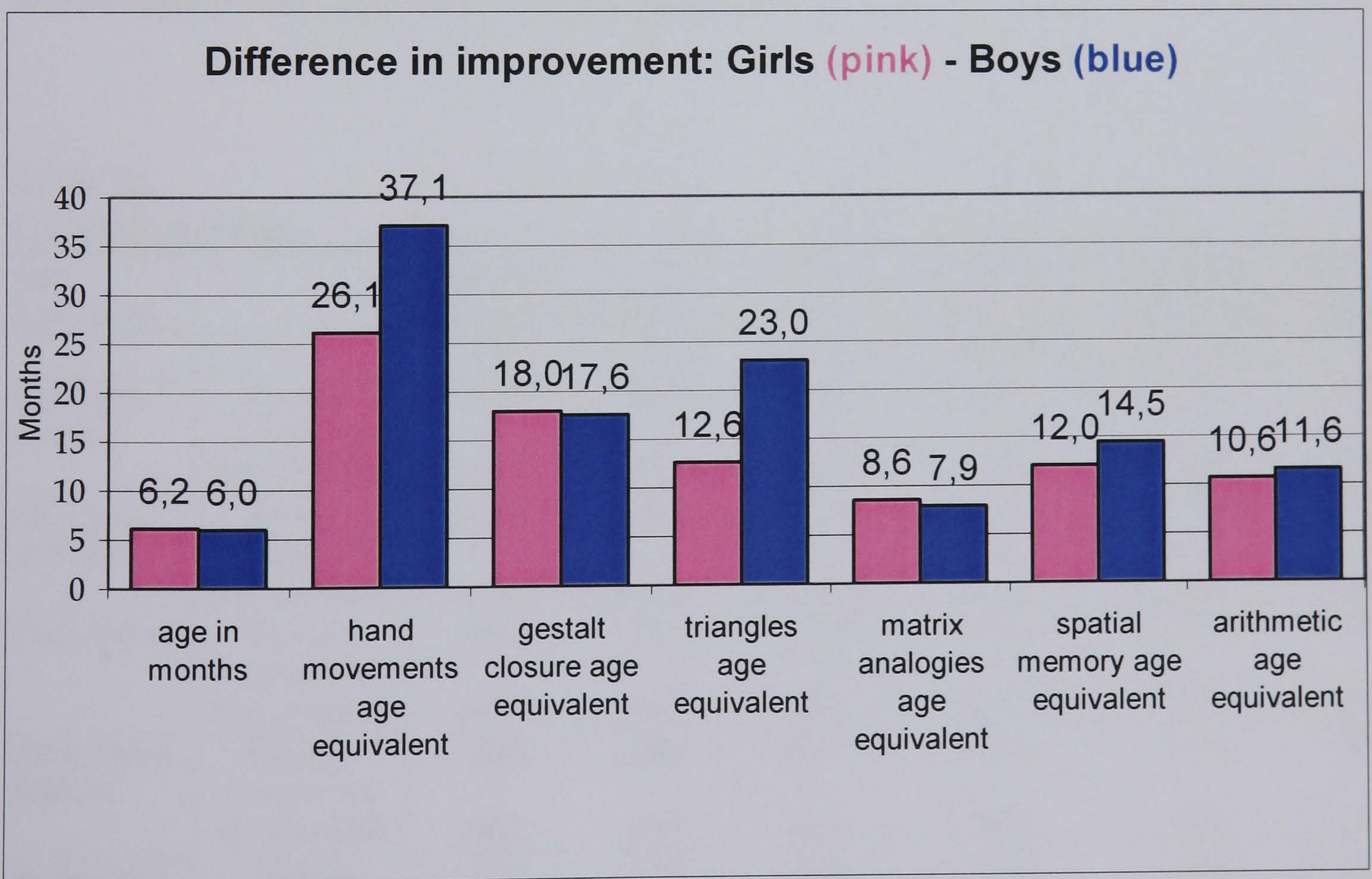
Graph 28
Difference for “Arithmetic age equivalent” between boys and girls (in months)

Finally, the gender differences in improvement are presented all together in table 29 and in corresponding graph 29.

Table 29
Gain values in improvement for all variables according to gender

Gender	Female			Male			
	N	Mean	S. D.	N	Mean	S. D.	P
Age in months	33	6,15	,57	28	6,00	,54	,287
Hand Movements age equivalent	33	26,09	31,10	28	37,11	23,38	,060
Gestalt Closure age equivalent	33	18,00	11,67	28	17,57	14,87	,839
Triangles age equivalent	33	12,55	15,05	28	23,04	16,75	,016
Matrix Analogies age equivalent	33	8,55	12,80	28	7,93	10,84	1,000
Spatial Memory age equivalent	33	12,00	10,42	28	14,46	12,91	,278
Arithmetic age equivalent	33	10,64	9,19	28	11,57	8,97	,546

The small significance value (p<0,02) for the variable of "triangles age equivalent" indicates that there is a significant difference between males and females for this variable. No other variable shows significant difference.



Graph 29
Gender differences in improvement

9.10. Correlation of pre-test scores and gain scores

Children who score the lowest during pre-testing have been found to improve the most over time. In other words, their post-test scores appear to be somewhat dependent upon their pre-test scores. In order to control for a pre-test score effect on children's gain scores, following procedure was followed.

Analysis of Covariance

In certain analysis of variance situations there is a need to remove potential bias due to the fact that the categories differ in their values of a covariate *X*. In other cases the consideration of a covariate may improve the precision of the comparisons of the categories in the analysis of variance.

In the analysis of covariance, the assumption is that **the response to the covariates is the same within each of the cells for the analysis of covariance**. In other words, each of the variables must have a significant correlation with each covariate and the regression curves must be parallel for each category. The following tables show the above correlation and its significance, separately for boys and for girls.

Table 30
Correlations Male

Age Equivalents.		Hand Mts. (difference)	Glt. Clsre. (difference)	Trgl. (difference)	Mtrx. Analog. (difference)	Sp. Memory (difference)	Arithmetic (difference)
N		28	28	28	28	28	28
Hand Mts. (before)	Pearson Correlation	,134	,223	-,116	,069	,127	,016
	Sig. (2-tailed)	**,497**	,255	,556	,729	,519	,935
Glt. Clsre. (before)	Pearson Correlation	-,266	-,073	,094	-,289	,193	,112
	Sig. (2-tailed)	,170	**,713**	,636	,135	,325	,571
Trgl. (before)	Pearson Correlation	-,084	,161	-,340	-,102	,158	,388
	Sig. (2-tailed)	,670	,412	**,077**	,605	,423	,041
Mtrx. Anlog. (before)	Pearson Correlation	-,080	,286	,219	-,583	,176	-,294
	Sig. (2-tailed)	,685	,141	,263	**,001**	,370	,129
Sp. Memory (before)	Pearson Correlation	,336	,150	-,236	-,140	-,246	,166
	Sig. (2-tailed)	,081	,445	,226	,479	**,207**	,400
Arithmetic (before)	Pearson Correlation	,267	,024	,023	-,072	,434	,073
	Sig. (2-tailed)	,169	,903	,906	,714	,021	**,713**

Table 31
Correlations Female

Age Equivalent		Hand Mts. (difference)	Glt. Clsr. (difference)	Trgl. (difference)	Mtrx. Anlog. (difference)	Sp. Memory (difference)	Arithmetic (difference)
N		33	33	33	33	33	33
Hand Mts. (before)	Pearson Correlation	-,377	,183	-,268	-,104	,147	-,190
	Sig. (2-tailed)	**,031**	,308	,131	,563	,413	,290
Glt. Clsr. (before)	Pearson Correlation	,324	-,180	-,224	,111	,147	,146
	Sig. (2-tailed)	,066	**,316**	,210	,540	,415	,418
Trgl. (before)	Pearson Correlation	,261	,028	-,723	-,039	,391	,432
	Sig. (2-tailed)	,143	,876	**,000**	,831	,025	,012
Mtrx. Anlog. (before)	Pearson Correlation	,403	,253	-,064	-,507	,048	,155
	Sig. (2-tailed)	,020	,156	,725	**,003**	,790	,389
Sp. Memory (before)	Pearson Correlation	,164	-,022	-,032	-,005	-,286	,555
	Sig. (2-tailed)	,363	,901	,860	,977	**,106**	,001
Arithmetic (before)	Pearson Correlation	,222	,206	-,151	-,233	,012	-,145
	Sig. (2-tailed)	,215	,250	,402	,191	,946	**,419**

After examining the above tables 30 and 31, it is obvious that Matrix Analogies age equivalent (difference) is the only variable for which the response to the covariate - Matrix Analogies age equivalent (before) - is the same within each of the cells defined by male and female. This is the only variable with a significant correlation with its covariate that satisfies the assumption for parallel regression curves. However, Matrix Analogies was the only sub-test that did not provide significant gain scores for either gender. Furthermore, from the results of the ANCOVA ($p>0.05$) it can be seen that this covariate does not improve the precision of the comparisons since results are almost identical to the previous ones.

9.11. Analysis of differences according to class

The participating children were taken from six different classes, which consequently means that they had six different teachers. In order to control for possible effects of the teachers or class on the test scores' improvement, all score-difference results were also compared among classes. Following is a list of tables showing values of difference of scores between the Pre-instruction and the Post-instruction testing, presented for each class separately, and a graph where direct comparison of the same task for different classes is possible.

Table 32a
Results for Class 1

	Minimum	Maximum	Mean	St. Dev.
Hand movements age equivalent (difference)	-12,00	84,00	26,73	30,49
Gestalt closure age equivalent (difference)	,00	54,00	18,27	16,40
Triangles age equivalent (difference)	,00	48,00	23,18	14,89
Matrix analogies age equivalent (difference)	-6,00	24,00	10,36	11,33
Spatial memory age equivalent (difference)	-3,00	30,00	13,64	9,52
Arithmetic age equivalent (difference)	-3,00	24,00	10,64	7,27

Table 32b
Results for Class 2

	Minimum	Maximum	Mean	St. Dev.
Hand movements age equivalent (difference)	-18,00	60,00	24,00	28,14
Gestalt closure age equivalent (difference)	3,00	45,00	21,55	12,43
Triangles age equivalent (difference)	-21,00	60,00	15,55	22,20
Matrix analogies age equivalent (difference)	-6,00	30,00	13,91	12,46
Spatial memory age equivalent (difference)	6,00	30,00	15,82	7,95
Arithmetic age equivalent (difference)	,00	30,00	13,91	10,33

Table 32c
Results for Class 3

	Minimum	Maximum	Mean	St. Dev.
Hand movements age equivalent (difference)	6,00	102,00	42,30	31,92
Gestalt closure age equivalent (difference)	,00	36,00	18,60	11,56
Triangles age equivalent (difference)	,00	48,00	15,00	15,49
Matrix analogies age equivalent (difference)	-18,00	15,00	-,90	10,87
Spatial memory age equivalent (difference)	,00	36,00	13,20	11,33
Arithmetic age equivalent (difference)	-3,00	18,00	9,60	7,18

Table 32d
Results for Class 4

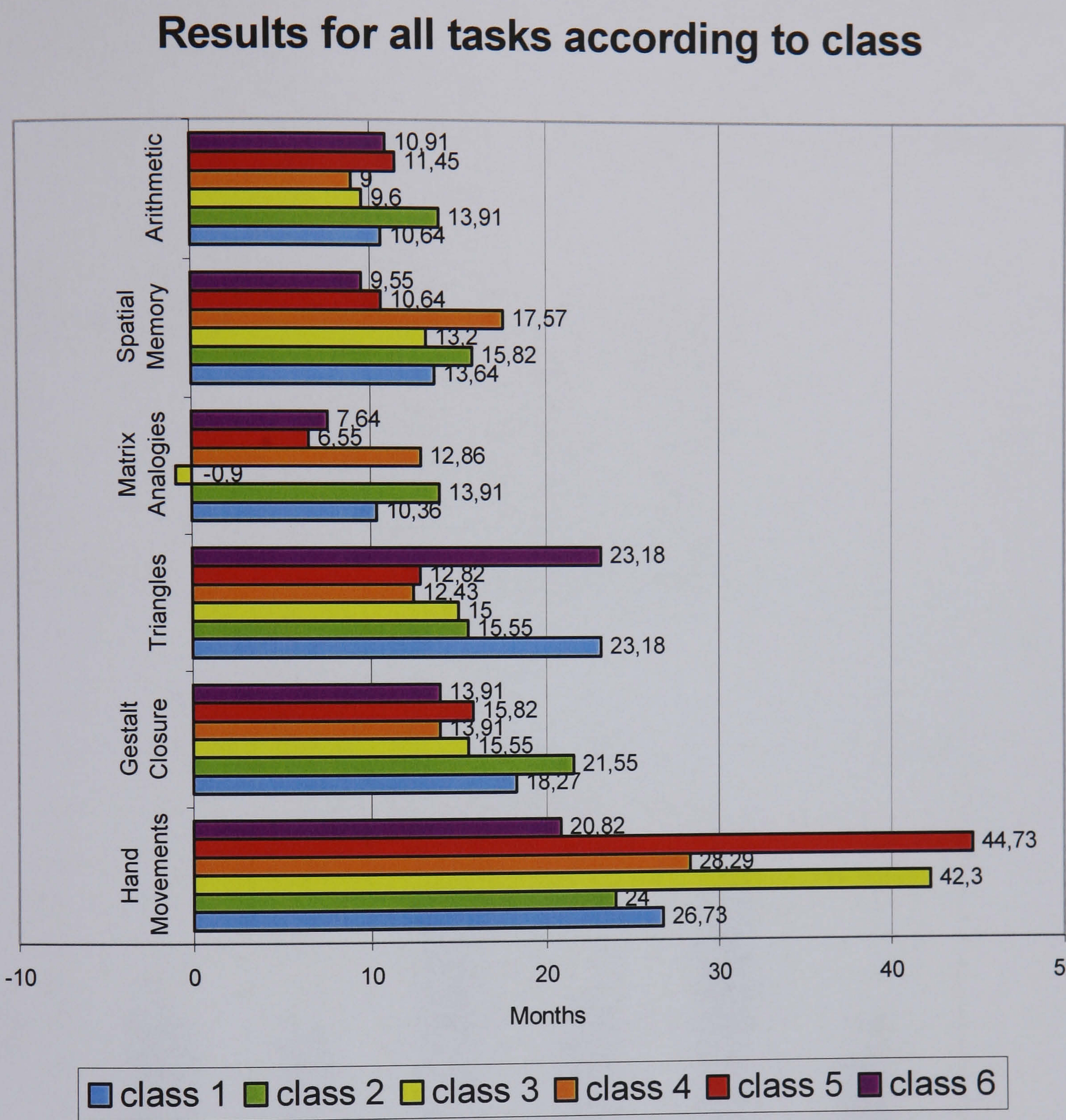
	Minimum	Maximum	Mean	St. Dev.
Hand movements age equivalent (difference)	-15,00	69,00	28,29	30,24
Gestalt closure age equivalent (difference)	9,00	51,00	22,71	13,84
Triangles age equivalent (difference)	,00	33,00	12,43	11,67
Matrix analogies age equivalent (difference)	,00	36,00	12,86	14,46
Spatial memory age equivalent (difference)	9,00	39,00	17,57	11,93
Arithmetic age equivalent (difference)	-3,00	24,00	9,00	8,83

Table 32e
Results for Class 5

	Minimum	Maximum	Mean	St. Dev.
Hand movements age equivalent (difference)	6,00	90,00	44,73	26,34
Gestalt closure age equivalent (difference)	,00	33,00	16,36	11,65
Triangles age equivalent (difference)	-6,00	30,00	12,82	11,93
Matrix analogies age equivalent (difference)	,00	24,00	6,55	7,92
Spatial memory age equivalent (difference)	-12,00	30,00	10,64	14,28
Arithmetic age equivalent (difference)	-3,00	30,00	11,45	9,75

Table 32f
Results for Class 6

	Minimum	Maximum	Mean	St. Dev.
Hand movements age equivalent (difference)	,00	54,00	20,82	18,60
Gestalt closure age equivalent (difference)	-18,00	30,00	11,18	12,45
Triangles age equivalent (difference)	6,00	63,00	23,18	19,26
Matrix analogies age equivalent (difference)	-12,00	24,00	7,64	11,01
Spatial memory age equivalent (difference)	-12,00	30,00	9,55	14,31
Arithmetic age equivalent (difference)	-6,00	33,00	10,91	11,25



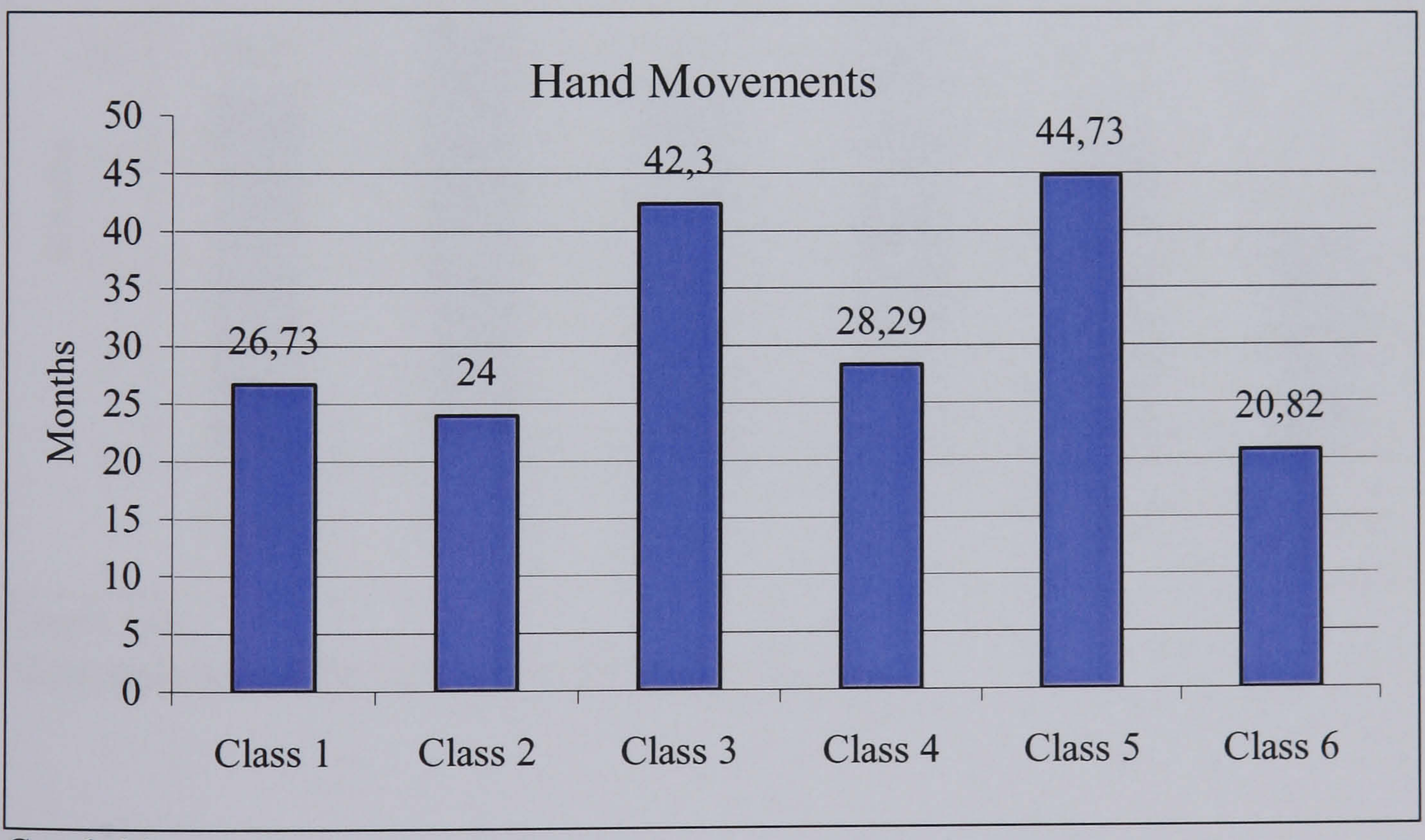
Graph 32
Comparison of classes

Results are also presented for each task separately in the following six tables and in their corresponding graphs.

For the Hand Movements task, results can be seen in Table 33a and in Graph 33a.

Table 33a
Class grouping for Hand Movements age equivalent (difference)

	Minimum	Maximum	Mean	St. Dev.
Class 1	-12,00	84,00	26,73	30,49
Class 2	-18,00	60,00	24,00	28,14
Class 3	6,00	102,00	42,30	31,92
Class 4	-15,00	69,00	28,29	30,24
Class 5	6,00	90,00	44,73	26,34
Class 6	,00	54,00	20,82	18,60



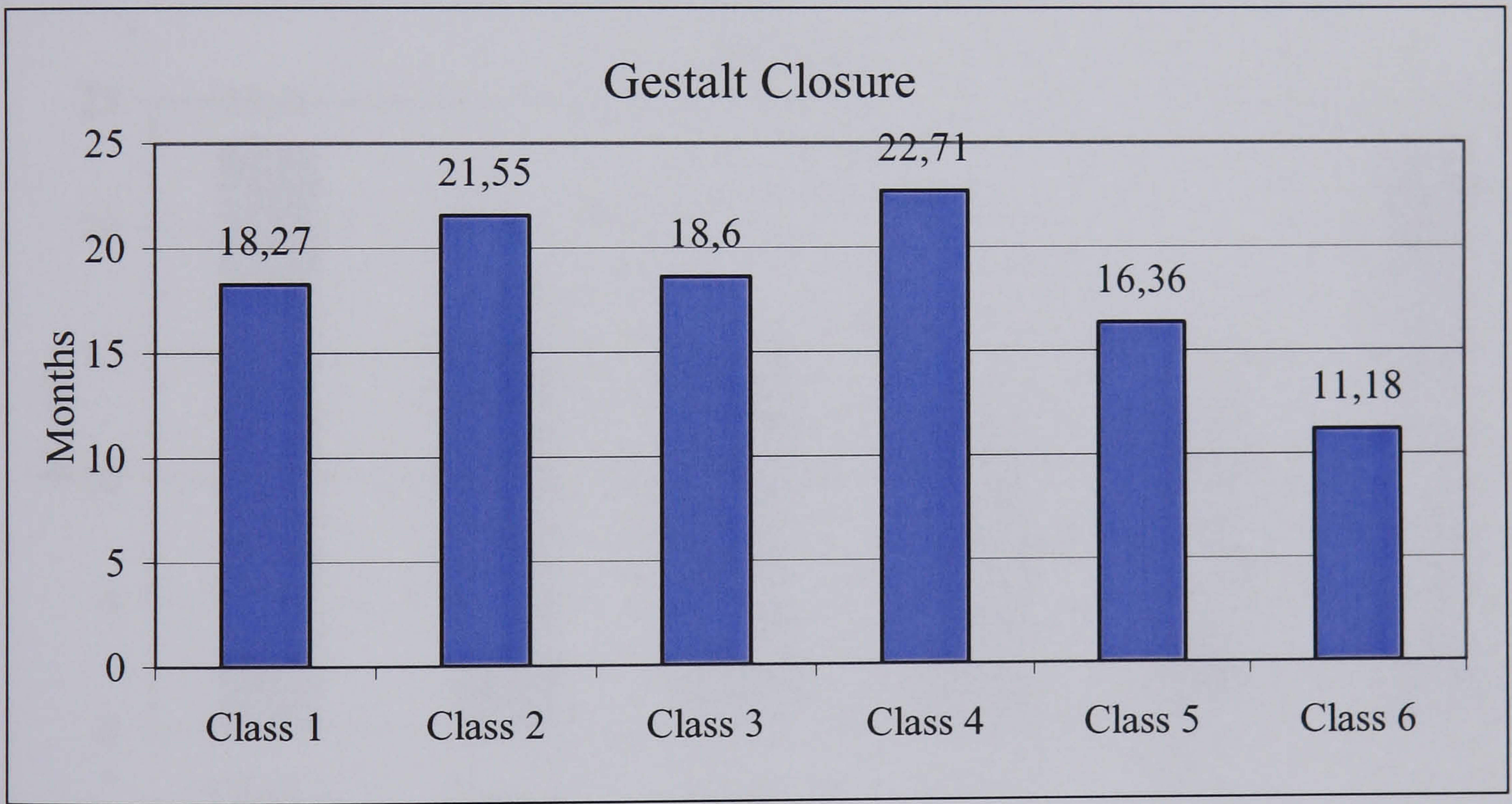
Graph 33a
Mean gain scores for Hand Movements for each class

It is not possible to identify clear reasons for the difference observed in Classes 3 and 5. However, it would be of heuristic interest to investigate possible individual teacher difference and/or whether children in Classes 3 and 5 had had extra experience in Hand Movement games.

For the Gestalt Closure task, results can be seen in Table 33b and in Graph 33b.

Table 33b
Class grouping for Gestalt Closure age equivalent (difference)

	Minimum	Maximum	Mean	St. Dev.
Class 1	,00	54,00	18,27	16,40
Class 2	3,00	45,00	21,55	12,43
Class 3	,00	36,00	18,60	11,56
Class 4	9,00	51,00	22,71	13,84
Class 5	,00	33,00	16,36	11,65
Class 6	-18,00	30,00	11,18	12,45

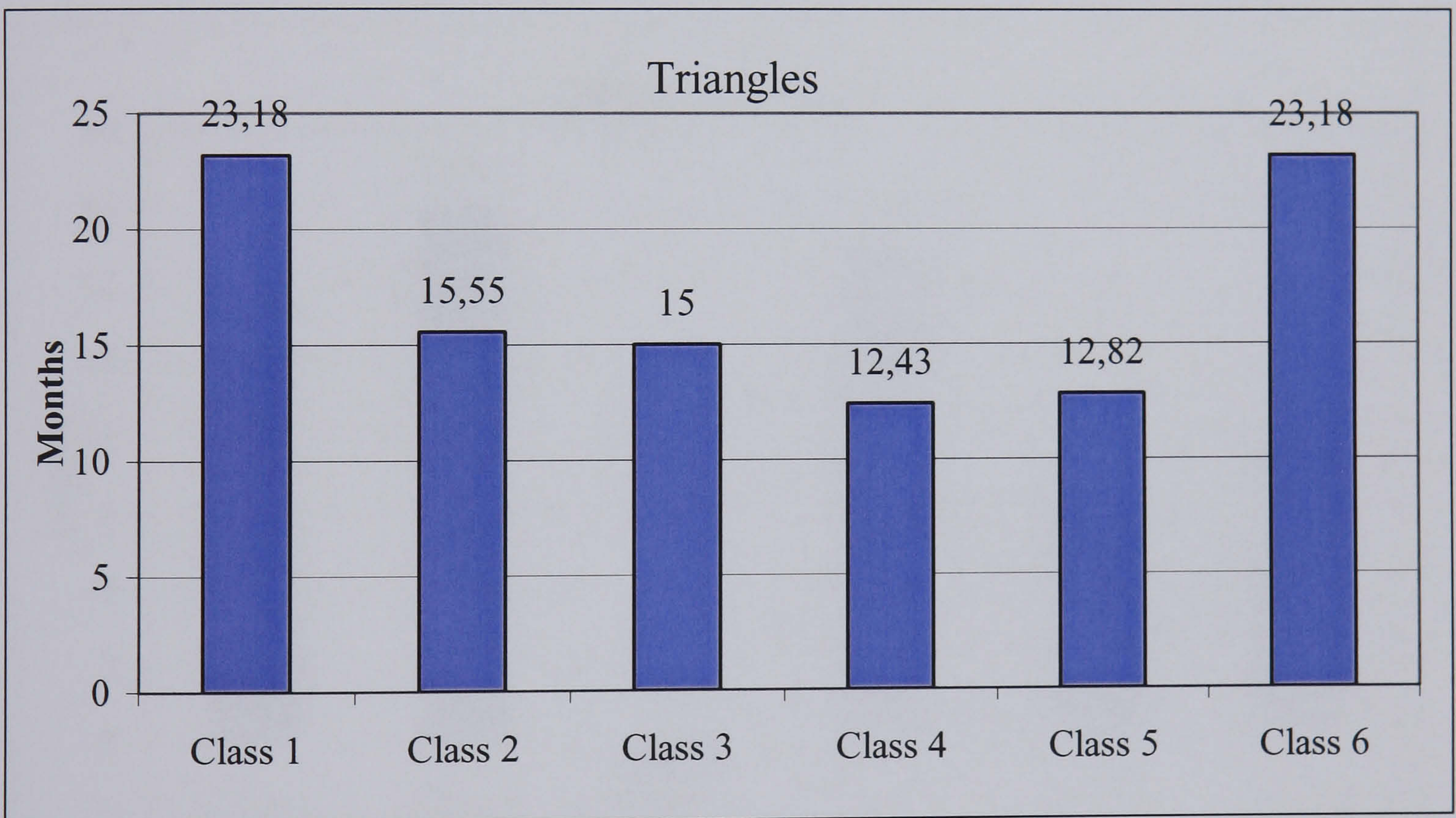


Graph 33b
Mean gain scores for Gestalt Closure for each class

For the Triangles task, results can be seen in Table 33c and in Graph 33c.

Table 33c
Class grouping for Triangles age equivalent (difference)

	Minimum	Maximum	Mean	St. Dev.
Class 1	,00	48,00	23,18	14,89
Class 2	-21,00	60,00	15,55	22,20
Class 3	,00	48,00	15,00	15,49
Class 4	,00	33,00	12,43	11,67
Class 5	-6,00	30,00	12,82	11,93
Class 6	6,00	63,00	23,18	19,26

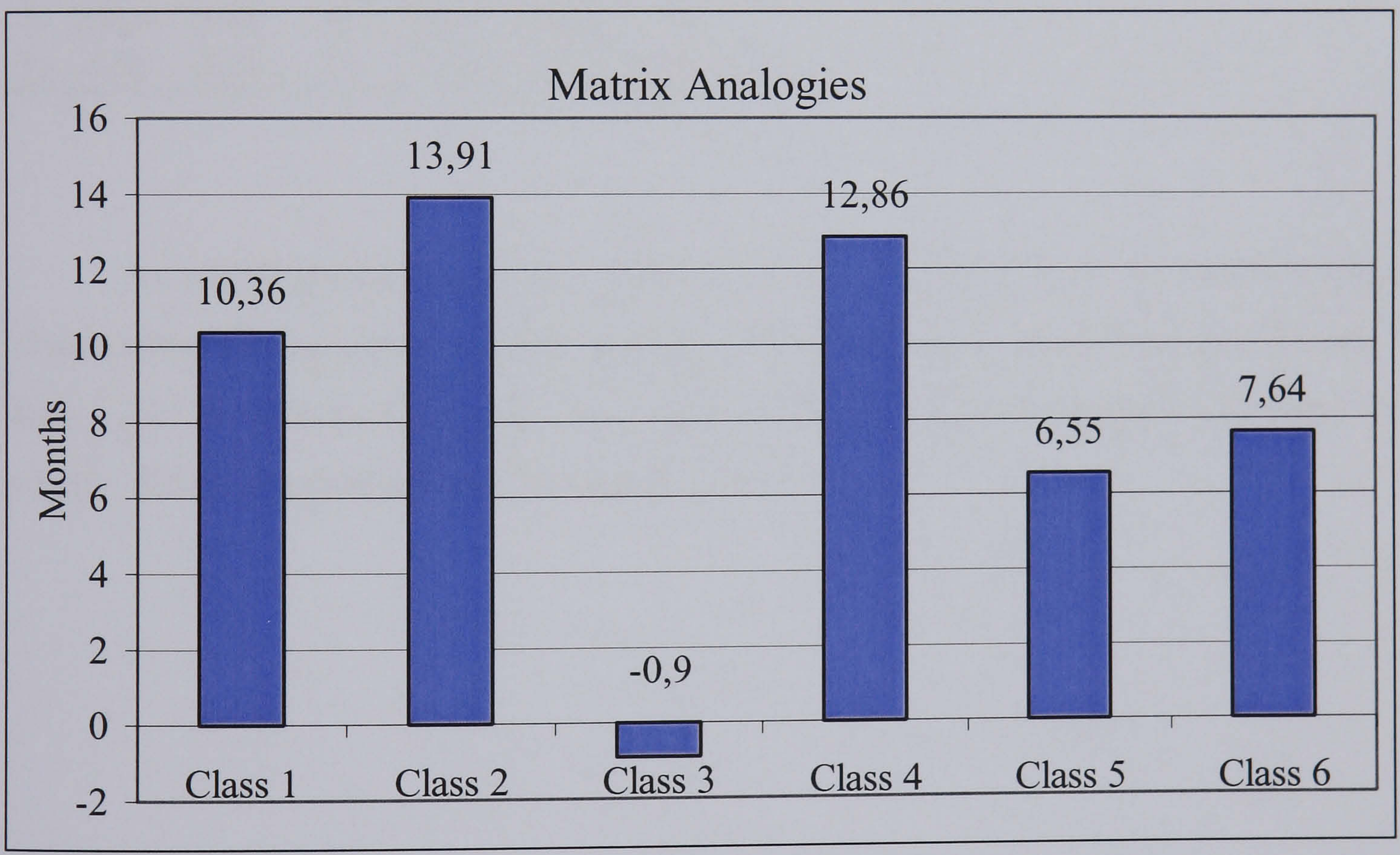


Graph 33c
Mean gain scores for Triangles for each class

For the Matrix Analogies task, results can be seen in Table 33d and in Graph 33d.

Table 33d
Class grouping for Matrix Analogies age equivalent (difference)

	Minimum	Maximum	Mean	St. Dev.
Class 1	-6,00	24,00	10,36	11,33
Class 2	-6,00	30,00	13,91	12,46
Class 3	-18,00	15,00	-,90	10,87
Class 4	,00	36,00	12,86	14,46
Class 5	,00	24,00	6,55	7,92
Class 6	-12,00	24,00	7,64	11,01



Graph 33d
Mean gain scores for Matrix Analogies for each class

In Graph 33d, Class 3 is clearly an outlier. Therefore, following established procedure, the data were reanalysed without this uncharacteristic result to investigate whether this would affect the significance of the results. This can be seen in following Table 33d-i. The *Wilcoxon signed-rank test* was used. The difference between pre- and post-training scores for Matrix Analogies, when data from Class 3 were **not** included, was **significant** ($p<0,03$) (Table 33d-i).

Table 33d-i
Age difference and Matrix Analogies age equivalent (without Class 3)

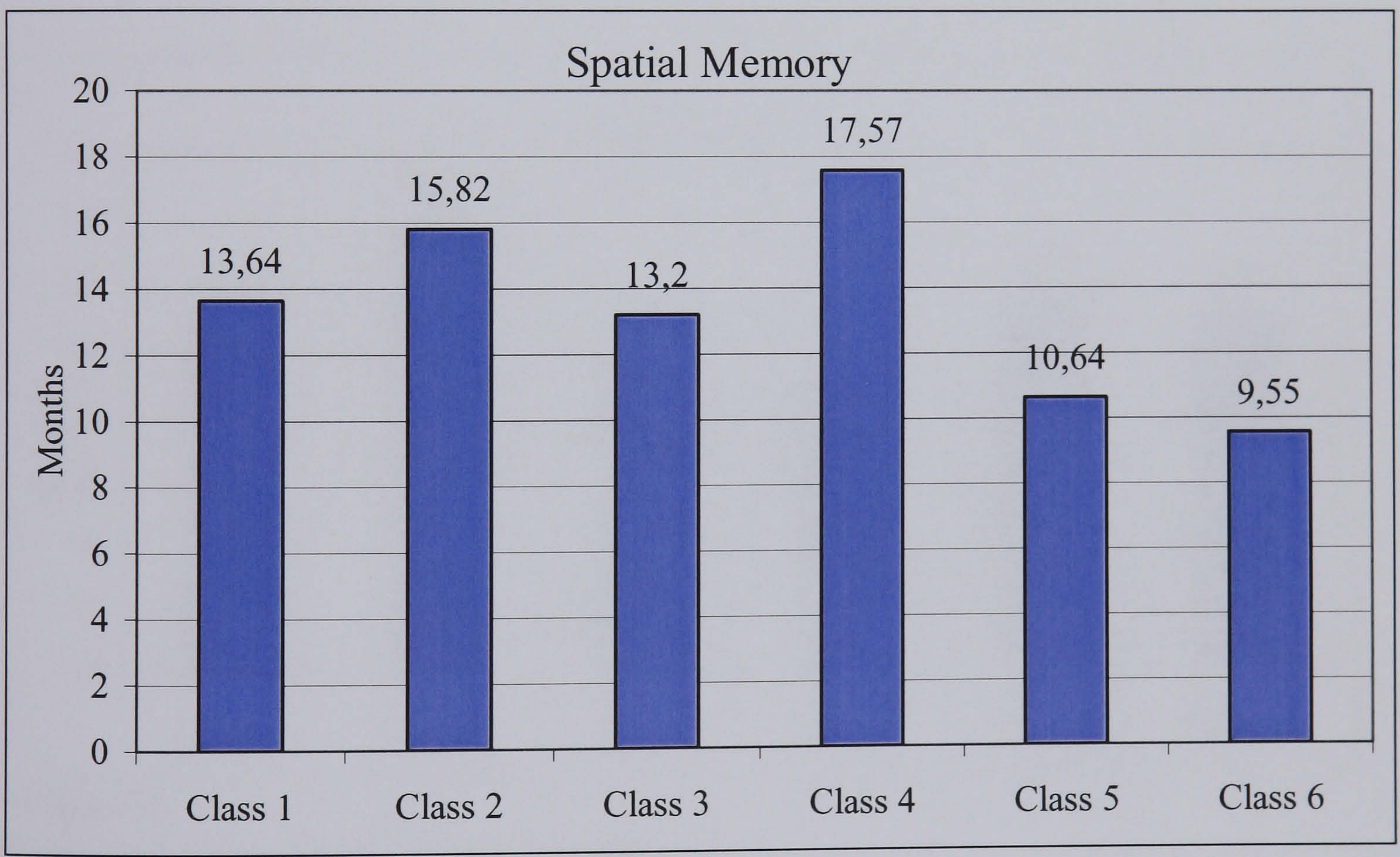
Age in months			Matrix analogies age equivalent			
N	Mean	S.D.	N	Mean	S.D.	p
51	6,06	0,58	51	10,06	11,27	0,023

An additional reason for this extra analysis was to investigate the possible influence of an individual teacher on a particular class. Of course, such an individual difference, if it does have an influence, may be presumed to be a potential influence elsewhere in the results. This is not possible to investigate further.

For the Spatial Memory task, results can be seen in Table 33e and in Graph 33e.

Table 33e
Class grouping for Spatial Memory age equivalent (difference)

	Minimum	Maximum	Mean	St. Dev.
Class 1	-3,00	30,00	13,64	9,52
Class 2	6,00	30,00	15,82	7,95
Class 3	,00	36,00	13,20	11,33
Class 4	9,00	39,00	17,57	11,93
Class 5	-12,00	30,00	10,64	14,28
Class 6	-12,00	30,00	9,55	14,31

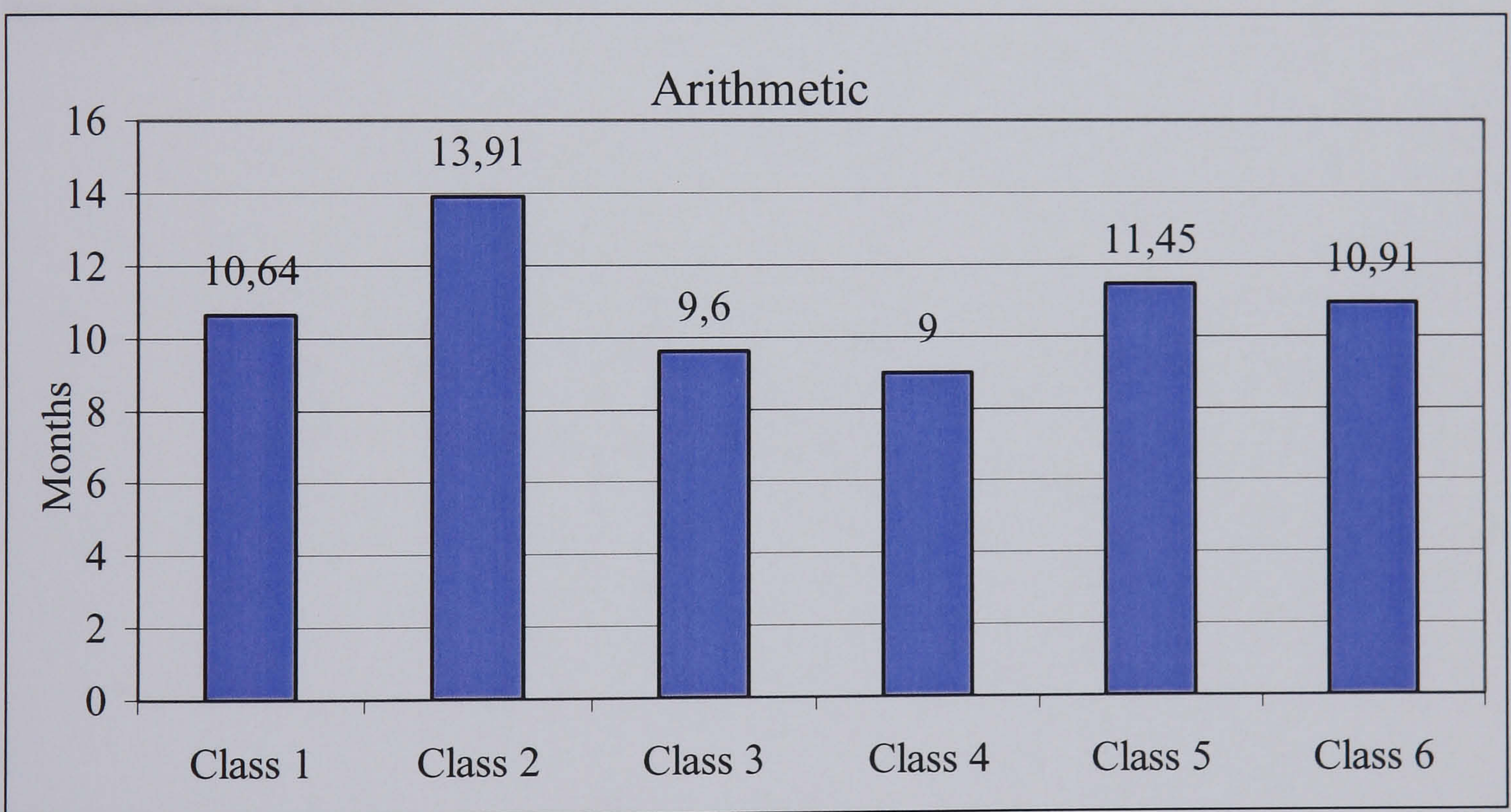


Graph 33e
Mean gain scores for Spatial Memory for each class

For the Arithmetic task, results can be seen in Table 33f and in Graph 33f.

Table 33f
Class grouping for Arithmetic age equivalent (difference)

	Minimum	Maximum	Mean	St. Dev.
Class 1	-3,00	24,00	10,64	7,27
Class 2	,00	30,00	13,91	10,33
Class 3	-3,00	18,00	9,60	7,18
Class 4	-3,00	24,00	9,00	8,83
Class 5	-3,00	30,00	11,45	9,75
Class 6	-6,00	33,00	10,91	11,25



Graph 33f
Mean gain scores for Arithmetic for each class

The data from the above tables was then analysed for difference using the Kruskal-Wallis test. This test is a non-parametric test alternative to one-way ANOVA. Significance levels below 0,05 indicate that the group locations differ. Results are shown in Table 34.

Table 34
Kruskal-Wallis significance values (Grouping Variable: Class)

	Sig.
Hand Movements age equivalent (difference)	,282
Gestalt Closure age equivalent (difference)	,585
Triangles age equivalent (difference)	,543
Matrix Analogies age equivalent (difference)	,164
Spatial Memory age equivalent (difference)	,780
Arithmetic age equivalent (difference)	,954

For all variables, it can be observed that the differences found between classes were **not significant** ($p>0,05$).

CHAPTER 10

DISCUSSION

10.1. General discussion

10.1.1. Introduction

In practically every civilisation and in every human society of the past, music played a more or less important role. Music often had a sacred character and was also used for its healing properties. There are indications and in some cases evidence that, from ancient times, societies had some form of music education. This might also apply to tribal or even preliterate societies, not only to the better-known civilisations of the past (Abeles, Hofer & Klotman, 1995). Since the present research was conducted in modern Greece though, it would be interesting, historically, to briefly discuss the role of music and music instruction in ancient Greek times.

Education in ancient Greece was centred on providing youth with grace and stamina, thus creating individuals of character. In order to realise these goals, the mind, the body and the soul had to be developed. Hence, early organisation of the Greek education focused on rhetoric and mathematics, gymnastics, and art and music respectively. By the time of Aristotle (fourth century B.C.) though, the Greek educational curriculum included writing and astronomy as well, and the first debates regarding the necessity of including music were a reality. Music had reached a high level of virtuosity becoming complex in every way.

In his Politics (ca. 330 B.C.), Aristotle doubted music's educational potential, questioned whether music served education or entertainment and challenged music's place in education. He wrote: "The right measure will be attained if students of music stop short of the arts which are practised in professional contests, and do not seek to acquire those fantastic marvels of execution which are now the fashion in such contests, and from these have passed into education. Let the young practise even such music as we have prescribed, only until they are able to feel delight in noble melodies and rhythms, and not merely in that common part of music in which every slave or child and even some animals find pleasure." (Grout & Palisca, 1988, p. 4). To better picture the surroundings and the heritage Aristotle commented upon, it is useful to take into account the opinion Plato held regarding music. In the Republic (book III, ca. 380 B. C.), Plato supports that music, together with literature and art, have a great influence on character. The aim of music education, according to Plato, is to instruct rhythm, harmony and temperance of the soul. All the above would lead to a good moral character. He believed that the power of the arts was considerable. Therefore, censorship of all arts was necessary to prevent the spreading of harmful qualities which would corrupt the soul. Parallel to the soul, the body should be educated through proper gymnastics. An individual with a harmonious soul and a beautiful body would then generate a noble love in others like himself (Abeles, Hoffer & Klotman, 1995).

10.1.2. Music and education

More recently, the issue of music and its place in education has been re-addressed. Music educators have consistently advocated the belief that music instruction is beneficial for young children. This, though, had not been supported by relevant scientific data; it was rather an empirical observation and knowledge. Rauscher et al. (1993) found improvement in spatial-temporal reasoning test scores of college students after they had listened to the Sonata for two pianos in D major, KV 448, by W. A. Mozart. This effect, termed the "Mozart effect", has been heavily criticised and is presented in greater detail earlier in this thesis. Studies, however, have increasingly been generated demonstrating that young children who receive instrumental music instruction score significantly higher on spatial-temporal ability tests compared to matched individuals who receive, for instance, computer instruction (Rauscher et al., 1997) or no lessons (e.g., Costa-Giomi, 1999; Rauscher et al., 1994; Rauscher et al., 1997; Rauscher & Zupan, 2000).

10.1.3. Spatial-temporal reasoning

Spatial-temporal ability has been described as the ability which "involves maintaining, transforming, and comparing mental images in space and time using symmetry operations" (Shaw, 2001, p.611). Spatial ability (lacking the temporal element) is defined as a "skill in representing, transforming, generating, and recalling symbolic, non-linguistic information" (Linn & Petersen, 1985, p. 1482), or, more descriptively "the ability to form a mental model of a spatial world and to be able to manoeuvre and operate using that model" (Gardner, 1993, p. 9). An overlapping in the ways humans think appears to exist between the above understanding of spatial abilities lacking the temporal element and the understanding of spatial-temporal thinking or reasoning, which is presented as a separate form of reasoning. A physical model is not necessarily involved in this process. This ability might be of importance in mathematical thought, in architectural planning, or in playing chess. Individuals displaying highly developed spatial intelligence include sailors, engineers, surgeons, sculptors or painters. Hence, Gardner clearly believes that spatial thought enables scientific and artistic thought (1983, 1993). In any case, a distinct differentiation between purely spatial and spatial-temporal reasoning is not, as of yet, clearly defined.

If the above is considered, then it is obvious that children whose spatial abilities are better developed will have an advantageous position over their peers with "regularly" developed spatial thought. More importantly, these spatially developed children would have better chances of functioning more successfully later in their lives, as adults. The construction of mental models in mathematics, in science or in other domains can be closely linked to this type of reasoning.

10.1.4. Language-analytic reasoning

Another type of reasoning is the language-analytic type. This involves "solving equations and obtaining quantitative results" (Grandin, Peterson & Shaw, 1998, p. 11). The differences between spatial-temporal and language analytic reasoning are more obvious in the product of thinking, the "end result". According to this understanding, every word that is used to express an object is the result of both types of reasoning. However, the word itself belongs to the language-analytic way of thinking.

The word "tree", for instance, does not refer to something unchanging although it can be thought as something stable and unchanging. But when an attempt is made to distance oneself and think what kind of tree is meant by the very word "tree", it is obvious that information that is more specific is necessary. "Tree" can equally mean an evergreen tree, a tree stripped of its leaves, a young tree or an old tree. The same goes for every word, man, elephant, pine, and so on. This might mean that within the mind, before the specific word is formulated, all the forms of the object it represents could be "seen" in a spatio-temporal reasoning manner. Perhaps, in previous societies there existed other words to express meanings as "tree stripped of leaves" and "evergreen tree" but in this society, it was not necessary to have two different words to express these differences. Today only one word exists for "tree" and whenever it is needed to go into differentiations the appropriate adjective is used. This, though, is a language analytic way of thinking.

As understood, language-analytic reasoning is a way of thinking by which one tries to be (or become) very precise, allowing the least of the surrounding always-changing world to interfere with the thoughts. The spatial-temporal reasoning way of thinking is a way by which one does not have any restriction as to what will be combined with what or how precise one will be, as long as a way is found to incorporate the extrinsic incoming stimuli with the inward generated modes of automatic self-activation (stimulation) of one's own brain cells. Words usually do not refer to a specific image or situation. Spatial-temporal reasoning, understood in this manner, allows for the transformation of mental images, mental image rotation or mental connection with other objects or acts in space and time. In other words, images can be treated as if they had existed.

The possibility to think in this and not in the other way appears to be innate in man. Several "steps" seem to exist allowing for back-and-forth movement between spatio-temporal and language-analytic reasoning. Grandin is a very high-functioning person with autism. The way Grandin describes her way of thinking is brought as an example. She is considered the world's expert in the design of livestock handling facilities. She can construct revolutionary designs which interact with animals in a natural way. Livestock can be effortlessly directed in a calm and kind manner. Grandin explains that when she designs the handling facilities, she is able to visualise herself as the animal and go through one of her systems. Therefore, she is able to anticipate and correct problematic patterns that might develop. "In her imagination, she walks around and through the structure and can fly over it in an imaginary helicopter. She moves herself around and through the structure instead of rotating the structure in her imagination." (Grandin et al., 1998).

10.1.5. Knowledge transfer from musical to other domains

Spatio-temporal reasoning allows for discrimination using symmetry operations. Bhattacharya et al., (2001) measured phase *synchronisation* and found that it was significantly increased between frontal cortex and right parietal cortex during mental rotation, whereby musicians showed significantly higher degrees of synchronisation than non-musicians. Non-musicians generally exhibited right hemispheric dominance while musicians exhibited left hemispheric dominance, stronger in the posterior parietal cortex and occipital region. These finding are in accord with other findings on music lateralisation in musicians (e.g., Münte, Altenmüler, & Jäncke, 2002) but also demonstrate a cortical activation pattern in musicians that directly links mental rotation and music proficiency.

Symmetry operations, as described by Leng and Shaw (1991), might be innate in the brain cells, they might also exist in the ways people sense extrinsic stimuli, or might have been in the person's long-term memory. In addition, they should exist in the person's short-term memory if the images were being processed at the time of the actual thinking process. The manner in which these images are incorporated within the brain might be temporal sequences of stimuli, in other words units of spikes or the frequencies displayed by the cells (Lehtelä, Salmelin & Hari, 1997). Rüsseler et al. (2001) state that sound change is automatically detected by the brain and that the **mis**match **n**egativity (MMN) of an auditory event-related brain potential can be used to investigate the time course of temporal integration in the acoustic system. Occasionally omitted sounds in an otherwise regular tone series evoked a reliable MMN at interstimulus intervals of 100, 120, 180 and 220 milliseconds in musicians and of 100 and 120 milliseconds in non-musicians. "These results indicate that the temporal window of integration seems to be longer and more precise in musicians compared to musical laypersons and that long-term training is reflected in changes in neural activity" (p. 33).

Concerning the impact music might have on brain-circuitry level, the trion model provides an interesting possibility. The basis of music's relations to other similar higher brain functions rests on the acceptance of the concept that they share key cortical features exploiting dynamic, abstract relationships among spatial-temporal patterns and their development across large regions of the cortex over fragments of seconds to minutes. As supported by Leng & Shaw (1991), "although each different HBF (higher brain function) will crucially depend on specific, different cortical areas and systems, essentially all the higher cortical areas are involved in each HBF in some important level. *It is the internal neural language of the brain that is the same for the various HBFs. Thus, music training at an early age is exercise for higher brain function.*" (p. 255).

Music training has also been shown to advance mathematical thought. Even though this remains a controversial issue (Vaughn, 2000), studies have shown the strong link between mathematical and musical processes (e.g., Peterson et al., 2000; Graziano, Peterson & Shaw, 1999). A comment by Stravinsky is enlightening in presenting a musician's view of the link between music and mathematics: "(Musical form) is at any rate far closer to mathematics than to literature...certainly to something like mathematical thinking and mathematical relationships...Musical form is mathematical because it is ideal, and form is always ideal." (Gardner, 1983, p. 126). When referring to ideal forms, Stravinsky also hints to a deeper, abstract-level connecting point of music and mathematics: spatial-temporal processes.

A third skill that music mingles with is language. The apparent connection of music and language in singing is obvious. Ancient Greeks considered music and poetry inseparable. The *teleion melos* (music in its perfect form) was always associated with words. Research has indicated that reading ability is linked to musical ability (e.g., Hurwitz et al., 1975; Lamb & Gregory, 1993), while other studies failed to show such a link (e.g., Andrews, 1997).

All above discussed procedures involve a transfer of knowledge from the musical to other domains. Knowledge transfer from one content area to another has been an irresolute issue that continues to generate research and discussion (e.g., Staines, 1999). Under the light of recent investigation, it has become a controversial issue for those educators and researchers who are concerned with the placement and the importance music should have in the school curricula.

10.1.6. K-ABC results

For this thesis, the investigation of skill similarities between music and cognitive abilities (including spatial-temporal intelligence) occurred in the context of an exploration of the effects of piano-keyboard training on the scores of six sub-tests of the K-ABC. The aim of this thesis was three-fold: firstly, to investigate the effectiveness of six months of piano-keyboard instruction on certain cognitive abilities of kindergarten children; secondly, to find if piano-keyboard instruction affects specific cognitive abilities more than others, and which abilities improve the most; and finally, to find if girls and boys show difference in improvement, and to measure this difference. The expectations at the beginning of the study were that the children would show significant difference in their K-ABC test scores between the pre- and post-testing. Furthermore, certain sub-tests were expected to be more positively affected, such as the Hand Movements and the Triangles, while others, such as Matrix Analogies, were expected to remain less affected or unaffected. Lastly, boys were expected to achieve better results than girls on tests of spatial tasks following the instruction period.

As previously presented in the statistical analysis, this study found significant differences between the pre- and the post-test scores of the children who received the piano-keyboard instruction program. Results analysis revealed that the children improved significantly on five of the six sub-tests administered. The sub-tests that showed significant improvement, here beginning with the one that showed the greatest increase and proceeding gradually, were the Hand Movements sub-test, the Gestalt Closure sub-test, the Triangles sub-test, the Spatial Memory sub-test and the Arithmetic sub-test. The Matrix Analogies sub-test did not show significant score increase.

All raw scores were converted to the corresponding age equivalents, according to the appropriate table (Kaufman & Kaufman, 1983b, p. 232). Age equivalents have often been accused of being inaccurate, chiefly due to the fact that "one year's growth" can have very different meanings at different points in the age continuum. However, age equivalents are a means of directly communicating test results. Additionally, according to the authors of the test age norms are frequently pertinent for the pre-school and elementary school years (Kaufman & Kaufman, 1983a). Since the children participating in this study fall exactly in this age group, the use of the age equivalents might be considered appropriate.

10.1.6.1. The Hand Movement task

The greatest increase was found in the results from the Hand Movement task. The children performed at post-testing as would have been expected if approximately twenty-five months more had passed since their original test. This finding is in accord with the findings of Rauscher & LeMieux, 1999 (Rauscher, 1999b). Improvement in this task suggests, among other possibilities, enhanced motor control, a good attention span, better concentration, better short-term memory, one, some, or all of the above. The motorical practice provided by the keyboard instruction could have enhanced motor control. Furthermore, the music learning process may have helped the children concentrate better for longer time-periods, because music reading requires prolonged concentration. The trion model of higher brain function, discussed in detail in previous parts of the thesis, provides a neurophysiological explanation, which may explain a possible lengthening of spatial-temporal memory. Both musical and spatial reasoning tasks are thought to exploit large regions of the cortex that display certain neural firing patterns organised in a complex spatial-temporal code. From all the above, it is obvious that such a difference was expected since all factors mentioned were expected to benefit by the music instruction.

10.1.6.2. The Gestalt Closure task

The second greatest increase was recorded in the Gestalt Closure sub-test, even though its gain difference from the Triangle results is marginal. The children performed at post-testing as would have been expected if nearly one year more had passed since their original test. This significant finding also agrees with other similar findings (Rauscher, 1999). The test constructors state that this is an accepted test of simultaneous processing and right hemispheric functioning (Kaufman & Kaufman, 1983a, p.40-41). Closure ability requires the correct "identification of whole figures from incomplete visual information"(Kaufman & Kaufman, 1983a, p.41). This task requires flexibility in perceiving and thinking, perceptual closure, perceptual inference and conversion of abstract stimuli into a concrete object. All the above may be considered spatial tasks. Verbal expression is also necessary, but visual detail, synthesis and imagination are primary. The spatial character of this sub-test might explain the significant improvement of the scores after the piano-keyboard instruction, based on the same arguments as in the previous task.

10.1.6.3. The Triangles task

Children, in the Triangles sub-test, performed at post-testing as would have been expected if over eleven months more had passed since their original test. This simultaneous processing sub-test is also generally accepted as a right hemisphere task. It represents a K-ABC analogue of Wechsler's Block Design. The test materials appeal to pre-school children and are easy in their manipulation. Performance on this task is worse for children who have difficulty working under time pressure and is improved for children who work systematically in the analysis of the model to its components, and for the children who are flexible in problem solving. Its constructors characterise the Triangles test by its unique ability of non-verbal concept formation (Kaufman & Kaufman, 1983a). The spatial-temporal process required for acquiring good results in this test is obvious. It involves spatial visualisation and mental rotation. Being a spatial task, improvement confirmed the hypothesis that the Triangles sub-test would provide a significant score increase. This is consistent with findings provided by similar studies (e.g. Rauscher and Zupan, 2000).

10.1.6.4. The Spatial Memory task

The Spatial Memory sub-test scores also showed significant increase. Children performed at post-testing as would have been expected if approximately seven more months had passed since their original test. This is a memory test, and the findings of this study are inconsistent with the findings of some studies (e.g., Rauscher & Zupan, 2000), but consistent with others (e.g., Bilhartz et al., 2000). The reasons for this incongruity might be diverse. The Bilhartz et al. (2000) study showed a significant increase in the Bead Memory task, taken from the Stanford-Binet Intelligence Scale: Fourth Edition. This was attributed to the fact that this sub-test measures both visual imagery and sequencing strategies. These mental processes, according to the model proposed by Leng and Shaw (1991), "require the same neural firing patterns that are needed in the performance of musical activity" (Bilhartz et al., 2000, p. 629).

Conversely, Rauscher & Zupan (2000) report that there were no significant music training effects on the Pictorial Memory task, taken from the McCarthy Scales of Children's Abilities. The test was viewed as a test of visual memory, which "required neither mental image formation nor temporal ordering" (Rauscher & Zupan, 2000, p. 220).

The Spatial Memory sub-test from the K-ABC was designed to be an innovative task "to assess short-term recall via simultaneous, not sequential processing" (Kaufman & Kaufman, 1983a, p. 48). The test-maker's intention was to create a sub-test where assessment could be made of "how stimuli are processed mentally, not (of) the underlying abilities of memory versus reasoning" (p. 48). Like the Hand Movements task, this task demands good concentration. A similarity with the Triangles is that here a good strategy might prove to be helpful. A possible explanation of the score increase may include the improvement of concentration through the music instruction, as well as the explanation Bilhartz et al. (2000) provided, linking this ability to cortical activation patterns. Conflicting gain results between studies might additionally be attributed to the memory tests' diversity.

It would have been useful to investigate **how** the children were thinking during the Spatial Memory task by getting them to verbalise how they performed these tasks. There could be a possible contrast between children who visualised the task compared to those who verbalised the task using self-generated labels. This was not in the present research since the tests were administered by a psychologist.

10.1.6.5. The Arithmetic task

The Arithmetic sub-test also displayed significant score improvement. Children performed at post-testing as would have been expected if five more months had passed since their original test. Compared to the six months that had intervened, this represents nearly double the actual time. As implied by its name, this test measures the child's ability to demonstrate understanding of mathematical concepts, to count, to compute, and, of course, to identify numbers. This sub-test was expected to be positively affected by the music instruction program. The findings are consistent with findings of relative research (e.g., Rauscher, 1999; Graziano, Peterson & Shaw, 1999; Peterson et al., 2000) and draw on the previously described neural network theory (Leng & Shaw, 1991), but also on a long tradition linking the two domains of music and mathematics beginning with Pythagoras.

10.1.6.6. The Matrix Analogies task

The last of the six K-ABC sub-tests that were administered to the children to be discussed, and the only one not to show a significant increase, was the Matrix Analogies sub-test. Children performed at post-testing as would have been expected if approximately two more months had passed since their original test. Although there was an increase in the post-testing scores, this was not a significant one. This is a test where impulsive or uncertain children might not perform as well. There is a sudden shift from pictorial to abstract analogies which asks for flexibility, on the part of the subject. A systematic strategy is also needed to deduce the nature of the analogy for each response. Analogies and analogic thinking have not been closely linked to music. Analogic thinking might be considered as an analytic process (because of the comparison involved), although "it is sometimes used to describe the processing style of the right cerebral hemisphere" (Kaufman & Kaufman, 1983a, p. 46). An existent but not significant relationship between music production and Raven's Standard Progressive Matrices test has been described (Hetland, 2000). Due to its different nature from the other sub-tests and because analogies and analogic thinking have not been closely linked to music instruction, no piano-keyboard instruction related improvement was expected in this task.

10.1.7. Gender differences

The issue of gender-based differences is an interesting part of this study. Sex differences in scores of spatial tests have been reported frequently (e.g., Linn & Peterson, 1985; Levine at al., 1999). These studies are unanimous in indicating a male superiority in spatial tasks. However, studies investigating boys' and girls' spatial task scores following music instruction have failed to report gender differences (e.g., Gromko & Poorman, 1998; Rauscher et al. 1997; Rauscher & Zupan, 2000). The only study that does report gender differences in spatial scores following music instruction is that of Hurwitz and colleagues (1975). In the Hurwitz et al. study though, the music instruction did not involve keyboard instruction. Rather, it was based on singing and other activities. In other words, none of the studies reviewed which investigated the effects of piano-keyboard training on children's spatial test scores (Rauscher et al., 1994, 1997; Costa-Giomi, 1999; Rauscher & Zupan, 2000) showed gender differentiation, despite the reports in other studies of boys outperforming girls in spatial tasks from the early age of four and a half (Levine et al., 1999). The reasons behind this controversy are unclear. A study investigating spatial intelligence and sex differences comparing the same group of children living in Greece at age five and then at age six, would be elucidating and would possibly provide a developmental explanation of gender differences. Such a study, though, was not found for review. Nevertheless, the above facts were the basis of investigating gender differences between the boys' and the girls' spatial test scores.

Interestingly, during pre-testing, boys' and girls' K-ABC sub-test scores showed no significant differences. It should also be noted that boys were approximately two months older than girls were. Instead of the expected superiority of boys in Triangles, for instance, girls were found to be ahead by over four months. Hand Movements showed a non-significant male advantage of less than three months. Gestalt Closure, also a spatially categorised sub-test, showed a five month non-significant male advantage. However, post-testing revealed that boys *significantly* outperformed girls in the Hand Movements task. Moreover, the situation in Triangles was reversed; boys were now ahead of girls by near to six months, though not reaching statistical significance possibly due to their original deficit. Spatial Memory, which was better performed by girls in pre-testing, was also reversed and displayed a male superiority during post-testing. In other words, boys outperformed girls in all sub-tests during post-testing despite the fact that pre-testing indicated female advantage in two of the sub-tests.

Results of comparison between the girls' and the boys' gain scores revealed a significant difference favouring boys in the Triangles task scores. While the girls showed a significant mean increase of 12,55 months between pre- and post-testing, boys' improvement was nearly double at 23,04 months. Apart from the Triangles, the Hand Movements task showed a notable – though not significant – increase favouring the boys, whose gain scores had a mean of about thirty-one months compared to approximately twenty for the girls. Other sub-tests where boys achieved higher scores, not significantly, were the Spatial Memory and the Arithmetic. The two remaining sub-tests, namely the Matrix Analogies and the Gestalt Closure, produced gain results marginally favouring girls.

As previously noted, the Triangles task is a spatial task. It might involve mental rotation, a skill where male superiority is well established (Levine et al., 1999; Voyer, Voyer & Bryden, 1995; Linn & Petersen, 1985). This particular sub-test is, according to its constructors, analogous to the Block Design task of the WISC. Studies utilising block construction tasks have reported sex differences favouring boys at this age (e.g., McGuinness & Morley, 1991). Therefore, the appearance of sex differences in spatial tasks favouring boys is consistent with the findings of other studies.

10.1.8. Sources of gender differences

Still, the difference in gain scores has unclear sources. It might reflect increased perceptiveness and enhanced response of the boys to spatial-temporal concepts introduced through the music instruction. Another possible explanation might be that cultural differences played a significant role. None of the other relevant studies were conducted in Greece, examining Greek children. A study of Greek children's spatial abilities might be helpful in clarifying maters. If it were shown, for instance, that girls in Greece do not show as significant spatial development between the ages of five and six as boys do, that would provide a plausible explanation of the sex differences found by this study.

A different explanation might be linked to the effects of hormones on spatial intelligence. Although the age of five is not characterised by a change in testosterone levels, exposure to music has been shown to influence the hormone's level in adults (Fukui, 2001). Hassler & Nieschlag (1991), on the other hand, stated that "it seems possible that an optimal testosterone range exists for the expression of creative musical behaviour" (p. 504). These children were exposed twice weekly to musical stimuli that they would not normally have experienced. Fukui's research (2001) showed that testosterone levels increased in men but decreased in women. The greatest level differentiation was recorded after listening to one's favourite music. If one of the musical goals of the instruction, which was to bring the children closer to keyboard music and piano pieces, was successful, it might be that these children listened to their "favourite" music twice a week. This could then have influenced hormonal levels in such a manner as to indirectly produce the sex differences observed. A relevant hormonal study might produce evidence in this area.

Differences in brain lateralisation have been reported when comparing men and women (e.g., Hassler, 1990; Kimura, 1996), although an evaluation of relative research reported that the gender differences account for only one to two percent of the variation in lateralisation (see Brannon, 2002, p. 54-55). Interestingly enough, British neurologist Simon Baron-Cohen (2002) believes that "systemising" and "empathising" are likely to depend on different regions in the human brain.

He presents a theory for the explanation of autism that is based on the assumption that the male brain prefers solving mental problems by "systemising" while female brain by "empathising". The essence of this theory is that males and females use different strategies to solve mental problems. "Systemising", the author explains, "is the drive to analyse the variables in a system, to derive the underlying rules that govern the behaviour of a system. Systemising also refers to the drive to construct systems... Evidence (suggests) that, on average, males spontaneously systemise to a greater degree than do females" (p. 248). Among the system kinds Baron-Cohen (2002) includes as systems that the human brain can analyse or construct, abstract and motoric (such as the technique for playing a musical instrument) systems lend themselves well to the music instruction tasks and the Triangle sub-test task. Female empathising "involves the attribution of mental states to others, and an appropriate affective response to the other's affective state" (p.248). It is presented as a way of understanding and predicting the social world, and has little obvious connection to the music instruction process and the Triangles task. If accepted, this theory could provide an explanation of the sex differences found by the present study.

All above explanations could apply to the other three sub-test results where boys outperformed girls. Matrix Analogies and Gestalt Closure though showed a marginal, but existent, female superiority. A possible interpretation could highlight the role choice of strategy might play and in non-verbal reasoning procedures such as those required for the Matrix Analogies task. This task requires the ability to handle several variables at the same time. A "systemising" male approach might then be less efficient than an "empathising" female one. The Gestalt Closure task, on the other hand, demanded that the children describe the drawing presented to them verbally. A female advantage in verbal abilities (e.g. Kramer et al., 1997) might have played a role here in forming this small difference.

10.1.9. Children's in-class behaviour and attitude

The observation sheets provided valuable information regarding the children's attitude towards the piano-keyboard instruction program. According to the results of the analysis, nearly sixty percent of the children participated with pleasure in the group activities, while almost all the others participated willingly. Only less than two percent of the children complained when instructed. Similarly, almost sixty percent of the children were very serious during the musical activities, while the rest were moderately serious. Close to ninety percent of the children co-operated without creating problems. Just over three percent would not co-operate, while the remaining less than nine percent would co-operate but caused problems to their group. Ninety percent remained attentive during the diverse musical activities, while the remainder ten percent did pay attention, only not quite as much as their peers.

Most interestingly, all children at the end of the program were able to move their fingers independently on the keyboard and to count rhythmic values correctly. A majority was also able to co-ordinate hands successfully while playing and to properly co-ordinate playing and reading at the same time. Around one third of the students could read a simple unknown music-piece without mistakes, while fewer children would take initiative and act independently when offered a new piece. Only eleven percent of the children improvised, while more than three-quarters waited for the teacher's assistance to play their music. However, these problems do not overweigh the positive outcomes. Although it must be stressed that the observations were subjective, tendencies outlined are clear.

The children learned to read simple music and to play this music on their instrument –a piano-keyboard. Furthermore, during performance they remained focused on their music, a fact that indicates that it must have been interesting or maybe even exciting for them. Their reluctance to improvise and to play without the teacher's presence is a negative observation. During the first group lessons, the children were excited and would not necessarily listen to the instructor. All children would start to play unorganised together, creating a considerable amount of noise and a chaotic class situation. It was then considered unavoidable to stress rules for the group, one of which was that "there are special times when we can all play together. Otherwise, we are not allowed to play whatever we like on the keyboard, especially since this might bother the others in the group". Children became progressively well adjusted. The above might explain why many children waited for a positive sign in order to start playing and would not improvise often.

10.1.10 Teacher interviews

After the program was completed, all kindergarten teachers whose students participated in the program were asked to give a brief written interview commenting on several aspects of the program. Several questions were asked, both closed and open-ended[6]. All teachers noted that their children showed interest in the piano-keyboard training program. They would impatiently ask when they had their next piano lesson, talk about it during other activities and enthusiastically describe their experiences in the piano program to their classmates who did not participate in the program.

It can be seen in all interviews that the children had a good relationship with their piano teacher and attained a positive attitude towards music. The children's behaviour improved in the course of the school year and the teachers felt that part of this improvement was caused by the piano program. Some children, after this initial encounter with music and the piano, continued to take piano lessons elsewhere after the end of the program.

Concluding, all the above findings, attained by comparing the scores of the children at the pre- and the post-testing period and by the results of further statistical analyses, support the original hypotheses and also allow for a rejection of the null hypotheses.

10.2. Criticism and improvements

At the end of the keyboard instruction period, all children were able to play simple songs, as described in detail in earlier sections of this dissertation. They had all arrived therefore at a level of minimum expected musical competence. Nevertheless, a standardised test measuring musical achievement could have been administered to the children in order to enable an investigation of correlation between spatial reasoning improvement and musical competence.

In further research, it would be important to investigate the possible effect of the role of the teacher as a role model in relation to the gender of the children. A clear way to do this would be to design further research with both female and male instructors and investigate the effect of the instructors' gender.

The fact that the children in this study showed significant improvement in some of the K-ABC sub-tests administered does not imply that the piano keyboard instruction is the best medium towards spatial-temporal reasoning enhancement of kindergarten children. Other, non-musical programs, such as a mathematical training program or a program involving model construction for instance, might have been more effective in enhancing spatial task scores than the piano keyboard instruction. However, the lack of an appropriate control group does not allow for such a comparison. Further research could incorporate such control groups and possibly provide some answers regarding the above hypotheses.

It would have been an appropriate way to thank parents and teachers for their support through this program, by giving them a short talk or other feedback on the results. For example, an appropriate point for teachers would have been that some children found to have difficult behaviour in the classroom, concentrated rather well in the piano sessions and focused their attention and physical activity with a promise that they could enjoy free play on the piano at the end of the session. It is important for teachers to know this, although they could not make a similar promise in the classroom.

Many questions remain open after the completion of this study. If it were to be replicated, changes implemented might include:

- Assessment of musical abilities and achievement at the beginning and at the end of the instruction period, for the reasons mentioned above.
- The inclusion of a control group receiving, for instance, mathematical concepts instruction, suitable for kindergarten children. Another control group might be one allowed to spend as much time using the piano keyboards as the treatment group, but without instruction. This would facilitate elimination of a possible effect on

[6] An open-ended question requires a response that provides descriptive information; a closed question can be

spatial task scores playing "with" and not "on" the musical instruments might have on the children. However, such a "use" of educational time of five-year-old children would be unethical.

- The inclusion of both age groups present in Greek kindergartens; four- and five-year-old children. This would allow for a comparison of the effectiveness of the piano-keyboard instruction on the two age groups. Results would possibly point to the more suitable age for inclusion of a similar instructional program in kindergartens.

- A follow-up study, conducted to investigate long-term effects of the piano-keyboard instruction on spatial-temporal task scores. Persellin (1999) has found that children's spatial-temporal performance increased significantly after six weeks of instruction, but this increase was not significant after six additional weeks without music instruction. However, the short instruction period might have influenced the temporary character of the enhancement.

Other studies are necessary to shed light on some of the unanswered questions produced by this research. These might include:

- Studies which explore the correlation between other musical instruments' instruction and cognitive skills;

- Studies to determine which musical skills have a greater potential to influence achievement in other content areas;

- Studies to investigate the spatial development of Greek children between the ages of five and six.

10.3. Limitations

Limitations include:

- The small number of children who participated in the study

- The study was limited to piano-keyboard instruction. Other instruments might have induced a different effect on the abilities investigated by this study.

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answered with a yes or a no

- Furthermore, it was conducted with children from middle to upper class families only. Additionally, all participants were Greek. This was possibly due to the area where the kindergarten was located. However, the study participants do not exactly represent the population that may be found in most other public schools, where low-income families and minorities are also represented among the children.

- The expressed wish of many of the children to continue their piano lessons after the completion of the training program was not systematically monitored. This willingness could have been a dependent variable, which could have been monitored through postal comments.

- The long-term effects of piano-keyboard training on the cognitive abilities measured cannot be estimated. It would have been useful to have had a delayed post-test some weeks or months after the present post-test. This was not possible because the children were dispersed to other schools. However, it is likely that such a delayed test would have shown some downward drift in the present positive results. In such a case, a "booster" class at regular intervals would probably sustain the higher level of results.

- All children were enrolled in the same kindergarten. However, they were selected from all six available classes.

- The lack of a control group. This is important because without a direct comparison of the treatment group with an appropriate control group, one might reasonably argue that the score improvements are observed because of a Hawthorne effect[7].

However, several other similar studies (e.g. Rauscher and Zupan, 2000; Bilhartz, Bruhn, and Olson, 2000; Rauscher et al., 1997; Rauscher et al., 1994) have included diverse control groups. In these studies, children were assigned to no lesson groups, singing session groups or computer lesson groups. Results have consistently indicated a greater improvement of the piano-keyboard group as compared to these control groups, minimising the presence of a Hawthorne effect for the spatial-temporal tasks. Nevertheless, the existence of the Hawthorne effect makes a true evaluation of the piano-keyboard

[7] The Hawthorne effect refers to a distortion of research results caused by the response of subjects to the special attention they receive from researchers. It emphasises the fact that even controlled scientific studies that focus only on measurable aspects may have central flaws

instruction's extra-musical effects a difficult task. Further research is necessary to eliminate this alternative explanation.

10.4. Implications

Neurological studies have provided an invaluable insight for research exploring non-musical aspects of music training. Studies regarding spatial processes produced quite definite evidence. The right hemisphere appears to contain the areas most importantly involved in spatial processing (Bodner et al., 2001; Nair et al., 2003). When the right posterior regions are damaged, the unlucky individual cannot recognise faces, notice fine details or be orientated around a site (Gardner, 1993). Similarly, music skill is based in areas found chiefly in the right hemisphere, although it is not as clearly located in a distinct area, as language might be, and depends on training, training method and duration (Altenmüller et al., 1997). Language, one of the first skills to be investigated neurologically with over one hundred years of research history, has been found to be mainly left lateralised in right-handed individuals. Just five percent of right-handed and thirty percent of left-handed individuals have the speech areas in the right hemisphere (Thompson, 2000).

Relatively recent research indicates that trained musicians tend to use more of the *left* half of their brains for music processing, possibly because they have learned to process musical information more *analytically*. Indeed, the left lateralisation involved in music processing is a secondary phenomenon brought about by music usage. This is supported by an important body of evidence (Schlaug, 1995; Schlaug et al., 1995; Jäncke, Schlaug, & Steinmetz, 1997; Pantev et al., 1998; Münte, Altenmüler, & Jäncke, 2002). Some of the implications of neurological findings for non-musical effects of music training are:

- Research indicating that learning verbal information through music creates different cortical patterns of activation, could lead to the development of alternative teaching methods through music for children with learning difficulties.

- Further research is necessary to determine the interaction or the relationship, if any, between the music processing centres and other overlapping or neighbouring functionally identified cortical areas.

- Brain imaging techniques, such as fMRI, EEG and PET-scans, reveal stimulation of "non-musical" brain areas by music. These findings may provide a physiological basis for the extra-musical effects of music. Further research must be conducted to demonstrate the pathways through which music possibly affects other learning.

This study's findings and conclusions provide the research and educational communities with some insight into a possible relationship between skill perception in music and in spatial-temporal reasoning. Future policies may be based on the assumption that learning in one area provides a conceptual basis for learning in another. Learning transfer characterised by the systematic presentation of specific skills common between various disciplines may emerge as an effective means of instruction for all students. The findings discussed here would provide support for the implementation of such policies in the schools.

Researchers must continue to investigate the possible role of music instruction in establishing a steadier foundation for later learning. Findings emphasise the benefits of:

- The inclusion of music instruction, provided by a music specialist, capable of specific instrumental skill instruction, in the kindergarten curriculum;

- The inclusion of instrumental music instruction in the general music classroom.

The children participating in the study expressed their feeling of enjoyment for learning activities associated with the instructional program. There was an enthusiasm expressed for learning of both musical and instrumental skills. It would be possible to use the positive affective responses of the children for group therapy, with, for example, children who have suffered abuse or trauma. Student advances paired with the positive educator reactions to the instrumental training activities presented suggest that teachers should keep on searching for subjects which students enjoy. This might provide a route through which achievement could be increased in those with which they may be experiencing difficulty. If or when teachers perceive problems of children having reading difficulties associated with phonics and perceptions of speech sounds, then the use of tones (aural piano discrimination exercises) might be of assistance.

This research generated evidence that piano-keyboard instruction produced some enhanced spatial-temporal test scores in kindergarten children, and that these scores were gender differentiated. These findings provide only a small contribution to the growing body of research investigating the extra-musical effects of music instruction. However, a further aim of the keyboard instruction program, irrelevant to the research objectives, was to provide the participating children with a learning experience, capable of inspiring those who might be interested to pursue a musical training and to enjoy the benefits of music making for its own sake. The extra-musical benefits of music, which have been recognised since the ancient times, constitute only part of the reason one should aspire to a musical education. Being an art, music can provide an invaluable means of self-expression and of personal enjoyment, and, in its higher form, it can even become a vehicle for the pursuit of excellence.

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APPENDICES

Feel The Beat!

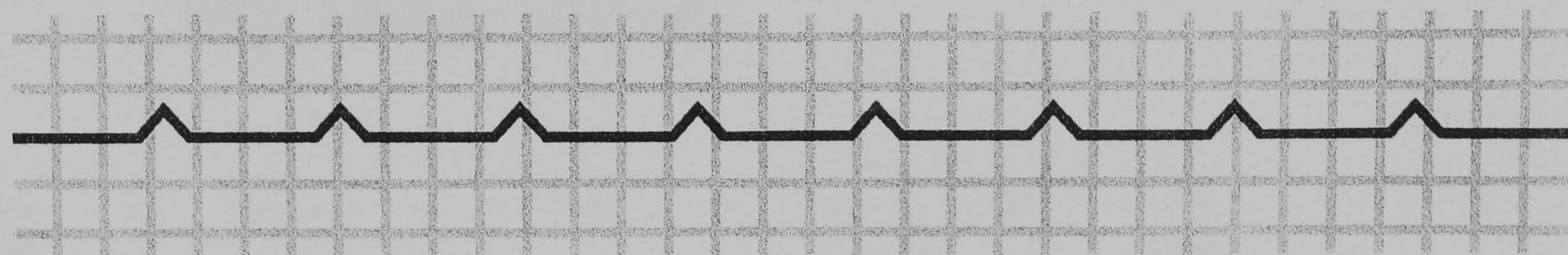
Become aware of the heartbeat inside your body. Feel how it beats in an even pulse. Sometimes your heart beats fast, like when you run; sometimes it beats slowly, like when you are asleep, but it always beats evenly.

Rhythm In Music

Music has a pulse, too. Just like your heartbeat, musical pulse can go fast or slow.

Clap this pulse as your teacher plays the accompaniment below three different times at different speeds:

1) at a slow speed, 2) at a moderate speed, 3) at a fast speed.



You can also play this pulse on the piano using any black key. Remember to keep the pulse even.

Accompaniments may also be played on audio CD or General MIDI Disk. Numbers indicate the track.

1/2/3 1

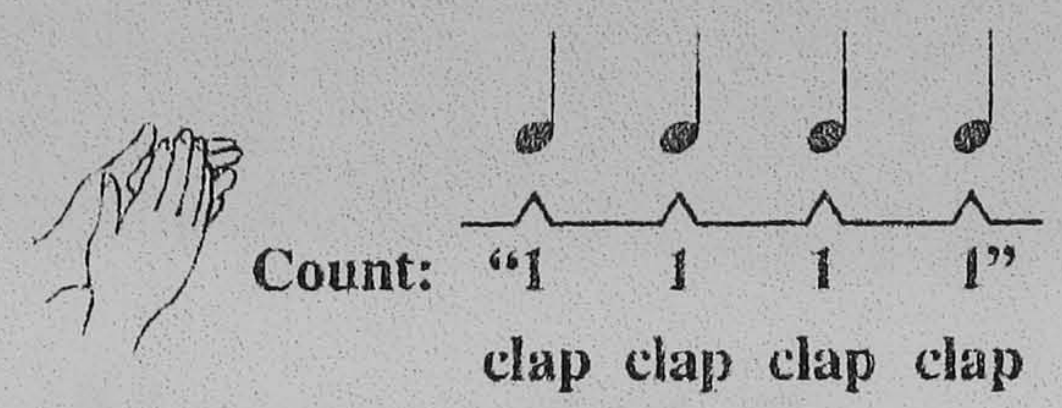
Accompaniment

When you play these pieces by yourself, use the middle of the keyboard.

It is helpful to clap the rhythm of a piece before playing it.

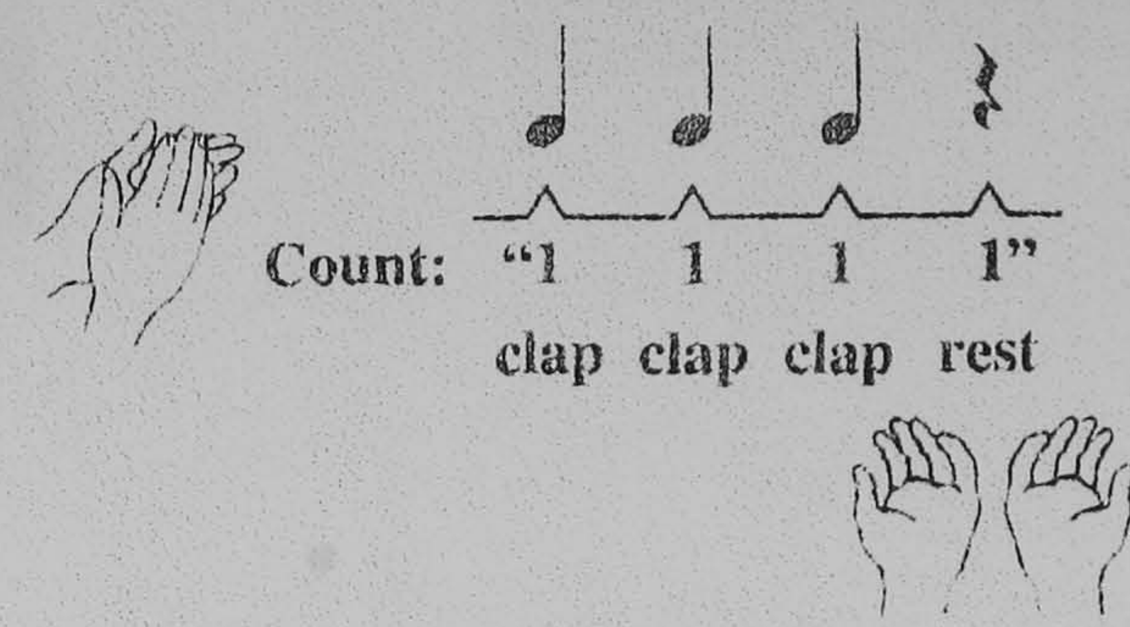
CROTCHET NOTE

Notes tell us how long the sounds last.
A **Crotchet Note** lasts for one pulse (beat).



CROTCHET REST

Rests are pictures of silence.
A **Crotchet Rest** lasts for one pulse (beat).



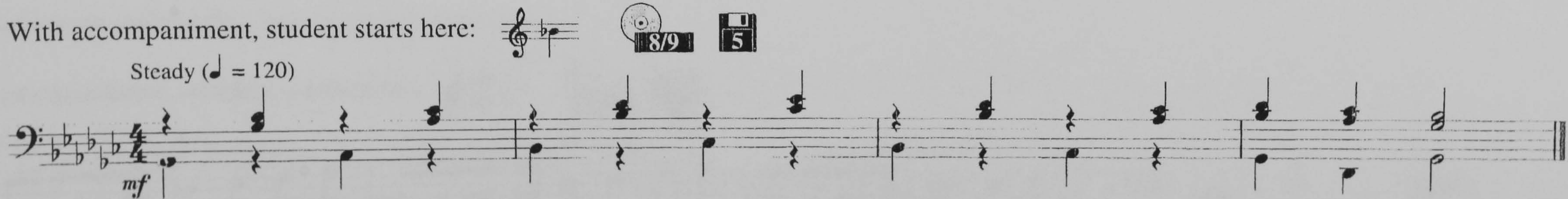
My Dog, Spike

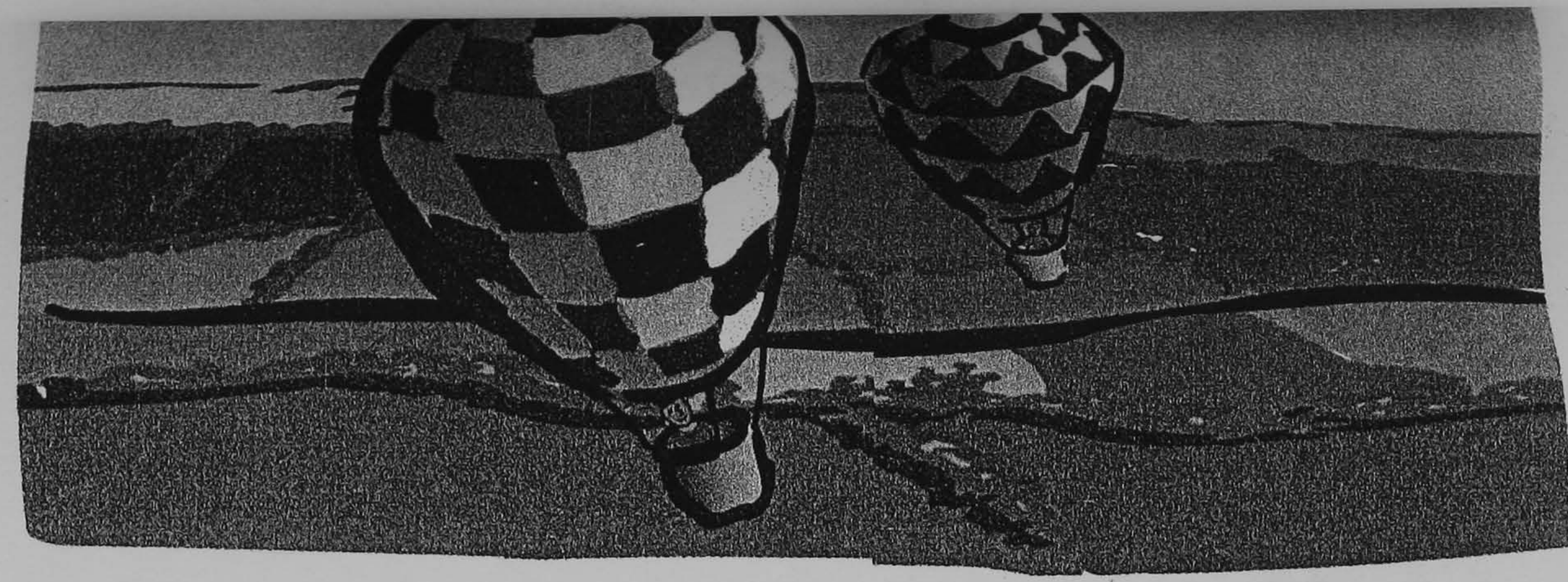
Steady

"Hot Cross Buns"

My dog, Spike, off to school, out to prove that he's so cool.

With accompaniment, student starts here:



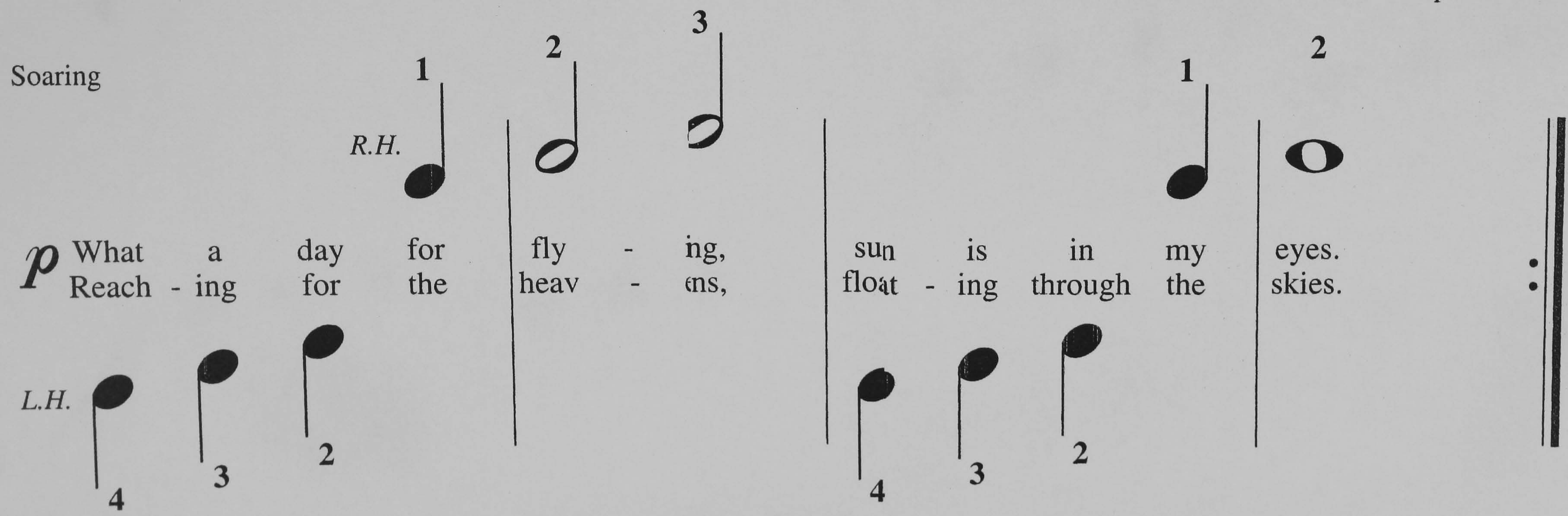


p
means soft

Dynamic Signs tell how loud or soft to play and help create the mood of the music.

Balloon Ride

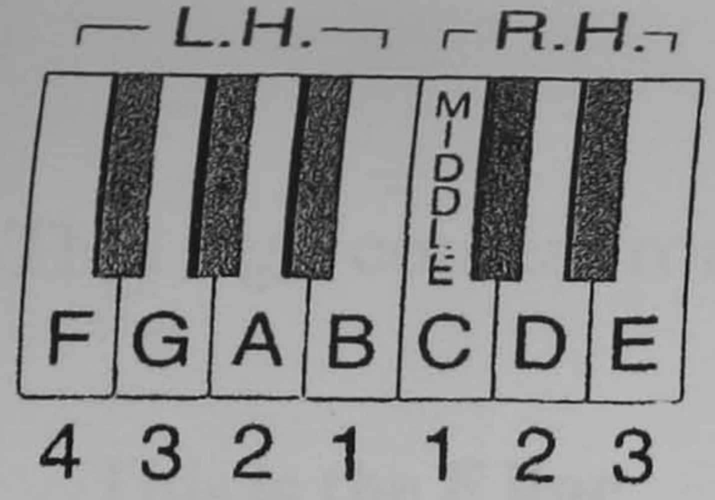
Phillip Keveren



Repeat Sign means to play the piece again.

Hold down the right pedal (sustain pedal) throughout.

With accompaniment, student starts here:



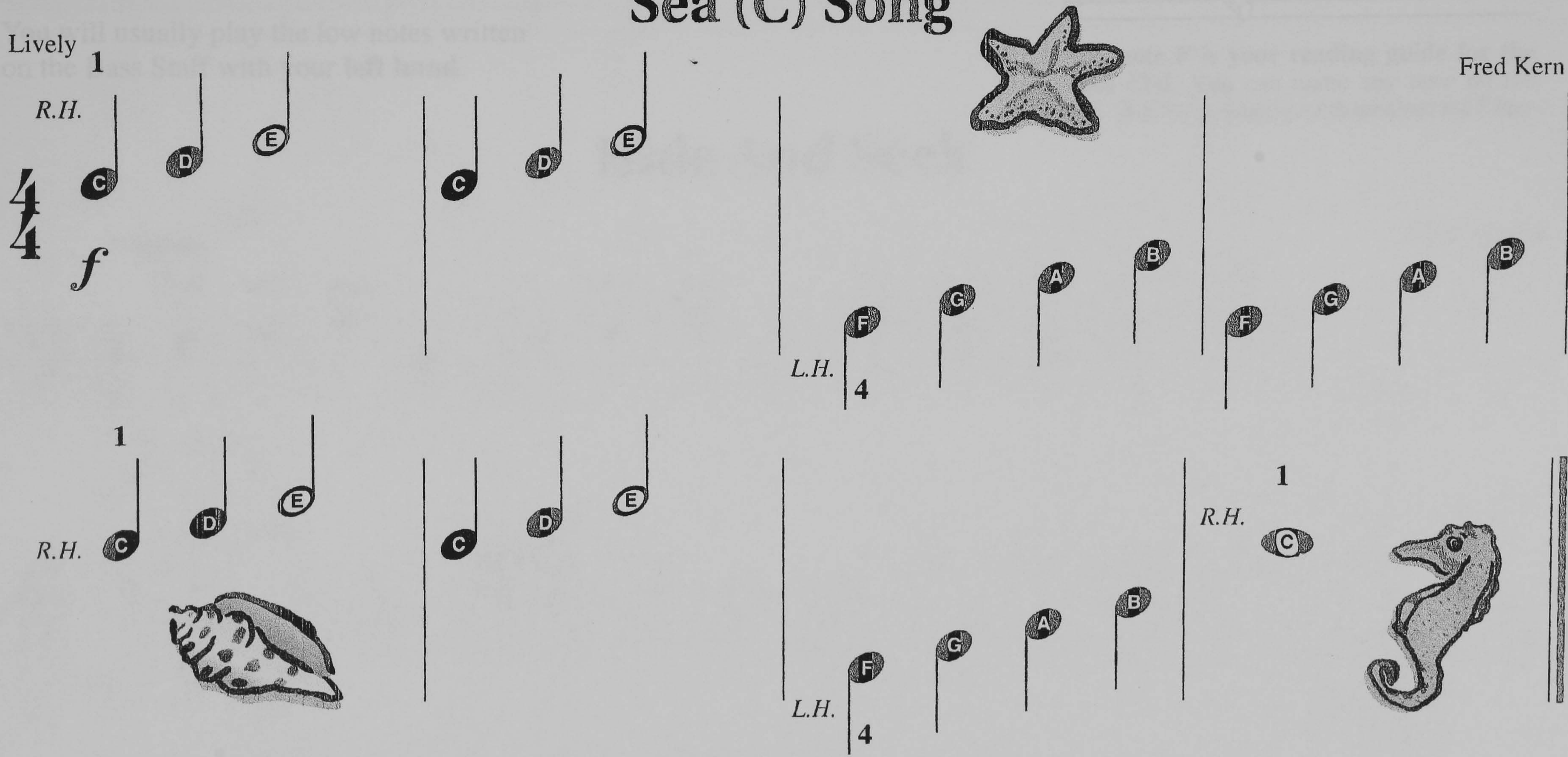
TIME SIGNATURE

4/4 (4/crotchet) = four beats fill every bar
= crotchet note gets one beat

Count: "1 1 1 1 | 1 1 1 - 2 | 1 - 2 - 3 - 4"
or "1 2 3 4 | 1 2 3 - 4 | 1 - 2 - 3 - 4"

Sea (C) Song

Fred Kern



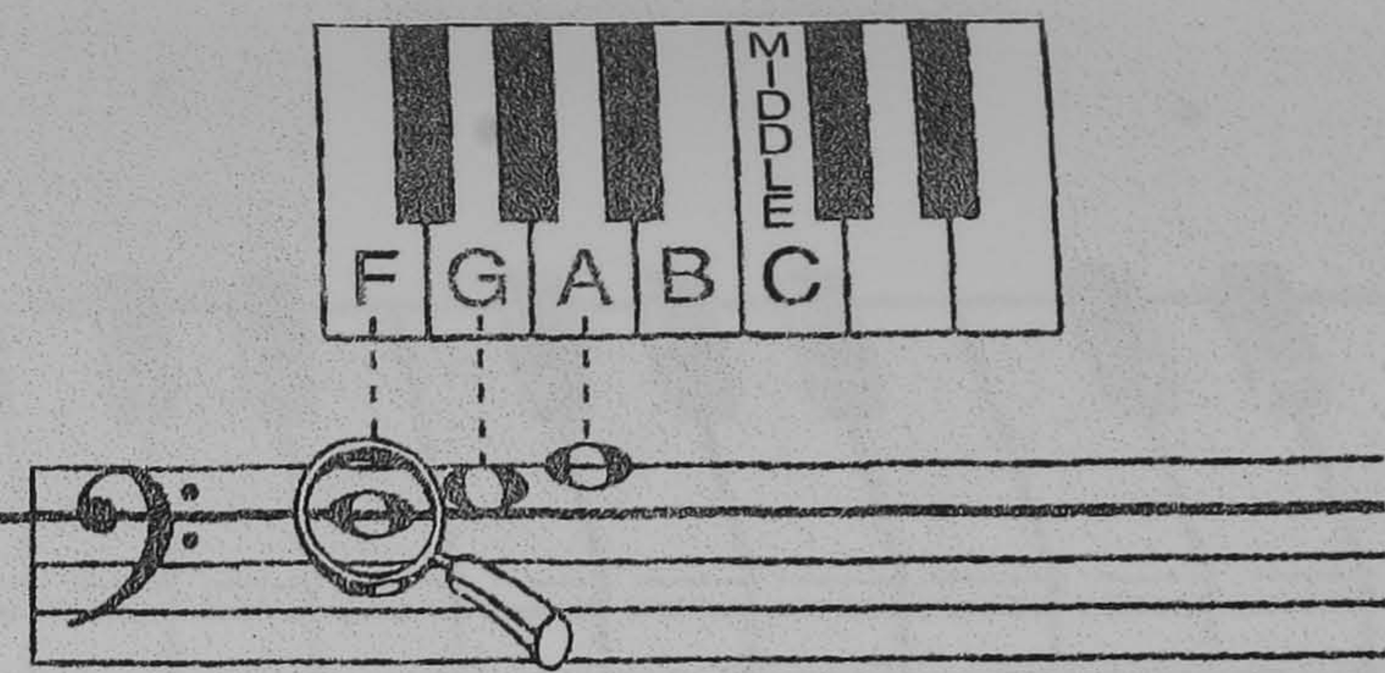
With accompaniment, student starts here:

THE BASS CLEF SIGN 𝄢
(The "F" Clef)

This sign comes from the old-fashioned letter F.

This is the F line

The F line passes between the two dots of the **Bass Clef** sign.

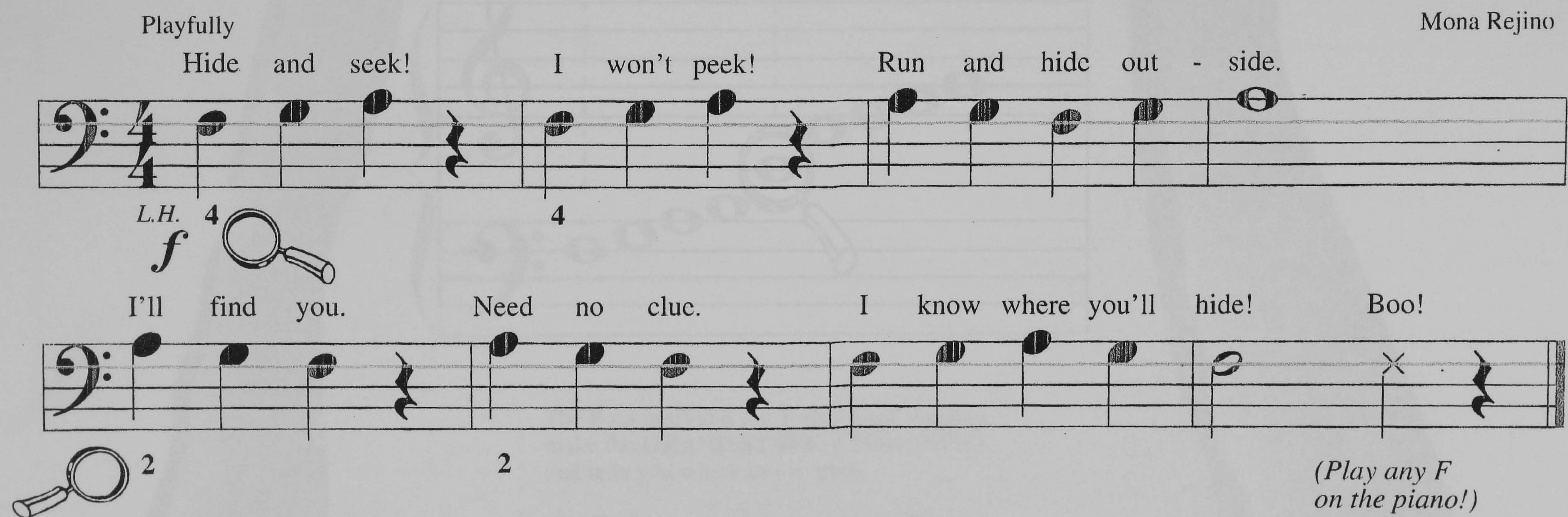


You will usually play the low notes written on the Bass Staff with your **left hand**.

The note F is your reading guide for the Bass Clef. You can name any note on the Bass Staff by moving up or down from the F line.

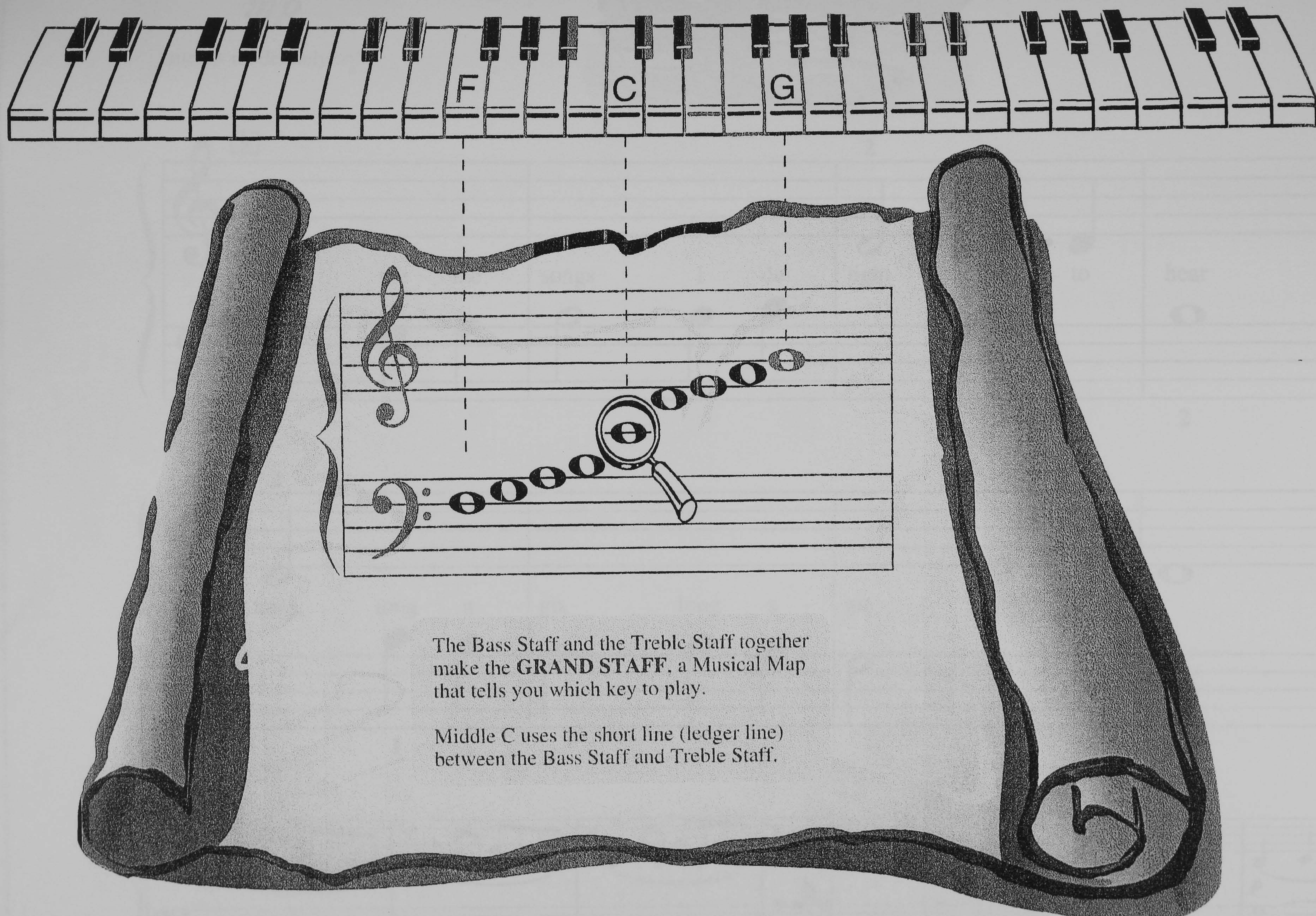
Hide And Seek

Mona Rejino



Accompaniment

THE GRAND STAFF
A Musical Map



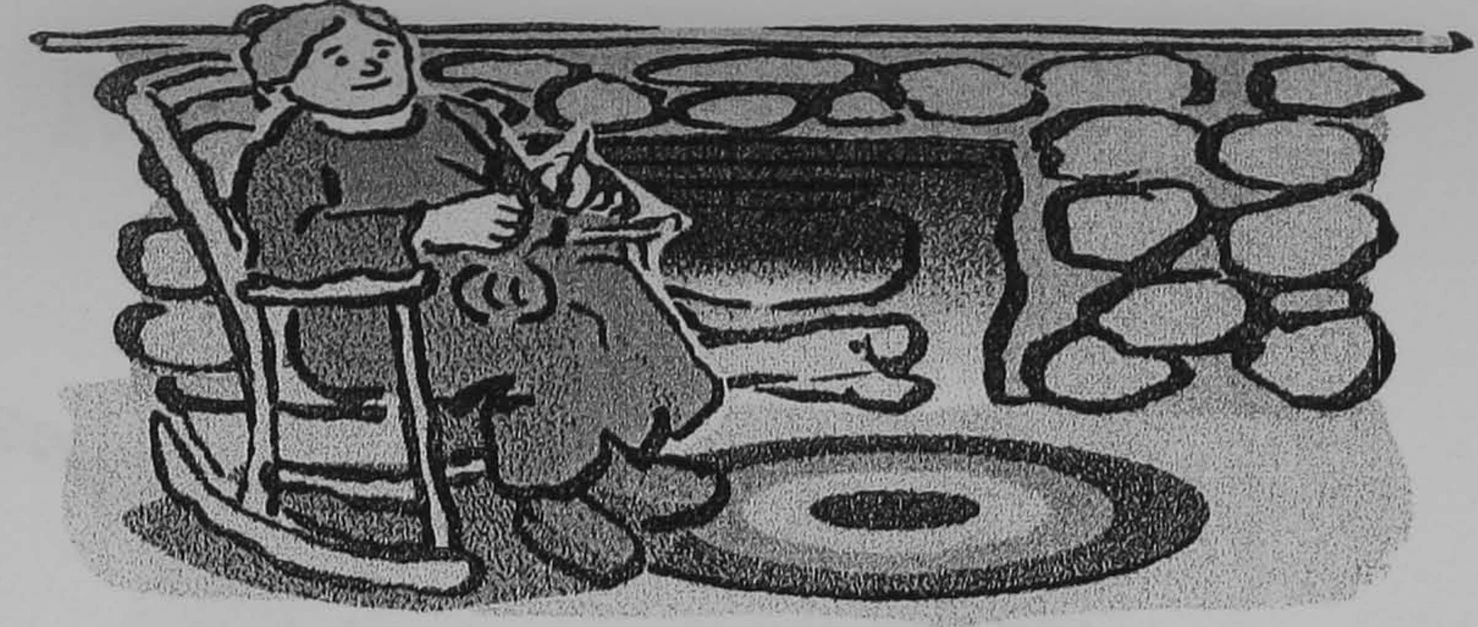
The Bass Staff and the Treble Staff together make the **GRAND STAFF**, a Musical Map that tells you which key to play.

Middle C uses the short line (ledger line) between the Bass Staff and Treble Staff.

MEZZO PIANO

mp

means moderately soft



My Own Song

With your right and left hands, choose any groups of two black keys in the upper part of the piano.

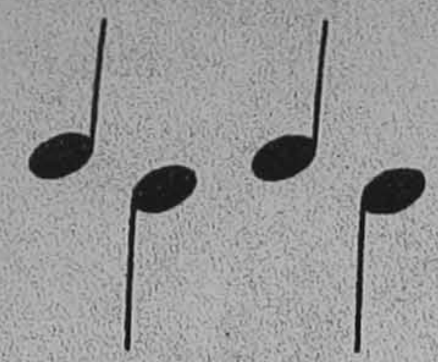
Listen and feel the pulse as your teacher plays the accompaniment below. When you are ready, play along and make up your own song.

Have fun!

Climbing Up

Two Black Keys
Moving Up The Keyboard

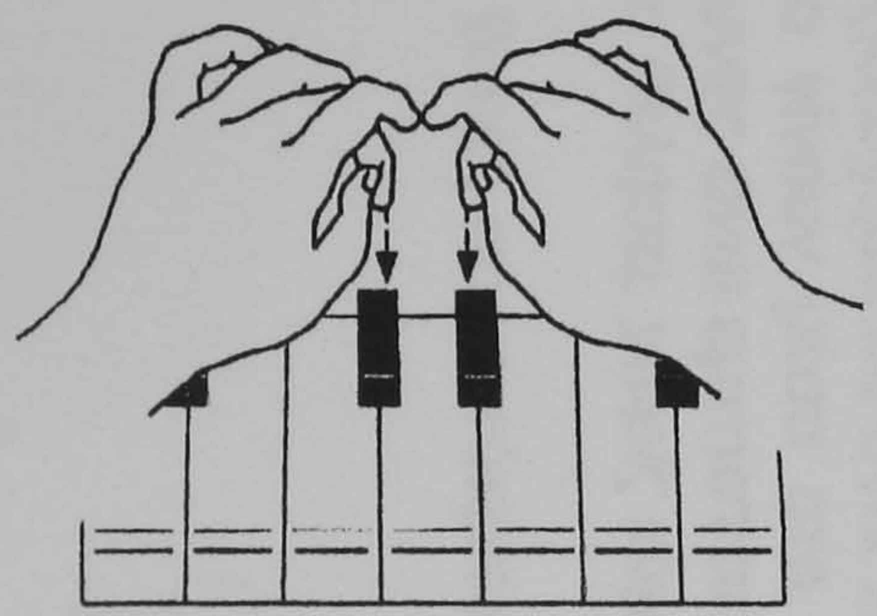
NOTES



Notes are pictures of sounds.

Stems up = Right Hand (*R.H.*)

Stems down = Left Hand (*L.H.*)



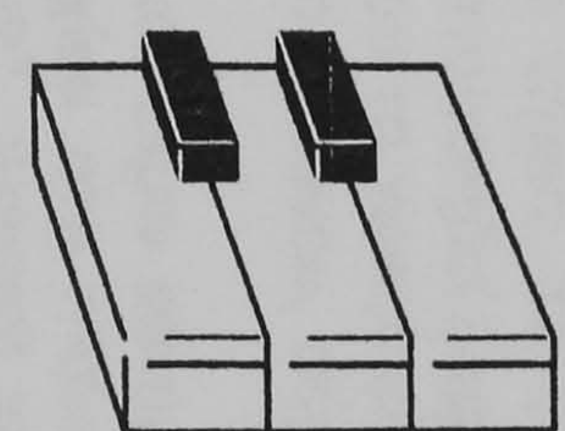
Play this song on two black keys with the third finger in each hand.

It is helpful to clap and sing the words of a piece before playing it. Remember to keep a steady pulse!

Climb - ing, climb - ing up this tree,

R.H.

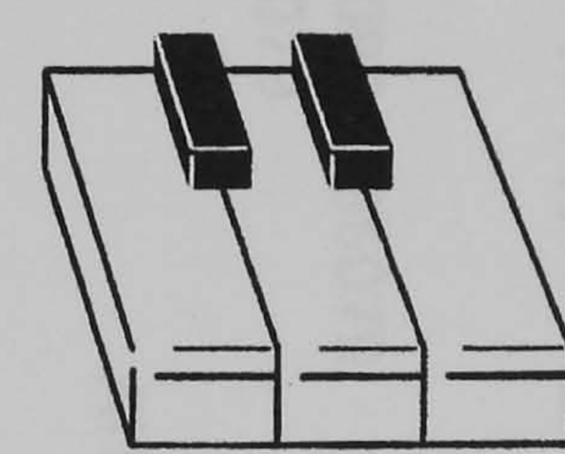
L.H.



High - er, high - er look at me!

R.H.

L.H.



With accompaniment, student starts here:

5/6 3

With determination (♩ = 120)

APPENDIX B **Informed consents**

Νικόλαος Ζαφρανάς
Εδμόνδου Ροστάν 47
54642 Θεσσαλονίκη
Τηλ.: (031) 815150
Κινητό: (093) 2429494

Προς την
Πρόεδρο
Του Εποπτικού Συμβουλίου των Πειραματικών Νηπιαγωγείων του Α.Π.Θ
Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης
Παιδαγωγική Σχολή
Τμήμα Επιστημών Προσχολικής Αγωγής και Εκπαίδευσης
Πανεπιστημιούπολη
54124 Θεσσαλονίκη
Τηλ.: (031) 995015/ 995090/ 995097/ 995079
Fax.: (031) 995015/ 995024/ 995079

ΑΙΤΗΣΗ

Θεσσαλονίκη, 17 Μαΐου 2001

Αξιότιμη κ. Πρόεδρε,

Με την παρούσα επιστολή αιτούμαι την άδεια διεξαγωγής εκπαιδευτικής έρευνας στα Πειραματικά Νηπιαγωγεία του Α.Π.Θ. κατά το σχολικό έτος 2001-2002. Η έρευνα αυτή εντάσσεται στα πλαίσια εκπόνησης της διδακτορικής μου διατριβής στο Πανεπιστήμιο Brunel της Μεγάλης Βρετανίας, με τίτλο «The effects of piano-keyboard instruction on cognitive abilities of female and male kindergarten children».

Σκοπός της έρευνας είναι η αξιολόγηση της επίδρασης ενός προγράμματος εκμάθησης πιάνου-αρμονίου διάρκειας ενός σχολικού έτους στις νοητικές ικανότητες των νηπίων.

Σύμφωνα με δημοσιευμένες έρευνες, μαθήματα πιάνου (αρμονίου) σε παιδιά προσχολικής ηλικίας είχαν σαν αποτέλεσμα στατιστικά σημαντική αύξηση των επιδόσεων των παιδιών αυτών σε τεστ χωρικής-χρονικής ικανότητας. Περαιτέρω, παιδιά που μαθαίνουν μουσική αποκτούν έναν εναλλακτικό τρόπο έκφρασης και επεκτείνουν τους δημιουργικούς και αισθητικούς τους ορίζοντες. Ταυτόχρονα, μαθαίνουν την σημασία της πειθαρχίας και της επιμονής. Αυτά είναι μόνον κάποια από τα πολλά οφέλη της μουσικής εκπαίδευσης.

Περιγραφή της έρευνας: Θα λάβουν μέρος μόνο νήπια. Τα παιδιά θα χωριστούν σε ομάδες «πιάνου» των πέντε με έξι παιδιών. Αυτό θα πραγματοποιηθεί λαμβάνοντας απολύτως υπ' όψιν τις ανάγκες του σχολείου και μη διαταράσσοντας διόλου το γενικό εκπαιδευτικό πρόγραμμα. Κάθε ομάδα παιδιών θα λαμβάνει δύο εβδομαδιαία μαθήματα πιάνου, σύμφωνα με μία σύγχρονη μέθοδο πιάνου (Hal Leonard - piano lessons).

Τα μαθήματα θα γίνουν όλα από εμένα προσωπικά. Είμαι κάτοχος Διπλώματος πιάνου (Εθνικό Ωδείο Αθηνών, 1990, με Άριστα παμψηφεί), Πτυχίου στο πιάνο από το Πανεπιστήμιο Μουσικής και Δραματικής Τέχνης του Γκράτς (Αυστρία, 1997, Άριστα) και μεταπτυχιακού τίτλου Magister Artium του ιδίου Πανεπιστημίου (Αυστρία, 1999). Επίσης έχω διδάξει πιάνο επί σειρά ετών και σε ιδιαίτερα μαθήματα αλλά και σε Ωδεία (Νέο Ωδείο Θεσσαλονίκης, Δημοτικό Ωδείο Πολυγύρου).

Τα παιδιά θα αξιολογηθούν σε έξι υπό-τεστ (Hand Movements, Gestalt Closure, Triangles, Spatial Memory, Matrix Analogies, Arithmetic) του Kaufman Assessment Battery for Children, σε δύο διαφορετικές στιγμές: **πριν** την έναρξη των μαθημάτων πιάνου και **μετά** τη λήξη τους. Πριν το πρώτο τεστ, τα παιδιά θα ερωτηθούν σύντομα προσωπικές ερωτήσεις, για την οικογενειακή τους κατάσταση καθώς και για τις μουσικές τους γνώσεις. Ο μέσος χρόνος απασχόλησης του κάθε παιδιού για αυτήν την αξιολόγηση θα είναι περίπου 45 λεπτά τη φορά.

Όλα τα τεστ θα γίνουν μέσα στο σχολείο και ***μόνο με την έγκριση του παιδιού***. *Τα* ***αποτελέσματα*** *της έρευνας είναι* ***εμπιστευτικά***. *Το παιδί έχει το δικαίωμα ελεύθερα να αποσυρθεί από την έρευνα όποτε το θελήσει, χωρίς καμία προειδοποίηση.*

Ευελπιστώ στη θετική σας απόκριση.

Με ιδιαίτερη τιμή,

Νικόλαος Ζαφρανάς

Nikolaos Zafranas
Edmondou Rostan 47
54642 Thessaloniki
Tel.: (031) 815150
Mobile phone: (093) 2429494

To
President
Supervisory Council of the Experimental Kindergartens of the Aristotle University of Thessaloniki
Faculty of Education
School of Early Childhood Education
University Campus
54124 Thessaloniki
Tel.: (031) 995015/ 995090/ 995097/ 995079
Fax: (031) 995015/ 995024/ 995079

APPLICATION

Thessaloniki, 17 May 2001

Honourable President,

With the present letter, I am applying for a permission to conduct educational research at the Experimental Kindergartens of the Aristotle University of Thessaloniki during the school year 2001-2002. This research is part of the work necessary for completing my doctoral thesis at Brunel University of the United Kingdom, titled "The effects of piano-keyboard instruction on cognitive abilities of female and male kindergarten children".

Aim of the study is to assess the effect of a piano-keyboard instruction program, lasting one school year, on cognitive abilities of kindergarten children.

According to published research, piano (keyboard) lessons given to preschool children resulted in a statistically significant increase of achievement of these children on spatial-temporal ability tests. Furthermore, children that learn music acquire an alternative way of expression and broaden their creative and aesthetic horizons. At the same time, they learn the importance of discipline and persistence. These are just some of the many profits of music education.

Research description: Only "*nipia*" [five- to six-year-old kindergarten children] will participate. The children will be divided in "piano" groups of five to six. This will be realised absolutely taking under consideration the needs of the school and not disrupting at the least the general educational program. Every group of children will receive two weekly piano lessons, following a contemporary piano method (Hal Leonard – piano lessons).

All lessons will be given by me personally. I hold the Piano Diploma (National Conservatory of Athens, 1990, Excellent unanimously), a degree in Piano Performance from the University for Music and Drama in Graz (Austria, 1997, Excellent) and the post-graduate degree Magister Artium of the same University. Additionally, I have taught piano for a number of years in private lessons as well as in Conservatories (New Conservatory of Thessaloniki, Municipal Conservatory of Poligiros).

The children will be assessed on six subtests (Hand Movements, Gestalt Closure, Triangles, Spatial Memory, Matrix Analogies, Arithmetic) of the Kaufman Assessment Battery for Children, at two different occasions: **before** the beginning of the piano lessons and **after** their completion. Before administering the first test, the children will be briefly asked personal questions, about their familial situation as well as their musical knowledge. The mean time of occupation of each child for this assessment will be approximately 45 minutes per session.

All tests will be conducted in the school and **only with the child's permission**. The **results** of this research are **confidential**. The child has the right to leave the research freely whenever it wishes, without any prior notice.

Hoping for your positive reply,

With distinctive honour,
(signature)
Nikolaos Zafranas.

Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης
Παιδαγωγική Σχολή
Τμήμα Επιστημών Προσχολικής Αγωγής και Εκπαίδευσης
Πανεπιστημιούπολη 54124 Θεσσαλονίκη
Τηλ.: (2310) 99.50.15 / 99.50.90 / 99.50.97 / 99.50.79
Fax: (2310) 99.50.15 / 99.50.24 / 99.50.79

Καθ. Μ. Κάτσιου–Ζαφρανά
Πρόεδρος Τ.Ε.Π.Α.Ε.

Θεσσαλονίκη, 18 Σεπτεμβρίου 20

Σε απάντηση της αίτησης με ημερομηνία 17 Μαΐου 2001 του κυρίου Νικολάου Ζαφρα υποψήφιου διδάκτορα του Πανεπιστημίου Brunel της Μεγάλης Βρετανίας, το Εποπτικό Συμβούλιο τ Πειραματικών Νηπιαγωγείων του Α.Π.Θ. αποφάσισε να εγκρίνει τη διεξαγωγή, από μέρους τ ενδιαφερομένου, έρευνας η οποία πραγματοποιείται στα πλαίσια της διδακτορικής του διατριβής π φέρει τον τίτλο: «The effects of piano-keyboard instruction on cognitive abilities of female and m kindergarten children».

Η παρούσα έρευνα θα διεξαχθεί στα Πειραματικά Νηπιαγωγεία του Α.Π.Θ. κατά το σχολ έτος 2001-2002 και θα έχει ολοκληρωθεί έως τις 30 Ιουνίου 2002.

Η Πρόεδρος
Του Εποπτικού Συμβουλίου
των Πειραματικών Νηπιαγωγείων του Α.Ι

ΑΡΙΣΤΟΤΕΛΕΙΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΟΝΙΚΗΣ
ΤΜΗΜΑ ΕΠΙΣΤΗΜΩΝ ΠΡΟΣΧΟΛΙΚΗΣ ΑΓΩΓΗΣ ΚΑΙ ΕΚΠΑΙΔΕΥΣΗΣ

Καθηγήτρια Μ. Κάτσιου-Ζαφρανά

(Logo) **<u>Aristotle University of Thessaloniki</u>**
Faculty of Education
School of Early Childhood Education
University Campus 54124 Thessaloniki
Tel.: (2310) 995015/ 995090/ 995097/ 995079
Fax: (2310) 995015/ 995024/ 995079

Prof. M. Katsiou-Zafrana

President of the School of Early Childhood Education

Thessaloniki, 18 September 2001

Answering the application dated 17 May 2001 of Mr. Nikoalos Zafranas, doctoral student of Brunel University of the U.K., the Supervisory Council of the Experimental Kindergartens of the Aristotle University of Thessaloniki has decided to approve the realisation, by the interested party, of research conducted as part of the work necessary for completing his doctoral thesis titled: "The effects of piano-keyboard instruction on cognitive abilities of female and male kindergarten children".

The present research will be conducted at the Experimental Kindergartens of the Aristotle University of Thessaloniki during the school year 2001-2002 and will be completed by 30 June 2002.

The President
Of the Supervisory Council
of the Experimental Kindergartens of the Aristotle University of Thessaloniki

(Signature, Stamp)

Professor M. Katsiou-Zafrana

ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ

ΥΠΟΥΡΓΕΙΟ ΕΘΝΙΚΗΣ ΠΑΙΔΕΙΑΣ & ΘΡΗΣΚΕΥΜΑΤΩΝ

ΠΕΡΙΦΕΡΕΙΑΚΗ Δ/ΝΣΗ Α/ΘΜΙΑΣ & Β/ΘΜΙΑΣ ΕΚΠ/ΣΗΣ

ΔΙΕΥΘΥΝΣΗ ΑΝΑΤΟΛΙΚΗΣ ΘΕΣΣΑΛΟΝΙΚΗΣ

ΠΕΙΡΑΜΑΤΙΚΑ ΝΗΠΙΑΓΩΓΕΙΑ Τ.Ε.Π.Α.Ε.

Θεσσαλονίκη

Ταχ. Δ/νση: Χαρ. Τρικούπη 2

Ταχ. Κώδικας: 55 236

Πληροφορίες: Σκουλοπούλου Μ.

Τηλ. Fax: 346217

e-mail : stepae@otenet.gr

Θεσσαλονίκη 1-10-2001

ΒΕΒΑΙΩΣΗ

Το Εποπτικό Συμβούλιο των Πειραματικών Νηπιαγωγείων του Α.Π.Θ. έδωσε την άδεια στον κ. Νικόλαο Ζαφρανά, πιανίστα και υποψήφιο διδάκτορα του Πανεπιστημίου Brunel της Αγγλίας, να πραγματοποιήσει ένα πειραματικό πρόγραμμα διδασκαλίας πιάνου στα παιδιά των Πειραματικών Νηπιαγωγείων του Α.Π.Θ., διάρκειας ενός έτους, ήτοι από τον Οκτώβριο του 2001 έως τον Μάιο του 2002.

Το εγκεκριμένο αυτό ερευνητικό πρόγραμμα εκμάθησης πιάνου εντάσσεται στο Αναλυτικό Πρόγραμμα των Πειραματικών Νηπιαγωγείων του Α.Π.Θ..

Η Διευθύντρια

Σκουλοπούλου Μαρία

HELLENIC REPUBLIC Thessaloniki, 1 October 2001

MINISTRY OF NATIONAL EDUCATION & RELIGIOUS AFFAIRS

REGIONAL DIRECTION OF PRIMARY & SECONDARY EDUCATION

DIRECTION OF EAST THESSALONIKI

EXPERIMENTAL KINDERGARTENS (School of Early Childhood Education)

Thessaloniki

Postal Address: Har. Trikoupi 2

Postal Code: 55236

Information: Skoulopoulou M.

Tel. Fax: 346217

e-mail: stepae@otenet.gr

CERTIFICATION

The Supervisory Council of the Experimental Kindergartens of the Aristotle University of Thessaloniki has granted permission to Mr. Nikolaos Zafranas, pianist and doctoral student of Brunel University of U.K., to conduct an experimental program of piano instruction with the children of the Experimental Kindergartens of the Aristotle University of Thessaloniki, lasting one year, that is from October 2001 until May 2002.

This approved research program of piano instruction is integrated into the Analytical Program of the Experimental Kindergartens of the Aristotle University of Thessaloniki.

The Director

(Signature, Stamp)

Skoulopoulou Maria

APPENDIX C Observation Sheets

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 1

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
		A-													
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Με παράπονα														
	Με προθυμία														
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ		✓	✓		✓	✓	✓	✓	✓	✓			✓	
	ΟΧΙ											✓	✓		
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ		✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	
	ΜΕΤΡΙΑ											✓			
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών		✓	✓		✓	✓	✓	✗	✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο		✓	✓		✓	✓	✓	✗	✓	✓	✓	✓	✓	
	Παίξιμο με δεξί και αριστερό χέρι		✓	✓		✓	✓	✓	✗	✓	✓	✓	✓	✓	
	Αυτοσχεδιασμός		-	✗		✗	✗	✗	✗	✓	✗	✗	✗	✗	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.		✓	✓		✗	✓	✗	✗	✓	✓	O	O	✗	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ														
	ΟΧΙ		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός			–		–	–	–	–	–	–	–	–	–	
	Οι προηγούμενες δραστηριότητες		✓	–		–	–	–	–	–	–	–	–	–	
	Η κούραση			–		–	–	–	–	–	–	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)			–		–	–	–	–	–	–	✓	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ											✓	✓		
	ΟΧΙ		✓	✓		✓	✓	✓	✓	✓	✓			✓	
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ											✓	✓		
	ΠΟΛΛΗ		✓	✓		✓	✓	✓	✓	✓	✓			✓	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 2

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
		A	A		A	A	Δ	A	A		A				
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά														
	Με παράπονα														
	Με προθυμία			✓						✓		✓	✓	✓	
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ														
	ΟΧΙ			✓						✓		✓	✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ													✓	
	ΜΕΤΡΙΑ			✓						✓		✓	✓		
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών			o						✓		✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο			✓						✓		✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο			o						o		o	o	✓	
	Παίξιμο με δεξί και αριστερό χέρι			o						o		o	o	✓	
	Αυτοσχεδιασμός			x						x		x	x	x	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.			o						o		o	o	x	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ														
	ΟΧΙ		✓							✓		✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		✓							✓		✓	✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός		–							–		–	–	–	
	Οι προηγούμενες δραστηριότητες		–							–		–	–	–	
	Η κούραση		–							✓		–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)		–							–		–	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		✓							✓		✓	✓	✓	
	ΟΧΙ														
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ									✓					
	ΑΡΚΕΤΗ		✓									✓	✓		
	ΠΟΛΛΗ													✓	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 3

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ								
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά						✓			
	Με παράπονα					✓		✓		✓
	Με προθυμία	✓	✓	✓	✓				✓	
	Δεν αποδέχεται									
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ									
	ΟΧΙ	✓	✓	✓	✓	✓	✓	✓	✓	✓
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ									
	ΜΕΤΡΙΑ	✓	✓	✓	✓		✓			✓
	ΚΑΘΟΛΟΥ					✓		✓	✓	
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	o	o	o	✓	x	✓	✓	✓	✓
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓	✓	✓	✓	o	o	✓
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	o	o	o	o	x	o	o	o	o
	Παίξιμο με δεξί και αριστερό χέρι	o	o	o	o	x	o	o	o	o
	Αυτοσχεδιασμός	x	x	x	x	x	x	x	x	x
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	x	x	x	x	x	o	o	o	x
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ		✓	✓	✓	✓	✓	✓	✓	✓
	ΟΧΙ	✓								
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓	✓						
	Δεν συνεργάζεται				✓	✓		✓	✓	✓
	Προκαλεί προβλήματα						✓			
	Μιμείται συμπεριφορές									
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	–	–	–	–	–	–	–	–	–
	Οι προηγούμενες δραστηριότητες	✓	–	–	–	–	–	–	–	–
	Η κούραση	–	–	✓	–	–	✓	–	–	–
	Βιωματικές ανάγκες(δίψα,πείνα)	–	–	–	–	–	–	–	–	–
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓	✓	✓	✓	✓	✓	✓	✓	✓
	ΟΧΙ									
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ									
	ΛΙΓΗ		✓	✓	✓	✓	✓	✓	✓	✓
	ΑΡΚΕΤΗ	✓								
	ΠΟΛΛΗ									

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 4

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
			Α		Α										
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής;	Αποδέχεται Με χαρά			✓		✓	✓	✓	✓	✓					
	Με παράπονα												✓	✓	
	Με προθυμία	✓									✓	✓			
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ	✓		✓		✓		✓	✓			✓			
	ΟΧΙ						✓			✓	✓		✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ	✓		✓		✓	✓	✓	✓			✓		✓	
	ΜΕΤΡΙΑ									✓	✓		✓		
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓		✓		✓	✓	✓	X	✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓		✓		✓	✓	✓	O	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	✓		✓		O	O	O	X	O	✓	✓	O	O	
	Παίξιμο με δεξί και αριστερό χέρι	✓		O		✓	✓	✓	X	✓	O	O	O	O	
	Αυτοσχεδιασμός	X		X		X	X	X	X	X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X		✓		X	O	X	X	O	O	O	O	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ												✓	✓	
	ΟΧΙ	✓		✓		✓	✓	✓	✓	✓	✓	✓			
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓		✓		✓	✓	✓	✓	✓	✓	✓		✓	
	Δεν συνεργάζεται												✓		
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	–	–	–		–	–	–	–	–	–	–	–	–	
	Οι προηγούμενες δραστηριότητες	–	✓	✓		✓	–	–	–	✓	–	✓	–	✓	
	Η κούραση	–	✓	✓		–	–	–	–	✓	✓	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	–	–	–		–	–	–	–	–	–	✓	–	–	
	ΑΛΛΟ												✓		
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ						✓				✓		✓	✓	
	ΟΧΙ	✓		✓		✓		✓	✓	✓		✓			
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ									✓			✓	✓	
	ΑΡΚΕΤΗ			✓		✓	✓				✓	✓			
	ΠΟΛΛΗ	✓						✓	✓						

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 5

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
				Α	Α			Α							
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά						✓		✓	✓	✓	✓	✓	✓	
	Με παράπονα														
	Με προθυμία	✓	✓			✓									
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ	✓	✓			✓	✓		✓	✓	✓	✓			
	ΟΧΙ												✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ	✓	✓			✓	✓		✓	✓	✓	✓	✓		
	ΜΕΤΡΙΑ													✓	
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓			✓	✓		X	✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	✓	✓			✓	✓		X	✓	✓	✓	✓	O	
	Παίξιμο με δεξί και αριστερό χέρι	✓	✓			✓	✓		X	✓	✓	✓	✓	✓	
	Αυτοσχεδιασμός	X	X			X	X		X	X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	✓			X	✓		X	✓	✓	✓	✓	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ	✓	✓			✓								✓	
	ΟΧΙ						✓		✓	✓	✓	✓	✓		
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	–	–			–	–		–	–	–	–	–	–	
	Οι προηγούμενες δραστηριότητες	–	✓			✓	–		–	✓	–	–	–	–	
	Η κούραση	✓	✓			✓	–		–	✓	✓	✓	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	–	–			–	–		–	–	–	–	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ												✓	✓	
	ΟΧΙ	✓	✓			✓	✓		✓	✓	✓	✓			
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ												✓	✓	
	ΠΟΛΛΗ	✓	✓			✓	✓		✓	✓	✓	✓			

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 6

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
					A					A					
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά						✓		✓			✓	✓	✓	
	Με παράπονα		✓			✓					✓				
	Με προθυμία	✓		✓				✓							
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ														
	ΟΧΙ	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ	✓	✓			✓	✓							✓	
	ΜΕΤΡΙΑ			✓				✓	✓		✓	✓	✓		
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	O	✓	O		O	O	O	✓		✓	O	✓	✓	
	Παίξιμο με δεξί και αριστερό χέρι	O	O	O		O	O	O	X		✓	O	✓	✓	
	Αυτοσχεδιασμός	X	X	X		X	X	X	X		X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	O	O		X	O	X	X		O	O	O	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ			✓							✓	✓			
	ΟΧΙ	✓	✓			✓	✓	✓	✓				✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓	✓		✓	✓	✓	✓				✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα										✓	✓			
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	–	–	–		–	–	–	–		–	–	–	–	
	Οι προηγούμενες δραστηριότητες	–	–	–		–	✓	–	–		–	–	–	–	
	Η κούραση	–	–	–		–	–	–	–		–	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	–	–	–		✓	–	–	–		–	–	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	
	ΟΧΙ														
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ											✓			
	ΑΡΚΕΤΗ	✓	✓	✓			✓	✓					✓	✓	
	ΠΟΛΛΗ					✓			✓		✓				

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 7

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής;	Αποδέχεται Με χαρά			✓		✓	✓			✓	✓	✓	✓	✓	
	Με παράπονα														
	Με προθυμία	✓	✓					✓	✓						
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ	✓		✓		✓				✓					
	ΟΧΙ		✓				✓	✓	✓		✓	✓	✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ		✓	✓		✓				✓			✓	✓	
	ΜΕΤΡΙΑ	✓					✓	✓			✓	✓			
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	✓	✓	✓		O	✓	✓	X	✓	O	O	✓	✓	
	Παίξιμο με δεξί και αριστερό χέρι	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Αυτοσχεδιασμός	X	X	X		X	X	X	X	X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	✓	✓		X	O	X	X	✓	O	O	O	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ	✓				✓	✓	✓	✓	✓					
	ΟΧΙ		✓	✓							✓	✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα	✓													
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	–	–	–		–	–	–	–	–	–	–	–	–	
	Οι προηγούμενες δραστηριότητες	–	–	–		–	✓	–	–	–	–	–	–	–	
	Η κούραση	–	–	–		–	✓	–	✓	–	–	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	–	–	–		✓	–	–	–	–		–	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ						✓	✓	✓		✓	✓	✓	✓	
	ΟΧΙ	✓	✓	✓		✓				✓					
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ						✓	✓			✓	✓			
	ΑΡΚΕΤΗ	✓		✓		✓			✓						
	ΠΟΛΛΗ		✓							✓			✓	✓	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 8

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
					Α				Α		Α	Α			
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής,	Αποδέχεται Με χαρά			✓		✓	✓	✓		✓			✓	✓	
	Με παράπονα														
	Με προθυμία	✓	✓												
	Δεν αποδέχεται.														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ		✓							✓					
	ΟΧΙ	✓		✓		✓	✓	✓					✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ	✓	✓	✓		✓				✓			✓	✓	
	ΜΕΤΡΙΑ						✓	✓							
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓		✓	✓	✓		✓			✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓		✓	✓	✓		✓			✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	O	✓	O		O	O	O		✓			✓	✓	
	Παίξιμο με δεξί και αριστερό χέρι	O	✓	✓		✓	✓	✓		✓			✓	✓	
	Αυτοσχεδιασμός	X	X	X		X	X	X		X			X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	✓	O		X	O	X		✓			O	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ														
	ΟΧΙ	✓	✓	✓		✓	✓	✓		✓			✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓	✓		✓	✓	✓		✓			✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	–	–	–		–	–	–		–			–	–	
	Οι προηγούμενες δραστηριότητες	–	–	–		–	–	–		–			–	–	
	Η κούραση	–	–	–		–	–	–		–			–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	✓	✓	–		✓	–	–		–			–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓	✓	✓		✓	✓	✓					✓	✓	
	ΟΧΙ									✓					
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ	✓		✓			✓	✓		✓					
	ΠΟΛΛΗ		✓			✓							✓	✓	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 9

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
					A				Δ						
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά					✓	✓			✓	✓		✓	✓	
	Με παράπονα														
	Με προθυμία	✓	✓	✓				✓				✓			
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ		✓											✓	
	ΟΧΙ	✓		✓		✓	✓	✓		✓	✓	✓	✓		
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ			✓		✓	✓	✓			✓			✓	
	ΜΕΤΡΙΑ	✓	✓							✓		✓	✓		
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	O	O	O		✓	✓	✓		O	O	O	✓	✓	
	Παίξιμο με δεξί και αριστερό χέρι	O	O	O		✓	✓	✓		O	O	✓	✓	✓	
	Αυτοσχεδιασμός	X	X	X		X	X	✓		X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	X	X		X	O	X		O	O	O	O	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ														
	ΟΧΙ	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	-	-	-		-	-	-		-	-	-	-	-	
	Οι προηγούμενες δραστηριότητες	-	-	-		-	-	-		-	-	-	-	-	
	Η κούραση	-	-	-		-	-	-		-	-	-	-	-	
	Βιωματικές ανάγκες(δίψα,πείνα)	-	-	-		✓	-	-		-	-	-	-	-	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓		
	ΟΧΙ													✓	
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ	✓	✓	✓						✓	✓	✓	✓	✓	
	ΠΟΛΛΗ					✓	✓	✓							

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 10

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά	✓				✓	✓	✓		✓	✓	✓	✓		
	Με παράπονα														
	Με προθυμία		✓	✓					✓					✓	
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ	✓	✓			✓	✓	✓		✓	✓	✓	✓	✓	
	ΟΧΙ			✓					✓						
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	ΜΕΤΡΙΑ														
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓		✓	✓	✓	✗	✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	✓	✓	✓		✓	✓	✓	✗	✓	✓	✓	✓	✓	
	Παίξιμο με δεξί και αριστερό χέρι	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Αυτοσχεδιασμός	✗	✗	✗		✗	✗	✗	✗	✗	✗	✗	✗	✗	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	✗	✓	✓		✗	✓	✗		✓	✓	✓	✓	✗	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ														
	ΟΧΙ	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	–	–	✓		–	–	–	–	–	–	–	–	–	
	Οι προηγούμενες δραστηριότητες	–	–	–		–	–	–	–	–	–	–	–	–	
	Η κούραση	–	–	–		–	–	–	✓	–	–	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	–	–	–		–	–	–	–	–	–	–	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ			✓					✓						
	ΟΧΙ	✓	✓			✓	✓	✓		✓	✓	✓	✓	✓	
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ														
	ΠΟΛΛΗ	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 11

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ												
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά		✓			✓	✓	✓	✓	✓	✓	✓		✓
	Με παράπονα													
	Με προθυμία	✓											✓	
	Δεν αποδέχεται													
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ	✓				✓				✓	✓	✓		✓
	ΟΧΙ		✓				✓						✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ	✓	✓			✓	✓	✓	✓	✓	✓	✓		✓
	ΜΕΤΡΙΑ												✓	
	ΚΑΘΟΛΟΥ													
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓			✓	✓	✓	X	✓	✓	✓	✓	✓
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	✓	✓			✓	✓	✓		✓	✓	✓	o	✓
	Παίξιμο με δεξί και αριστερό χέρι	✓	o			✓	✓	✓	✓	✓	✓	✓	✓	✓
	Αυτοσχεδιασμός	X	X			X	X	X		X	X	X	X	X
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	✓			X	✓	X		✓	✓	✓	o	X
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ													
	ΟΧΙ	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
	Δεν συνεργάζεται													
	Προκαλεί προβλήματα													
	Μιμείται συμπεριφορές									✓				
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	–	–			–	–	–	–	–	–	–	–	–
	Οι προηγούμενες δραστηριότητες	–	–			–	–	–		–	–	–	–	–
	Η κούραση	–	–			–	–	–	–	–	–	–	–	–
	Βιωματικές ανάγκες(δίψα,πείνα)	–	✓			✓	–	–	–	–	–	–	–	–
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		✓				✓	✓	✓				✓	
	ΟΧΙ	✓				✓				✓	✓	✓		✓
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ													
	ΛΙΓΗ													
	ΑΡΚΕΤΗ												✓	
	ΠΟΛΛΗ	✓	✓			✓	✓			✓	✓	✓		✓

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 12

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΡΙΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
				Ά	A			A							
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά								✓		✓	✓	✓	✓	
	Με παράπονα		✓												
	Με προθυμία	✓				✓	✓			✓					
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ														
	ΟΧΙ	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ					✓									
	ΜΕΤΡΙΑ		✓				✓		✓	✓	✓	✓	✓	✓	
	ΚΑΘΟΛΟΥ	✓													
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓			✓	✓		X	✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	o	✓			✓	✓		X	o	✓	✓	✓	✓	
	Παίξιμο με δεξί και αριστερό χέρι	o	✓			✓	✓		X	✓	✓	✓	✓	o	
	Αυτοσχεδιασμός	X	X			X	X		X	X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	✓			X	o		X	o	o	o	o	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	
	ΟΧΙ														
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα					✓	–		–	–	–	–	–	–	
	Δεν συνεργάζεται					–	–		–	–	–	–	–	–	
	Προκαλεί προβλήματα	✓	✓			–	✓		✓	✓	✓	✓	✓	✓	
	Μιμείται συμπεριφορές	✓				–	–		–	–	–	–	–	–	
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	–	–			–	–		–	–	–	–	–	–	
	Οι προηγούμενες δραστηριότητες	–	✓			✓	–		–	✓	–	–	–	✓	
	Η κούραση	–	✓			✓	–		–	✓	✓	✓	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα) Άλλο	–	–			–	–		–	–	–	–	– ✓*	– ✓	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓	✓							✓	✓	✓	✓	✓	
	ΟΧΙ					✓	✓		✓						
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ	✓													
	ΛΙΓΗ		✓						✓	✓				✓	
	ΑΡΚΕΤΗ					✓	✓				✓	✓	✓		
	ΠΟΛΛΗ														

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 13

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
		A	A		A										
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής,	Αποδέχεται Με χαρά					√	√	√		√		√	√	√	
	Με παράπονα														
	Με προθυμία			√							√				
	Δεν αποδέχεται.														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ									√	√		√	√	
	ΟΧΙ			√		√	√	√	√			√			
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ			√			√	√	√	√	√		√	√	
	ΜΕΤΡΙΑ					√						√			
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών			√		√	√	√	√	√	√	√	√	√	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο			√		√	√	√	/	√	√	√	√	√	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο			√		√	√	√	×	√	o	√	√	√	
	Παίξιμο με δεξί και αριστερό χέρι			o		√	√	√	√	√	√	√	√	√	
	Αυτοσχεδιασμός			√		×	√	√	×	√	√	√	√	√	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.			√		×	O	×	×	√	o	o	√	×	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ			√		√	√	√	/	√	√	√	√	√	
	ΟΧΙ														
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα					√			√				√	√	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα			√			√	√		√	√	√			
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός			–		–	–	–	–	–	–	–	–	–	
	Οι προηγούμενες δραστηριότητες			–		–	–	–	–	√	–	–	–	–	
	Η κούραση			–		–	–	–	–	–	–	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)			–		√	–	–	–	–	–	–	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ			√		√	√	√	√	√	√	√			
	ΟΧΙ												√	√	
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ			√		√				√	√	√		√	
	ΠΟΛΛΗ						√	√	√				√		

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 14

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
				Α	Α										
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής;	Αποδέχεται Με χαρά		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Με παράπονα	✓													
	Με προθυμία														
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ														
	ΟΧΙ	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ					✓								✓	
	ΜΕΤΡΙΑ	✓	✓				✓	✓	✓	✓	✓	✓	✓		
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓			✓	✓	✓	.	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	o	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Παίξιμο με δεξί και αριστερό χέρι	o	o			✓	✓	✓	✓	✓	o	o	o	✓	
	Αυτοσχεδιασμός	x	x			x	x			x	x	x	x	x	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	x	✓			x	o	x		o	o	o	o	x	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ	✓					✓	/			✓				
	ΟΧΙ		✓			✓				✓		✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές	✓													
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	–	–			–	–	–	–	–	–	–	–	–	
	Οι προηγούμενες δραστηριότητες	–	–			–	–	–	–	–	–	–	–	–	
	Η κούραση	–	–			–	–	–	–	–	–	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	✓	–			✓	–	–	–	–	–	✓	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	
	ΟΧΙ														
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ	✓													
	ΑΡΚΕΤΗ		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	
	ΠΟΛΛΗ														

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 15

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ												
		A			A				A					
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά						✓	✓			✓	✓	✓	✓
	Με παράπονα													
	Με προθυμία		✓	✓		✓				✓				
	Δεν αποδέχεται													
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ						✓							
	ΟΧΙ		✓	✓		✓		✓		✓	✓	✓	✓	✓
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ					✓	✓					✓		
	ΜΕΤΡΙΑ		✓	✓				✓		✓	✓		✓	✓
	ΚΑΘΟΛΟΥ													
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών		0	✓		✓	✓	✓		0	✓	✓	✓	✓
	Ικανότητα κίνησης δακτύλων στο αρμόνιο		✓	✓		✓	✓	✓		0	✓	✓	✓	✓
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο		0	0		✓	0	0		0	0	✓	✓	✓
	Παίξιμο με δεξί και αριστερό χέρι		0	0		✓	✓	✓		0	✓	✓	✓	0
	Αυτοσχεδιασμός		X	X		X	X	X		X	X	X	X	X
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.		0	0		X	0	0		0	0	0	0	X
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ		✓	✓										
	ΟΧΙ					✓	✓	✓		✓	✓	✓	✓	✓
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		✓	✓		✓	✓	✓		✓	✓			✓
	Δεν συνεργάζεται													
	Προκαλεί προβλήματα											✓		
	Μιμείται συμπεριφορές		✓										✓	
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός		–	–		–	–	–		–	–	–	–	–
	Οι προηγούμενες δραστηριότητες		✓	✓		–	–	–		–	–	–	–	–
	Η κούραση		✓	✓		✓	=	–	–	✓	✓	✓	–	–
	Βιωματικές ανάγκες(δίψα,πείνα)	–	–	–		–	–	–		–	–	–	–	–
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
	ΟΧΙ													
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ													
	ΛΙΓΗ		✓							✓				
	ΑΡΚΕΤΗ			✓				✓			✓	✓	✓	✓
	ΠΟΛΛΗ					✓	✓							

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 16

Ονομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
		A		A	A				A						
1.Οταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά						✓	✓		✓	✓	✓	✓	✓	
	Με παράπονα														
	Με προθυμία		✓			✓									
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ														
	ΟΧΙ		✓			✓	✓	✓		✓	✓	✓	✓	✓	
3.Πόσο σόβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ														
	ΜΕΤΡΙΑ		✓			✓	✓	✓		✓	✓	✓	✓	✓	
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών		0			✓	✓	✓		0	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο		✓			✓	0	0		0	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο		0			0	✓	✓		0	✓	0	0	0	
	Παίξιμο με δεξί και αριστερό χέρι		0			0	✓	✓		0	✓	✓	✓	✓	
	Αυτοσχεδιασμός		X			X	X	X		X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.		0			X	0	0		0	0	0	0	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ		✓			✓	✓	✓		✓	✓	✓			
	ΟΧΙ												✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		✓				✓	✓		✓		✓		✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα					✓					✓		✓		
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός		−			−	−	−		−	−	−	−	−	
	Οι προηγούμενες δραστηριότητες		✓			−	−	−		✓	−	−	−	−	
	Η κούραση		✓			✓	−	−		✓	✓	✓	−	−	
	Βιωματικές ανάγκες(δίψα,πείνα)		−			−	−	−		−	−	−	−	−	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		✓			✓	✓	✓		✓	✓	✓	✓	✓	
	ΟΧΙ														
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ		✓			✓				✓		✓	✓		
	ΑΡΚΕΤΗ						✓	✓			✓			✓	
	ΠΟΛΛΗ														

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 17

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
		A			A				A				A		
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά					✓	✓	✓		✓	✓	✓		✓	
	Με παράπονα														
	Με προθυμία		✓	✓											
	Δεν αποδέχεται.														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ														
	ΟΧΙ		✓	✓		✓	✓	✓		✓	✓	✓		✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ						✓	✓		✓		✓		✓	
	ΜΕΤΡΙΑ		✓	✓		✓					✓				
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών		✓	✓		✓	✓	✓		✓	✓	✓		✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο		✓	✓		✓	✓	✓		✓	✓	✓		✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο		0	✓		✓	✓	✓		✓	0	0		✓	
	Παίξιμο με δεξί και αριστερό χέρι		0	0		0	✓	✓		✓	✓	✓		✓	
	Αυτοσχεδιασμός		✓	X		X	X	X		X	X	X		X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.		0	0		X	✓	✓		0	0	0		X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ		✓	✓		✓	✓	✓			✓	✓			
	ΟΧΙ									✓				✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		✓	✓		✓	✓	✓		✓	✓	✓		✓	
	~~Δεν συνεργάζεται~~														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός		–	–		–	–	–		–	–	–		–	
	Οι προηγούμενες δραστηριότητες		✓	✓		✓	–	–		✓	–	–		–	
	Η κούραση		✓	✓		✓	–	–		✓	✓	✓		–	
	Βιωματικές ανάγκες(δίψα,πείνα)		–	–		–	–	–		–	–	–		–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		✓	✓		✓	✓	✓		✓	✓	✓		✓	
	ΟΧΙ														
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ		✓												
	ΑΡΚΕΤΗ			✓		✓				✓	✓	✓		✓	
	ΠΟΛΛΗ						✓	✓							

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 18

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
		Α			Α					Α	Α		Α		
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά											✓			
	Με παράπονα			✓											
	Με προθυμία		✓			✓	✓	✓	✓					✓	
	Δεν αποδέχεται.														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ														
	ΟΧΙ		✓	✓		✓	✓	✓	✓			✓		✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ						✓	✓				✓			
	ΜΕΤΡΙΑ		✓	✓		✓			✓					✓	
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών		O	✓		✓	✓	✓	✓			✓		✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο		✓	✓		✓	✓	✓	✓			✓		✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο		O	O		✓	✓	✓	X			✓		✓	
	Παίξιμο με δεξί και αριστερό χέρι		O	O		o	✓	✓	X			O		O	
	Αυτοσχεδιασμός		X	X		X	X	X	X			X		X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.		O	O		X	O	O	X			✓		X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ														
	ΟΧΙ		✓	✓		✓	✓	✓	✓			✓		✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		✓	✓		✓	✓	✓	✓			✓		✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές						✓								
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός		–	–		–	–	–	–			–		–	
	Οι προηγούμενες δραστηριότητες		V	✓		–	–	–	–			–		=	
	Η κούραση		✓	✓		V	–	–	–			–		–	
	Βιωματικές ανάγκες(δίψα,πείνα)		–	–		–	–	–	–			–		–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		✓	✓		✓	✓	✓	✓			✓		✓	
	ΟΧΙ														
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ		V												
	ΑΡΚΕΤΗ			✓		✓	✓	✓	✓			✓		✓	
	ΠΟΛΛΗ														

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 19

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ												
					Α				Α		Α			
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής;	Αποδέχεται Με χαρά						✓			✓				
	Με παράπονα			✓									✓	
	Με προθυμία	✓	✓			✓		✓				✓		✓
	Δεν αποδέχεται													
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ											✓		
	ΟΧΙ	✓	✓	✓		✓	✓	✓		✓			✓	✓
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ													
	ΜΕΤΡΙΑ		✓			✓	✓	✓		✓		✓	✓	✓
	ΚΑΘΟΛΟΥ	✓		✓										
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	o	o	o		✓	✓	✓		✓		✓	✓	✓
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓		✓	✓	✓		✓		o	✓	✓
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	o	o	x		o	o	o		o		o	✓	o
	Παίξιμο με δεξί και αριστερό χέρι	o	o	x		o	o	o		o		o	o	o
	Αυτοσχεδιασμός	[illegible]	x	✓		x	✓	✓		x		✓	x	x
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	x	o	x		x	o	x		o		o	o	x
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ	✓	✓	✓		✓	✓	✓		✓		✓	✓	✓
	ΟΧΙ													
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα													
	Δεν συνεργάζεται	✓		✓		✓	✓	✓						
	Προκαλεί προβλήματα									✓		✓	✓	✓
	Μιμείται συμπεριφορές	✓	✓											
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	–		–		–	–	–		–		–	–	–
	Οι προηγούμενες δραστηριότητες	–	✓	✓		✓	–	–		✓		–	–	✓
	Η κούραση	✓	✓	✓		✓	–	–		✓		✓	–	–
	Βιωματικές ανάγκες(δίψα,πείνα)	– ✓	✓	✓ ✓		– ✓	– ✓	– ✓		– ✓		– ✓	– ✓	– ✓
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓	✓	✓		✓	✓	✓		✓			✓	✓
	ΟΧΙ											✓		
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ	✓	-	✓										
	ΛΙΓΗ		✓			✓	✓	✓		✓		✓		✓
	ΑΡΚΕΤΗ												✓	
	ΠΟΛΛΗ													

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 20

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
			A	A	A	A						A			
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά						✓	✓	✓	✓	✓			✓	
	Με παράπονα														
	Με προθυμία	✓											✓		
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ	✓						✓		✓				✓	
	ΟΧΙ						✓		✓		✓		✓		
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ	✓					✓	✓	✓					✓	
	ΜΕΤΡΙΑ									✓	✓		✓		
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓					✓	✓	X	✓	✓		✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓					✓	✓	✓	✓	✓		✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	✓					✓	✓	X	✓	✓		✓	✓	
	Παίξιμο με δεξί και αριστερό χέρι	✓					✓	✓	X	✓	✓		✓	✓	
	Αυτοσχεδιασμός	X					X	X	X	X	X		X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X					✓	X	X	✓	✓		o	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ														
	ΟΧΙ	✓					✓	✓	✓	✓	✓		✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓					✓	✓	✓	✓	✓		✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	-					-	-	-	-	-		-	-	
	Οι προηγούμενες δραστηριότητες	-					-	-	-	✓	-		-	-	
	Η κούραση	✓					-	-	-	✓	✓		-	-	
	Βιωματικές ανάγκες(δίψα,πείνα)	✓					✓	✓	✓	-	-		-	-	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓					✓	✓			✓		✓		
	ΟΧΙ								✓	✓				✓	
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ	✓											✓	✓	
	ΠΟΛΛΗ						✓	✓	✓	✓	✓				

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 21

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ												
			A		A									
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής;	Αποδέχεται Με χαρά							✓	✓	✓	✓	✓	✓	✓
	Με παράπονα													
	Με προθυμία	✓		✓		✓	✓							
	Δεν αποδέχεται													
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ			✓					✓		✓	✓		
	ΟΧΙ	✓				✓	✓	✓		✓			✓	✓
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ			✓		✓	✓	✓	✓		✓	✓		✓
	ΜΕΤΡΙΑ	✓								✓			✓	
	ΚΑΘΟΛΟΥ													
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓		✓		✓	✓	✓	X	✓	✓	✓	✓	✓
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	o		O		O	o	o	X	O	o	✓	✓	O
	Παίξιμο με δεξί και αριστερό χέρι	o		O		O	O	o	X	✓	o	✓	✓	✓
	Αυτοσχεδιασμός	X		X		X	X	X	X	X	✓	X	X	X
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X		o		X	O	X	X	O	o	✓	✓	X
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ													
	ΟΧΙ	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
	Δεν συνεργάζεται													
	Προκαλεί προβλήματα													
	Μιμείται συμπεριφορές													
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	–		–		–	–	–	–	–	–	–	–	–
	Οι προηγούμενες δραστηριότητες	–		✓		✓	–	–	–	✓	–	–	–	–
	Η κούραση	✓		✓		✓	–	–	–	✓	✓	✓	–	–
	Βιωματικές ανάγκες(δίψα,πείνα)	–		–		–	–	–	–	–	–	–	–	–
	[illegible]	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓				✓	✓	✓		✓			✓	✓
	ΟΧΙ			✓					✓		✓	✓		
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ													
	ΛΙΓΗ													
	ΑΡΚΕΤΗ	✓		✓		✓		✓		✓	✓			✓
	ΠΟΛΛΗ						✓		✓			✓	✓	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 22

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ												
				Δ	Α									
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής;	Αποδέχεται													
	Με χαρά								✓	✓				
	Με παράπονα													
	Με προθυμία	✓	✓			✓	✓	✓			✓	✓	✓	✓
	Δεν αποδέχεται													
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ								✓					
	ΟΧΙ	✓	✓			✓	✓	✓		✓	✓	✓	✓	✓
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ		✓							✓				
	ΜΕΤΡΙΑ	✓				✓	✓	✓			✓	✓	✓	✓
	ΚΑΘΟΛΟΥ													
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓			✓	✓	✓	X	✓	✓	✓	✓	✓
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	o	o			o	o	o	X	✓	o	o	o	o
	Παίξιμο με δεξί και αριστερό χέρι	o	o			o	o	o	X	✓	o	✓	✓	o
	Αυτοσχεδιασμός	X	X			X	X	X	X	X	X	X	X	X
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	o			X	o	X	X	o	o	o	o	X
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ													
	ΟΧΙ	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
	Δεν συνεργάζεται													
	Προκαλεί προβλήματα													
	Μιμείται συμπεριφορές													
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	-	-			-	-	-	-	-	-	-	-	-
	Οι προηγούμενες δραστηριότητες	-	✓			✓	-	-	-	✓	-	-	-	-
	Η κούραση	✓	✓			✓	-	-	-	✓	✓	✓	-	-
	Βιωματικές ~~ανάγκες(δίψα,πείνα)~~	- / ✓	- / ✓			- / ✓	- / ✓	- / ✓	- / ✓	- / ✓	- / ✓	- / ✓	- / ✓	- / ✓
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
	ΟΧΙ													
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ													
	ΛΙΓΗ	✓				✓	✓	✓				✓		✓
	ΑΡΚΕΤΗ		✓						✓		✓		✓	
	ΠΟΛΛΗ									✓				

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 23

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ												
		A			A									
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά									√				√
	Με παράπονα			√								√		
	Με προθυμία		√			√	√	√	√		√		√	
	Δεν αποδέχεται													
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ													
	ΟΧΙ		√	√		√	√	√	√	√	√	√	√	√
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ									√	√	√		√
	ΜΕΤΡΙΑ		√	√		√	√	√	√				√	
	ΚΑΘΟΛΟΥ													
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών		o	o		√	√	√	X	√	√	√	√	√
	Ικανότητα κίνησης δακτύλων στο αρμόνιο		o	o		√	√	√	√	√	√	√	√	√
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο		X	X		o	o	o	X	o	√	√	√	√
	Παίξιμο με δεξί και αριστερό χέρι		X	X		o	o	o	X	√	√	√	√	√
	Αυτοσχεδιασμός		X	X		X	X	X	X	X	X	X	X	X
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.		X	X		X	X	X	X	o	o	o	o	X
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ			√		√	√	√	√	√				
	ΟΧΙ		√								√	√	√	√
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		√	√		√	√	√	√	√	√	√	√	√
	Δεν συνεργάζεται													
	Προκαλεί προβλήματα													
	Μιμείται συμπεριφορές													
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός		–	–		–	–	–	–	–	–	–	–	–
	Οι προηγούμενες δραστηριότητες		√	–		–	–	–	–	–	–	–	–	–
	Η κούραση		–	–		–	–	–	–	√	–	–	–	–
	Βιωματικές ανάγκες(δίψα,πείνα)		–	–		–	–	–	–	–	–	–	–	–
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		√	√		√	√	√	√	√	√	√	√	√
	ΟΧΙ													
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ													
	ΛΙΓΗ			√										
	ΑΡΚΕΤΗ		√			√	√	√	√	√			√	√
	ΠΟΛΛΗ										√	√		

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 24

Όνομα μαθητή :

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
		Α			Α			4	Α					Δ	
1.Οταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά		✓			✓				✓	✓		✓		
	Με παράπονα														
	Με προθυμία			✓			✓					✓			
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ		✓	✓		✓				✓		✓			
	ΟΧΙ						✓				✓		✓		
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ		✓	✓		✓	✓				✓	✓	✓		
	ΜΕΤΡΙΑ									✓					
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών		✓	✓		✓	✓			✓	✓	✓	✓		
	Ικανότητα κίνησης δακτύλων στο αρμόνιο		✓	✓		✓	✓			✓	✓	✓	✓		
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο		✓	✓		✓	✓			✓	✓	✓	✓		
	Παίξιμο με δεξί και αριστερό χέρι		✓	✓		✓	✓			✓	✓	✓	✓		
	Αυτοσχεδιασμός		X	X		X	X			X	X	X	X		
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.		✓	✓		X	✓			O	O	✓	✓		
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ														
	ΟΧΙ		✓	✓		✓	✓			✓	✓	✓	✓		
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		✓	✓		✓	✓			✓	✓	✓	✓		
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός		–	–		–	–			–	–	–	–		
	Οι προηγούμενες δραστηριότητες		✓	–		–	–			–	–	–	–		
	Η κούραση		–	–		–	–			✓	–	–	–		
	Βιωματικές ανάγκες(δίψα,πείνα)		–	–		–	–			–	–	–	–		
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		✓				✓				✓		✓		
	ΟΧΙ ✓			✓		✓				✓		✓			
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ		✓	✓						✓			✓		
	ΠΟΛΛΗ ✓					✓	✓				✓	✓			

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 25

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
		Α			Α			Α	Α	Α					
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά ✓										✓		/	✓	
	Με παράπονα		✓	✓		✓									
	Με προθυμία						✓					✓			
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ														
	ΟΧΙ		✓	✓		✓	✓				✓	✓	✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ						✓					✓		✓	
	ΜΕΤΡΙΑ		✓	✓							✓		✓		
	ΚΑΘΟΛΟΥ					✓									
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών		o	o		✓	✓				✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο		✓	✓		✓	✓				✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο		o	o		o	o				o	✓	✓	✓	
	Παίξιμο με δεξί και αριστερό χέρι		o	x		x	o				o	✓	✓	✓	
	Αυτοσχεδιασμός		x	x		x	x				x	x	x	x	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.		x	x		x	o				o	o	o	x	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ		✓	✓		✓					✓	✓	✓	✓	
	ΟΧΙ						✓								
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα			✓			✓				✓	✓	✓	✓	
	Δεν συνεργάζεται		✓			✓									
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός		–	–		–	–				–	–	–	–	
	Οι προηγούμενες δραστηριότητες		✓	–		✓	–				–	–	–	–	
	Η κούραση		✓	✓		✓	–				–	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)		✓	–		–	✓				–	–	–	✓	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		✓	✓		✓	✓				✓	✓	✓	✓	
	ΟΧΙ														
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ		✓	✓		✓									
	ΑΡΚΕΤΗ						✓				✓	✓	✓	✓	
	ΠΟΛΛΗ														

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 26

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
		A			A										
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά						✓	✓		✓			✓		
	Με παράπονα								✓		✓				
	Με προθυμία		✓	✓		✓						✓		✓	
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ														
	ΟΧΙ		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ						✓								
	ΜΕΤΡΙΑ		✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών		o	o		o	✓	✓	x	✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο		o	o		o	✓	✓	✓	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο		o	o		o	✓	✓	x	o	o	o	o	o	
	Παίξιμο με δεξί και αριστερό χέρι		o	o		o	✓	✓	x	o	o	o	o	o	
	Αυτοσχεδιασμός		x	x		x	x	x	x	x	x	x	x	x	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου		o	o		x	o	x	x	o	o	o	o	x	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ		✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	
	ΟΧΙ						✓								
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		✓	✓		✓	✓	✓	✓	✓					
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα										✓	✓	✓	✓	
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός		–	–		–	–	–	–	–	–	–	–	–	
	Οι προηγούμενες δραστηριότητες		–	–		–	–	–	–	–	–	–	–	–	
	Η κούραση		–	–		–	–	–	–	–	–	–	–	–	
	Βιωματικές ανάγκες (δίψα, πείνα)		– ✓	– ✓		– ✓	– ✓	– ✓	– ✓	– ✓	– ✓	– ✓	– ✓	– ✓	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	ΟΧΙ														
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ		✓	✓									✓	✓	
	ΑΡΚΕΤΗ					✓		✓	✓	✓	✓	✓			
	ΠΟΛΛΗ						✓								

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 27

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ											
		Α		ρ									Δ
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά						V	V	V	V	V	V	V
	Με παράπονα												
	Με προθυμία		V	V		V							
	Δεν αποδέχεται												
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ									V			
	ΟΧΙ		V	V		V	V	V	V		V	V	V
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ		V	V		V	V	V	V		V	V	V
	ΜΕΤΡΙΑ									V			
	ΚΑΘΟΛΟΥ												
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών		V	V		V	V	V	X	V	V	V	V
	Ικανότητα κίνησης δακτύλων στο αρμόνιο		V	V		V	V	V	V	/	V	V	V
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο		V	V		V	V	V	X	V	O	V	V
	Παίξιμο με δεξί και αριστερό χέρι		V	V		V	V	V	X	V	V	V	V
	Αυτοσχεδιασμός		\	X		X	X	X	X	V	V	X	X
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.		V	V		X	O	X	X	O	O	V	V
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ												
	ΟΧΙ		V	V		V	V	V	V	V	V	V	V
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		V	V		V	V	V	V	V	V	V	V
	Δεν συνεργάζεται												
	Προκαλεί προβλήματα												
	Μιμείται συμπεριφορές												
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός		–	–		–	–	–	–	–	–	–	–
	Οι προηγούμενες δραστηριότητες		V	–		–	–	–	–	–	–	–	–
	Η κούραση		–	–		–	–	–	–	V	–	–	–
	Βιωματικές ανάγκες(δίψα,πείνα)		–	–		–	–	–	–	–	–	–	–
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		V	V		V	V	V	V		V	V	V
	ΟΧΙ									V			
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ												
	ΛΙΓΗ												
	ΑΡΚΕΤΗ		V	V		V		V	V	V			
	ΠΟΛΛΗ						V				V	V	V

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 28

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ												
		Α			Α		Α					Α		Α
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά					√		√	√	√			√	
	Με παράπονα		√											
	Με προθυμία			√							√			
	Δεν αποδέχεται													
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ		√						√					
	ΟΧΙ			√		√		√		√	√		√	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ √		√			√		√	√					
	ΜΕΤΡΙΑ			√						√	√		√	
	ΚΑΘΟΛΟΥ													
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών		√	√		√		√	×	√	√		√	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο		√	√		√		√	√	√	√		√	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο		√	√		√		√	×	o	√		o	
	Παίξιμο με δεξί και αριστερό χέρι		√	√		o		√	×	o	o		√	
	Αυτοσχεδιασμός		×	×		×		×	×	×	×		×	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου		√	√		×		×	×	o	o		o	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ √		√	√						√	√			
	ΟΧΙ					√		√	√				√	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		√	√		√		√	√	√	√		√	
	Δεν συνεργάζεται													
	Προκαλεί προβλήματα													
	Μιμείται συμπεριφορές													
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός			–		–		–	–	–	–		–	
	Οι προηγούμενες δραστηριότητες		√	–		–		–	–	–	–		–	
	Η κούραση			–		√		–	–	√	–		–	
	Βιωματικές ανάγκες(δίψα,πείνα)			–		–		–	–	–	–		–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		√	√		√		√	√	√	√		√	
	ΟΧΙ													
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ													
	ΛΙΓΗ												√	
	ΑΡΚΕΤΗ		√	√		√		√		√	√			
	ΠΟΛΛΗ								√					

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 29

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
		c			A	A		A	A		A				
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής;	Αποδέχεται Με χαρά													✓	
	Με παράπονα														
	Με προθυμία		✓	✓			✓			✓		✓	✓		
	Δεν αποδέχεται.														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ					–									
	ΟΧΙ		✓	✓		–	✓			✓		✓	✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ						✓					✓	✓	✓	
	ΜΕΤΡΙΑ		✓	✓						✓					
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών		✓	✓			✓			✓		✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο		✓	✓			✓			✓		✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο		0	0			✓			0		✓	✓	✓	
	Παίξιμο με δεξί και αριστερό χέρι		0	0			✓			0		✓	✓	✓	
	Αυτοσχεδιασμός		X	X			X			X		X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.		0	0			0			0		0	0	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ														
	ΟΧΙ		✓	✓			✓			✓		✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		✓	✓			✓			✓		✓	✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός		–	–			–			–		–	–	–	
	Οι προηγούμενες δραστηριότητες		✓	–			–			–		–	–	–	
	Η κούραση		–	–			–			✓		–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)		–	–			–			–		–	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		✓	✓			✓			✓		✓	✓	✓	
	ΟΧΙ														
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ		✓	✓			✓			✓		✓			
	ΠΟΛΛΗ												✓	✓	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 30

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ												
		Α			Α	Δ								
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά						✓	✓	✓		✓	✓	✓	✓
	Με παράπονα													
	Με προθυμία		✓	✓						✓				
	Δεν αποδέχεται													
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ						✓	✓	✓					✓
	ΟΧΙ		✓	✓						✓	✓	✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ						✓	✓	✓	✓	✓		✓	✓
	ΜΕΤΡΙΑ		✓	✓								✓		
	ΚΑΘΟΛΟΥ													
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών		✓	✓			✓	✓	X	✓	✓	✓	✓	✓
	Ικανότητα κίνησης δακτύλων στο αρμόνιο		✓	✓			✓	✓	O	✓	✓	✓	✓	✓
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο		O	O			✓	✓	X	O	O	O	✓	✓
	Παίξιμο με δεξί και αριστερό χέρι		O	O			✓	✓	X	✓	✓	✓	✓	✓
	Αυτοσχεδιασμός		X	X			✓	X	X	X	X	X	X	X
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.		O	O			O	X	X	O	O	O	O	X
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ													
	ΟΧΙ		✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
	Δεν συνεργάζεται													
	Προκαλεί προβλήματα													
	Μιμείται συμπεριφορές													
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός			–			–	–	–	–	–	–	–	–
	Οι προηγούμενες δραστηριότητες		✓	–			–	–	–	–	–	–	–	–
	Η κούραση			–			–	–	–	✓	–	–	–	–
	Βιωματικές ανάγκες(δίψα,πείνα)			–			–	–	–	–	✓	✓	–	–
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		✓	✓			✓	✓	✓	✓	✓	✓	✓	
	ΟΧΙ													✓
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ													
	ΛΙΓΗ													
	ΑΡΚΕΤΗ		✓	✓				✓	✓	✓		✓		
	ΠΟΛΛΗ						✓				✓		✓	✓

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 31

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
		A			A	A	A		A		A				
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά			✓								✓		✓	
	Με παράπονα														
	Με προθυμία ✓		✓					✓		✓			✓		
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ														
	ΟΧΙ		✓	✓				✓		✓		✓	✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ														
	ΜΕΤΡΙΑ		✓	✓				✓		✓		✓	✓	✓	
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών		✓	✓				✓		O		✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο		✓	✓				✓		✓		✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο		O	O				O		O		O	O	O	
	Παίξιμο με δεξί και αριστερό χέρι		O	O				O		O		O	O	O	
	Αυτοσχεδιασμός		-|-	✓				✓		✓		X	x	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.		O	O				X		O		O	)	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ														
	ΟΧΙ		✓	✓				✓		✓		✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		✓	✓				✓		✓		✓	✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός		-	-				-		-		-	-	-	
	Οι προηγούμενες δραστηριότητες		-	-				-		-		-	-	-	
	Η κούραση		-	-				-		-		-	-	-	
	Βιωματικές ανάγκες(δίψα,πείνα)		-	-				-		-		-	-	-	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		✓	✓				✓		✓		✓	✓	✓	
	ΟΧΙ														
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ			✓											
	ΑΡΚΕΤΗ		✓					✓		✓		✓	✓	✓	
	ΠΟΛΛΗ														

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 32

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
					A	A	A								
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά												✓		
	Με παράπονα														
	Με προθυμία	✓	✓	✓				✓	✓	✓	✓	✓		✓	
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ														
	ΟΧΙ	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ											✓	✓		
	ΜΕΤΡΙΑ	✓	✓	✓				✓	✓	✓	✓			✓	
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	O	O	O				O	X	✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓				✓	O	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	O	O	O				O	X	✓	O	O	✓	O	
	Παίξιμο με δεξί και αριστερό χέρι	O	O	O				O	X	✓	✓	✓	✓	✓	
	Αυτοσχεδιασμός	X	X	X				X	X	X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	X	O				X	X	O	O	O	O	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ														
	ΟΧΙ	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές	✓													
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	✓	–					–	–	–	–	✓	–	–	
	Οι προηγούμενες δραστηριότητες		–					–	–	–	–	–	–	–	
	Η κούραση		–					–	–	–	✓	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)		–	✓				–	–	–	✓	–	✓	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	
	ΟΧΙ														
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ							✓							
	ΑΡΚΕΤΗ	✓	✓	✓					✓		✓	✓		✓	
	ΠΟΛΛΗ									✓			✓		

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 33

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
				A	A				A				A		
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά	V				V	V	V		V	V	V		V	
	Με παράπονα														
	Με προθυμία		V												
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ	V	V			V	V	V		V		V		V	
	ΟΧΙ										V				
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ	V	V			V	V	V		V	V	V		V	
	ΜΕΤΡΙΑ														
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	V	V			V	V	V		V	V	V		V	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	V	V			V	V	V		V	V	V		V	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	V	V			V	V	V		V	V	V		V	
	Παίξιμο με δεξί και αριστερό χέρι	V	V			V	V	V		V	V	V		V	
	Αυτοσχεδιασμός	X	X			X	X	X		X	X	X		X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	V			X	V	X		V	V	V		X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ	V				V									
	ΟΧΙ		V				V	V		V	V	V		V	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	/	V			V	V	V		V	V	V		V	
	~~Δεν συνεργάζεται~~										/				
	Προκαλεί προβλήματα	V													
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	V										V			
	Οι προηγούμενες δραστηριότητες									V					
	Η κούραση										V				
	Βιωματικές ανάγκες(δίψα,πείνα)														
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ										V				
	ΟΧΙ	V	V			V	V			V		V		V	
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ														
	ΠΟΛΛΗ	V	V			V	V	V		V	V	V		V	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 34

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής;	Αποδέχεται Με χαρά	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Με παράπονα														
	Με προθυμία														
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	ΟΧΙ														
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	ΜΕΤΡΙΑ														
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓		✓	✓	✓	X	✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	✓	✓	✓		✓	✓	✓	X	✓	✓	✓	✓	✓	
	Παίξιμο με δεξί και αριστερό χέρι	✓	✓	✓		✓	✓	✓	X	✓	✓	✓	✓	✓	
	Αυτοσχεδιασμός	X	X	X		X	X	X	X	X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	✓	✓		X	✓	X	X	✓	✓	✓	✓	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ														
	ΟΧΙ	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα	✓													
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	–		–		–	–	–	–	–	–	–	–	–	
	Οι προηγούμενες δραστηριότητες	–	✓	–		–	–	–	–	–	–	–	–	–	
	Η κούραση	–	✓	–		✓	–	–	–	–	–	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	–		–		–	–	–	–	–	–	–	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ														
	ΟΧΙ	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ	✓													
	ΠΟΛΛΗ		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 35

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ												
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά													
	Με παράπονα													
	Με προθυμία	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
	Δεν αποδέχεται													
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ	✓												
	ΟΧΙ		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ										✓		✓	✓
	ΜΕΤΡΙΑ	✓	✓	✓		✓	✓	✓	✓	✓		✓		
	ΚΑΘΟΛΟΥ													
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	o	✓		✓	✓	✓	X	✓	✓	✓	✓	✓
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	o	o	✓		o	o	o	X	o	✓	✓	✓	✓
	Παίξιμο με δεξί και αριστερό χέρι	o	o	o		o	o	o	X	✓	✓	o	✓	✓
	Αυτοσχεδιασμός	X	X	X		X	X	X	X	X	X	X	X	X
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	o	✓		X	o	X	X	o	✓	o	o	X
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ	✓	✓											
	ΟΧΙ			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
	Δεν συνεργάζεται													
	Προκαλεί προβλήματα													
	Μιμείται συμπεριφορές	✓	✓											
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	–	–	–		–	–	–	–	–	–	–	–	–
	Οι προηγούμενες δραστηριότητες	–	✓	–		–	–	–	–	–	–	–	–	–
	Η κούραση	✓	✓	–		✓	–	–	–	–	–	–	–	–
	Βιωματικές ανάγκες(δίψα,πείνα)	–	–	–		–	–	–	–	–	–	–	–	–
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
	ΟΧΙ	✓												
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ													
	ΛΙΓΗ	✓				✓		✓						
	ΑΡΚΕΤΗ		✓				✓		✓	✓		✓		
	ΠΟΛΛΗ			✓							✓		✓	✓

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 36

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
					Λ	Α									
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής;	Αποδέχεται Με χαρά						✓			✓	✓	✓		✓	
	Με παράπονα														
	Με προθυμία ✓	✓	✓	✓				✓	✓				✓		
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ								✓					✓	
	ΟΧΙ	✓	✓	✓			✓	✓		✓	✓	✓	✓		
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ			✓			✓			✓			✓	✓	
	ΜΕΤΡΙΑ	✓	✓					✓	✓		✓	✓			
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓			✓	✓	X	✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	O	✓	✓			✓	✓	X	✓	✓	O	✓	✓	
	Παίξιμο με δεξί και αριστερό χέρι	O	O	O			✓	✓	X	✓	✓	✓	✓	✓	
	Αυτοσχεδιασμός	X	X	X			✓	X	X	X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	O	✓			O	X	X	O	✓	O	✓	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ	✓	✓						✓						
	ΟΧΙ			✓			✓	✓		✓	✓	✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές	✓													
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	–	–	–			–	–	–	–	–	–	–	–	
	Οι προηγούμενες δραστηριότητες	–	✓	–			–	–	–	–	–	–	–	–	
	Η κούραση	✓	✓	✓			–	–	–	–	–	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	–	✓	–			–	–	–	–	–	–	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓		
	ΟΧΙ													✓	
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ		✓												
	ΑΡΚΕΤΗ	✓					✓	✓	✓	✓		✓			
	ΠΟΛΛΗ			✓							✓		✓	✓	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 37

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ			A										
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά						✓			✓		✓			
	Με παράπονα	✓				✓						·	✓		
	Με προθυμία		✓	✓				✓	✓		✓			✓	
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ									✓					
	ΟΧΙ	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ						✓			✓	✓			✓	
	ΜΕΤΡΙΑ	✓	✓	✓		✓		✓	✓			✓	✓		
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓		✓	✓	✓	X	✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	O	O	✓		O	O	O	X	✓	✓	✓	✓	✓	
	Παίξιμο με δεξί και αριστερό χέρι	O	O	O		[illegible]	✓	✓	X	✓	✓	✓	✓	✓	
	Αυτοσχεδιασμός	X	X	X		[illegible]	X	X	X	X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	O	O		[illegible]	O	X	X	O	✓	O	O	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ	✓	✓	✓		✓	✓	✓	✓	✓				✓	
	ΟΧΙ										✓	✓	✓		
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	-	-	-		-	-	-	-	-	-	-	-	-	
	Οι προηγούμενες δραστηριότητες	-	✓	-		-	-	-	-	-	-	-	-	-	
	Η κούραση	✓	✓	✓		-	-	-	-	-	-	-	-	-	
	Βιωματικές ανάγκες(δίψα,πείνα)	-	-	-		-	-	-	-	-	-	-	-	-	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	ΟΧΙ														
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ							✓							
	ΑΡΚΕΤΗ	✓	✓	✓		✓	✓		✓	✓		✓		✓	
	ΠΟΛΛΗ										✓		✓		

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 38

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ												
			A		A									A
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται													
	Με χαρά									✓	✓			
	Με παράπονα													
	Με προθυμία	✓		✓		✓	✓	✓	✓			✓	✓	
	Δεν αποδέχεται.													
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ			✓										
	ΟΧΙ	✓				✓	✓	✓	✓	✓	✓	✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ			✓		✓					✓			
	ΜΕΤΡΙΑ	✓					✓	✓	✓	✓		✓	✓	
	ΚΑΘΟΛΟΥ													
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓		✓		✓	✓	✓	X	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	O		✓		O	O	O	X	✓	✓	O	O	
	Παίξιμο με δεξί και αριστερό χέρι	O		✓		✓	O	O	X	✓	O	O	✓	
	Αυτοσχεδιασμός	X		X		X	[illegible]	X	X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X		O		X	O	X	X	O	✓	O	O	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ													
	ΟΧΙ	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	
	Δεν συνεργάζεται													
	Προκαλεί προβλήματα													
	Μιμείται συμπεριφορές													
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	[illegible]		–		–	–	–	–	–	–	–	–	
	Οι προηγούμενες δραστηριότητες	–		–		–	–	–	–	–	–	–	–	
	Η κούραση	✓		–		✓	–	–	–	–	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	–		–		–	–	–	–	–	–	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓				✓	✓	✓	✓	✓	✓	✓	✓	
	ΟΧΙ			✓										
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ													
	ΛΙΓΗ													
	ΑΡΚΕΤΗ	✓				✓	✓	✓	✓	✓	✓	✓	✓	
	ΠΟΛΛΗ			✓										

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 39

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
						A									
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά					V				V	V	V	V	V	
	Με παράπονα														
	Με προθυμία	V	U	V			V	V	V						
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ	V		V											
	ΟΧΙ		V			V	V	V	V	V	V	V	V	V	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ			V			V		V						
	ΜΕΤΡΙΑ	V	V			V		V		V	V	V	V	V	
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	V	V	V		V	V	V	X	V	V	O	V	V	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	V	V	V		V	V	V	V	V	V	V	V	V	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	V	O	V		V	V	V	X	V	V	V	V	V	
	Παίξιμο με δεξί και αριστερό χέρι	V	V	V		V	V	V	X	V	V	V	V	V	
	Αυτοσχεδιασμός	X	X	X		X	X	X	X	X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	O	V		X	V	X	X	O	O	O	O	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ	V	V	V		V	V	V	V	V	V	V	V	V	
	ΟΧΙ														
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		V	V		V			V						
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα	V	U	V			V	V		V	V	V	V	V	
	Μιμείται συμπεριφορές	V		V									V		
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	V		–		–	–	–	–	–	–	V	–	–	
	Οι προηγούμενες δραστηριότητες		–	–		–	–	=	–	V	–	–	–	–	
	Η κούραση			–	–	–	–	–	V	–	V	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	V	–		–	–	–	–	–	–	–	–	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	V	V	V		V	V	V	V	V	V	V	V	V	
	ΟΧΙ														
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ	V	V						V			V		V	
	ΑΡΚΕΤΗ			V		V	V	V		V	V		V		
	ΠΟΛΛΗ														

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 40

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
					A								A		
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά						✓				✓			✓	
	Με παράπονα														
	Με προθυμία	✓	✓	✓		✓		✓	✓	✓		✓			
	Δεν αποδέχεται.														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ	✓													
	ΟΧΙ		✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ			✓			✓				✓	✓		✓	
	ΜΕΤΡΙΑ	✓	✓			✓		✓	✓	✓					
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓		✓	✓	✓	X	✓	✓	✓		✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	O	✓	✓		✓	✓	✓	X	✓	✓	✓		✓	
	Παίξιμο με δεξί και αριστερό χέρι	O	O	✓		O	✓	✓	X	✓	✓	✓		✓	
	Αυτοσχεδιασμός	X	X	X		X	X	X	X	X	X	X		X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	✓	✓		X	O	X	X	O	✓	✓		X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ														
	ΟΧΙ	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός		-	-		-	-	-	-	-	-	-		-	
	Οι προηγούμενες δραστηριότητες		-	-		-	-	-	-	-	-	-		-	
	Η κούραση	✓	✓	-		✓	-	-	-	-	-	~		-	
	Βιωματικές ανάγκες(δίψα,πείνα)		-	-		-	-	-	-	-	-	-		-	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	
	ΟΧΙ	✓													
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ	✓	✓			✓	✓	✓	✓	✓					
	ΠΟΛΛΗ			✓							✓	✓		✓	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 41

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ												
		Α			Α				Α		Α			Α
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά													
	Με παράπονα													
	Με προθυμία		√	√		√	√	√		√		√	√	
	Δεν αποδέχεται													
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ													
	ΟΧΙ		√	√		√	√	√		√		√	√	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ		√							√		√	√	
	ΜΕΤΡΙΑ √			√		√	√	√						
	ΚΑΘΟΛΟΥ													
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών		√	√		√	√	√		√		√	√	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο		√	√		√	√	√		√		√	√	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο		O	O		O	√	O		√		O	O	
	Παίξιμο με δεξί και αριστερό χέρι		O	O		O	√	√		√		√	√	
	Αυτοσχεδιασμός		X	X		X	X	X		X		X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου		O	O		X	O	X		O		O	O	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ													
	ΟΧΙ		√	√		√	√	√		√		√	√	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		√	√		√	√	√		√		√	√	
	Δεν συνεργάζεται													
	Προκαλεί προβλήματα													
	Μιμείται συμπεριφορές													
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός		–	–		–	–	–		–		–	–	
	Οι προηγούμενες δραστηριότητες		–	–		–	–	–		–		–	–	
	Η κούραση		–	–		–	–	–		–		–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)		–	–		–	–	–		–		–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		√	√		√	√	√		√		√	√	
	ΟΧΙ													
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ													
	ΛΙΓΗ													
	ΑΡΚΕΤΗ		√	√		√	√	√				√	√	
	ΠΟΛΛΗ									√				

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ . 42

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ 12/3	15/3	19/3	22/3	26/3	29/3	2/4	5/4	9/4	12/4	16/4	19/4	23/4
					Α	Α	Α	Α	Α	Α	Α			
1.Οταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται													
	Με χαρά		✓											
	Με παράπονα													
	Με προθυμία	✓		✓								✓	✓	✓
	Δεν αποδέχεται													
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ													
	ΟΧΙ	✓	✓	✓								✓	✓	✓
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ	✓											✓	
	ΜΕΤΡΙΑ		✓	✓								✓		✓
	ΚΑΘΟΛΟΥ													
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓								✓	✓	✓
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓								0	✓	✓
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	0	0	0								0	0	0
	Παίξιμο με δεξί και αριστερό χέρι	0	0	0								0	✓	0
	Αυτοσχεδιασμός	×	×	×								×	×	×
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	×	0	0								0	0	×
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ		✓											
	ΟΧΙ	✓		✓								✓	✓	✓
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓	✓								✓	✓	✓
	~~Δεν συνεργάζεται~~													
	Προκαλεί προβλήματα													
	Μιμείται συμπεριφορές											✓		
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	✓	–	–								✓	–	–
	Οι προηγούμενες δραστηριότητες		–	–								–	–	
	Η κούραση	–	–	–								–	–	–
	Βιωματικές ανάγκες(δίψα,πείνα)	–	–	–								–	✓	–
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓	✓	✓								✓	✓	✓
	ΟΧΙ													
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ													
	ΛΙΓΗ		✓											
	ΑΡΚΕΤΗ	✓		✓								✓		✓
	ΠΟΛΛΗ												✓	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 43

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
					Α		Α								
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής;	Αποδέχεται Με χαρά									✓	✓		✓		
	Με παράπονα														
	Με προθυμία	✓	✓	✓		✓		✓	✓			✓		✓	
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ	✓	✓	✓						✓	✓				
	ΟΧΙ					✓		✓	✓			✓	✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	
	ΜΕΤΡΙΑ														
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓		✓		✓	X	✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	✓	✓	✓		✓		✓	X	✓	✓	✓	✓	✓	
	Παίξιμο με δεξί και αριστερό χέρι	✓	✓	✓		✓		✓	X	✓	✓	✓	✓	✓	
	Αυτοσχεδιασμός	X	X	X		X		X	X	X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	✓	✓		X		X	X	✓	✓	✓	o	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ														
	ΟΧΙ	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	✓	–	–		–		–	–	–	–	✓	–	–	
	Οι προηγούμενες δραστηριότητες	–	–	–		–		–	–	–	–	–	–	–	
	Η κούραση	–	–	–		–		–	–	–	✓	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	–	–	–		–		–	–	–	–	–	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓							✓					✓	
	ΟΧΙ		✓	✓		✓		✓		✓	✓	✓	✓		
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ			✓				✓			✓		✓		
	ΠΟΛΛΗ	✓	✓			✓			✓	✓		✓		✓	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 44

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ												
			Α	Α		Α								
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά			√	√	-	√	√		√	√	√	√	
	Με παράπονα	√							√					
	Με προθυμία													
	Δεν αποδέχεται													
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ	√		√			√						√	
	ΟΧΙ				√			√	√	√	√	√		
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ	√		√	√		√	√	√	√	√	√	√	
	ΜΕΤΡΙΑ													
	ΚΑΘΟΛΟΥ													
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	√		√	√		√	X	√	√	√	√	√	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	√		√	√		√	√	√	√	√	√	√	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	√		√	√		√	X	o	√	√	√	√	
	Παίξιμο με δεξί και αριστερό χέρι	√		√	√		√	X	O	o	√	√	√	
	Αυτοσχεδιασμός	X		X	X		X	X	X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X		√	X		X	X	o	√	o	o	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ √	√		√	√		√		√					
	ΟΧΙ							√		√	√	√	√	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	√		√	√		√	√		√	√	√	√	
	Δεν συνεργάζεται													
	Προκαλεί προβλήματα								√					
	Μιμείται συμπεριφορές	√												
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	-		-	-		-	-	-	-	-	-	-	
	Οι προηγούμενες δραστηριότητες	-		-	-		-	-	√	-	-	-	-	
	Η κούραση	-		-	-		-	-	-	-	-	-	-	
	Βιωματικές ανάγκες(δίψα,πείνα)	-		-			-	-	-	-	-	-	-	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ				√			√	√	√	√	√		
	ΟΧΙ	√		√			√						√	
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ													
	ΛΙΓΗ	√												
	ΑΡΚΕΤΗ			√	√		√	√	√					
	ΠΟΛΛΗ									√	√	√	√	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 45

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΡΙΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
				A	A										
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά								✓		✓			✓	
	Με παράπονα														
	Με προθυμία	✓	✓			✓	✓	✓		✓		✓	✓		
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ														
	ΟΧΙ	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ					✓	✓	✓	✓	✓	✓		✓	✓	
	ΜΕΤΡΙΑ	✓	✓									✓			
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓			✓	✓	✓	X	✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	O	O			✓	✓	✓	X	O	✓	✓	O	✓	
	Παίξιμο με δεξί και αριστερό χέρι	O	O			O	✓	✓	X	✓	O	✓	✓	✓	
	Αυτοσχεδιασμός	X	✓			X	X	X	X	X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	O			X	O	X	X	O	O	O	O	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ														
	ΟΧΙ	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	✓	–			–	–	–	–	–	–	✓	–	–	
	Οι προηγούμενες δραστηριότητες	–	–			–	–	–	–	–	–	–	–	–	
	Η κούραση	–	–			–	–	–	–	–	✓	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	–	–			–	–	–	–	–	–	–	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	
	ΟΧΙ														
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ	✓													
	ΑΡΚΕΤΗ		✓						✓	✓	✓	✓	✓	✓	
	ΠΟΛΛΗ					✓	✓	✓							

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 46

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
					Α				Α						
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής;	Αποδέχεται Με χαρά														
	Με παράπονα														
	Με προθυμία	√	√	√		√	√	√		√	√	√	√	√	
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ														
	ΟΧΙ	√	√	√		√	√	√		√	√	√	√	√	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ	√													
	ΜΕΤΡΙΑ		√	√		√	√	√		√	√	√	√	√	
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	O	O	O		O	√	√		√	√	√	√	√	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	√	√	√		√	√	√		√	√	√	√	√	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	X	X	O		O	O	O		O	O	O	O	O	
	Παίξιμο με δεξί και αριστερό χέρι	X	X	O		O	O	O		O	O	O	O	O	
	Αυτοσχεδιασμός	X	X	X		X	X	X		X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	X	O		X	O	X		O	O	O	O	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ												√		
	ΟΧΙ	√	√	√		√	√	√		√	√	√		√	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	√	√	√			√	√		√	√	√	√	√	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές					√									
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	√	-	-		-	-	-		-	-	√	-	-	
	Οι προηγούμενες δραστηριότητες		-	-		-	-	-		-	-	-	-	-	
	Η κούραση	[illegible] √	-	-		-	-	-		-	√	-		-	
	Βιωματικές ανάγκες(δίψα,πείνα)		-	-		-	-	-		-	-	-	-	-	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	√	√	√		√	√	√		√	√	√	√	√	
	ΟΧΙ														
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ	√	√							√	√	√	√	√	
	ΑΡΚΕΤΗ			√		√	√	√							
	ΠΟΛΛΗ														

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 47

Ονομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
		Α			Α	Α						Α	Α		
1.Οταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά		✓	✓			✓	✓	✓	✓	✓			✓	
	Με παράπονα														
	Με προθυμία														
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ		✓	✓				✓			✓			✓	
	ΟΧΙ						✓		✓	✓					
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ		✓	✓			✓	✓	✓		✓			✓	
	ΜΕΤΡΙΑ									✓					
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών		✓	✓			✓	✓	X	✓	✓			✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο		✓	✓			✓	✓	✓	✓	✓			✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο		✓	✓			✓	✓	X	✓	✓			✓	
	Παίξιμο με δεξί και αριστερό χέρι		✓	✓			✓	✓	X	✓	✓			✓	
	Αυτοσχεδιασμός		+	X			X	X	X	X	X			X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου		✓	✓			✓	X	X	✓	○			X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ														
	ΟΧΙ		✓	✓			✓	✓	✓	✓	✓			✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		✓	✓			✓	✓	✓	✓	✓			✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός		–	–			–	–	–	–	–			–	
	Οι προηγούμενες δραστηριότητες		–	–			–	–	–	–	–			–	
	Η κούραση		–	–			✓	–	–	–	–			–	
	Βιωματικές ανάγκες(δίψα,πείνα)		–	–			–	–	–	✓	–			–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ ✓		✓				✓	✓		✓					
	ΟΧΙ			✓					✓		✓			✓	
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ						✓			✓					
	ΠΟΛΛΗ		✓	✓				✓	✓		✓			✓	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 48

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται														
	Με χαρά									✓					
	Με παράπονα														
	Με προθυμία	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ														
	ΟΧΙ	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ					✓								✓	
	ΜΕΤΡΙΑ	✓	✓				✓	✓	✓	✓	✓	✓	✓		
	ΚΑΘΟΛΟΥ			✓											
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓		✓	✓	✓	x	✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓		✓	✓	✓	o	✓	✓	o	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	o	x	x		o	o	o	x	o	o	o	✓	o	
	Παίξιμο με δεξί και αριστερό χέρι	o	x	x		o	o	o	x	✓	✓	o	✓	✓	
	Αυτοσχεδιασμός	x	x	x		x	x	x	x	x	x	x	x	x	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	x	x	x		x	o	x	x	o	o	o	o	x	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ			✓		✓									
	ΟΧΙ	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα			✓											
	Μιμείται συμπεριφορές			✓											
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	-	-	-		-	-	-	-	-	-	-	-	-	
	Οι προηγούμενες δραστηριότητες	-	-	-		-	-	-	-	-	-	-	-	-	
	Η κούραση	-	-	-		-	-	-	-	-	-	-	-	-	
	Βιωματικές ανάγκες(δίψα,πείνα)	-	-	-		-	-	-	-	✓	-	✓	-	-	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	ΟΧΙ														
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ			✓											
	ΛΙΓΗ	✓	✓				✓	✓		✓	✓	✓			
	ΑΡΚΕΤΗ					✓			✓				✓	✓	
	ΠΟΛΛΗ														

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 49

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ										A	A	A
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά	✓	✓	✓		✓	✓	✓	✓	✓	✓			
	Με παράπονα													
	Με προθυμία													
	Δεν αποδέχεται.													
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ		✓	✓		✓		✓		✓				
	ΟΧΙ	✓					✓		✓		✓			
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ	✓	✓	✓		✓	✓	✓	✓	✓	✓			
	ΜΕΤΡΙΑ													
	ΚΑΘΟΛΟΥ													
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓		✓	✓	✓	×	✓	✓			
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓		✓	✓	✓	✓	✓	✓			
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	✓	✓	✓		✓	✓	✓	×	✓	✓			
	Παίξιμο με δεξί και αριστερό χέρι	✓	✓	✓		✓	✓	✓	×	✓	✓			
	Αυτοσχεδιασμός	+	+	×		×	×	×	×	×	×			
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	+	✓	✓		×	ο	×	×	✓	✓			
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ													
	ΟΧΙ	✓	✓	✓		✓	✓	✓	✓	✓	✓			
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓	✓		✓	✓	✓	✓	✓	✓			
	Δεν συνεργάζεται													
	Προκαλεί προβλήματα													
	Μιμείται συμπεριφορές													
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	–	–	–		–	–	–	–	–	–			
	Οι προηγούμενες δραστηριότητες	–	–	–		–	–	–	–	–	–			
	Η κούραση	–	–	–		–	–	–	–	–	–			
	Βιωματικές ανάγκες(δίψα,πείνα)	–	–	–		–	–	–	–	–	–			
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ													
	ΟΧΙ	✓	✓	✓		✓	✓	✓	✓	✓	✓			
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ													
	ΛΙΓΗ													
	ΑΡΚΕΤΗ	✓	✓											
	ΠΟΛΛΗ			✓		✓	✓	✓	✓	✓	✓			

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 50

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
		A	A		C										
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής;	Αποδέχεται Με χαρά														
	Με παράπονα														
	Με προθυμία			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ					✓									
	ΟΧΙ			✓			✓	✓	✓	✓	✓	✓	✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ					✓	✓	✓	✓	✓	✓	✓	✓	✓	
	ΜΕΤΡΙΑ			✓											
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών			✓		✓	✓	✓	X	✓	o	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο			o		✓	✓	✓	X	✓	✓	✓	✓	✓	
	Παίξιμο με δεξί και αριστερό χέρι			o		✓	✓	✓	X	✓	✓	✓	✓	✓	
	Αυτοσχεδιασμός			X		X	X	X	X	X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.			o		X	o	X	X	✓	✓	o	o	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ														
	ΟΧΙ			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός			–		–	–	–	–	–	–	–	–	–	
	Οι προηγούμενες δραστηριότητες			–		–	–	–	–	–	–	–	–	–	
	Η κούραση			–		–	–	–	–	–	–	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)			–		–	–	–	–	–	–	–	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	ΟΧΙ														
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ			✓				✓		✓					
	ΠΟΛΛΗ					✓	✓		✓		✓	✓	✓	✓	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 51

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
					A			A				A			
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής;	Αποδέχεται Με χαρά					✓			✓	✓	✓				
	Με παράπονα														
	Με προθυμία	✓	✓	✓			✓						✓	✓	
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ		✓											✓	
	ΟΧΙ	✓		✓		✓	✓		✓	✓	✓		✓		
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ		✓	✓					✓	✓	✓			✓	
	ΜΕΤΡΙΑ	✓				✓	✓						✓		
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓		✓	✓		X	✓	✓		✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓		✓	✓		✓	✓	✓		✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	O	✓	✓		✓	✓		X	✓	✓		✓	O	
	Παίξιμο με δεξί και αριστερό χέρι	O	✓	O		O	O		X	O	O		O	✓	
	Αυτοσχεδιασμός	X	X	X		X	X		X	X	X		X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	O	O		X	O		X	O	O		O	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ	✓								✓					
	ΟΧΙ		✓	✓		✓	✓		✓		✓		✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓	✓		✓	✓		✓		✓		✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα	✓		✓											
	Μιμείται συμπεριφορές						✓			✓					
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	✓	–	–		–	–		–	–	–		–	–	
	Οι προηγούμενες δραστηριότητες		–	–		–	–		–	✓	–		–	–	
	Η κούραση		–	–		–	–		–	–	✓		–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	✓	–	–		–	–		✓	–	–		–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓	✓	✓		✓	✓		✓	✓	✓		✓		
	ΟΧΙ													✓	
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ	✓													
	ΑΡΚΕΤΗ		✓	✓		✓	✓			✓			✓	✓	
	ΠΟΛΛΗ								✓		✓				

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 52

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
				Α	Α						Α				
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά	√	√			√	√	√	√	√		√	√	√	
	Με παράπονα														
	Με προθυμία														
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ	√	√				√	√	√	√		√	√	√	
	ΟΧΙ					√									
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ	√	√			√	√	√	√	√		√	√	√	
	ΜΕΤΡΙΑ														
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	√	√			√	√	√	X	√		√	√	√	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	√	√			√	√	√	√	√		√	√	√	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	√	√			√	√	√	X	√		√	√	√	
	Παίξιμο με δεξί και αριστερό χέρι	√	√			√	√	√	X	√		√	√	√	
	Αυτοσχεδιασμός	X	X			X	X	X	X	X		X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	√			X	O	X	X	√		√	√	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ		√												
	ΟΧΙ	√				√	√	√	√	√		√	√	√	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	√	√			√	√	√	√	√		√	√	√	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	–	–			–	–	–	–	–		–	–	–	
	Οι προηγούμενες δραστηριότητες	–	–			–	–	–	–	–		–	–	–	
	Η κούραση	√	–			–	–	–	–	–		–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	√	–			–	–	–	–	–		–	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		√					√							
	ΟΧΙ	√				√	√		√	√		√	√	√	
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ	√								√					
	ΠΟΛΛΗ		√			√	√	√	√			√	√	√	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 53

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ											
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά								✓	✓	✓	✓	✓
	Με παράπονα	✓	✓	✓									
	Με προθυμία				✓	✓	✓	✓					
	Δεν αποδέχεται												
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ										✓	✓	
	ΟΧΙ	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ					✓				✓	✓	✓	
	ΜΕΤΡΙΑ		✓		✓		✓	✓	✓				✓
	ΚΑΘΟΛΟΥ	✓		✓									
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓	✓	✓	✓	O	✓	✓	✓	✓	✓
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	O	O	X	O	✓	✓	X	✓	✓	✓	✓	✓
	Παίξιμο με δεξί και αριστερό χέρι	O	O	X	O	O	O	X	✓	✓	✓	✓	✓
	Αυτοσχεδιασμός	X	X	X	X	X	X	X	X	X	X	X	X
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	+	O	X	X	O	X	X	O	O	O	O	X
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ	✓	✓	✓	✓		✓	✓	✓				✓
	ΟΧΙ					✓				✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	–	–	–		✓	–	✓	–	–	–	–	
	Δεν συνεργάζεται	–	✓		✓	–	–		–	–	–	–	
	Προκαλεί προβλήματα	✓	✓	✓	✓	–	✓		✓	–	–	–	✓
	Μιμείται συμπεριφορές	✓	–	–		–	–		–	–	–	–	
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	–	–	–	–	–	–	–	–	–	–	–	–
	Οι προηγούμενες δραστηριότητες	–	–	–	–	–	–	–	–	–	:	–	–
	Η κούραση	–	–	–	–	✓	–	–	–	–	–	–	–
	Βιωματικές ανάγκες(δίψα,πείνα)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
	ΟΧΙ										✓	✓	
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ	✓											
	ΛΙΓΗ			✓			✓	✓					
	ΑΡΚΕΤΗ		✓		✓	✓			✓				✓
	ΠΟΛΛΗ									✓	✓	✓	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 54

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά					✓	✓		✓	✓	✓	✓	✓		
	Με παράπονα														
	Με προθυμία	✓	✓	✓				✓						✓	
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ	✓	✓			✓				✓					
	ΟΧΙ			✓			✓	✓	✓		✓	✓	✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ		✓	✓		✓	✓	✓	✓	✓	✓			✓	
	ΜΕΤΡΙΑ	✓										✓	✓		
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓		✓	✓	✓	×	✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	✓	✓	✓		✓	✓	✓	×	✓	○	✓	○	○	
	Παίξιμο με δεξί και αριστερό χέρι	✓	✓	✓		○	✓	✓	×	✓	✓	✓	✓	✓	
	Αυτοσχεδιασμός	×	×	×		×	×	×	×	×	✓	×	×	×	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	×	✓	✓		×	✓	×	×	✓	○	○	○	×	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ	✓	✓	✓			✓	✓	✓			✓	✓	✓	
	ΟΧΙ					✓				✓	✓				
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		✓	✓		✓	✓			✓	✓				
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα	✓						✓	✓			✓	✓	✓	
	Μιμείται συμπεριφορές	✓													
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	✓	–	–		–	–	–	–	–	–	✓	–	–	
	Οι προηγούμενες δραστηριότητες	–	–	–		–	–	–	–	–	–	–	–	–	
	Η κούραση	–	–	–		–	–	–	–	–	✓	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	–	–	–		–	–	–	–	–	–	–	✓	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ						✓	✓	✓		✓	✓	✓	✓	
	ΟΧΙ	✓	✓	✓		✓				✓					
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ	✓									✓	✓		✓	
	ΑΡΚΕΤΗ			✓		✓		✓		✓			✓		
	ΠΟΛΛΗ		✓				✓		✓						

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 55

Ονομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
			A	A	A										
1.Οταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής;	Αποδέχεται Με χαρά					V	V	V		V				V	
	Με παράπονα														
	Με προθυμία ✓	V							V		V	V	V		
	Δεν αποδέχεται.														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ						V							V	
	ΟΧΙ	V				V		V	V	V	V	V	V		
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ					V	V	V	V	V			V	V	
	ΜΕΤΡΙΑ	V									V	V			
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	V				V	V	V	X	V	V	V	V	V	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	V				V	V	V	V	V	V	V	V	V	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	V				V	V	V	X	V	O	V	V	V	
	Παίξιμο με δεξί και αριστερό χέρι	V				V	V	O	X	V	V	V	V	V	
	Αυτοσχεδιασμός	X				X	X	X	X	X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X				X	O	X	X	O	O	O	O	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ	V													
	ΟΧΙ					V	V	V	V	V	V	V	V	V	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	V				V	V	V	V	V	V	V	V	V	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα	V													
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	V				–	–	–	–	–	–	V	–	–	
	Οι προηγούμενες δραστηριότητες	–				–	–	–	–	–	–	–	–	–	
	Η κούραση	–				–	–	–	–	–	V	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	–				–	–	–	–	–	–	–	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	V				V	V	V	V	V	V	V	V		
	ΟΧΙ													V	
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ	V				V		V		V	V	V		V	
	ΠΟΛΛΗ						V		V				V		

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 56

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
					A			A							
1.Οταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	
	Με παράπονα														
	Με προθυμία														
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ		✓	✓		✓	✓		✓	✓				✓	
	ΟΧΙ	✓									✓	✓	✓		
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	
	ΜΕΤΡΙΑ														
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓		✓	✓		X	✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	✓	✓	✓		✓	✓		X	✓	✓	✓	✓	✓	
	Παίξιμο με δεξί και αριστερό χέρι	✓	✓	✓		✓	✓		X	✓	✓	✓	✓	✓	
	Αυτοσχεδιασμός	X	X	X		X	X		X	X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	✓	✓		X	✓		X	✓	✓	✓	✓	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ														
	ΟΧΙ	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	
	~~Δεν συνεργάζεται~~														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	✓	–	–		–	–		–	–	–	✓	–	–	
	Οι προηγούμενες δραστηριότητες	–	–	–		–	–		–	–	–	–	–	–	
	Η κούραση	–	–	–		–	–		–	–	✓	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	–	–	–		–	–		–	–	–	–	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ											✓	✓		
	ΟΧΙ	✓	✓	✓		✓	✓		✓	✓	✓			✓	
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ														
	ΠΟΛΛΗ	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 57

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ			A										
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Με παράπονα														
	Με προθυμία														
	Δεν αποδέχεται.														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ		✓	✓						✓	✓	✓			
	ΟΧΙ	✓				✓	✓	✓	✓				✓	✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	ΜΕΤΡΙΑ														
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓		✓	✓	✓	X	✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	✓	✓	✓		✓	✓	✓	X	✓	✓	✓	✓	✓	
	Παίξιμο με δεξί και αριστερό χέρι	✓	✓	✓		✓	✓	✓	X	✓	✓	✓	✓	✓	
	Αυτοσχεδιασμός	X	X	X		X	X	X	X	X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	✓	✓		X	✓	X	X	✓	O	O	✓	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ ✓	✓	✓	✓		✓		✓	✓						
	ΟΧΙ						✓			✓	✓	✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	-	-	-		-	-	-	-	-	-	-	-	-	
	Οι προηγούμενες δραστηριότητες	-	-	-		-	-	-	-	✓	-	-	-	-	
	Η κούραση	-	-	-		-	-	-	-	-	-	-	-	-	
	Βιωματικές ανάγκες(δίψα,πείνα)	-	-	-		-	-	-	-	-	-	-	-	-	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		✓	✓		✓	✓	✓	✓	✓			✓	✓	
	ΟΧΙ	✓									✓	✓			
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ	✓	✓			✓					✓				
	ΠΟΛΛΗ			✓			✓	✓	✓	✓		✓	✓	✓	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 58

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
				Α	Α	Α	Α	Α	Α						
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά	✓								✓	✓	✓	✓	✓	
	Με παράπονα														
	Με προθυμία		✓												
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ	✓	✓							✓		✓		✓	
	ΟΧΙ										✓		✓		
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ	✓	✓							✓	✓	✓	✓	✓	
	ΜΕΤΡΙΑ														
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓							✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓							✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	✓	✓							O	O	✓	✓	✓	
	Παίξιμο με δεξί και αριστερό χέρι	✓	✓							✓	✓	O	✓	✓	
	Αυτοσχεδιασμός	X	X							X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	✓							O	O	✓	O	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ	✓	✓												
	ΟΧΙ									✓	✓	✓	✓	✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα	✓	✓							✓	✓	✓	✓	✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα	✓													
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	-	–							–	–	–	–	–	
	Οι προηγούμενες δραστηριότητες	–	-							–	–	–	–	–	
	Η κούραση	–	–							–	–	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	–	–							–	–	–	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ		✓								✓		✓		
	ΟΧΙ	✓								✓		✓		✓	
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ														
	ΑΡΚΕΤΗ										✓				
	ΠΟΛΛΗ	✓	✓							✓		✓	✓	✓	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 59

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
		Α	Α		Α							Α	Δ		
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής;	Αποδέχεται Με χαρά						✓		✓	✓	✓			✓	
	Με παράπονα														
	Με προθυμία			✓		✓		✓							
	Δεν αποδέχεται														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ										✓				
	ΟΧΙ			✓		✓	✓	✓	✓	✓				✓	
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ			✓					✓	✓	✓			✓	
	ΜΕΤΡΙΑ					✓	✓	✓							
	ΚΑΘΟΛΟΥ														
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών			✓		✓	✓	✓	X	✓	✓			✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο			✓		✓	✓	✓	✓	✓	✓			✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο			O		O	✓	✓	X	✓	✓			O	
	Παίξιμο με δεξί και αριστερό χέρι			O		O	O	O	X	✓	✓			✓	
	Αυτοσχεδιασμός			X		X	X	X	X	X				X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.			O		X	O	X	X	✓	O			X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ														
	ΟΧΙ			✓		✓	✓	✓	✓	✓	✓			✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα			✓		✓	✓	✓	✓	✓	✓			✓	
	Δεν συνεργάζεται														
	Προκαλεί προβλήματα														
	Μιμείται συμπεριφορές														
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός			–		–	–	–	–	–	–			–	
	Οι προηγούμενες δραστηριότητες			–		–	–	–	–	–	–			–	
	Η κούραση			–		–	✓	–	–	–	–			–	
	Βιωματικές ανάγκες(δίψα,πείνα)			–		–	–	–	–	–	–			–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ			✓		✓	✓	✓	✓	✓				✓	
	ΟΧΙ										✓				
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ					✓									
	ΑΡΚΕΤΗ			✓			✓	✓			✓				
	ΠΟΛΛΗ								✓	✓				✓	

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 60

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ												
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής	Αποδέχεται Με χαρά			✓		✓	✓	✓		✓	✓	✓	✓	✓
	Με παράπονα													
	Με προθυμία		✓						✓					
	Δεν αποδέχεται	✓												
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ			✓						✓			✓	✓
	ΟΧΙ	✓	✓			✓	✓	✓	✓		✓	✓		
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ		✓	✓		✓	✓			✓	✓	✓	✓	✓
	ΜΕΤΡΙΑ	✓						✓	✓					
	ΚΑΘΟΛΟΥ													
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓		✓	✓	✓	X	✓	✓	✓	✓	✓
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	O	✓	O		✓	✓	✓	X	✓	✓	✓	✓	✓
	Παίξιμο με δεξί και αριστερό χέρι	O	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
	Αυτοσχεδιασμός	X	X	X		X	X	X	✓	✓	✓	X	X	X
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	✓	O		X	O	X	✓	✓	✓	✓	✓	X
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ	✓	✓	✓										
	ΟΧΙ					✓	✓	✓	✓	✓	✓	✓	✓	✓
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
	Δεν συνεργάζεται	✓												
	Προκαλεί προβλήματα													
	Μιμείται συμπεριφορές													
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	-	-	-		-	-	-	-	-	-	-	-	-
	Οι προηγούμενες δραστηριότητες	-	-	-		-	-	-	-	-	-	-	-	-
	Η κούραση	-	-	-		-	-	-	✓	-	-	-	-	-
	Βιωματικές ανάγκες(δίψα,πείνα)	-	-	-		✓	-	-	-	-	-	-	-	-
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓	✓			✓	✓	✓	✓		✓	✓		
	ΟΧΙ			✓						✓			✓	✓
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ													
	ΛΙΓΗ	✓												
	ΑΡΚΕΤΗ			✓			✓	✓	✓					
	ΠΟΛΛΗ		✓			✓				✓	✓	✓	✓	✓

ΦΥΛΛΟ ΠΑΡΑΤΗΡΗΣΗΣ 61

Όνομα μαθητή

ΚΑΤΑΓΡΑΦΟΜΕΝΕΣ ΣΥΜΠΕΦΟΡΕΣ	ΣΧΟΛΙΑ	ΗΜΕΡΟΜΗΝΙΕΣ ΜΑΘΗΜΑΤΩΝ													
					A		A								
1.Όταν άρχισε ο δάσκαλος τη συγκεκριμένη δραστηριότητα πως αντέδρασε ο μαθητής;	Αποδέχεται Με χαρά							✓		✓	✓	✓	✓	✓	
	Με παράπονα	✓	✓												
	Με προθυμία			✓		✓									
	Δεν αποδέχεται.														
2.Το παιδί παίρνει την πρωτοβουλία να ξεκινήσει μόνο του τη δραστηριότητα;	ΝΑΙ										✓			✓	
	ΟΧΙ	✓	✓	✓		✓		✓	✓	✓		✓	✓		
3.Πόσο σοβαρά παίρνει το παιδί τη δραστηριότητα;	ΠΟΛΥ					✓		✓		✓	✓	✓		✓	
	ΜΕΤΡΙΑ			✓									✓		
	ΚΑΘΟΛΟΥ	✓	✓												
4.Ποιες συγκεκριμένες ικανότητες παρατηρώ ότι έχει:	Μέτρημα ρυθμικών αξιών	✓	✓	✓		✓		✓	X	✓	✓	✓	✓	✓	
	Ικανότητα κίνησης δακτύλων στο αρμόνιο	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	
	Συντονισμός ανάγνωσης νότων και παίξιμο στο αρμόνιο	✓	✓	✓		✓		✓	✓	✓	✓	✓	O	✓	
	Παίξιμο με δεξί και αριστερό χέρι	O	O	O		O		✓	✓	✓	O	✓	✓	✓	
	Αυτοσχεδιασμός	X	X	X		X		X	X	X	X	X	X	X	
	Ικανότητα ανάγνωσης αδίδακτου μουσικού κειμένου.	X	O	O		X		X	✓	✓	O	✓	O	X	
5.Φαίνεται το παιδί να θέλει να λειτουργήσει ανεξάρτητα;	ΝΑΙ	✓	✓	✓				✓			✓	✓	✓		
	ΟΧΙ					✓			✓	✓				✓	
6.Πως συμπεριφέρεται το παιδί μέσα στην ομάδα;	Συνεργάζεται εύκολα			✓		✓		✓	✓	✓	✓	✓		✓	
	Δεν συνεργάζεται		✓												
	Προκαλεί προβλήματα	✓													
	Μιμείται συμπεριφορές												✓		
7.Ποιοι υποθέτουμε ότι είναι οι εξωτερικοί παράγοντες που επηρεάζουν τη συμπεριφορά του παιδιού;	Ο καιρός	–	–	–		–		–	–	–	–	–	–	–	
	Οι προηγούμενες δραστηριότητες	–	–	–		–		–	–	–	–	–	–	–	
	Η κούραση	–	✓	–		–		–	–	–	–	–	–	–	
	Βιωματικές ανάγκες(δίψα,πείνα)	–	–	–		✓		–	–	–	–	–	–	–	
8.Περιμένει το παιδί τη βοήθεια του δασκάλου προκειμένου να εμπλακεί στη συγκεκριμένη δραστηριότητα;	ΝΑΙ	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓		
	ΟΧΙ													✓	
9.Πόση προσοχή δίνει το παιδί στη συγκεκριμένη δραστηριότητα με την οποία ασχολείται;	ΚΑΘΟΛΟΥ														
	ΛΙΓΗ	✓	✓										✓		
	ΑΡΚΕΤΗ			✓		✓			✓		✓				
	ΠΟΛΛΗ							✓		✓		✓		✓	